

Characteristics of Stakeholder Networks Supporting Institutional Development in Rural Water Service Delivery



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DECLARATION

This dissertation is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Acknowledgements and specified in the text.

It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Acknowledgements and specified in the text. I further state that no substantial part of my dissertation has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Acknowledgements and specified in the text.

It does not exceed the prescribed word limit for the Degree Committee of the Faculty of Engineering.

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ABSTRACT

This research applies social network analysis, the study of relationships between actors, to identify stakeholder relationships that support institutional development for rural water service delivery. Whereas technical aspects of water engineering are well understood, building institutional capacity for sustaining rural water services remains a challenge. Institutions exist with other stakeholders in a complex environment of relationships and power dynamics that influence how these institutions develop, and this research provides insight into how these influences can be both rigorously and practically understood.

Social network analysis is appropriate for studying relationships around institutions because it focuses on ties between actors. Recognition of its potential is growing in the water sector, but its utility for understanding how stakeholder networks in rural water sectors influence institutional development remains largely unexplored. Social network analysis deserves closer attention because the quantitative aspect of networks has potential to rigorously investigate the many relationships that institutions have, while visual representations of networks might help practitioners to better engage with these complex environments.

This research therefore tests the applicability of social network analysis in a broad range of contexts through cases studies in Africa, Asia, and South America. Each case study focuses on a specific instance of institutional development in rural water sectors – either government offices or community operator committees. Primary data collection in Ghana, Malawi, India, Tajikistan, Bangladesh, and Bolivia involved 162 interviews with governments, the private sector, non-governmental organisations, academic institutions, donor agencies, and community members. Each participant mapped their network during a facilitated exercise to identify who they interact with and how, and then commented on the importance of specific relationships. Data from these interviews were then combined to produce networks for analysis along with qualitative descriptions of network characteristics.

When viewed through a social network perspective, the case studies consistently reveal three characteristics of stakeholder networks that support institutional development. The first network characteristic is multiple information and skill ties between an institution and local stakeholders. Through these ties the institution can provide support to local stakeholders, and receive feedback on how to improve performance. The second

network characteristic is strong information and skill ties between an institution and higher levels of sector hierarchy. These ties can provide ongoing support to overcome challenges and improve institutional performance. The third characteristic is coordination between stakeholders at higher levels of sector hierarchy that have strong information and skill ties with an institution. Strong information and skill ties between these support providers can help them to align their efforts behind the same outcomes, and collaborate to complement each other's work.

These three network characteristics were identified as positive influences supporting institutional development for rural water supply in multiple countries. Although stakeholder relationships are nuanced and contextual, social network analysis can be used to identify where network characteristics that might support institutional development are missing. Practically, methods from this research can be used to analyse stakeholders and relationships around specific institutions in order to inform strategies for coordination and support to institutions. This research also contributes to the academic discourse on how complex stakeholder interactions can be studied through social network analysis, both quantitatively and qualitatively, to add rigour to the investigation of factors supporting institutional development. The academic and practical benefits identified in this research suggest that there is considerable potential for advancing the application social network analysis for understanding influences that support institutional development in rural water supply.

GLOSSARY

Alter – A node that is directly connected to the ego node in an ego network.

Ego – The central node in an ego network that is directly connected to all other nodes (its alters).

Ego Network – A specific kind of network that examines the network of nodes with direct ties to a specific node of interest (the ego).

Heterophilic – The tendency of an ego node to be linked to nodes with a different property than the ego node.

Homophilic – The tendency of an ego node to be linked to nodes with the same property as an ego node.

Homophily – A measure of the proportion of alters with similar versus dissimilar properties to the ego in an ego network.

Institution – In the context of this research, these are either government departments or community operator committees. These institutions have permanent and formally recognised roles in the management of rural water services, either directly or indirectly.

Multiplex – Multiple tie types between nodes that exist in parallel.

Node – A point within a network that is connected by ties. Nodes in the context of this research are stakeholders and institutions.

Reciprocity – The tendency for network ties to be two-way instead of one-way.

Stakeholder – Any organisation, department, or group of individuals that influences or is influenced by rural water service delivery. Stakeholders include, but are not limited to: non-governmental organisations; government departments; private companies; water system operators; bi-lateral or multi-lateral organisations; and civil stakeholders such as communities or water users.

Tie – Nodes in a network are connected by ties. In the context of this research there are four tie types investigated: information, skills, resources, and authority.

ABBREVIATIONS

BRAC	Bangladesh Rural Advancement Committee
BS	Bolivianos (Bolivian currency)
CAPyS	Comité para Agua Potable y Saneamiento
CSO	Civil Society Organisation
DfID	UK Department for International Development
DMSB	Direcciones Municipales de Saneamiento Básico
DWSP	District Water and Sanitation Plan
DWST	District Water and Sanitation Team
GDP	Gross Domestic Product
ICEIDA	Icelandic Aid
IIST	Indian Institute of Engineering, Science, and Technology
INR	Rupees (Indian currency)
INGO	International Non-Governmental Organisation
IRC	The International Water and Sanitation Centre
IWRM	Integrated Water Resource Management
JMP	Joint Monitoring Programme
MDG	Millennium Development Goal
NGO	Non-Governmental Organisation
ODI	Overseas Development Institute
PEA	Political Economy Analysis
SDG	Sustainable Development Goal
SNA	Social Network Analysis
TajWSS	Tajikistan Water Supply and Sanitation Network
THF	Technology with a Human Face
Triple-S	Sustainable Services at Scale

USD	United States Dollars
WASH	Water, Sanitation, and Hygiene
WB	World Bank Group
WfP	Water for People
WHO	World Health Organisation

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1 INTRODUCTION

Safe drinking water access is important globally. An estimated 663 million people did not have access to improved drinking water sources when the Millennium Development Goals concluded in 2015 (United Nations, 2015), and a Sustainable Development Goal is now committed to achieving universal safe water access by 2030 (United Nations, 2016). The goal is clear, but questions remain about how to achieve it.

Infrastructure plays an important role. Investment in infrastructure was critical in the success of the Millennium Development Goal of halving the number of people without access to water, and continued investment will be important for achieving universal access to safe drinking water. The required capital investment of extending basic water supply services to the unserved is estimated at USD\$37.6 billion per year (Hutton & Varughese, 2016).

But the goal of universal access cannot be achieved through infrastructure alone. Pumps and pipes eventually break. An estimated USD\$1.2-\$1.5 billion has been lost over the past 20 years in sub-Saharan Africa alone due to infrastructure non-functionality (Narkevic, Harvey, & Morgan, 2009). The presence of infrastructure alone also does not guarantee that everyone nearby can access safe water. Challenges with sustaining functionality of infrastructure and recognition of water access as a service have gained increasing attention internationally, and addressing these issues will be an essential complement to infrastructure development.

Safe water is increasingly recognised as a service that requires both infrastructure and people to manage it. Users, operators, and regulators are a few of the important actors with roles in ensuring that safe drinking water is reliably accessible. Institutions,

including governments, also have permanent roles in directly or indirectly sustaining safe water access (Lockwood & Smits, 2011). Supporting these institutions to play their roles effectively is therefore an essential complement to the role of technology in providing safe water.

The importance of institutional development raises questions about how to best support it, and this proves to be challenging. How institutions develop can vary with context. These contexts contain influential power dynamics and complex stakeholder interactions which complicate how change happens (Ramalingam, 2013). Some argue that institutional change cannot simply be designed and implemented, suggesting instead that it is influenced through a complex process of adaptation and adoption that is more evolutionary than strategically planned (F Cleaver, 2012; Ostrom, Janssen, & Anderies, 2007). These arguments suggest a need to understand institutional development differently: as a complex result of many influences instead of the successful implementation of a detailed design (Merrey & Cook, 2012).

Supporting institutional development is important even if the process is complex. If multiple influences can affect institutional development simultaneously, understanding the breadth of stakeholders interacting with an institution might help to identify relationships that support institutional development. This view is supported by writing on the importance of stakeholder power dynamics and the broader institutional structures in water sectors (Mollinga, 2008). Investigating stakeholder relationships might be useful for identifying the types of relationships that support institutions to develop. Although methods such as Political Economy Analysis exist for analysing the complex power dynamics in water sectors (Edelmann, 2009), there is still a gap in approaches for rigorously studying these environments while cutting through the complexity to offer actionable insights for policy-makers (Whaley & Cleaver, 2017).

Social Network Analysis (SNA), with its focus on the ties between actors, might offer solutions. SNA can be used to study relationships between stakeholders, making it suited to investigating the simultaneous relationships influencing an institution. Ego network analysis, a specific type of SNA, is particularly relevant because it analyses relationships around a specific node of interest (Crossley, Bellotti, & Edwards, 2015). Ego network analysis might therefore be used to study the relationships that influence institutional development, and this research is designed to test its potential.

This research therefore studies specific institutions that are developing in order to identify characteristics of their stakeholder networks. The chosen scope is broad.

Geographical regions for case studies includes Africa, Asia, and South America, and the types of institutions includes national government, district government, and community operator committees. This diversity of contexts and institution types is selected to explore how certain common characteristics of stakeholder networks might support institutional development across different circumstances. Even if the contexts are different, perhaps similarities exist in the relationships of these institutions that might be identified from a stakeholder network perspective.

Findings intend to offer insight into how stakeholder relationships support institutional development, and how these relationships can be understood from a network perspective. Such findings are intended to have both academic and practical value. Academically, SNA might provide a basis for quantitatively studying complex stakeholder interactions in water sectors and beyond. Practically, identification of institutional relationships and supportive influences might help practitioners to strategically strengthen certain relationships, and to monitor change in networks over time. At the outset, however, these intended results are aspirational because the potential of SNA for characterising influences on institutional development is a new area of inquiry.

2 BACKGROUND

This chapter explores how the fundamentally technocratic challenge of safe water access necessarily extends to include institutional development, and how change in institutions must be approached differently from implementation of an engineered design. New approaches are needed that can rigorously account for the complex stakeholder interactions that shape institutions, while also providing practical value that can inform strategic interventions. To this end, social network analysis is identified as an underexplored opportunity for studying influences on institutional development that might provide valuable and pertinent insights to support the global effort towards universal safe water access.

2.1 The Global Effort Towards Safe Water Access

The case for the importance of safe drinking water is easy to make. Water, Sanitation, and Hygiene (WASH) services are essential for both human health and economic development. An estimated USD\$5-28 is returned for each USD\$1 invested in WASH (Hutton & Haller, 2004), and poor access to WASH services is a cause of diarrhoea, a leading cause of death for children in Africa (Black *et al.*, 2010). The necessity of improving WASH services has almost universal appeal, and organisations, governments, and people around the world have united behind this cause.

Progress is being made. The Millennium Development Goal target for water access was met by 116 countries, and over 2 billion people have gained access to clean water since 1990 (World Health Organization and UNICEF, 2014). The trend is encouraging, but achieving universal access to safe water is anything but guaranteed.

Despite the importance of safe water access, and considerable progress towards reducing the number of people without access, 663 million people still used unimproved drinking water sources when the Millennium Development Goals concluded in 2015 (United Nations, 2015). Aggregate numbers can also hide disparities, such as differences between regions or between rural and urban areas (RWSN, 2009), and the number of people without access to safe water in rural Africa actually *increased* from 1990 to 2006 due to both population growth and infrastructure breakdowns (RWSN, 2009). The global commitment towards water services has been renewed to engage these challenges, and the Sustainable Development Goals aim to achieve universal safe water access by 2030 (United Nations, 2016).

Part of the solution involves continuing to build on what is working. Efforts during the Millennium Development Goals supported an increase in the global population using improved drinking water sources from 76 percent to 91 percent (United Nations, 2015). The Millennium Development Goals themselves also build on a longer history of international efforts towards safe water access, including the International Drinking Water Supply and Sanitation Decade from 1981-1990, that have prioritised international financing and the development of country infrastructure investment plans (United Nations Economic and Social Council, 1990).

Investment in infrastructure will continue to be an essential part of the global water access agenda. An assessment of water access in sub-Saharan Africa finds that substantial investment will be needed to achieve the Sustainable Development Goal for water (Roche, Bain, & Cumming, 2017), and a global assessment of investment requirements estimates that capital investments in water supply require USD\$37.6 billion annually, which is considerably higher than current investment levels (Hutton & Varughese, 2016). Investment requirements can be difficult to estimate, however, because of the difficulty of ascertaining actual costs (Smits *et al.*, 2011), and a 2014 global financial analysis found 80% of countries reporting insufficient financing for water and sanitation, despite official development assistance of USD\$6.7 billion (UN Water, 2014). All of these figures indicate that technology, infrastructure, and finance will be important parts of achieving the Sustainable Development Goal for water by 2030.

But other issues have also come to the forefront. The same report that estimated investment requirements cautions that sustaining universal coverage will require more than just capital inflows for infrastructure (Hutton & Varughese, 2016). Challenges with

ongoing maintenance and operations of water facilities were noted even at the conclusion of the International Drinking Water Decade (United Nations Economic and Social Council, 1990), and an advancing agenda of international commitments are actively considering the broader factors influencing service delivery. The Dublin Principles are one such example, highlighting the importance of integrated water resource management, multi-stakeholder participation, and gender and equity issues (ICWE, 1992). Even if gaps exist between the rhetoric of commitments such as the Dublin Principles and actual practice (Moriarty *et al.*, 2000), there is broad acknowledgement that continuing business as usual is unlikely to be enough, and achieving universal safe water access will need to engage broader issues that include the institutional environment around infrastructure and service delivery (Doczi *et al.*, 2013).

2.2 Barriers to Safe Water Access

Safe water access is ultimately about people. Infrastructure needs maintenance to continue functioning, and people need to be able to access the infrastructure in order to benefit from it. Although investing in infrastructure will continue to be important, investing in infrastructure alone does not necessarily translate into more people accessing safe water (Koestler *et al.*, 2010).

Ensuring that infrastructure continues to function is crucial, although few projects conduct the long-term follow up studies necessary to understand the sustainability of investments (Taylor, 2013). Approximately one in three handpumps in sub-Saharan Africa are non-functional, representing a waste of \$US1.2-1.5 billion in infrastructure investments over a 20 year period (Narkevic *et al.*, 2009). Despite these losses, construction of new infrastructure continues to be prioritised (Smits *et al.*, 2011). Sustainability, defined as the continued delivery and uptake of services, is threatened by many factors (Carter *et al.*, 1999). The issue is complex, and requires a holistic perspective to planning and implementation that goes beyond well-constructed facilities (Harvey & Reed, 2004).

The need for water service sustainability leads to consideration of the people that access and manage the operation and maintenance of services (McConville & Mihelcic, 2007). Even well-constructed infrastructure needs support from proper institutional arrangements to sustain functionality (Sara & Katz, 1997), and a shift is needed away from the focus on provision of hardware for water access (Moriarty *et al.*, 2013). In response, sustainability assessments have expanded to include both technical indicators

and indicators of how local institutions, such as waterpoint committees, are managing services (Chowns, 2014; Foster, 2013; Schweitzer & Mihelcic, 2012), and resources such as the WaterAid Sustainability Framework have highlighted how organisations working on water supply need to practically consider a broad range of factors (WaterAid, 2011).

Sustainability analysis has expanded to encompass both direct factors such as technology and financing, and indirect factors such as governance and regulatory structures (Danert & Flowers, 2012; Walters & Chinowsky, 2016). Even actors not directly providing services can influence the governance, management, and ultimately functionality of water services (Walters & Javernick-Will, 2015). The operation and maintenance of facilities involves dynamic interactions (Montgomery *et al.*, 2009) that need to be understood and strengthened in order to sustain access to safe water.

2.3 Safe Water as Service Delivery

The term ‘service delivery’ frames water access around the experience of users and the institutional relationships that make outcomes possible. Viewing water access as service delivery highlights the need for both ‘hard’ systems, such as infrastructure, and ‘soft’ systems, such as the regulatory environment (Butterworth, 2010; de la Harpe, 2011). The 2004 World Development Report focused explicitly on service delivery, arguing that weak or unclear institutional arrangements limit the effectiveness of resources invested even if the aid sector continues to provide support (World Bank, 2004). From this lens, issues including safe water access can be considered through the institutional arrangements between people, policymakers, and providers. The exact nature of these relationships can differ depending on context, but all of these stakeholders play important roles (World Bank, 2004).

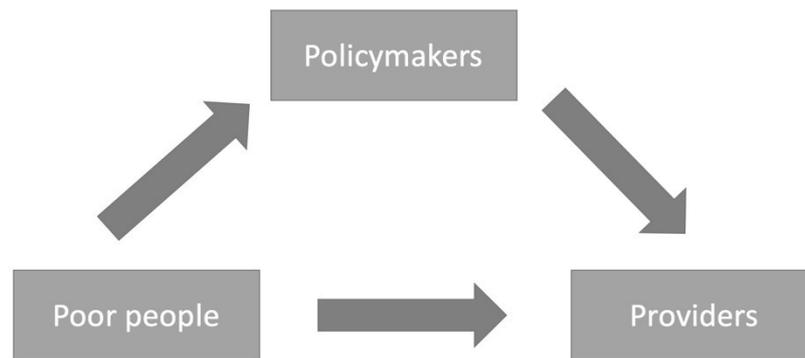


Figure 1 – The institutional arrangement central to service delivery (World Bank, 2004)

In the rural water sector, service delivery is defined as an extension of approaches beyond capital-intensive infrastructure development to consider the full life-cycle of a service, including operations, maintenance, and the learning and adaptive management that institutions responsible for these services must perform (Lockwood & Smits, 2011). A series of ‘building blocks’ describes specific components necessary for achieving and sustaining service delivery (Lockwood & Smits, 2011). These functions need to be effectively executed, even if the precise configuration of who does what differs depending on the context.

List 1 – Service Delivery Building Blocks (Lockwood & Smits, 2011)

1. Professionalisation of community management;
2. Recognition and promotion of alternative service provider options;
3. Monitoring service delivery and sustainability;
4. Harmonisation and coordination;
5. Support to service providers;
6. Capacity support to local government;
7. Learning and adaptive management;
8. Asset management;
9. Regulation of rural services and service providers; and
10. Financing to cover all life-cycle costs

As described by these building blocks, supporting service delivery involves more than the development of infrastructure, and adopting service delivery models at scale has implications for stakeholders from users up to local, national, and international institutions (Smits *et al.*, 2012). Service delivery concepts are now being used to assess

the performance of water facilities by considering user experience, performance of the service provider, and performance of the broader institutional authorities that provide support for service delivery (Bey *et al.*, 2014). Understanding these broader institutional arrangements and how they develop is therefore crucial for improving safe water service delivery.

2.4 Institutions in Service Delivery

The institutions highlighted by the service delivery building blocks, including government departments and community operator committees, are central to improving water service delivery. Problematically, however, institutions have received insufficient investment compared to infrastructure (Easter & McCann, 2010). Institutional weaknesses can exist from local through national levels within a country, affecting everything from water quality, to sustainability, to the information management systems that are necessary to improve services (Nez & Pérez-Foguet, 2010). These institutions need to be strengthened, but this is no easy task.

Institutions can be difficult to understand and engage because, unlike infrastructure, they are not ‘things’. Institutions can instead be understood as norms and policies (Williamson, 2000), and in the water sector these institutions have included specific stakeholders managing norms and policies such as community waterpoint committees and government departments (Cleaver, 2012). Government is important because it plays a larger role in shaping the environment in which services are created and accessed (OECD, 2010), and some argue that the global water crisis has resulted chiefly from failures in water governance (OECD, 2015; UNDP, 2004). Despite consensus on the importance of institutions in water supply, understanding what these institutions are, what they ‘should’ be, and how to support processes of change remains challenging.

A growing body of research and tools are attempting to respond to the need. Political Economy Analysis (PEA) is one such body of work being adapted to the water sector that, broadly speaking, uses interdisciplinary understanding of underlying causes of poor governance to inform change management initiatives in institutions. Interest in PEA across development organisations has become widespread even if the precise definitions and applications differ (Harris, 2013). This group of approaches recognises the distribution of power and wealth in political and economic processes, and uses this understanding to diagnose opportunities and barriers to change (Collinson, 2003;

Edelmann, 2009). Others have also sought to consider how aid might be used to address governance constraints that undermine service delivery (Tavakoli *et al.*, 2013).

Growing interest in PEA suggests its possible value, but the effectiveness of these tools depends partly on implicit assumptions about how change in institutions happens. Some approaches are designed for use by specific aid organisations intending to design and execute programme strategies (ODI, 2009). Assumptions about who is using a tool informs which analysis is relevant, but these assumptions may conflict with realities of how institutional change happens in practice. Implicit assumptions about how change happens might bias the type of analysis used by an organisation (McNicholl & Cruickshank, 2015). As the next section will explore, institutional change is a complex process that is not easily designed, planned, and implemented as an engineering project might be.

2.5 Theories of Institutional Change

Managing water is inherently political (Mollinga, 2008), and institutions exist within a context of power dynamics and broader institutional dynamics that influences how change happens (Plummer & Slaymaker, 2007; Stein *et al.*, 2006). In short, international development exists in a complex environment (Ramalingam, 2013). It is therefore unlikely that ideal institutional designs can be known (Merrey & Cook, 2012), and even rigorously designed strategies are unlikely to be realised as intended (Mintzberg, 1987).

A prevailing belief has been that implementation of blueprint designs can solve complex governance problems with a small set of simple models. These simplified blueprints for institutional reform have a history of failure (Andrews, 2013; Ostrom *et al.*, 2007), and the tendency to apply engineering metaphors and approaches rarely leads to institutional change (Merrey *et al.*, 2007). Furthermore, implementation of idealised designs can result in institutions adopting superficial outputs without achieving the desired outcome in order to appease donor organisations (Andrews *et al.*, 2012). There is a need to study and support institutional development from a diagnostic perspective rather than a prescriptive one (Ostrom *et al.*, 2007). A non-prescriptive approach might identify solutions that are ‘good enough’ for the desired outcome by supporting what is working instead of trying to implement an ideal institutional design (Grindle, 2004).

Instead, some argue that institutions evolve through complex processes of adoption and adaptation of practice that has stronger parallels with an organic creative approach than implementation of detailed design (Merrey & Cook, 2012). Cleaver (2012) offers the concept of *bricolage* whereby institutional change is described as a patchwork process of innovation, adaptation, and legitimisation. Change might therefore be effectively supported by supporting institutions to develop their own rules and ways of working through experimentation and learning (Ostrom, 2014).

Academic theory further supports the view of multiple pathways for institutional change, including evolution. Dorado (2005) proposes three profiles of how institutional change happens. The different profiles are characterised by different approaches to resource mobilisation, the agency of participating stakeholders, and the opportunities present in the system. Logically testing combinations of these different aspects combines to produce the three profiles: entrepreneurship, partaking, and convening (Dorado, 2005).

Entrepreneurship is perhaps the closest description to the strategic implementation of a blueprint design. This profile describes an organisation, acting strategically towards a long-term change, taking advantage of an opportunity that others may not see or be able to exploit. This strategic behaviour can initiate change, and eventually attract further resources for support when other actors in the space observe benefits (Dorado, 2005).

Contrasted with such strategic behaviour is the *partaking* profile, which can be colloquially described as ‘business as usual’. Non-strategic stakeholders working on routine and near-term tasks through minor adjustments eventually and incrementally change the status quo over time (Dorado, 2005).

The *conveners* change profile offers a third possibility. In this, stakeholders behave strategically and collectively, pooling resources to condition the space for collaboration prior to targeting a specific reform. The approach retains a long-term vision without necessarily knowing the eventual results of the process at the outset (Dorado, 2005).

These profiles are not judgments on a preferred method; they are simply alternatives. Importantly, they challenge the idea that a single actor behaving strategically is the primary possibility for creating institutional change. The partaking and conveners change profiles in particular support the idea of institutional evolution, and suggest that change might be supported by nurturing the environment that supports institutional evolution. For example, given that processes of social learning can support

improvements in water management (Pahl-Wostl *et al.*, 2007), perhaps intentionally strengthening relationships around institutions might support the evolutionary process of development.

Uptake of alternative approaches to institutional development will, however, be limited by the accessibility of these concepts for practitioners. There is a need to interpret complexity through means understood by a variety of stakeholders including policy-makers, NGOs, donors, and others involved in programmes that influence how services are managed (Hall *et al.*, 2013). Analysis that emphasises complexity can be difficult for policy-makers to access (Frances Cleaver & De Koning, 2015). New research has attempted to expand Political Economy Analysis to understand broader factors influencing service delivery (Jones, 2015), but it is unclear how effective such analysis is for making complex stakeholder relationships more accessible to non-academic audiences. There remains a pressing need for approaches that can rigorously account for the complex relationships surrounding institutions while still providing practical insight for policy-makers, and presently available methods do not sufficiently address this gap (Whaley & Cleaver, 2017).

2.6 Potential for Social Network Analysis

Social Network Analysis, with its emphasis on relationships between actors, holds potential for providing rigorous yet practical understanding of relationships that support institutional development in water sectors. Its potentially unique value is the ability to visualise and even quantitatively analyse complex social relationships. Network visuals might help make understanding of stakeholder interactions accessible to busy practitioners, and the quantitative aspect of networks might provide rich grounds for academic inquiry into the otherwise qualitative influences on institutions.

The study of social networks has an established history of quantitatively studying the otherwise qualitative phenomenon of social relationships (Scott, 2013). Studying the breadth of relationships that an actor has can sometimes provide surprising insights, such as the effect that relatively weak network ties can have on outcomes (Granovetter, 1973). These applications could logically be extended to understand influences on institutional development as well.

Considering the networked relationships of stakeholders and institutions is itself not new. Development work is embedded in networks of actors (Bebbington & Kothari, 2006), and networks have been used conceptually to understand influences on

organisational development in Africa (Romo & Anheier, 1996). Networks have also been used to consider where particular stakeholders participate in broader network structures and might be providing valuable horizontal and vertical linkages between stakeholders that can influence policy development (Brown, 1991).

Network analysis has further been considered in natural resources sectors (Bodin *et al.*, 2006), and emerging research is also beginning to consider the potential of social network analysis in a WASH context specifically, although the precise applications differ. A study of networks managing water scarcity in Mexico examined how water management is socially embedded in networks that are fragmented by local jurisdictions (Navarro-Navarro *et al.*, 2017). Network mapping methods have also been used to consider linkages across the water-energy-food nexus in Ethiopia, and to study water governance in Tanzania (Stein *et al.*, 2011, 2014). These examples suggest that social network analysis might have applicability for understanding relationships in water sectors, even though existing research has yet to focus specifically on environments that support institutional development.

This research therefore proposes to formally explore the potential of social network analysis for identifying influences that can support institutional development in rural water supply. The visual and quantitative components in particular might help to analyse complexity of stakeholder interactions in a rigorous yet accessible way to identify characteristics of environments that support institutional development in a diagnostic rather than prescriptive way. Identifying and facilitating the development of supportive stakeholder relationship environments might then help to support processes of institutional evolution that have pertinent application to challenges currently faced in rural water supply.

3 AIMS, OBJECTIVES, AND SCOPE

Identifying environments that support institutional development for water service delivery will be a crucial part of achieving the Sustainable Development Goal for water. This necessity inspires the research aims, objectives, and scope that are defined in this chapter. The intent is to explore how the variety of stakeholders and their interactions in a water sector combine to create favourable conditions for institutional development through rigorous analysis that can still provide practical insights for practitioners. If successful, a stronger understanding of influences supporting institutional development has significant potential to help achieve the Sustainable Development Goal for water.

This chapter expands on this research intent and how it translates into specific questions and case studies for investigation. It is meant to equally clarify what is included and what is excluded from the research, and the reasons for the chosen scope. This chapter also presents the case studies that have been selected for this research. A total of five countries are included. Each one is described with some background on its rural water sector and justification for its inclusion in this study.

3.1 Research Aim

The research aim describes the overall intent of the work as informed by the gap in existing research (Section 2.6). The aim of the research is:

“to characterise stakeholder relationships that support institutions managing rural water service delivery to improve performance.”

A few clarifications help to define specific terms and the type of findings that are expected:

A **stakeholder** is any organisation, department, or group of individuals that have a vested interest in the rural water service delivery sector. These stakeholders influence or are influenced by decisions in the sector (Hemmati *et al.*, 2002). Stakeholders include, but are not limited to: non-governmental organisations; government departments; private companies; water system operators; bi-lateral or multi-lateral organisations; and civil stakeholders such as communities or water users.

Institutions in this research are government departments or community operator committees. This definition is in line with other writing on waterpoint committees and government departments as institutions in water sectors (Cleaver, 2012). These institutions have permanent and formally recognised roles in the management of rural water services, either directly or indirectly.

Managing rural water service delivery describes involvement with some aspect of service delivery – not necessarily direct provision of water. This language is included to accommodate governments as well as water system operators. Governments do not necessarily operate systems, but nevertheless play important roles in regulating and supporting water supply efforts in their jurisdictions (Lockwood & Smits, 2011). Studying stakeholder environments that support the development of government institutions is relevant to improving water services, and is therefore included in this research.

The term **improve performance** is a relative one. There is no single criterion that applies equally to all institutions in all countries because of their different contexts and roles. Performance improvement is therefore directly related to the specific functions of an institution in its role to support rural water service delivery. Whatever those roles are, a suitable case study institution must show some improvement in these functions in the recent past. The common thread between different case studies is therefore not a specific type of change in institutional performance in a specific role, but rather the fact that improvements relevant to its role have been documented in the 3-5 years prior to fieldwork.

Overall, this research aims to explore the potential utility of social network analysis for understanding environments of stakeholder relationships that support institutional development in rural water supply. The research is therefore exploratory in nature and

does not test specific hypotheses. The intent is instead to understand how adaptations of established social science methods and analysis can provide useful insights into influences on institutional development by allowing findings to emerge from studying cases of institutional development in a variety of contexts.

3.2 Objectives

Objectives are the specific research questions that will be answered in the course of the study in service of the broader research intent. The research questions are:

1. What are common characteristics of stakeholder networks around specific institutions relevant to rural water supply that are improving performance?
2. Which network characteristics are perceived by stakeholders in these networks as important for supporting institutional development?

The first question is important because it specifically explores how social network analysis can be used to understand stakeholder interactions around cases of institutional development in the rural water sector. Identifying common characteristics in cases of success might describe network characteristics to look for in future research. The second question is important because simply observing differences in network structures might not identify significant factors. Social networks are dynamic interactions and need qualitative interpretation by those experiencing them in order to identify causal factors.

Asking both research questions is expected to identify characteristics of stakeholder relationships that are both observable from a network perspective and perceived as important for institutional development by those participating in these networks. The perceived importance of network interactions helps to qualify their significance. The expected result is a set of stakeholder network characteristics linked to cases of institutional development for rural water service delivery in a variety of contexts.

3.3 Scope

Appropriate scoping must allow the project to be a manageable doctoral study while still answering the research questions. The scope is designed to be ambitious, yet achievable in a three-year period undertaken by a single researcher. It is therefore important to clarify both what is within the research scope, and what is outside of it.

Studying different countries and institution types broadens the potential applicability of the research, and it is desirable to answer the research questions as generally as possible. Broadening the scope to include case studies in Africa, Asia, and South America helps to investigate network characteristics that exist in different contexts to identify common properties. Case studies are therefore selected from different continents and types of institution to offer diverse perspectives on stakeholder network interactions.

Another scope consideration is the decision to focus on rural water supply specifically instead of the broader WASH sector. This scoping decision is purely practical. As a sub-set of the WASH sector, the rural water sector is expected to include fewer stakeholders. Rural water supply is assumed to be a manageable scope for this project that maintains the integrity of investigating questions relevant to the broader WASH sector.

3.3.1 Case Study Selection

Specific institutions that are improving performance are the focus of this research. Their performance improvements indicate that they are growing in capacity, and are therefore examples of institutional development. Appropriate case studies are identified through existing documentation of performance improvements provided either by these institutions directly or by a third party monitor. Accessing existing performance records is important because this requires longitudinal evidence that could not be collected by the researcher in addition to doing research for this study. These records show where a specific institution has been developing in the recent past, and such cases are the focal point for research.

Suitable case studies of developing institutions were identified by soliciting feedback from WASH professionals internationally. Contacts were provided with information on the research background, aims, and criteria for suitable cases of institutional development. Their recommendations were then vetted for alignment with research aims and objectives, as well as practical considerations of what could be achieved through field work by a single doctoral candidate.

Two criteria were used to identify case studies. A suitable case study of institutional development must:

1. **Have a permanent mandate in rural water supply** – Institutions studied must have a permanent and formally recognised role in water service delivery. The

roles can be either direct or indirect. Community operator committees provide direct services because they manage the provision of safe water. Indirect relationships describe entities like government authorities that regulate and support direct service providers, but do not necessarily manage services themselves.

2. **Be improving in its role** – Suitable institutions must have demonstrated improvement in performance of their respective roles in the past 3-5 years. The specific type of performance depends on what is appropriate for that institution. What matters is that improvement has been documented, and that it is relevant for the types of functions that the institution performs in service of rural water supply. Documentation can be provided either directly by the institution or by a third-party monitor. The temporal element is also important for identifying institutions demonstrating positive change rather than simply consistent high performance. Institutions that are improving performance provide an opportunity to investigate the relationships that might be supporting this process of change.

These conditions for suitable case studies were then shared with an international network of WASH professionals to get feedback on the research design, and to identify suitable case studies. All case studies included in this research were selected through the recommendation of knowledgeable practitioners in the sector.

3.4 Study Limitations

Limitations identified at the research outset influenced decisions on what is deliberately outside the research scope for both practical and theoretical reasons. These limitations are presented to clarify expectations of what this research will and will not do, and how these limitations have affected the chosen scope. The four main limitations are data availability, contextual differences, the timeframe for data collection, and the myriad cases of institutional development that exist globally.

3.4.1 Data Availability

An important scoping choice was the decision to focus on institutional development instead of larger changes in service delivery. This decision was informed by consultation with professionals in the WASH sector including the Overseas Development Institute (ODI), which has done extensive ethnographic research to determine levels of service delivery, and Aguaconsult and the International Water and

Sanitation Centre (IRC). Both of these organisations have played formative roles in the development of service delivery concepts in the water sector. Ideally, it would be preferred to identify a region that has significantly improved levels of service delivery, and to study the overall network characteristics that have supported the improvement. This scope, however, is too big.

Even longitudinal data on performance of institutions in rural water supply can be relatively difficult to find. Project activities are commonly documented, however, because these are often part of project deliverables for governments, NGOs, and the private sector alike. Recognition of the need to collect data indicators of services, including institutions, is gaining international attention, but is not standard practice. Larger sources of data, such as the WHO/UNICEF Joint Monitoring Programme, provide aggregate estimates of water access and do not provide the required data to inform case study selection. Documentation on institutional performance exists in some cases, however, because it provides middle ground between service delivery indicators and infrastructure implementation data. The implication is that cases of institutional development can be identified, but these rely on records provided by organisations working directly with these institutions. Case studies are therefore primarily informed by the availability of data on cases of institutional development that were made accessible to the researcher.

3.4.2 Contextual Differences

Controlling for contextual variables is difficult when studying institutional development. This is particularly true at higher levels of sector hierarchy, such as national level, where specific institutions might not have an immediate equivalent within the country. For example, a government ministry responsible for rural water services cannot readily be compared to an equivalent ministry in another country. Even within the same country, different geographical areas may have sufficiently different contexts to necessitate different interactions around otherwise similar institutions. Comparative analysis is therefore not emphasised in this research because of the challenges of controlling for contextual differences across different case studies.

These practical limitations contributed to the decision to characterise relationships around institutions that are developing without relying on comparative analysis to draw conclusions. Data on institutions that are declining in performance were collected where possible, but these cases are the minority, and only emerged as potential opportunities

during fieldwork. Consequently, only a few instances from India and Bolivia are available for comparative analysis in this research, and findings from these cases are considered for interest, but are not the basis of final conclusions. Overall, the research focuses on understanding characteristics of stakeholder networks around institutions that are developing, and the significance of these characteristics is qualified through commentary from the stakeholders experiencing these networks.

3.4.3 Timeframe for Data Collection

The research design is required to fit within a three-year timeframe, which therefore limits the ability to monitor institutional change over time. For this reason, the chosen methods rely on ‘snapshots’ of stakeholder networks instead of longitudinal studies. This trade-off allows the inclusion of multiple case studies from different contexts at the expense of greater depth in fewer locations. The ‘snapshot’ approach is deemed acceptable because participating stakeholders can refer to how their networks have existed over time, and further qualify how networks are experienced or changing through verbal commentary. Future research, however, perhaps with more time and resources, might consider formally establishing longitudinal studies to investigate how networks change over time.

3.4.4 Myriad Cases of Institutional Development

The research scope does not cover all documented cases of institutional development, and findings are therefore not intended to be a prescriptive or comprehensive definition of how institutional development should work. No reader should interpret findings in any of the case studies as presenting one correct way to approach the issue of institutional development for water service delivery. This research aspires to broaden the applicability of findings by drawing on multiple case studies, but this is not intended to produce a fully generalisable recommendation for all cases. Instead, findings from the research are intended to characterise what to look for in networks around institutions from a diagnostic perspective, and all findings should be critically considered in light of each specific context.

Furthermore, this research does not prefer one model of service delivery over others. Many different combinations of technologies, financing, and institutional structures can work, depending on the context. Rather than being prescriptive, this research tries to understand environments of stakeholder relationships that support processes of institutional improvement in different contexts. Understanding enabling environments

may be more generalisable than prescriptions for creating specific types of change because enabling environments may be more adaptive to handling different types of contextually specific problems by using a common process.

3.5 Specific Case Studies

This research includes case studies of institutional development in five different countries: Ghana, Malawi, India, Tajikistan, and Bolivia. All were identified through consultation with WASH professionals who recommended suitable case studies. These case study locations are chosen to represent a diversity of contexts, based on available data on institutional development, while still being manageable within the scope of a three-year research project. Bangladesh was also included as a potential case study location, but had to be dropped due to security issues. Bangladesh was still visited during the course of research, but the number of interviews conducted was not sufficient to construct a full case study. The Bangladeshi interview is instead considered in the methods section to discuss the implications of alternative methods for data collection, and the impact these might have on potential findings (Section 4.6.2). This section presents the rationale for including the other five countries as case study locations.

The institutions studied are district governments, a national government, and community operator committees. Each one has a permanent role in the rural water sector that is formally recognised. Unlike international organisations that might play temporary roles to develop infrastructure, these institutions play clear roles that are critical to the long-term success of safe water access.

3.5.1 Ghana

Instances of institutional improvement have been recently documented in certain Ghanaian districts. The country was selected as a pilot country for the Sustainable Services at Scale (Triple-S) initiative, which ran from 2009 to 2014. This initiative, led by IRC and funded by the Bill and Melinda Gates Foundation, supported improvements in rural water supply service delivery through learning and piloting new approaches for service delivery (IRC, 2010). Their initiative and associated monitoring provided the basis for selecting Ghana as a case study.

3.5.1.1 Ghana Rural Water Access

Ghana has made a marked improvement in water access coverage over the past 15 years, and these gains have propelled access statistics to 84% coverage as measured in

the 2008 Demographic Health Survey (IRC & Aguaconsult, 2011). This progress includes tangible benefits beyond coverage statistics. In the late 1980s Ghana was ranked second globally for cases of guinea worm disease, a waterborne parasite that grows inside of humans, and eventually emerges from painful skin sores. International efforts responded with efficacy, and the World Health Organisation declared guinea worm eradicated from Ghana in 2015 (The Carter Center, 2015).

Despite a government pledge to deliver universal water access by 2025 (Daily Graphic, 2014), sustainability challenges with existing infrastructure may undermine progress towards this target. Infrastructure does not provide access when broken, and functionality figures are not officially measured nationwide. Sustainability is regarded as a critical challenge in Ghana, and there is broad interest in improving services.

The Triple-S initiative responded to this challenge. It has highlighted the need for government to play a lead role in coordinating and harmonising efforts towards a strong service delivery model because of the importance of the institutional structure behind service delivery that can provide and sustain access (IRC & Aguaconsult, 2011).

3.5.1.2 Selected Districts

The two districts from the Triple-S initiative selected as case studies represent different regions, cultures, and distances from the capital. The districts are briefly described here, and henceforth anonymised. Anonymous representation is important for adhering to the ethical expectations set with all participants interviewed (Section 4.2), and is further important for focusing on networks as social structures that can be characterised more generally than relationships between specific stakeholders.

Monitoring of service delivery authorities in these districts was conducted during the Triple-S initiative from 2012-2014, and monitoring data have been generously provided by the managing organisation, The International Water and Sanitation Centre (IRC). These indicators assess the performance of local governments in their roles as institutions for managing aspects of rural water service delivery in their jurisdictions. Each district was assessed annually on six indicators (IRC, 2011):

1. There is a well-resourced District Water and Sanitation Team (DWST), consisting of 3 well qualified and experienced staff members, receiving the needed support by the Regional Government Community Water and Sanitation Agency, and District Assemblies;
2. There are efficient monitoring and data flows;

3. District Water and Sanitation Plan (DWSP) is incorporated into medium term development plans and budget of the assembly, which is used to guide implementation;
4. DWST monitors Operation & Maintenance of water facilities in terms of financial, technical and administrative performance, including periodic audits, and provides support where needed;
5. By-laws for the Water and Sanitation Committees and Water and Sanitation Development Boards exist and are enforced effectively; and
6. NGOs and CSOs providing water facilities do so in coordination with the District Assemblies.

3.5.1.2.1 East Gonja

East Gonja District, located in Ghana's Northern Region is home to approximately 200,000 people (Government of Ghana, 2006). Most of the population are rural, and agriculture is the chief economic activity (Adank *et al.*, 2013). Salaga is district capital.

Table 1 presents the summary of indicators measured by the Triple-S project. Values for the different government functions are scored on a binary scale of present (1) or absent (0). These indicate a performance improvement in the years leading up to the time of research.

Table 1 - East Gonja service delivery indicators over time

Indicator	2012	2014
Presence of service authority	1	1
DWSP	1	1
Budget allocation and utilisation	ND	1
By-laws	0	0
Coordination of NGOs	0	1
Monitoring and data flows	1	1
Total	3	5

(0 = absent; 1 = present; ND = no data)

3.5.1.2.2 Akatsi

Akatsi District, located in Ghana's Volta Region, technically split into two districts midway through the Triple-S initiative. The project continued assessing both. This research focused on where the main district office resided previously: now Akatsi South. This section of the former district includes the district capital of the same name, Akatsi. Table 2 presents the same indicators used to measure district government performance under the Triple-S project. These also show an improvement over the project period in terms of specific government functions related to rural water service delivery.

Table 2 – Akatsi service delivery indicators over time

Indicator	2012	2014
Presence of service authority	1	1
DWSP	1	1
Budget allocation and utilisation	1	1
By-laws	0	1
Coordination of NGOs	ND	1
Monitoring and data flows	1	0
Total	4	5

(0 = absent; 1 = present; ND = no data)

3.5.2 Malawi

Institutions studied in Malawi are also district governments. Two districts were identified in Malawi where performance improvements have been documented. The two districts were identified with the assistance of organisations working with these district governments that have generously provided documentation from their evaluations.

3.5.2.1 Malawi Rural Water Access

Rural water access is particularly important in Malawi because the majority of the population is rural. Figures from the national Sector Performance Report and the international Joint Monitoring Programme indicate that Malawi achieved the Millennium Development Goal for water access (Government of Malawi, 2014). Rural

water access in particular has shown a large increase in access since 1990 (WHO/UNICEF JMP, 2015a).

Gains remain uncertain, however, because of sustainability issues. Malawi's small economy and limited government revenue creates incentive for international donors to continue financing new infrastructure, but government investment in operational expenses and human resources is perceived as disproportionately low when compared to other sectors (Ng'ambi, 2013). Sustaining access gains will require tackling sustainability issues, and developing the local institutions that manage these services.

3.5.2.2 Selected Districts

The two districts represent different geographies, tribes, and networks of stakeholders they engage with. Each district is described briefly here, and henceforth referred to anonymously.

3.5.2.2.1 *Mangochi*

Mangochi is in Malawi's Southern Region, and forms the lower end of Lake Malawi. The national census from 2008 estimated the population at nearly 800,000 and this figure may be approaching 1,000,000 at the time of writing (Mkamanga, 2014). The majority of this population is rural. The local economy is largely agricultural, combined with fishing in Lake Malawi and other water sources.

Mangochi District is the sole focus area for the Icelandic International Development Agency (ICEIDA). The ICEIDA programme focuses on health, education, and WASH sectors through a multi-year programme that began in 2012. This programme is based on a tripartite agreement between ICEIDA, Mangochi District Council, and the Ministry of Local Government and Rural Development that prioritises working through government systems with minimal direct implementation by ICEIDA (Mkamanga, 2014).

The successful management of this programme by Mangochi District Council, particularly in the WASH sector, demonstrates a growing level of capability. This is evident from the influx of resources and responsibilities being managed since 2012 (Table 3), and by comparing against parallel programmes in health and education (Table 4) (Mkamanga, 2014).

Table 3 - Mangochi District council WASH output expenditure

Outputs	Budgeted Funds Expenditure up to June 2014 (USD)	Funds Expenditure up to June 2014 (USD)	% Funds Utilised
At least 150 new boreholes constructed	\$218,039.97	\$217,430.93	99.7%
At least 100 protected shallow wells constructed	\$54,551.81	\$55,735.35	102.2%
At least 100 defunct boreholes rehabilitated	\$71,663.11	\$71,384.95	99.6%
At least 350 water point management committees trained in community based management in TA Chimwala	\$22,610.84	\$22,512.67	99.6%
At least 80% of households in TA Chimwala construct and use improved pit latrines and hand wash facilities	\$15,360.54	\$14,396.98	93.7%
System strengthening for WASH service delivery	\$139,506.53	\$137,888.49	98.8%
Environmental aspects around water points and in relation to sanitation activities have been examined and addressed	\$8,470.20	\$8,764.72	103.5%
Total	\$530,203.00	\$528,114.08	99.6%

Table 4 – Mangochi District Council programme expenditure by sector

Programme	Budgeted Funds up to June 2014 (USD)	Expenditure up to June 2014 (USD)	% Funds Utilised
Education	\$966,100.96	\$637,484.95	66.0%
Health	\$2,390,191.31	\$1,622,249.99	67.9%
WASH	\$530,203.00	\$528,114.08	99.6%
Total	\$3,886,495.27	\$2,787,849.01	71.7%

The successful uptake of the WASH programme provides evidence contrary to the widely held belief amongst donors in the Malawi WASH sector that Districts do not have capacity. The experience of the ICEIDA programme suggests otherwise; that Districts can develop their management capacities when given the opportunity, which in this case includes direct both infrastructure development and supporting community management committees in WASH service delivery. The programme evaluation report finds no major issues with financial reporting, and considers Mangochi District Council to be demonstrating a growing level of capacity in its service delivery roles (Mkamanga, 2014).

3.5.2.2.2 Rumphi

The second case study district was identified by a different organisation. WaterAid Malawi (WAMA) has a strong policy and advocacy programme that has focused on building local government capacity for WASH service delivery over the past decade. As a larger International NGO, WaterAid actively engages approximately one third of districts in Malawi through its programmes.

The results are mixed. One district, however, was highlighted by WAMA as an excellent example of a local government strengthening its role as a service authority. Unlike ICEIDA, WAMA’s engagement with Rumphi District Council does not focus on large financial flows for service implementation, but instead focuses on facilitating dialogue and citizens’ engagement to strengthen service delivery arrangements. WaterAid Malawi has generously provided their evaluation reports on their work with Rumphi District Council, which form the basis of its inclusion as a case study institution.

Situated in Northern Malawi, Rumphi is a geographically diverse district that ranges from 400m in elevation along the northern shore of Lake Malawi, to the highlands of the Nyika Plateau National Park at 2400m. Rumphi is culturally important, being home to the seat of the Paramount Chief of the Tumbuka tribe. In terms of water access, as of 2010, only 45% of its approximately 175,000 people were estimated to have access to improved drinking water sources (Rumphi District Council, 2010).

The WaterAid Sector Policy and Governance Project ran from 2013 to December 2015, and builds on a history of WaterAid as a leader in policy and advocacy work in Malawi's WASH sector. Rumphi is one of their six target districts, and a mid-term evaluation from June 2015 showcased Rumphi as a success. Targets relevant to Rumphi's assessment are extracted from this report and summarised in Table 5 (Papermate Consulting, 2015).

Table 5 – Rumphi District Council performance as a service delivery authority (Papermate Consulting, 2015)

Indicator	Meeting Target?	Details
Water points mapping database updated	Yes	Reported as up to date by Rumphi District Council
District Sector Investment Plans (DSIPs) reviewed and progress report informing the MDG report	Yes	Secured support from an NGO to update the DSIP, although additional funding will be required to print it.
Allocation of 60% of district WASH funds informed by DSIPs	No, but DSIP is used to guide investments and adhere to locally developed priorities.	Rumphi District Council rejected support from an NGO whose activities did not align with investment priorities. However, there is overall insufficient funding to reach the 60% mark.
District Learning Forums	Yes	Open days and exchange visits are improving interactions between the District Council and communities.
Four coordination meetings take place annually	Yes	Rumphi District Council holds quarterly meetings, bi-annual meetings, and additional meetings as necessary.
80% of funds for District quarterly meetings raised within the Districts	Yes	Only Rumphi District Council indicated it can raise funds to continue meeting after this project ends.
Project districts allocate funds for WASH activities through the Local Development Fund	Yes	There is evidence that some LDF funds are being used in Rumphi for the provision of WASH services.

These indicators show that Rumphi District Council has increased activity in its role as a service authority since the beginning of the measurement period when it was not performing these functions. The local government is improving performance, and this success has not gone unnoticed by other stakeholders. Rumphi was mentioned to the researcher by others in the sector as a good example worth studying, and, as further mentioned in the mid-term report, there are indications that the Rumphi's effectiveness influenced the decision for the African Development Bank to plan their next project phase to include the district. Other District Councils are now becoming interested in learning best practices from Rumphi (Papermate Consulting, 2015).

3.5.3 West Bengal, India

Arsenic is a naturally occurring groundwater toxin in West Bengal, India. Community operator committees managing arsenic filtration systems are responding to the issue, and have been doing so in some cases for over a decade (Sarkar *et al.*, 2010). Some of these operators are continuing to improve performance in their operations by increasing revenue, upgrading facilities, and increasing their customer base. These community operator committees make suitable case studies for understanding networks of service operators that directly interact with consumers.

3.5.3.1 Arsenic in West Bengal

The state of West Bengal covers a region of the country that is sometimes referred to as India's 'arsenic belt'. The arsenic naturally occurs in aquifers here, posing an additional challenge to providing safe drinking water. The issue became increasingly recognised in the late 1990s, and influenced the development of technologies and infrastructure development programmes to respond to the arsenic challenge (Sarkar *et al.*, 2010). Established technologies are capable of filtering arsenic from water using a cation exchange process, but issues of sustainability remain particularly important because filter media degrades over time (German *et al.*, 2014). Water quality must be consistently tested and the filters replenished periodically for the infrastructure to continue functioning. This makes the performance of the operators managing these facilities particularly important.

Figure 2 illustrates the scale of arsenic groundwater contamination in the southern part of West Bengal where this research focused. The maximum safe level of arsenic concentration in drinking water is set in India at 0.05 mg/L, and the World Health Organization standard is 0.01 mg/L.

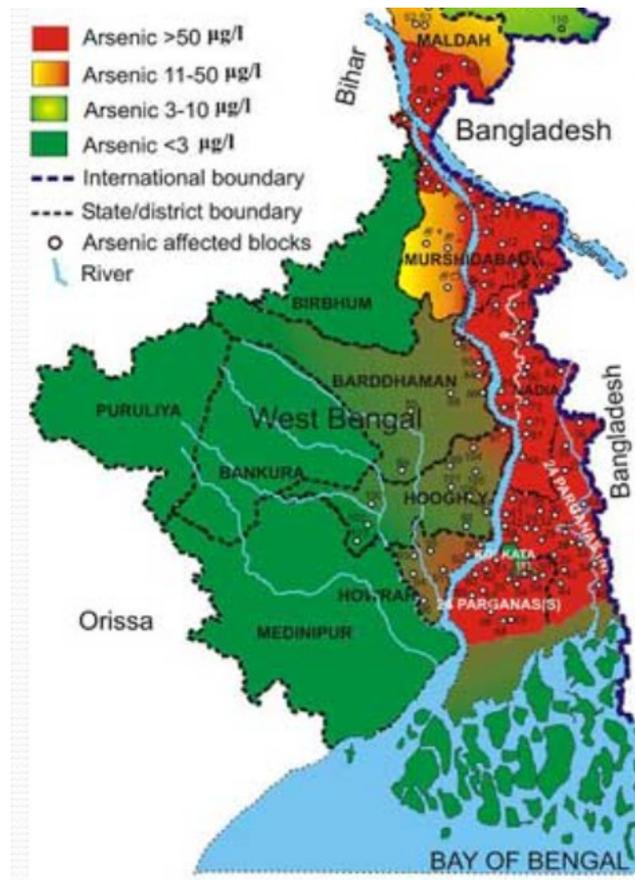


Figure 2 – Presence of naturally occurring aquifer arsenic in the southern part of West Bengal (Society for Technology with a Human Face, 2016)

3.5.3.2 Arsenic Filtration

All operator committees studied were using one of two technologies for removing arsenic from groundwater. The two technologies are the Amal filters and the Drinkwell system, both of which use cation exchange to filter arsenic from the water. These filter media differ depending on the manufacturer, but a similar process is used to pump raw groundwater through resin filter media. Other purification steps can be added to this process such as filtration for iron content, removal of particulates, and ultraviolet treatment to treat contamination from microorganisms.



Figure 3 – Filtration unit at a case study location in West Bengal. Groundwater is pumped from left to right through the three tanks that filter arsenic, iron, and other particulates, respectively. The small unit to the right performs ultraviolet treatment. (photo: D. McNicholl)

Groundwater is pumped through these filtration systems and stored in tanks on site. Customers then come to collect water in person at specific times, or pay an additional fee to have water delivered to them by rickshaw. Payment for these services is typically charged monthly. Through this technology and operational structure, these community operators are able to provide safe drinking water to local households at an affordable price.

3.5.3.3 Selected Locations

Operator committees studied were recommended by local non-governmental organisations Technology with a Human Face (THF) and SATHEE with additional support from the Indian Institute of Engineering, Science, and Technology at Shibpur (IEST). Members of these organisations have extensive experience with arsenic removal sites in West Bengal and were able to identify sites most suitable for the research. Records that they collect directly from the community operator committees provide the basis for identifying performance improvements of these local operators in the recent past.

Furthermore, these partner organisations were able to identify operators within the same geographic area that had either failed or were declining in performance. This allows for some comparative analysis between successful and less successful instances of these

local institutions. Although not the original focus of the research, the opportunity to capture some comparative data was considered to be worthwhile during fieldwork. Some comparative analysis is possible in West Bengal because these communities reside in the same geographical area and are similar in many respects. Such comparison was not possible in the same way in Ghana and Malawi because too many differences existed between each of the case study locations, but West Bengal offered better opportunities for control cases.

All sites visited were in the 24 North Parganas district near the city of Kolkata. The case study institutions are the operators of arsenic removal facilities and the community committees that manage these. A total of fifteen operators were selected after consultation with the partner organisations supporting the research. The presence of some operators that were declining in performance provided the opportunity to capture data on operators demonstrating different levels of performance. Eleven community operator committees were improving performance by serving more customers, and a twelfth had been losing customers until it had recently turned its performance around to raise funds, regenerate filter media, and reaffirm community trust in the facility (Table 6). The other three facilities are either declining in performance, or have ceased operations (Table 7). These three declining or failed community operator committees are later used to consider how comparative analysis might be done from a network perspective (Section 7.1).

Performance measurements were defined by change in the number of facility users and change in facility revenues. These records are kept by the facilities themselves. Data on facility operations is later compiled by the organisations working with these communities, and it was through them that these data were obtained.

Table 6 – Performance records of community arsenic filter operators that are improving (IEST, shared records, 3 March 2016; THF, shared records, 2 February 2016)

Site Name	Start Date	Number of Users	Change in Number of Users in Past 24 Months	Change in Available Funds in Past 24 Months (INR)	Date Filter Media was last Regenerated
Nabayan Sanstha Amal Jal Samity	12/2006	170	from 150-170	+7000	Jan-2012
Sri Rama Krishna School	06/2005	200	from 170-200	-	Oct-2015
Ichapur Amal Jal Samity	01/2002	50	from 6-50	+19000	Apr-2015
Laxmipur Hindu Milon Mondir Amal Jal Samity	05/2000	80	from 50-80	+5000	Aug-2015
Binimaypara	2005	250	+25	+1000	Dec-2014
Shakti Sadhana Club	2009	700	+42	+1680	Feb-2015
Jaygachi Amal Jal Samity	6/2005	700	from 500-700	spent 322000 INR to upgrade facility	Aug-15
Dahalthuba Amal Jal Samity	01/2005	275	from 200-275	+50000	Sep-2014
United Amal Jal Samity	03/2008	203	from 180-203	+10000	Mar-2016
Kayadanga Amal Jal Samity	01/2012	331	from 290-331	+100000	Feb-2014
Nabarum Sangha	07/2004	600	from 500-600	+50000	Feb-2015
Jaygachi Janapriya	04/2014	290	from 360-290	+35000	Jun-2016

Table 7 - Performance records of community arsenic filter operators that are declining in service or have failed (IEST, shared records, 3 March 2016; THF, shared records, 2 February 2016)

Site Name	Start Date	Number of Users	Change in Number of Users in Past 24 Months	Change in Available Funds in Past 24 Months	Date Filter Media was last Regenerated
Narikela Amal Jal Samity	03/2006	closed			
Kachuabagpra	12/2014	closed			
Muktisangha Amal Jal Samity	02/2016	56	170-56	+6000	Nov-2011

Many operators exist in the same district, and differences in their performance provides an opportunity for some comparative analysis. Their similar geographies and roles minimises contextual differences, but some operators are improving performance whereas others are declining have failed (Table 7). These lower performers are also studied to consider how differences in network characteristics might relate to differences in performance (Section 7.1).

3.5.4 Tajikistan

Case studies so far have focused on district governments and local operators. The missing level of sector hierarchy is national institutions. These include powerful authorities such as ministries, and other national regulatory institutions. They may not interact with the operations of water services as directly as local operators, but their role as authorities can shape the policy and operations of services throughout a country. Tajikistan was included to provide perspective on how change happens in national institutions.

3.5.4.1 Rural Water Access in Tajikistan

Tajikistan is a small country in central Asia bordered by Afghanistan, Uzbekistan, Kyrgyzstan, and China. It is a developing country that has the lowest GDP per capita of former Soviet states. Its economic development was not helped during period of civil war from 1992-1997 (Lynch, 2001), and today it is investing to develop water and energy resources for the country.

Water resources are an important issue for Tajikistan, both internally and regionally. Tajikistan resides upstream of larger populations in Turkmenistan and Uzbekistan, and control of these watersheds makes water access an international issue (Stucker *et al.*, 2012). Water is important for several industries as well as for rural drinking water. Cotton is an important export crop, and water demands to irrigate cotton are high. Energy and manufacturing are two other sectors that also have high water demands. Overall safe drinking water coverage was estimated at 79% in 2015, and the trend has been towards growth (WHO/UNICEF JMP, 2015b). This combination of factors creates substantial interest both nationally and internationally to see Tajikistan manage its water sector effectively, and rural water access is a part of this.

3.5.4.2 National Institution Leadership in Policy Reform

Tajikistan provided the opportunity to study change in a national level institution. The change is high level, and affects rural water supply along with other parallel sectors such as energy and irrigation. The need to manage competing needs in multiple sectors necessitated the development of an Integrated Water Resources Management policy that could manage resources by watershed instead of political jurisdiction. Such a policy change would affect all water sectors, including rural water supply. A proposal to change the boundaries and institutional structure of water resource management began development in 2006. The idea was there, but challenges negotiating the politics and inertia of established institutions suspended progress.

Progress was reinvigorated in 2013 with the restructuring of national institutions. The Ministry of Land Reclamation and Water Resources was abolished, and in its stead the Ministry of Energy and Water Resources was created along with the Agency for Land Reclamation and Irrigation. This signalled the beginning of intent to reform the water sector along the lines of Integrated Water Resource Management (IWRM), but the true test would be the capacity of newly formed national institutions to perform their functions. These institutions became central to the process of identifying the need for reform, negotiating the development of details within it, and eventually seeking official approval to formally implement a change in institutional structure for water resource management throughout the country.

Successful development of the reform is a testament to the performance improvement of the lead institution managing the reform process. The reform was approved by the Presidential office in December 2015 and was set to begin implementation at the time of

research. The nature of the reform is defined by official government documentation (translated from Tajik):

The water sector reform aims to lay the foundation for application of decentralisation and devolution of part of service delivery in the process of division of responsibility between the ministries and agencies, and partially, NGOs. The proposed reforms are based on common regulatory principles of IWRM and focus on taking into account social, economic and environmental interests through sustainable and balanced management and development of the water resources (Government of the Republic of Tajikistan, 2015).

The purpose of the case study was to understand the stakeholder network characteristics that supported the central government institution to develop the reform and have it officially approved. Such a large institutional change is a bold undertaking, and studying the conditions that helped to develop and approve the proposed change could be insightful. Understanding the Tajik case study could help understanding of conditions that support change in national institutions elsewhere.

It should be clear, however, that full implementation of the reform has yet to happen, and it will take time before the full effects can be appreciated. Nevertheless, even achieving the political intent to undertake a large reform in a sector as crucial as water resources is important to understand. Learning about the implementation of the reform to develop the water basin authorities could be grounds for future research that applies at regional and local levels of the water sector in Tajikistan.

3.5.5 Bolivia

The final case study provides perspective from Latin America. Municipal governments in the Department of Cochabamba, Bolivia, are the case study institutions that have demonstrated performance improvements. Several have developed management units, including hiring specific technical staff, in order to better support community operators in their efforts to achieve complete access to safe water and sanitation in their municipalities. The INGO Water for People (WfP) recommended the suitability of this case study as one of the best examples of institutional development for service delivery they have observed in their work across nine countries in Latin America.

3.5.5.1 Rural Water Access in Bolivia

The Bolivian government is committed to improving rural water access. President Evo Morales aspired to achieving complete access to safe water across Bolivia by 2020, but this commitment was later downgraded to complete coverage across four departments to match technical and financial capacities (Cambio, 2016). Nevertheless, the political will towards improving water access remains strong in Bolivia.

In the area of the case study, water supply is managed in rural areas through community operator committees called CAPyS (*Comité para Agua Potable y Saneamiento*). Municipal governments liaise with these local operators to provide technical support and coordinate new infrastructure investments. The Department offices based in regional capitals are the next step of authority above municipalities, followed by ministries at the national level. The Departmental office for the case study municipalities in Bolivia is Gobernación Cochabamba.

Not all municipalities in the Cochabamba Department report performance improvements, and this difference allows some comparative analysis. Three municipalities studied are improving performance, and one reports that it is not improving. Although comparative analysis is not the main intent of this research, the latter municipality that was not improving performance was identified during fieldwork, and data on the network surrounding this institution was captured when the opportunity became available. Stakeholder networks interacting with these municipalities are later compared to consider how network characteristics might differ between the municipalities that are improving performance and the one that is not improving (Section 7.2).

3.5.5.2 Improving Municipalities

Three municipalities that are improving their capacity for supporting water service delivery are studied. These are all in the Department of Cochabamba and contain populations of approximately 30,000, and their similar contexts and geographies aids in the identification of common network characteristics that support their development. The three municipalities are: Villa Rivero, Arani, and Tiraque. All of these case study municipalities have developed management units for responding to water supply issues in their jurisdictions in the recent past.

Each municipality has hired new staff to form technical support teams specifically for water and sanitation. These teams are called DMSBs: 'Direcciones Municipales de Saneamiento Básico'. This investment in internal capacity represents a clear

improvement in each institution’s performance in providing support to local communities and operators managing services, and the investment is easily quantified by the financial resources committed to the team from each municipality. All municipalities show an increasing investment in staff and operational expenses of these DMSB teams that directly expand the capacity of the municipalities to perform their service delivery functions.

Table 8 – Summary of municipality investments in DMSB staff and operations by year (\$USD to nearest dollar) (Agua Para el Pueblo Bolivia, 2012, 2013, 2014, and 2015)

Municipality	2012	2013	2014	2015
Villa Rivero	\$14,368	\$13,362	\$13,362	\$25,877
Arani	\$0	\$28,394	\$18,103	\$46,109
Tiraque	\$718	\$21,552	\$13,362	\$26,897

3.5.5.2.1 Comparative Analysis

The presence of several municipalities in the same area also allows comparative analysis by including one municipality that is not improving performance. Its name is anonymised because there is only one underperforming district included in this research from Bolivia. It is considered underperforming because they have not formed a DMSB nor are displaying improved performance in their role as a municipality. A quote captured during an interview with this municipal government illustrates the perceived performance of this municipality at the time of research:

The truth is that there is nothing that is improving... We will need more workshops, for the office and to be autonomous and for that we will need a big workshop. Community development and what it is, basic relationships. We only have the norms, but we cannot do anything with only norms with the community. Because they don't understand almost nothing. So we're just beginning (Municipality staff, primary interview, August 2, 2016).

This municipality reports no improvements in its performance, and no available documentation stated otherwise. This is therefore included as a comparison against the three improving municipalities to see whether network characteristics identified in their networks are absent from the underperforming municipality’s network.

3.6 Chapter Summary

The aim of this research is to characterise relationships in stakeholder networks that support institutional development in rural water sectors. The research asks two specific questions to identify the network of stakeholders that interacts with a specific institution that is improving performance, and to understand the importance of specific relationships within these networks that support the institution to develop. The desired result is a richer understanding of the simultaneous influences that can support a process of positive change in institutional performance.

Five case study countries are included in order to identify network characteristics that might have relevance in a variety of contexts. The countries are Ghana, Malawi, India, Tajikistan, and Bolivia. Each case study focuses on specific institutions that have been improving performance in the recent past to understand influences from each one's surrounding stakeholder network that might be supporting the institution to develop. Despite contextual differences in each case, all case study institutions have exhibited indications of development, and these institutions can be studied to identify influences that support a process of positive institutional change from a stakeholder network perspective.

The next chapter on methodology details how existing network research approaches are adapted to this study in order to answer the research questions.

4 METHODS

This chapter presents the approach to data collection and analysis used to address the research questions. Research methods are drawn from the established fields of social network analysis and supplemented with qualitative methods. These methods are adapted and combined to investigate how stakeholder relationships support institutional development in rural water supply.

Methods are divided into two parts. The first part describes techniques drawn from social network analysis, and the definition of specific ties that are appropriate to understanding rural water sectors. This includes the assumptions about network boundaries in order to define the scope of data collection (Section 4.3.3). The second part explains the qualitative techniques used to analyse the importance of observed network characteristics from the perspectives of those experiencing these social networks (Section 4.4).

The final section of this chapter reflects on experiences applying these methods in the field (Section 4.6). Case studies from Ghana and Bangladesh are presented to highlight how the methods worked during the initial data collection process. Bangladesh, although not completed a full case study in this research due to security issues, nevertheless provided an opportunity to conduct some interviews to test the possibility of alternative means of data collection (Section 4.6.2). These experiences provide reflections on the benefits and challenges of these methods, addressed in the latter part of this chapter (Section 4.6.3 and 4.6.4).

4.1 Theoretical Assumptions

The main theoretical decision is considering which data are valid for answering the research questions. Social network analysis can be conducted on existing data records from sources such as emails, contracts, and other archival information, or on data captured directly from stakeholder interviews. The choice about which data are appropriate is influenced partly by the availability of data, because local institutions might not have accurate records documenting their interactions, but the main consideration is which data might provide the most useful construction of reality with respect to the research questions.

This research adopts a constructivist epistemological perspective whereby agents may perceive and interpret reality differently (Craig & Craig, 1999; Fosnot, 1996). This assumption means that primary data collected from network actors about how they perceive their relationships will be the basis of analysis. Individual perspectives on their relationships with others are assumed to be a valid construction of reality that may differ from formally intended institutional structures and relationships. It is not known how closely the institutions studied in this research will represent their intended forms, functions, and relationships, and a constructivist perspective can accommodate discrepancies between the intended and the actual. Using individual perspectives therefore allows participants to describe how relationships are actually experienced in practice, and to describe how these relationships have existed over time.

These theoretical assumptions emphasise the importance of directly interacting with network actors to capture data. Space needs to be created for them to express their perspectives in ways that can be analysed to answer the research questions. Primary interviews in person with network stakeholders are therefore selected as the source of data in this research, and proposed methods now consider how network data specifically can be gathered from these interviews.

4.2 Ethics

The main ethical responsibility in involving interview participants is to consider potential harm that the study might cause to the participants. Precautions are therefore taken to prevent any potential harm. The primary concern is creating a safe environment for participants to speak freely without fear of repercussions.

Anonymity is applied to both the individual interviewed, and the name of the stakeholder they represent. Veiling participant identity is important for several reasons.

Firstly, individuals commenting on a sector may face repercussions for making statements about others, or statements on behalf of their organisations. Keeping participants anonymous avoids concerns about consequences of their statements. Anonymity of responses presented in research documentation and findings protects participants while still allowing investigation of the research questions.

Anonymity is also important for analysing network characteristics as social structural patterns instead of relationships between specific stakeholders. Identifying, for example, the most powerful stakeholder in a network may be tactically interesting for those working in the network, but the specific names have little value for developing broader scientific findings. In this research, stakeholders are therefore classified by their type and level of sector hierarchy instead of their unique names. Individuals participating in interviews are further protected because even the identification of a stakeholder does not identify the individual within it who was interviewed. Classification by stakeholder type and level of hierarchy can identify patterns in links between, for example, government and the private sector without identifying specific organisations. This protects the identities of particular stakeholders, and the individuals within these, while still allowing investigation of network characteristics.

The anonymous nature of the research was discussed with participants during interviews, and their consent to participate is confirmed through their signing a release form (Appendix B). This allows participants to also indicate whether they would prefer to have their verbal responses recorded in writing instead of by audio recording. The approach to ethics used in this research is in line with the requirements of the Cambridge University Department of Engineering, and was adhered to throughout the research process.

4.3 Egocentric Network Mapping

Social network analysis is the core method used in this research. This section explains how it applies to the research questions, with specific focus on egocentric network analysis. It further defines the types of ties that are used to connect network nodes, and how the definition of these ties has been adapted from existing definitions of social power. Finally, this section describes the data collection methods used to capture network data during stakeholder interviews.

Social Network Analysis has gained attention for mapping characteristics of social systems (Borgatti *et al.*, 2013; Scott, 2013). Social network analysis originated from

connecting ‘nodes’ using ‘ties’ to identify clusters of social interaction (Scott, 2013), and this practice remains the basis for fruitful research in different fields to investigate how relationships describe social phenomena (see Bebbington & Kothari, 2006; Frank *et al.*, 2014; Romo & Anheier, 1996). Its many applications have been extended to include topics ranging from analysis of performance in the private sector where organisational effectiveness may be more than the sum of its parts (Cross *et al.*, 2005), to characteristics of social support networks amongst friends (Bellotti, 2008).

Social network analysis was selected for this research because of its potential utility for understanding stakeholder relationships that influence institutional development. Egocentric network mapping is a specific subset of social network analysis that examines a specific node to understand its direct relationships (Crossley *et al.*, 2015). Egocentric network analysis, or ego net analysis for short, can identify characteristics of an actor’s network that may influence their behaviour. This approach has been used to investigate social dynamics including the structure of friend networks (see Bellotti, 2008), and influences on individual political behaviour (Zhang & Ahmed, 2011). This research proposes that egocentric network analysis can be extended to the institutional context of this research to understand network characteristics around a specific institution that is improving performance. Key decisions about how to study stakeholder networks involve deciding what constitutes a tie in the networks of interest (Section 4.3.1), how data will be collected (Section 4.3.2), and how nodes and network boundaries are identified (Section 4.3.3).

4.3.1 Proposed Network Tie Categories

Power ties are used to define connections between nodes in rural water sectors studied in this research. Power ties are assumed to be the most relevant basis for investigation because of the inherent power dynamics in water service delivery (Lockwood and Smits, 2011). More nuanced definitions of power are required, however, to understand stakeholder relationships in detail. Tie definitions also need to use language that is commonly understood by all interview participants to reduce interpretive bias. This research therefore proposes four categories of network ties, each weighted and directional, as the basis of social network analysis. These are the relationships that interview participants are asked to identify, and are adapted from a definition of social power to use concepts assumed to be familiar to stakeholders in rural water sectors.

Social power, as conceptualised by French and Raven (1959), includes six dimensions (List 2), and the proposed network tie types adapt these definitions of power into specific tie types and sub-types. Table 9 presents the proposed tie types, sub-types, and definitions of the different tie strengths. These sub-types are designed to show relative differences in the weight of network connections using standardised definitions that are assumed to be commonly understood by research participants. The weighting of ties allows interview participants to show relative distinctions in weights between different ties in their networks even if they interpret the precise definitions of sub-categories slightly differently. Discussion about how these ties and sub-types are derived from the 'Bases of Social Power' (French & Raven, 1959) follows in List 2 after the presentation of Table 9.

Table 9– Proposed network categorisation of network ties by type and sub-type

Tie Type	Sub-type (weight)	Description
1. Information	1.1 Download	Information sent from one to the other
	1.2 Discussion	Issues are identified, discussed, and clarified
	1.3 Dialogue	Exploring assumptions together leads to new understanding between stakeholders
2. Resources	2.1 Low	< \$100,000 USD per year
	2.2 Mid	\$100,000 - \$1 million USD per year
	2.3 High	> \$1 million USD per year
3. Authority	3.1 Influence	Ability to influence interests of others indirectly
	3.2 Authority	Control; the authority able to enforce consequences for non-compliance
4. Skills	4.1 Consulting	Temporary skill provision to complete a task
	4.2 Training	Providing temporary skill building activities
	4.3 Coaching	On-going customised interaction to support participants' ability to overcome challenges
	4.4 Co-Development	Supporting another stakeholder to develop their own way of doing things

These proposed tie types and sub-types can be directly related to the 'Bases of Social Power' (French & Raven, 1959). Each base of social power in the following list is highlighted in bold and each paragraph describes how the tie types used in this research relate to the power bases.

List 2 – Bases of Social Power (bold) (French & Raven, 1959) and their relationships to ego network tie types

- I. **Information** is looked at directly. This category is broken into further sub-categories to explore a breadth of information interactions. Respondents are anticipated to be able to identify to whom they report, with whom they co-develop ideas, and so on. This is expected to be a familiar concept to all interview participants across different cultures and levels of education.
- II. **Expertise** is partly shown by skills transfer, which is an aspect of expertise. Further combinations with information flows that can exist in parallel help to further identify the presence of expertise power. Respondents are assumed to be able to identify those providing them with skill and capacity support or training. They are also assumed to be able to distinguish between interactions that are one time instances of training or consultation versus ongoing interactions that support their capacity development.
- III. **Coercive** and **reward power** are combined as opposing aspects of the same dynamic. These are represented by the authority sub-type ‘influence’ (3.1). Respondents are assumed to be able to identify stakeholders that can influence or are influenced by the interests of the respondent. These are relationships that can change the behaviour of a stakeholder without directly forcing a change through a controlling relationship. The stronger version of this tie, authority, represents control (3.2), and relates to the definition of legitimacy power that is discussed next. Raven and French identify coercive and reward power as being similar because they both represent a type of incentive (1958). They can therefore be combined into an ‘authority’ tie type that represents either formal control or influence between stakeholders.
- IV. **Legitimacy** is represented by an ‘authority’ tie (3.2). An example of this is a directive from a national ministry to a district government that must be obeyed. Respondents are expected to be able to identify who has direct control over them, or to whom they have a strong obligation, either formally or informally.
- V. **Referent** power, the desire to be associated with individual or groups, does not need to be identified by participants in interviews because relationships can be observed directly from network data. Communities of influence can be identified later by graphing and aggregating egocentric networks. Respondents may struggle to identify this property independently, and therefore are not asked to

do so. The network ties they report during interviews instead provide the data to eventually explore this type of power.

Further influences on tie sub-type categorisation are also worth noting. Skill transfer, for example, could conceivably be left as a single category representing expertise power. Additional detail is included to recognise the impact that different skill transfer approaches may have. Action research in the related field of public administration identified a distinction between one-time training (4.2) and training followed by coaching support (4.3), with the latter showing significantly larger improvements (Olivero, Bane, & Kopelman, 1997). A distinction is therefore made where training is supplemented with on-going support for practice and feedback. The final skill link, 'Co-development' (4.4), was introduced at the recommendation of study participants in Ghana who identified relationships they considered went beyond coaching to actively co-generate and implement solutions.

Finally, information links are differentiated to represent multiple possible collaborative relationships. The basic exchange labelled 'download' (1.1) represents information exchange possible without further relationship, as if the source provides data to a target. Writing that distinguishes monologue from dialogue illustrates this point (Busser & Wegner, 2012). Relative middle ground is represented by 'discussion' (1.2), which encourages multiple viewpoints and clarification. Discussion may include debate when viewpoints conflict. 'Dialogue' (1.3) represents the strongest form of information engagement, allowing for collective sense-making through the suspension of judgment and re-evaluation of assumptions (Nagda *et al.*, 2008). Definitions of different information tie strengths are meant to be illustrative of the relative differences. The important implication for interview participants is the ability to differentiate between stronger and weaker ties when describing their relationships.

Through these tie definitions the bases of social power can be represented by the tie types and sub-types proposed for this research (Table 9). These tie definitions are designed to include a broad definition of social power dimensions using language familiar to stakeholders in rural water sectors. Definitions are designed to help participants to quickly and easily identify relative differences between relationships in their networks even if they do not grasp the complete nuance of sub-type definitions.

4.3.2 Network Mapping

Data capture methods are informed by both data requirements and practical interview considerations. Interviews need to reliably capture accurate data from all types of potential interview participants. Participants may not have time or interest to participate in extended interviews involving unfamiliar concepts with a stranger. Research design therefore has to consider how stakeholders of different levels of power, availability, experience with research, interest in the subject matter, and education will respond to the interview design.

Individual stakeholder interviews are an important design choice for both practical and theoretical reasons. These emphasise the individual perspectives, and recognise that practical constraints may hinder group-mapping exercises with the whole network. Getting large groups of stakeholders in a room at the same time for an interview can be logistically challenging. It also poses risks for influencing participant responses if dominant voices crowd out quieter ones, if conflicting opinions are not recognised, or if majority consensus produces general sentiments instead of detailed insights. Individual interviews are better suited to accommodate these considerations.

Interviews with individuals are used to represent a stakeholder, which consists of multiple individual perspectives. The individual selected therefore has to be knowledgeable and capable of speaking on behalf of the group. This is achieved by speaking to knowledgeable staff with strong experience of the organisation's relationships, and this individual may or may not be in a leadership position. The relevant individual depends on the stakeholder being interviewed, and in practice the researcher was commonly referred to specific people and redirected if the recommended person could not provide the required information. Interviewing knowledgeable individuals was deemed the preferred approach and was standard practice during fieldwork.

Individual interviews are used to identify egocentric networks between the interviewee (the 'ego') and those they have direct relationships with ('alters'). Other studies have asked egos to comment on ties between alters (Bellotti, 2008), but in this research participants are not asked to speculate on links between their alters. This is because follow up interviews with the alters themselves can gather these data directly. Data from all interviews are later combined to create ego networks around the case study institutions for analysis.

The facilitated interview structure is inspired by the net-map graphing tool. This tool allows participants to visualise their network and represent it using post-it notes, flip chart paper, and coloured markers to represent different tie types (Schiffer, 2007). In the first step, the name of the interview participant is written on a post-it note and placed in the centre of the paper. The participant then identifies other stakeholders they have direct ties with according to the defined tie types (Table 9) and these stakeholders are written on post-it notes and distributed in a circle around the periphery. The participant is then asked about each tie type individually and asked to draw ties between them and their alters, but participants are not asked to draw ties between alters.

This process is repeated for each of the four tie types. The drawn ties show arrows to indicate direction, colour to indicate tie type, and the number of arrow heads to represent tie weight. The participant holds the pens throughout the exercise. The researcher can easily convert this drawn network to electronic format for analysis by coding the nodes and ties drawn by participants with minimal risk of misinterpreting data. The process is intuitive, visual, and can be completed quickly depending on the number of stakeholders in a network.

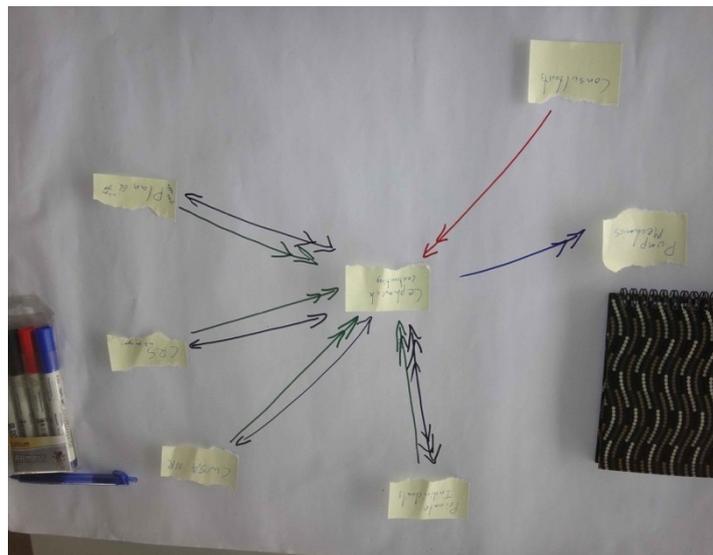


Figure 4 – A completed egocentric network map from an interview (photo: D. McNicholl)

4.3.3 Scope and Sampling Criteria

The previous chapter described the case study institutions in selected countries that are the focus of this research (Section 3.5). Interviews with them are the starting points for network investigation. The next step is to define how other stakeholders are identified for subsequent interviews. These subsequent interviews are used to verify ties in the ego

networks of case study institutions, and to capture data on ties between alters. Selection criteria were developed to identify which other stakeholders to interview, given that not every stakeholder in every rural water sector can be interviewed. Assumptions about network boundaries therefore need to define two things: who to include in interviews; and where to draw boundaries in order to answer research questions.

4.3.3.1 Identifying Network Interviews

Identification of nodes in an ego network uses a name generator approach (Marsden, 1987). This means that interview participants are asked to identify stakeholders from memory without prompting or selecting from a pre-specified list. This approach is appropriate because full lists of network nodes were not available to the researcher prior to fieldwork and, even if stakeholder lists were available, the name generator approach allows new stakeholders to be identified. The name generator approach identifies the most important stakeholders by assuming the most important stakeholders are the easiest to recall. This approach can be sensitive to influence by the researcher depending on how participants are prompted to identify stakeholders (Marsden, 2003), and this challenge was addressed by asking participants to identify whomever they have a relationship with in the context of water supply that can be described by any one of the four tie types: information, skills, resources, and authority. Asking about these relationships specifically is assumed to be more precise than a general prompt such as: “who do you interact with?” These names then inform which stakeholders to include in subsequent interviews through a ‘snowball’ sampling approach.

4.3.3.2 Sampling Criteria

Selection criteria ensure that the interviewing process stops at natural network boundaries instead of continuing on indefinitely to potentially include all stakeholders in a country. The chief criterion is that a stakeholder needs to be mentioned in more than one interview to be eligible for a follow up interview. This allows stakeholders to be identified as significant in the networks around case study institutions without prior judgment by the researcher, while still ensuring that follow up interviews do not continue indefinitely. Stakeholders at higher levels of sector hierarchy needed to be mentioned at least three times, and lower hierarchy stakeholders needed to be mentioned at least twice. The original design was simply to ensure that any stakeholder mentioned more than once received a follow up interview, but an initial pilot of fieldwork in Ghana (Section 4.6.1) found that national level stakeholders were too numerous, and the threshold for the number of times mentioned was elevated to three.

Overall, these criteria mean that if a stakeholder is mentioned only once it will appear in overall network data, but a follow up interview to understand that stakeholder's network would not be conducted.

The sampling method requires some stakeholders to be interviewed initially as starting points. The case study institutions are the initial starting point (see Section 3.5), and stakeholders connected to them such as government institutions or communities can serve as other starting points because they have permanent roles in water supply. If it is later found that these secondary stakeholders are only mentioned once, data from their interviews can be excluded from network analysis. In this way, case study stakeholders and those immediately connected to them can be starting points for snowball networks.

Figure 5 provides a visual illustration of how these criteria are applied, and shows how the snowball network grows with each interview. It begins with one of the case study institutions that is improving performance (Section 3.5), and this initial interview identifies its direct ties to other stakeholders. Some of these other stakeholders likely have permanent roles in rural water supply that will require interviewing, such as communities or key government offices. One of these is identified by a small orange dot in the first interview in Figure 5, which then becomes the second interview. Other stakeholders are identified in this second interview, some new and some that have been referenced previously. These stakeholders have now been mentioned twice in interviews, and are interviewed subsequently. Note how some stakeholders change from yellow nodes to orange ones when they have been identified multiple times. One of these becomes the third interview. This process repeats until all stakeholders identified have either been interviewed, or do not meet the criteria for a follow up interview. Networks are developed through these methods and boundaries emerge naturally.

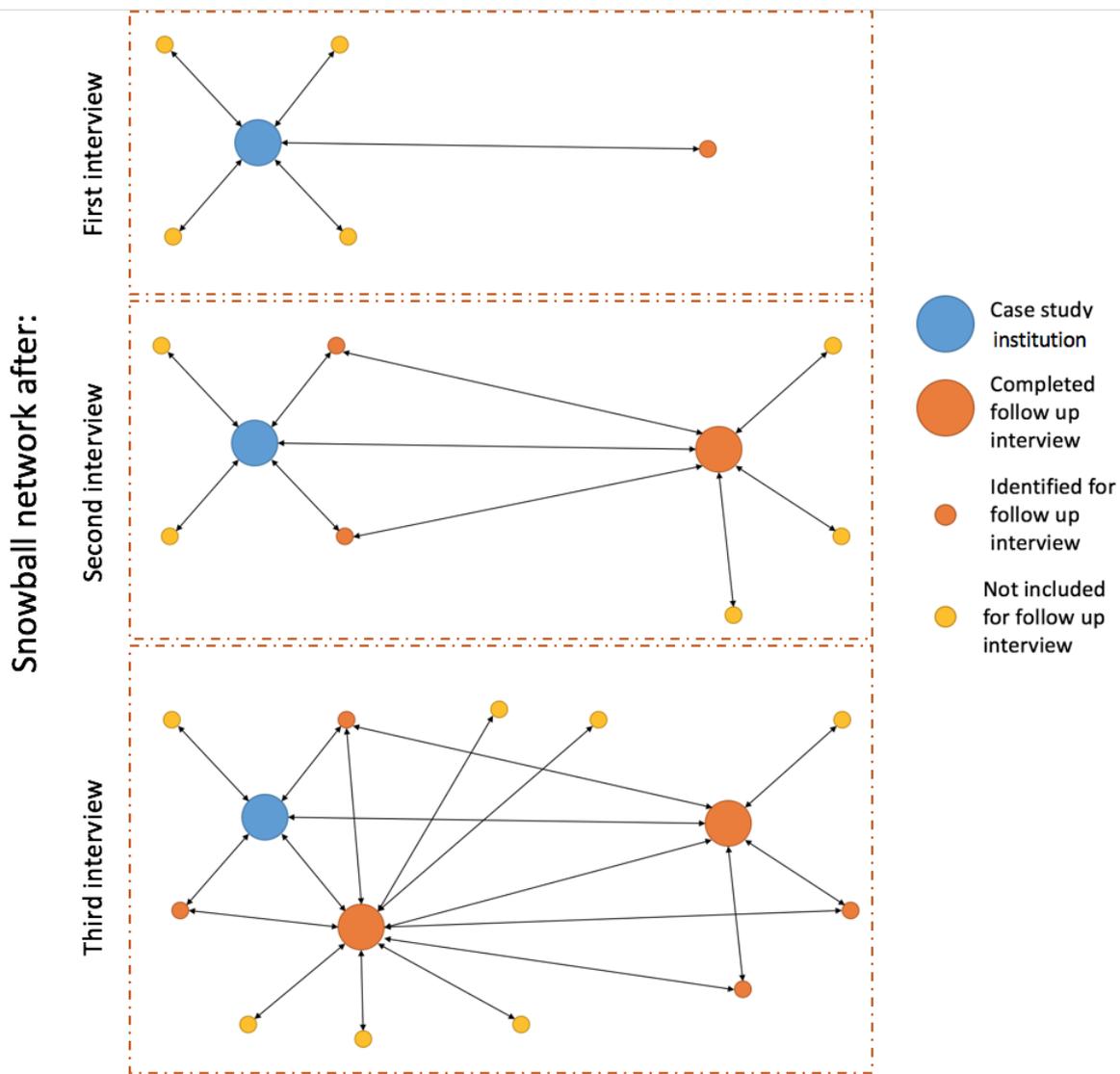


Figure 5 – Visual illustration of snowball network evolution identifying starting points, follow up interviews, and stakeholders identified but not yet included for subsequent interviews.

This selection approach naturally identifies network boundaries without requiring advance knowledge of network membership. The criteria for inclusion therefore only influences the necessity of a follow up interview, which can expand the network to include new stakeholders, and verify network links mentioned in other interviews. Interviews with only a select subset of stakeholders in a water sector can still therefore produce a relevant network for analysis.

4.3.3.3 Identifying Stakeholder Groups

Another boundary challenge is the presence of many instances of the same stakeholder type. Communities are a good example of this; a single district in Malawi may have several hundred communities. Other stakeholders may report that they connect with

these communities, but follow up interviews with each community is infeasible in the scope of this research. A grouping approach is therefore applied to capture perspectives from communities without having to interview each one.

In this research, multiple stakeholders of an identical type (e.g. communities) are grouped together as a single node, and then one or more of these is separated to provide a specific instance for interviewing. This means that perspectives can be captured from this stakeholder group without interviewing each stakeholder. For communities and water users, two instances were typically interviewed from within a larger group. Figure 6 illustrates how this works.

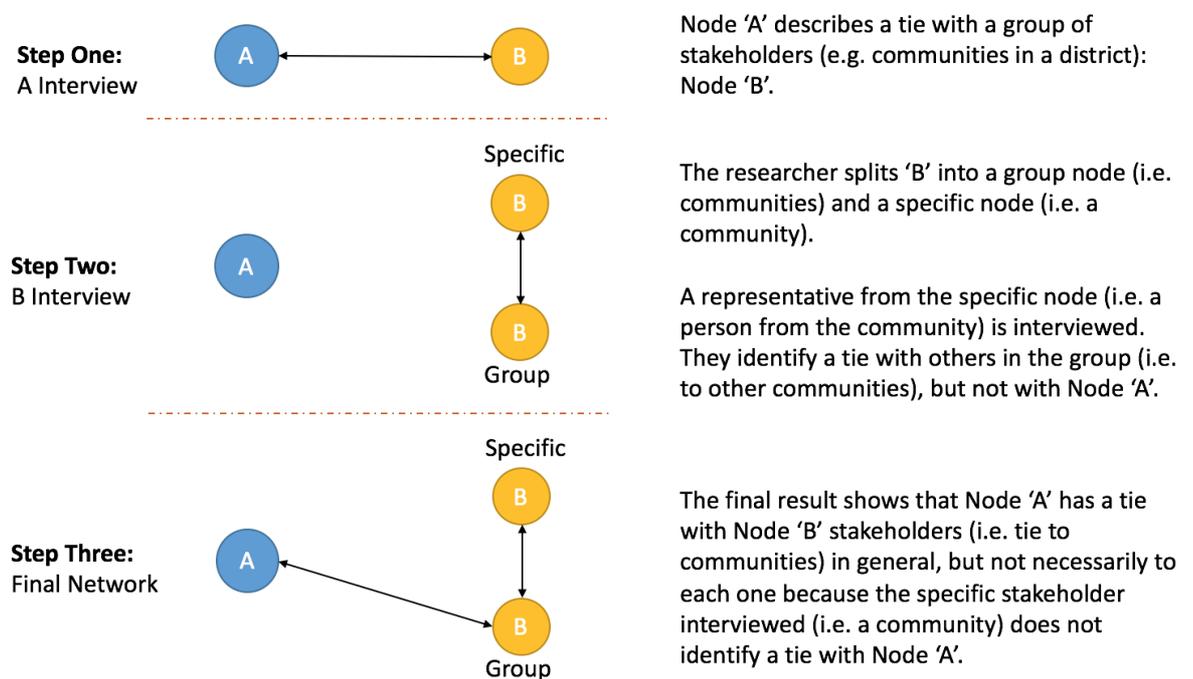


Figure 6 – Illustration of how similar stakeholders are grouped and at least one of their members is interviewed to produce network data for analysis

Assume that node A describes a tie with communities in a district during its interview. This type of statement is general and may not apply equally to all communities in the district. Follow up interviews are necessary to verify the network relationship. Following up with each community in the district is impractical, however, so community node is split into a 'Group' node and a 'Specific' node. A follow up interview with the specific node, an individual community, happens next. It identifies a tie with other communities, the general node, but not one with node A. The final network therefore shows a tie between the B nodes, and a tie from node A to the group B node, but not the specific B node because the interview with the B node did not

mention a tie between itself and A. The approach means that if a stakeholder makes a general claim, such as ‘we have relationships with all communities in a district’, this can be captured as data, and follow up interviews with specific communities can clarify the nature of the relationship in specific instances.

The grouping approach allows interview participants to reference larger groups of stakeholders and to verify these ties with a follow up interview. This also provides some indication of ties within a group of like stakeholders. This approach creates a network boundary to capture perspective from large groups of similar stakeholders without requiring follow up interviews with each instance within a group.

4.3.4 Aggregating Egocentric Networks

Network data from all interviews are combined to produce snowball networks. These snowball networks are then filtered to show the ego networks of the institutions being studied. Combining interview data therefore includes both direct ties between an ego and its alters, and ties between alters.

Combining data from multiple interviews means that conflicts occasionally arise. A conflict occurs when two interviewed stakeholders perceive a tie between them differently. The first possibility is where the two stakeholders both identify a tie, but perceive different strengths. In these cases, the tie weight is averaged. Taking the average gives both interview participants equal ability to perceive their relationship without preferring one perspective over the other. A second type of conflict arises through omissions. These are where an interview participant identifies ties to another stakeholder, but these same tie types are not mentioned in the subsequent interview with the other stakeholder. In these cases, all reported ties are included in final network data. This means that if one side remembers ties and the other side forgets them, the ties are still included in the final network. Including all ties identified during interviews and taking the average of conflicting perceptions of tie weights allows data from multiple interviews to be combined in a final network for analysis.

Figure 7 presents a visual illustration of how data from multiple interviews are combined to produce final networks for analysis. Example one shows how two different stakeholders identify the same type of tie between them in separate interviews. The difference is that they perceive the weight of the tie differently. The final result takes the average of the two. In example two, one of the stakeholders reports a tie while the other does not. This is treated as an omission where the stakeholder in interview B may

have simply forgotten to identify this tie. The final result therefore takes the tie that was reported and ignores the fact that this was omitted in another interview.

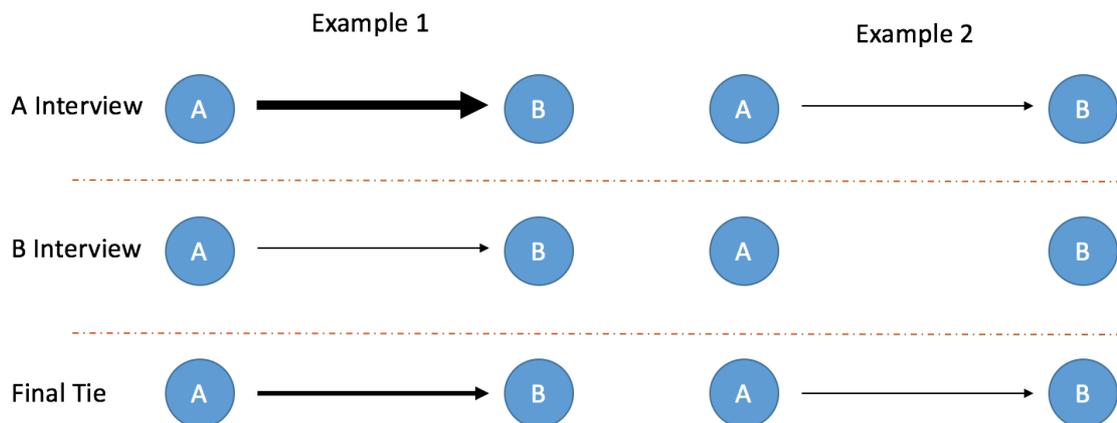


Figure 7 – Illustration of the process for averaging conflicts in network data from interviews

These design choices combine multiple individual interviews to produce snowball networks for analysis from individual stakeholder perspectives. Perspectives are aggregated from a series of interviews that eventually identify the network nodes and ties necessary for egocentric network analysis around the case study institutions. Analysing ego networks provides the starting point for answering the research questions, and is next supplemented by qualitative stakeholder interpretations of the importance of network characteristics.

4.4 Participant Perspective Coding

Characteristics of networks are not inherently good or bad. The concept of brokerage, for example, was previously assumed to be a desirable role in a network, but further research has demonstrated that this is not always the case (Crossley, 2010). Stakeholder perspectives therefore help to inform the value and significance of observed network characteristics. Network characteristics are qualified by capturing and collating stakeholder perceptions of network characteristics during interviews.

After drawing their ego networks, interview participants are asked about their perceptions of the network to further understand how the network supports institutional development. These perspectives are recorded and later coded to identify network characteristics that are independently identified by multiple stakeholders referring to a specific set of network relationships. Individual perspectives can also provide unique insights if one stakeholder sees something that others do not. Whether they agree with

others or not, stakeholder commentary provides insight into how the networks are experienced by the stakeholders that participate in these relationships.

All interview participants are asked the same question immediately after drawing their ego network. These responses are audio recorded for later transcription and analysis. The exact language sometimes requires adaptation depending on the vernacular, level of education, and familiarity with considering abstract concepts such as institutional development, but the intent of the question remains constant. Referring to the ego network the participant has just drawn, the question is:

“What about this network is helping the management of rural water services to improve?”

Follow up questions from the interviewer are limited, except for clarifications and encouragement to elaborate on the full breadth of network interactions that the participant perceives as important. This questioning structure allows participants, instead of the researcher, to guide the direction of conversation towards what they perceive as most important. The question is designed to identify network characteristics that support institutional development, while being broad enough to allow participants to share whatever they feel is important. The theme of the question is clear, but its open-ended nature allows participants to lead the identification of what they perceive as most important with minimal influence from the preconceived ideas from the researcher.

Transcriptions from audio recordings are later coded by the researcher. Commentaries are sorted by the network characteristics they describe, and how these relate to institutional development. These commentaries can then be grouped to identify where multiple stakeholders describe a similar network characteristic as an important influence supporting institutional development. This coding method is inspired by Grounded Theory methodology (see Charmaz, 2006) and draws on established coding processes to identify themes in data (Flick, 2006) and approaches to synthesising qualitative interviews with network data (Herz *et al.*, 2014), but differs slightly because not all comments are equally included in the final findings. Coding first identifies where commentaries describe network characteristics related to institutional development, and participant commentary can sometimes deviate from the intended research focus. Coding also screens commentaries to make sure that the respondent directly observes the part of the network that they describe. This guards against stakeholders making general comments that may not apply equally to all parts of a network. The coding

method therefore provides a set of described network characteristics that are used to qualify the importance of numerical network data (McNicholl *et al.*, 2017).

Combining the quantitative and qualitative methods strengthens the overall research to identify network characteristics and to qualify which characteristics have positive influences on institutional development. Network investigation is able to lend quantitative weight to the qualitative nature of stakeholder interactions, but it is not enough on its own. Understanding the significance of particular network interactions needs to be complemented by qualifying statements, and coding stakeholder perceptions to identify commonly observed themes achieves this.

4.5 Combined Analysis

To summarise the overall analysis, perspectives from participant responses about network characteristics augment quantitative network analysis to identify which characteristics are positive. The process is two step. The first part applies standard quantitative ego network numerical analysis to characterise the ego networks of interest. The second step uses interview verbal responses to describe the importance of network characteristics. The result is a set of both quantitative and qualitative network characteristics that describe stakeholders improving performance from a network perspective. The combined methods determine the presence of network characteristics numerically, then qualify their importance with narratives from interviews.

4.6 Field Testing Methods

Advantages and disadvantages of data collection methods were identified from an initial test in Ghana, expanded through research in the other four case study countries. An alternate data collection method was also tested in Bangladesh where a single interview with a knowledgeable stakeholder attempted to develop a complete ego network that included all ties between stakeholders identified in the interview. This section outlines experiences from fieldwork, and concludes with benefits and limitations of the data collection methods.

4.6.1 Piloting Methods in Ghana

Ghana, the first country case study, provided an opportunity to pilot data collection methods. Ghana was selected because the researcher had some experience in the country but did not know the water sector there intimately. Piloting fieldwork methods allowed adaptation of methods where necessary, and the opportunity to return to Ghana

at a later date if methods had to be adapted significantly enough to disqualify the data collected during the pilot fieldwork. Fortunately, the pilot study was successful, and data collected from the trip were deemed suitable for analysis.

Fieldwork in Ghana was conducted from April to May 2015, and a total of 43 stakeholders participated in interviews. The starting point of investigation were the two district governments that are improving performance (Section 3.5.1.2), and further stakeholder interviews explored network relationships connecting to local, regional, and national levels. Network and narrative data collected during these interviews became the basis for the Ghana case study.

Interviews typically took less than 60 minutes, and could be completed in as little as 20 minutes when time constraints demanded efficiency and the number of stakeholders in an ego network was small. Interview participants found intuitive the process of identifying stakeholders and describing their relationships through drawing arrows. They would commonly ask clarifying questions, or describe a particular relationship to understand how it could best be represented using the tie type framework used in this research. Characterising other relationships typically progressed smoothly once a few initial examples were completed.

All interviews followed a simple three-step format:

1. Writing stakeholder names on the flip chart that the participating stakeholder (the ego) has any information, skill, resource, or authority ties with;
2. Drawing ties between the stakeholder being interviewed (the ego) and the other stakeholders identified (the alters) for each tie type on the flip chart; and
3. Commentary on network characteristics (recorded verbal response).

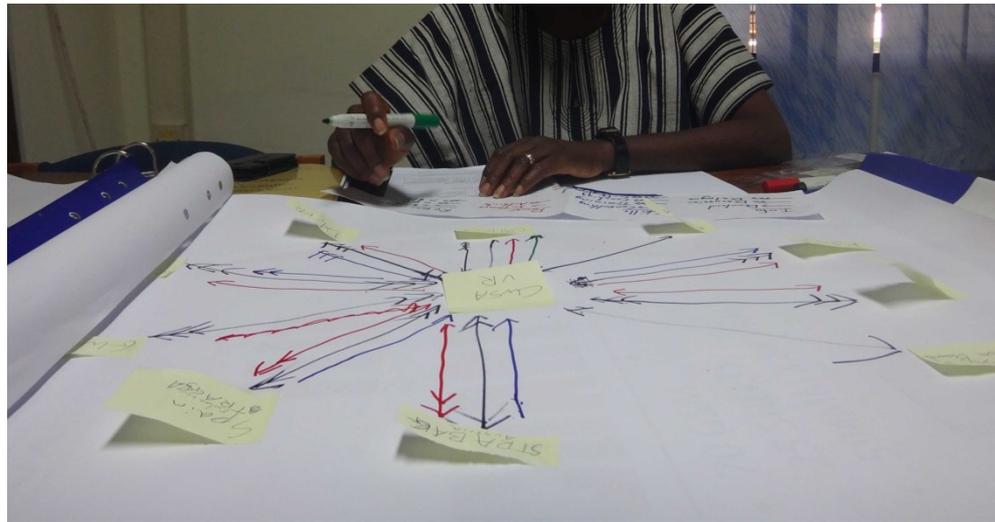


Figure 8 – An interview participant identifies the egocentric network of his organisation (photo: D. McNicholl)

The majority of these interviews were conducted in English in the offices or residences of the participants. The few interviews that were conducted in local languages benefitted from the assistance of local government staff that were kind enough to translate. Concepts in the exercise were typically grasped quickly by participants, and the visual nature of the exercise helped to make it intuitive regardless of participant literacy.

Participants typically felt comfortable having their verbal responses recorded, although several first clarified that their responses would be anonymous. The depth to which each respondent explored particular issues differed, but all were willing to qualify the importance of network characteristics to some extent. Capturing multiple perspectives from independent interviews then allowed the triangulation of important issues.

The length and depth of these commentaries could be unpredictable. Some participants would insist on having only a brief period for an interview, and then spend 90 minutes explaining their views. These commentaries could be surprisingly candid, even about potentially sensitive issues. It is possible that the confidentiality of the interview and the perception of the researcher as a neutral party without a direct agenda in the Ghanaian water sector are two factors that supported an open interview environment.

The methods used in Ghana collected the desired data, and no methodological changes were necessary in subsequent case studies. Data collection became more efficient in different contexts as the researcher became more experienced, but the structure remained the same. The data collection methods were able to capture the required data in all case study countries.

4.6.2 Testing Alternative Data Collection in Bangladesh

One methodological experiment was conducted in Bangladesh to test the ability of a single knowledgeable stakeholder to describe an entire ego network, including ties between alters. The network mapping interviews used in this research did not ask the participant to describe ties between other stakeholders in its ego network based on the assumption that an ego might struggle to define ties between alters because it does not experience these relationships directly. A brief visit to Bangladesh provided an appropriate opportunity to test this assumption because follow up interviews with alters was not possible.

The Bangladesh Rural Advancement Committee (BRAC) has been lauded as one of the most successful NGOs in the world (Smillie, 2009). From their beginnings as a small local NGO in 1972, BRAC has grown to become the largest NGO in Bangladesh, and has extended its presence to 12 other countries. Its most recent water and sanitation programme, with support from the Bill and Melinda Gates foundation, targeted an estimated 8.9 million households (Jacimovic *et al.*, 2014). Their work would have made them an interesting case study for this research, but this possibility was abandoned due to security issues in Bangladesh at the time of fieldwork.

One interview was conducted with a senior representative of the BRAC WASH department. The interview applied the same approach used in previous country case studies with one important difference: the participant was asked to draw alter-to-alter ties in his ego network. This means that the ego network drawn in the interview showed all connections between all stakeholders as perceived by the individual interviewed. His extensive experience makes him knowledgeable of the sector, but the extent to which he can accurately characterise connections between other stakeholders was unknown.

Attempting this modified interview approach found that the alter-to-alter ties lacked detail and the participant was not confident in his responses. Although he had some sense of interactions between alters in his ego network, he was not able to confidently report on the details of these ties. The number of ties also made the drawn network difficult to interpret after completion of the interview (Figure 9).



Figure 9 – Section of the network drawn by the interview participant (photo: D. McNicholl)

Preliminary findings were developed after the interview and presented to BRAC for feedback. This allowed the opportunity to identify any omissions from the network in the original interview. Their feedback highlighted both a strength of the research methods, and the limitation of attempting to understand a whole network from the perspective of only one stakeholder.

According to staff at BRAC, the methods had “drawn up the stakeholder dynamics quite nicely – especially considering the short amount of time and the volume of information” (N. Khan, email correspondence, Feb 9, 2016). This positive feedback suggests that the ego network mapping exercise has some value as a stand-alone exercise in its ability to quickly interpret direct ego-alter ties and possibly some of the alter-to-alter ties, but drawing alter-to-alter ties may require supplemental data from interviews with those alters. Consequently, data on alter-to-alter ties were not captured in interviews outside of this one experiment.

4.6.3 Benefits of Methods

The research methods were used to collect required data in the five case study countries between April 2015 and August 2016. A total of 162 interviews were conducted in six countries over a sixteen-month period. The methods met the demands of this ambitious project, and this section considers several reasons why these methods worked.

Firstly, participants generously made time for the interviews. Participation was likely helped by the fact that the interviews needed to be conducted in person and therefore

required specific scheduling. Remotely conducted surveys can be easier to ignore. Although many have busy schedules, participants often followed up when unavailable and offered alternatives for meeting times. One local government official suggested meeting on a Sunday evening because it was most convenient for him. Flexibility of the researcher was an important part of responding to stakeholder availability, and helped to ensure that the exercise could be completed efficiently if busy schedules required it.

The majority of participants were not concerned about sharing their perspectives during interviews. An exception was in Tajikistan where anonymity was particularly important because of the sensitive political environment. Almost all participants in Tajikistan declined to be audio recorded, but permitted handwritten notes and collection of network data. A release form helped clarify how data would be managed and confirmed willingness to participate (Appendix B). This was important for stakeholders facing restrictions about how they are allowed to represent an organisation, and for managing fear of potential repercussions when discussing politically sensitive material. All stakeholders approached were at least willing to draw their egocentric networks even if they declined to have their verbal responses audio recorded.

The visual nature of network mapping was an asset. The network drawing exercise was engaging, and held participant attention throughout the interview. All participants were able to complete the exercise. Being able to draw the network also allowed the participants to visually sense how long the exercise would take, which appealed to busy stakeholders.

The visual process had further benefits. Participants sometimes double-checked their responses for completeness, which they may have struggled to do in an exclusively oral interview. Being focused on drawing one connection in the network at a time also made it more difficult for participants to be aware of the overall picture they were creating. For example, if one were asked to describe a network generally, he or she might talk in imprecise generalisations. Describing each relationship individually identifies where relationships between similar types of stakeholders are in fact different, and provides detail that might be lost in a summary description.

Multiple participants also saw value in the exercise itself because of the detail used to describe networks. This was particularly true for stakeholders actively considering their own role within the network and how they might participate more strategically. This seems to be partly because connecting stakeholders one at a time allows detailed network characteristics to emerge, which might not be evident from generalised

assumptions that individuals have about the networks in which they participate. A few participants took photos of the egocentric network after the exercise because they found it interesting; others asked about when the method will be published and potentially available for use.

The verification provided by interviewing stakeholders separately was also deemed to be useful. Although participants may omit or misremember certain stakeholders or ties, interviewing stakeholders individually helps to verify data. The detailed structure of network graphing during interviews also makes it difficult for participants to wilfully collude to provide misleading data. Experiences collecting these data suggest that the networks are accurate representations of the stakeholders and relationships in the rural water sectors studied.

In summary, the research methods were deemed to be effective for collecting the required data, and were found to have several advantages. The necessity of one-on-one interviews helped participants to create time for the exercise, and to openly share their views once they understood the conversation was anonymous. Participants often became engaged in the visual nature of the network mapping exercise once it began, clarifying how they could best represent their experiences, and double checking their responses. Some were interested in the insights that came from visualising their networks. Subsequent interviews with other stakeholders independently then helped to verify data and gather different views on issues. Further research might build on these methods to consider how they can be used again and adapted to different contexts.

4.6.4 Challenges with Methods

There were also challenges with applying the research methods. These relate to both the experience of conducting interviews, and limitations of trying to understand complex realities through a particular type of approach. Multiple challenges were identified that had to be managed in the context of this research.

Firstly, participant oral responses sometimes deviate from the intended topic. Maximum space was given for participants to speak as they saw fit, sometimes involving lengthy digressions. Clarification was only requested during points of confusion, and summaries were occasionally ventured to help wrap up a topic and proceed to a new one. Future case studies may consider encouraging further oral responses more closely related to the topic of interest after participants have fully expressed their views on what is important.

Some challenges arose from trying to approximate dynamic relationships with a drawn snapshot. The exercise did not capture the frequency of interaction between stakeholders. One participant in Ghana, while giving feedback on the exercise, tentatively suggested including some way of measuring interaction frequency. On further consideration, however, he then backtracked in favour of simplicity because he believed that the levels of intensity within link types give some indication of interaction frequency. Intensity of a relationship is, however, not the same as frequency of interaction, and future iterations of these methods might consider finding an efficient way of incorporating frequency of interaction into the mapping exercise.

Drawn networks also do not show how things change over time, meaning that interviews provide a snapshot that is an approximation of relationships over a period spanning several years. This is accepted as a limitation of the methods, since capturing multiple snapshots over several years was not feasible in this research. The relatively stable nature of institutional relationships, particularly involving government and civil society, and allowing interview participants to verbally describe the nature network interactions can justify accepting this limitation.

Limitations with interviewing knowledgeable individuals on behalf of an organisation or stakeholder group was also identified as a trade-off earlier in this chapter. Overall, the experience of interviewing knowledgeable individuals seemed to provide the appropriate data. It might be possible to interview more people from an organisation, but would probably require collation of separate interviews. Multiple people from the same organisation were present in a small number of interviews, but it was unclear whether this benefitted the research or instead sacrificed detail for consensus. In these cases, one of the members drew the network while the others offered their views on how ties should be represented. A perceived desire to reach consensus may have lessened the respondent's candidness and may have contributed to groupthink, but it is difficult to know the exact effect without formally studying these differences.

Introducing a framework for graphing network tie types occasionally introduced interpretive challenges. There is potential for tie types and their sub-types to be interpreted differently. All participants, however, appeared able to grasp the framework quickly. Clarification was offered when requested using standardised descriptions, and assistance categorising tie types was further offered when participants were confused about what to draw. Loss of detail is unavoidable when categorising a complex reality into a standardised framework, although strong pushback against the framework design

was not encountered. This suggests that the tie types and their sub-types are reasonable classifications, even if they are imperfect.

An interesting challenge emerged at the community level where participants interviewed could belong to multiple stakeholder groups simultaneously. For example, a community member can simultaneously be a chief and a representative on several committees. These groups were linked closely enough that these stakeholders were able to describe the relationships between multiple nodes at the community level, although future fieldwork may benefit from further detail by interviewing community sub-groups separately.

A final, practical challenge was logistical. Participants were consistently supportive of the research, and willing to make time for interviews provided that the researcher could adapt to their schedules. This was sometimes challenging, requiring traveling to a new town on short notice, spending an unexpected night somewhere, or sometimes being unable to make plans for more than a few hours at a time. Chasing down interviews could be unpredictable and tiring, especially in foreign and occasionally sweltering climates.

4.7 Methods Summary

The methods presented in this section were applied to case studies in Ghana, Malawi, India, Tajikistan, and Bolivia to capture network data on how stakeholders in rural water service delivery sectors interact. The methods combine egocentric network mapping to capture quantitative data, and verbal descriptions of networks are used to capture qualitative data. These two types of data are then used to identify stakeholder networks and their characteristics that are perceived as supporting institutional development for rural water supply.

The next chapter presents quantitative analysis of network data. This is the first analytical step that investigates quantitative properties of ego networks for specific cases of institutions that are improving performance. The chapter will show how ego networks are analysed to present findings. This analytical step is then followed by the chapter on Qualitative Analysis (Chapter 6), which presents analysis of stakeholder commentary on important network characteristics.

5 QUANTITATIVE ANALYSIS

Network data collected during stakeholder interviews are analysed quantitatively using established methods. This chapter explains the analytical process and presents quantitative findings. Analysis proceeds from four angles: network size; homophily; multiplexity; and reciprocity. Each is defined in its respective section of this chapter, and some definitions of network terminology and analytical methods are presented first as the basis for investigation in this chapter.

5.1.1 Visualising Snowball Networks

Snowball networks are composed of all stakeholders and the ties between them that were identified in each country case study through primary data collection. These are the larger networks around the specific case study institutions that are the core interest of this research (see Section 3.5). All nodes and ties in these snowball networks can be visualised using Gephi network graphing software (Bastian, Heymann, & Jacomy, 2009), as shown in the examples of the Ghana network in Figure 10 and the Indian network in Figure 11. Nodes are depicted as grey dots, black arrows are ties, arrowheads indicate tie direction, and arrow thickness is proportional to tie weight.

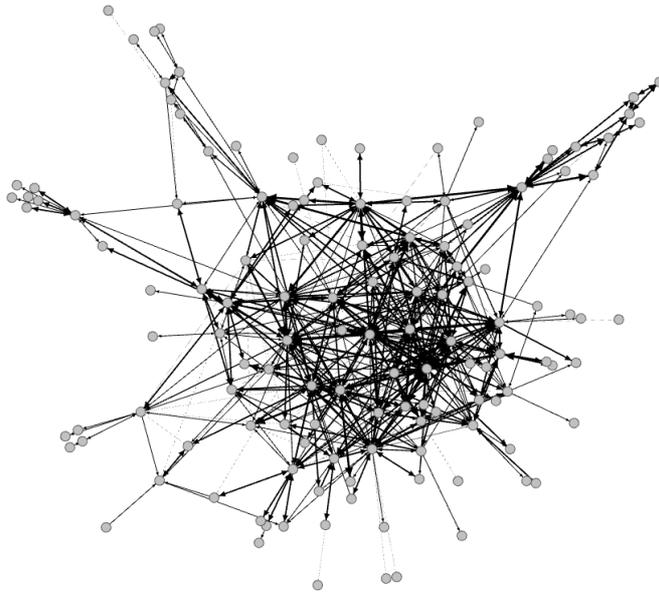


Figure 10 – Snowball network of all data captured in Ghana.

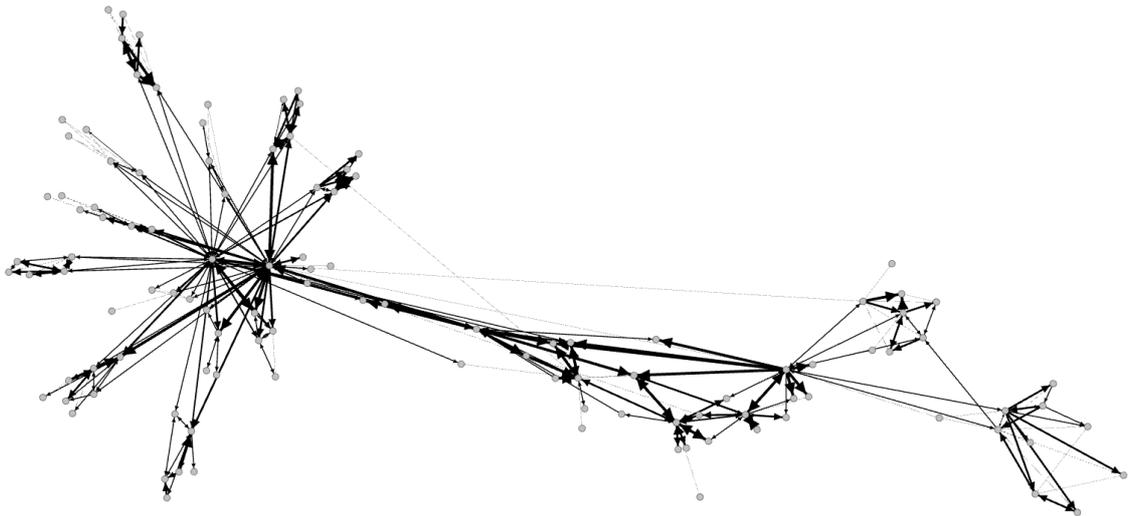


Figure 11 – Snowball network of all data captured in India.

Each case study focused on specific institutions that are improving performance in their roles related to rural water service delivery, as described earlier (Section 3.5). These will be referred to throughout this chapter as case study institutions, and they include local government, national government, or local water service operators, depending on the country. Case study institutions in India are community operator committees managing arsenic removal facilities. Case study institutions in Ghana, Malawi, and Bolivia are district and municipal governments. Research in Tajikistan focuses on a national government institution that sets policy and regulates the water sector. Each case study institution exists within the larger snowball network that contains all nodes and ties identified through primary data collection in each country.

5.1.2 Identifying Ego Networks within Snowball Networks

Ego networks exist within the larger snowball network that is created by combining all node and tie data collected in each country. An ego network shows only nodes directly connected to a particular node of interest. The node of interest around which the network is created is called the ego, and nodes that are directly connected to the ego are called alters (Crossley *et al.*, 2015).

Snowball networks can be filtered to show the ego network of any node, as shown in Figure 12 and Figure 13. Ego nodes are presented as larger than others in the filtered ego networks (right frames) in Figure 12 and Figure 13, but their original positions in the network visuals are maintained. This shows how ego networks fit into the larger snowball networks in Ghana and India respectively.

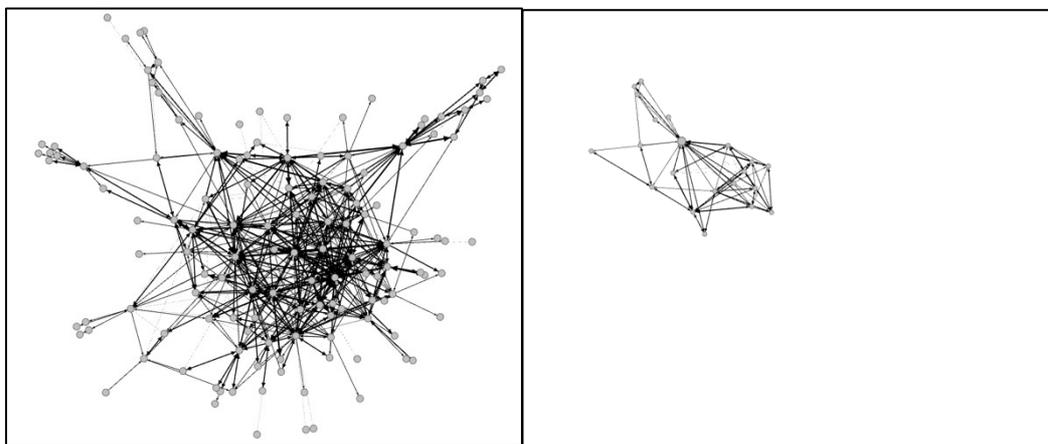


Figure 12 – Ghana snowball network (left) filtered for a specific ego network (right)

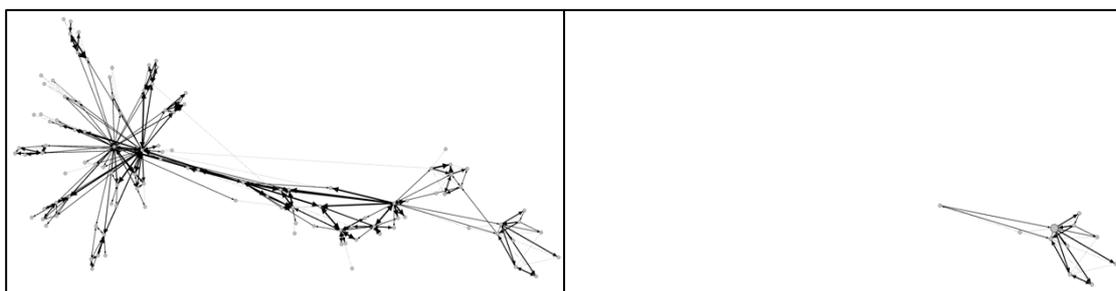


Figure 13 – India snowball network (left) filtered for a specific ego network (right)

Each ego network consists of the ego stakeholder and the other stakeholders it directly connects with – its alters. Ties are either between the ego and alters or between alters. Data on alter to alter ties were captured during follow up interviews with at least one of the two alters in the relationship. Figure 14 illustrates how these terms apply to an ego network.

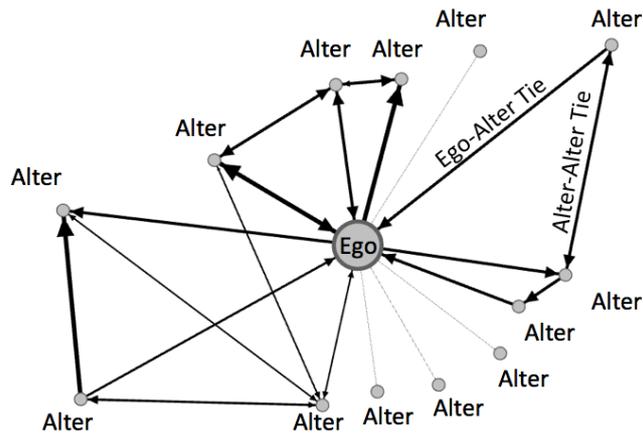


Figure 14 – Ego network example with terms defined (McNicholl *et al.*, 2017)

5.1.3 Identifying Egos to Analyse

The institutions that are improving performance, referred to as case study institutions, were pre-determined before field work began (Section 3.5), and the ego networks of these case study institutions are the principal unit of analysis. The ego networks of other stakeholders interviewed can also be analysed to provide some comparison. Analysing these other ego networks can provide perspective on typical values for ego network properties for other stakeholders in each country. Two sets of ego networks – those of case study institutions, and those of others interviewed – allows some comparison of how case study institution network characteristics differ from those of other stakeholders in their respective countries.

There are therefore three categories of stakeholders in the snowball network of each country studied. The first category includes the case study institutions that are improving performance. Analysis of their ego networks is the basis of this chapter. The second category includes other stakeholders that were interviewed whose performance is unknown. Comparing ego network properties of others interviewed to the case study institutions provides perspective on how case study institution ego network properties differ from others in the same sector. The third category includes stakeholders that were identified during fieldwork but not interviewed. They are not analysed because their full ego networks are not known. Table 10 quantifies the number of case study institutions and the number of other stakeholder ego networks included in each country.

One other category of ego networks is also used for comparison in the India and Bolivia case studies. Capturing cases for comparison was not originally planned during fieldwork, but these were included when the opportunities presented themselves. These

institutions are the same as the other case study institutions in terms of level of hierarchy and role, but these institutions are declining in performance or have failed. These instances provide a more direct comparison in these two countries to see how network characteristics identified in case study institution ego networks are represented in the ego networks of institutions that are not developing. Data on underperforming institutions were only available in two case study countries because data on other institutions were either unavailable or, in the case of Tajikistan, because there is no other equivalent institution in the country. Differences in performance and comparison against case study institutions is explored in the chapter on Comparative Analysis (Chapter 7).

Table 10 – Number of ego networks by country included in quantitative analysis

	Ghana	Malawi	India	Tajikistan	Bolivia
Case study institutions	2	2	12	1	3
Others interviewed	41	38	25	14	19
Others identified but not interviewed	90	107	64	49	65
Underperforming institutions	0	0	3	0	1
Total egos for analysis	43	40	40	15	23
Total in snowball network	133	147	104	64	88

The purpose of quantitatively analysing these different ego networks is to provide perspective on how case study institution ego networks differ from other stakeholders in their sector; the purpose is not to test for statistical significance. Comparison can help to understand whether or not, for example, the number of alters in case study institution ego networks are relatively high compared to others in the sector. The purpose is not to draw conclusions about influences on institutional development from this comparative

analysis, but rather to provide some perspective on typical values for different ego network properties in the respective countries.

5.1.4 Case Study Ego Networks

Ego networks for case study institutions can be visually represented to show two properties of the alters they interact with: type and level of sector hierarchy. These properties are used for ego network analysis in this chapter and in subsequent ones. Each property is described in turn.

Levels of hierarchy are defined by the institutional structures in these countries, and stakeholder level of hierarchy is defined by where a stakeholder is based (Table 11). In Bolivia, for example, analysis considers the tendency of case study municipal governments to connect to others within that municipality versus to stakeholders at department or national levels. In India, the consideration is the tendency of local operators to connect to others within their communities versus those outside of it. Levels of hierarchy differ slightly depending on the institutional structures of case study countries, but all reflect similar ideas of decentralised jurisdictions spanning from local to national levels.

Table 11 – Definition of levels of sector hierarchy by country used in analysis

Level of Sector Hierarchy	Ghana	Malawi	Bolivia	India	Tajikistan
High	National	National	National	State	National*
Middle	Regional	Regional	Department	District	Regional
Local	District*	District*	Municipal*	Community*	District

** denotes case study institution level of sector hierarchy*

Stakeholder type is the property used to define network nodes by the role of the stakeholder (Table 12). Definitions are consistent across all case studies. Stakeholder types are defined for this research with the intent to understand how case study institutions connect to similar versus different stakeholder types. These definitions draw on common terms in rural water sectors to simplify identification of stakeholder types during interviews.

Table 12 – Definitions of stakeholder types used in network analysis

Type	Definition
Government	Official government agencies or departments.
Private	For profit stakeholders that provide goods or services.
Operator	Dedicated manager of a water system. These are distinguished from Private because these perform a specific function in providing water services that may not be profit-driven.
DP	Development Partners, or donor organisations, that includes bi-lateral and multi-lateral organisations such as the UK Department for International Development (DfID) and the World Bank Group (WB).
INGO	International Non-Government Organisations that run projects or provide services with international scope and resources such as WaterAid or Water for People.
NGO	Non-Government Organisations that operate with scope and resources within the country only.
Academic	Academic institutions including universities.
Civil	Other local stakeholders from civil society including citizens, communities, religious leaders, and traditional leaders.

Colour coding and spatial orientation of nodes can be used to visualise ego networks that identify node types and levels of hierarchy. Examples of these ego networks from each country are presented next.

5.1.4.1 Ghana

The case study institutions in Ghana are two district governments that are improving performance with respect to their roles in rural water service delivery (Section 3.5.1.2). One of them is shown in this section; the other is included in Appendix A. The case study district government in Figure 15 is the ‘ego’ and is represented as the largest node in the network. Levels of sector hierarchy are defined by the y-axis and the red dotted boxes; x-axis locations are distributed randomly for visual clarity. Stakeholder types are defined by node colour and the legend to the right of the figure. Arrows indicate the direction of a tie, and the thickness of the line represents the ‘weight’ of the combined information, skill, resource, and authority ties. Ties to and from the ego combine data

from both the interview with the ego, and data from interviews with alters that described ties with the ego. Ties between alters are included where one or both of the alters provided data on these ties during follow-up interviews.

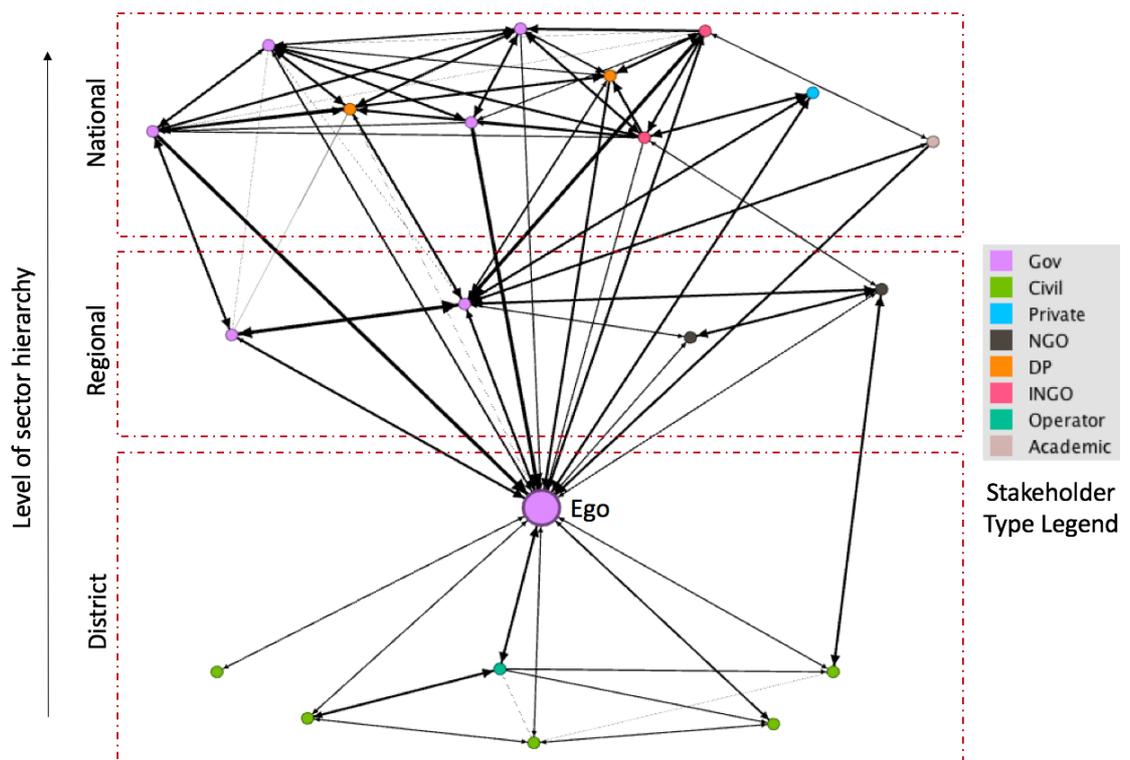


Figure 15 – Ego network of a case study district government in Ghana for all tie types visualised to show levels of sector hierarchy and stakeholder types (McNicholl *et al.*, 2017)

Figure 15 includes all network ties and tie types: information, skills, resources, and authority. The number of alters in the ego network change, however, depending on the tie types included. This is demonstrated by filtering each tie type and showing the resulting ego networks in Figure 16.

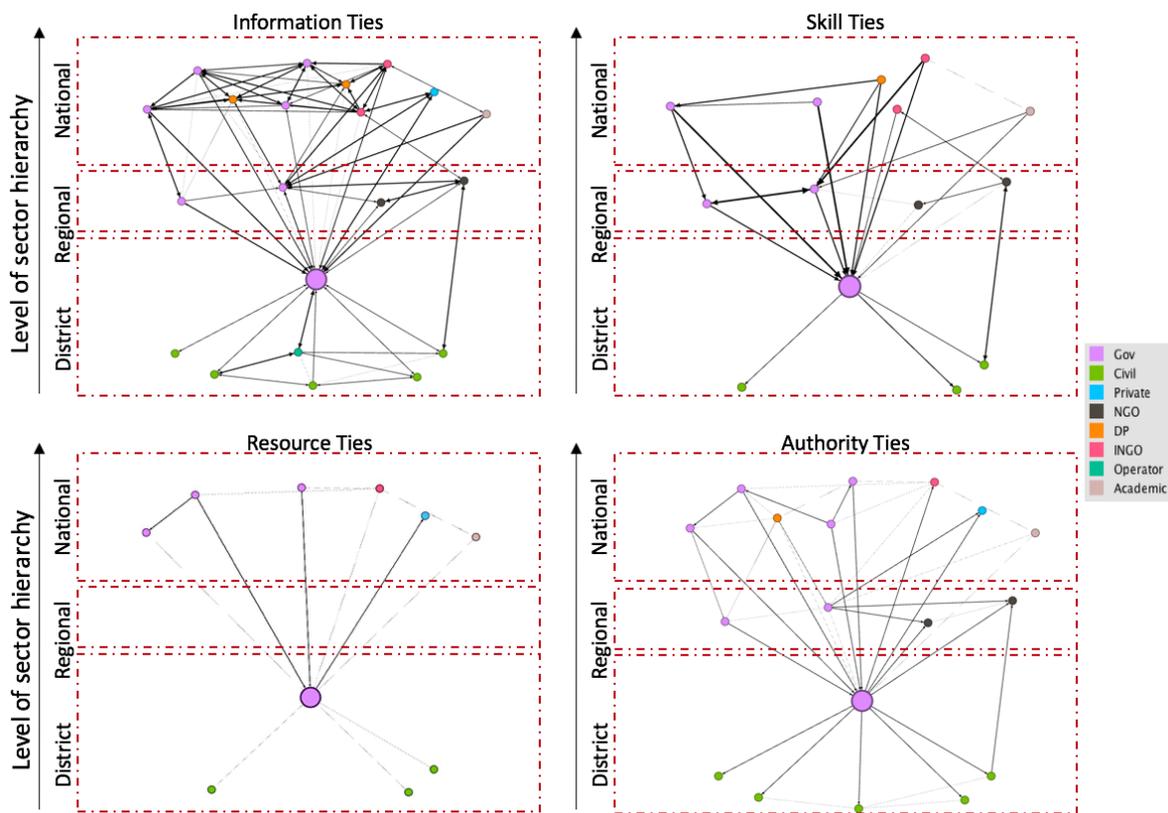


Figure 16 – Ego networks for different tie types of a Ghanaian district government

For the ego network of each tie type, node positions are kept the same, but network membership changes. For example, some alters are part of the information network, but are not present in the resource ego network. Information ties are the most common, and analysis of multiplex ties explores how multiple tie types exist in parallel (Section 5.4).

5.1.4.2 Malawi

The case study institutions in Malawi are also two district governments. The ego network for one of them is presented here (Figure 17), and the other is included in Appendix A. Government hierarchy in Malawi is similar to the structure in Ghana, but with fewer districts. District Authorities are the local units of formal government, followed by regional, then national levels. Malawi has 28 districts in three regions. The result is that the total number of stakeholders in the ego networks can differ depending on country, and even within a country, depending on the context.

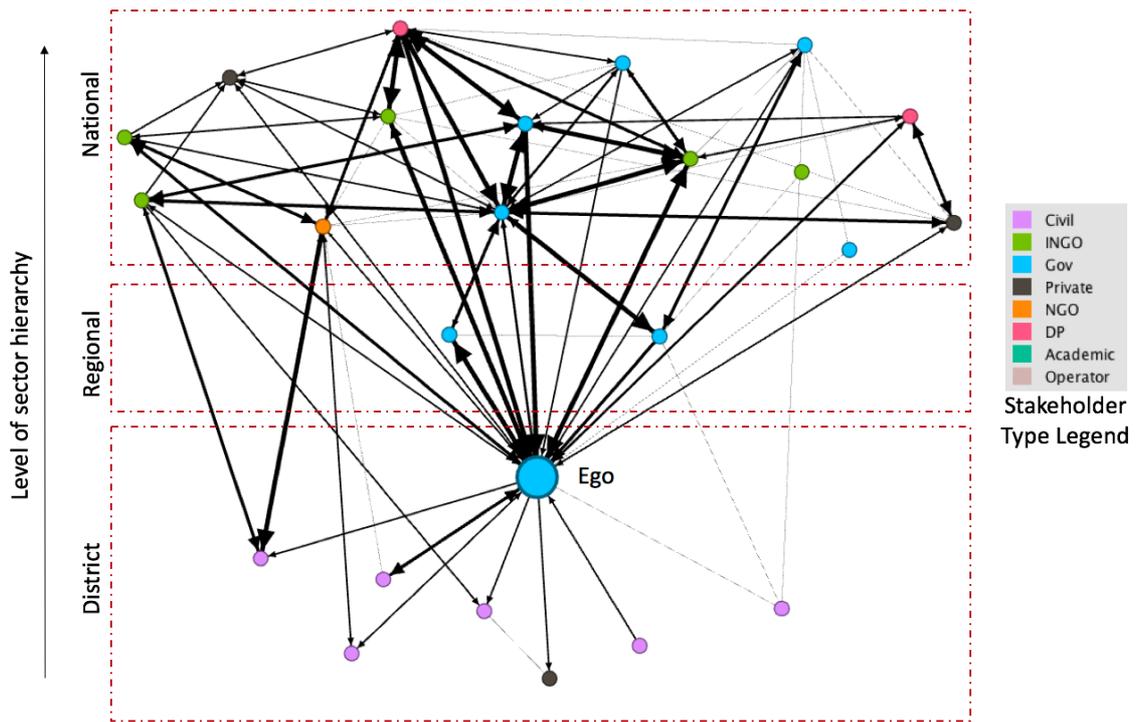


Figure 17 - Ego network of a case study district government in Malawi for all tie types visualised to show levels of sector hierarchy and stakeholder types

This network can also be separated to show the ego network for each tie type (Figure 18).

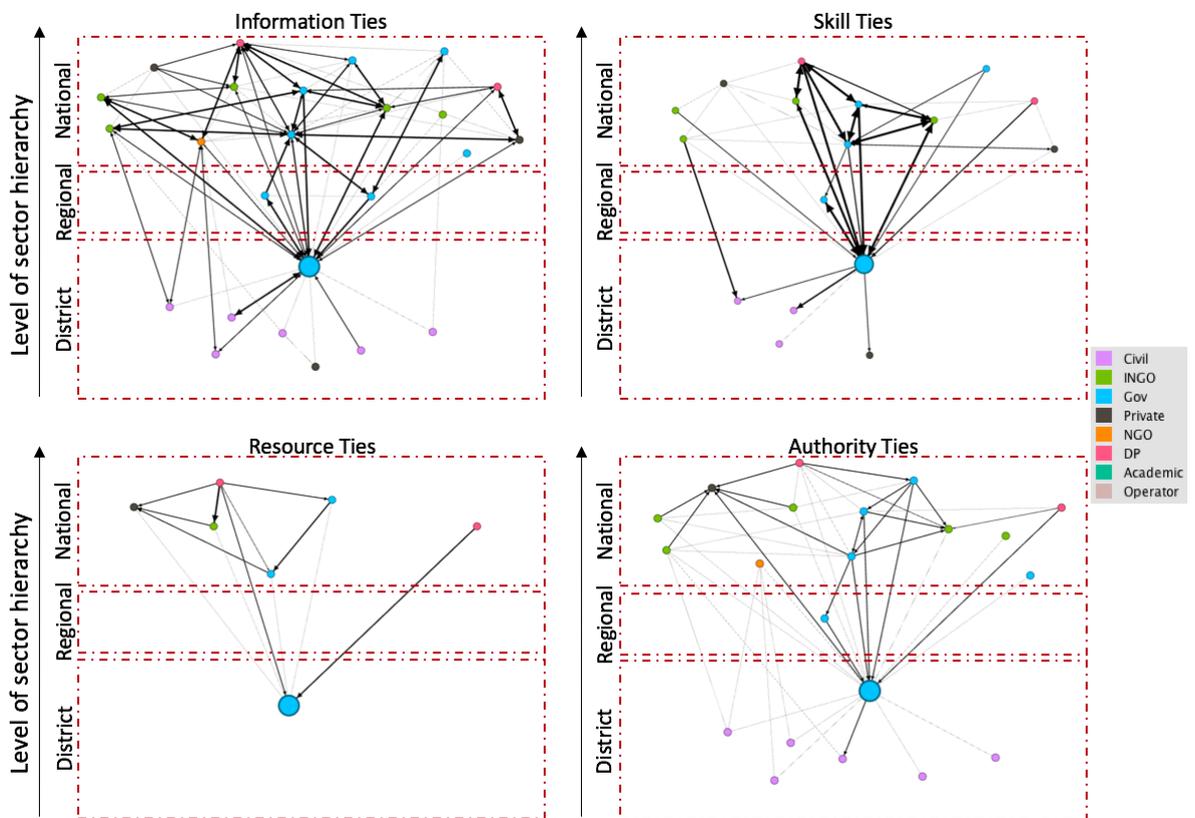


Figure 18 - Ego networks for different tie types of a Malawian district government

5.1.4.3 India

Case study institutions in India are operators of community arsenic filter units. There are three levels of hierarchy in this case study: community, district, and state. The highest level of hierarchy that directly connects to case study stakeholder are based in the state capital of West Bengal, Kolkata, and the state is therefore the highest level of hierarchy. Within West Bengal, all case study stakeholders are in the district of 24 North Parganas.

This definition of hierarchy considers the case study institutions, in this case community arsenic filter operators, as being members of their immediate community, and connections beyond this are considered links to other levels of hierarchy. Other levels of hierarchy include other stakeholders in the district, or stakeholders based in the state capital. The important distinction when considering hierarchy is investigating links to the immediate community as distinct from links to stakeholders beyond this. The ego network of a case study operators is presented in Figure 19, and Figure 20 shows the separate ego networks for each tie type.

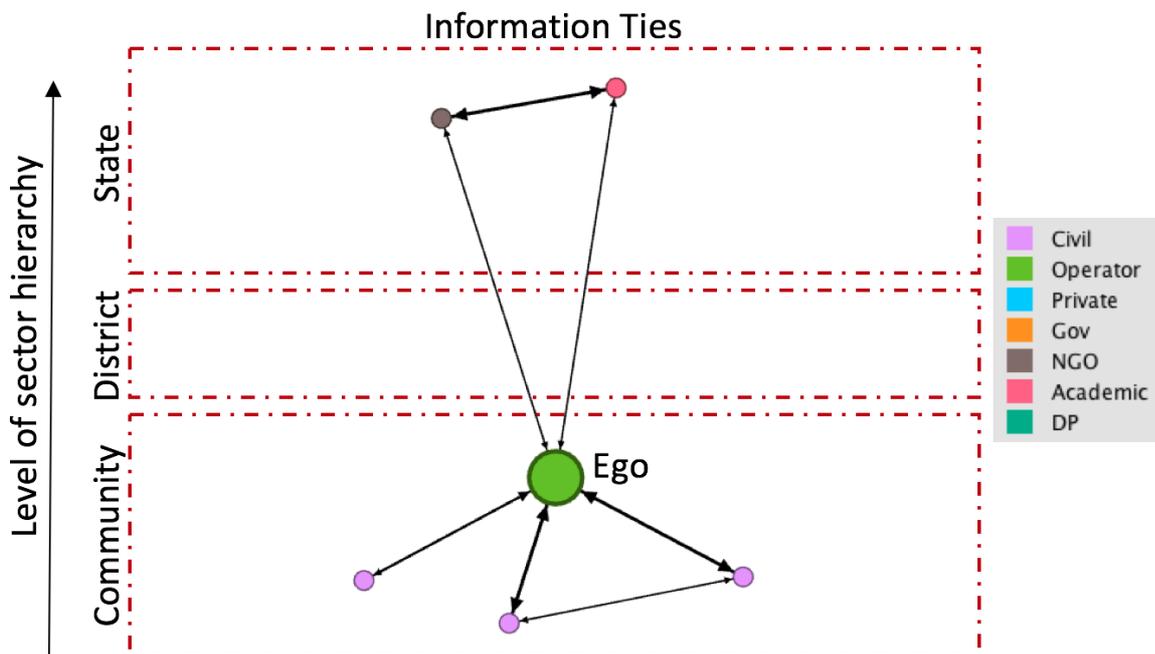


Figure 19 - Ego network of a case study arsenic filter operator in India for all tie types visualised to show levels of sector hierarchy and stakeholder types

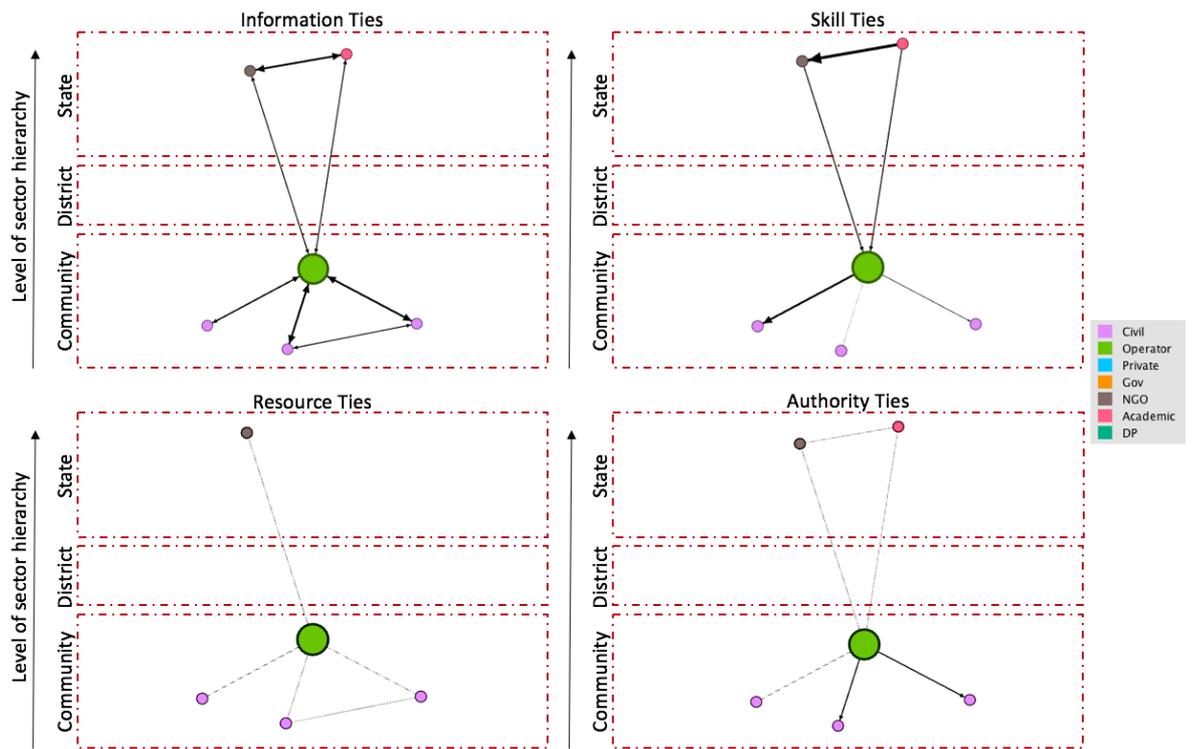


Figure 20 - Ego networks for different tie types of a Indian local arsenic filter operator

5.1.4.4 Bolivia

Case study institutions in Bolivia are municipal governments. Four were studied, and one is presented in this section. The institutional structure is similar to that in Ghana and Malawi but with different names. The equivalent of a district is a municipality, and the equivalent of a region is a department. Figure 21 and Figure 22 present one example of a case study municipality overall ego network and ego networks by tie type, respectively.

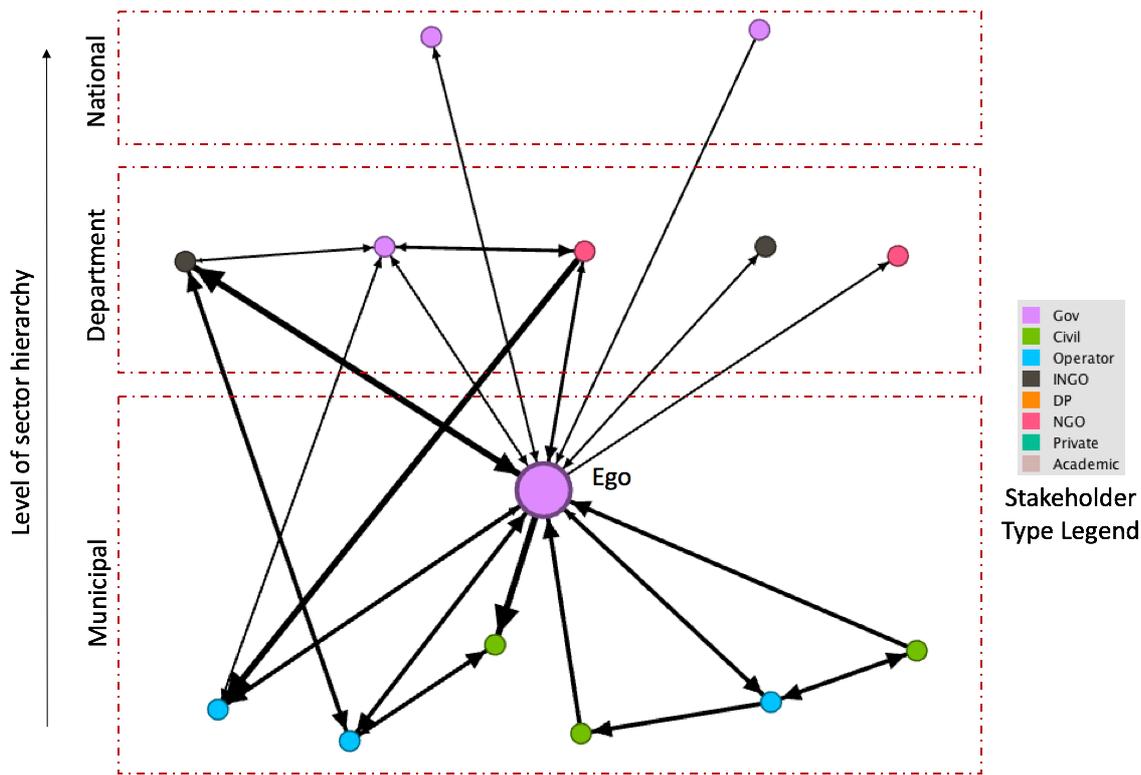


Figure 21 - Ego network of a case study municipal government in Bolivia for all tie types visualised to show levels of sector hierarchy and stakeholder types

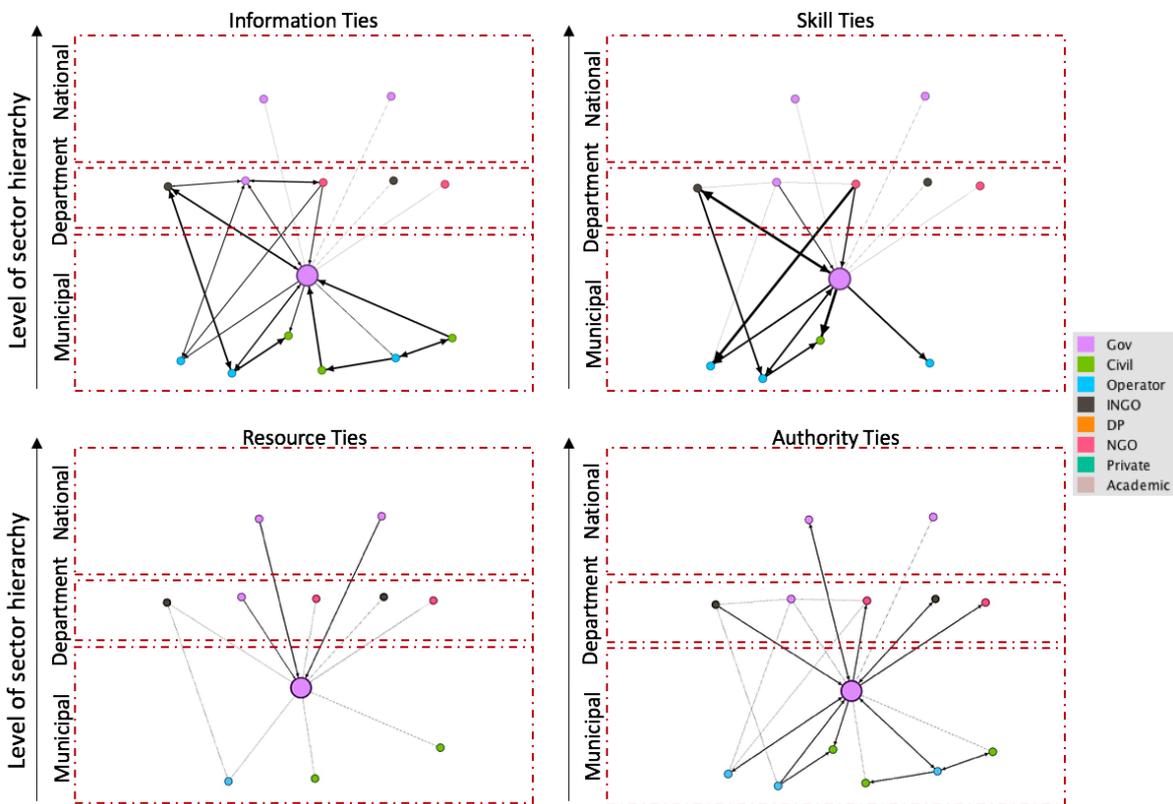


Figure 22 - Ego networks for different tie types of a Bolivian municipal government

5.1.4.5 Tajikistan

The case study institution in Tajikistan is a national government institution. This national institution is interesting because of its relatively few connections to lower levels of sector hierarchy compared to its national ties. As with other countries, the national, regional, and district institutional hierarchy is present, but these other levels of hierarchy have little direct relevance to the ego network of the case study institution.

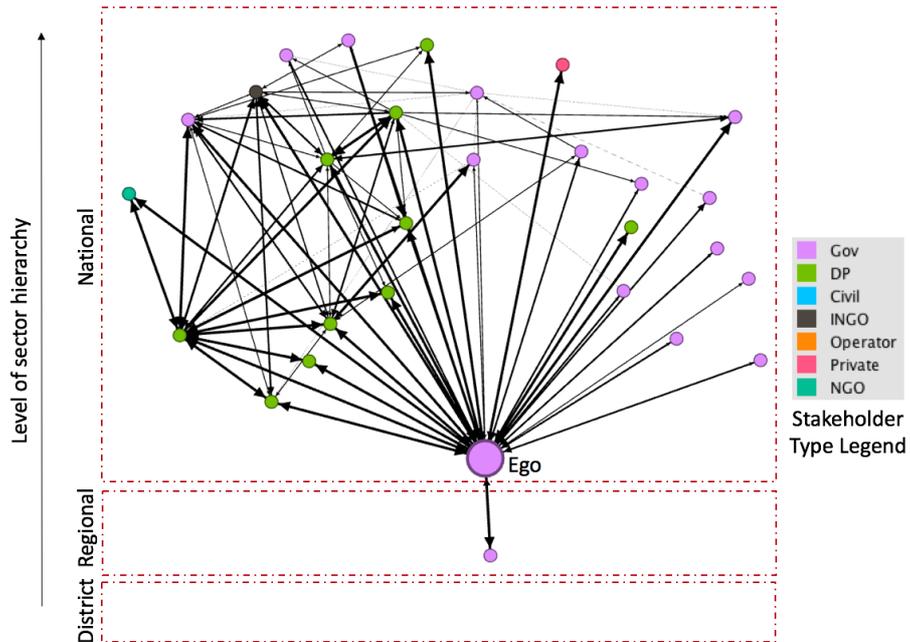


Figure 23 - Ego network of the case study institution in Tajikistan for all tie types visualised to show levels of sector hierarchy and stakeholder types

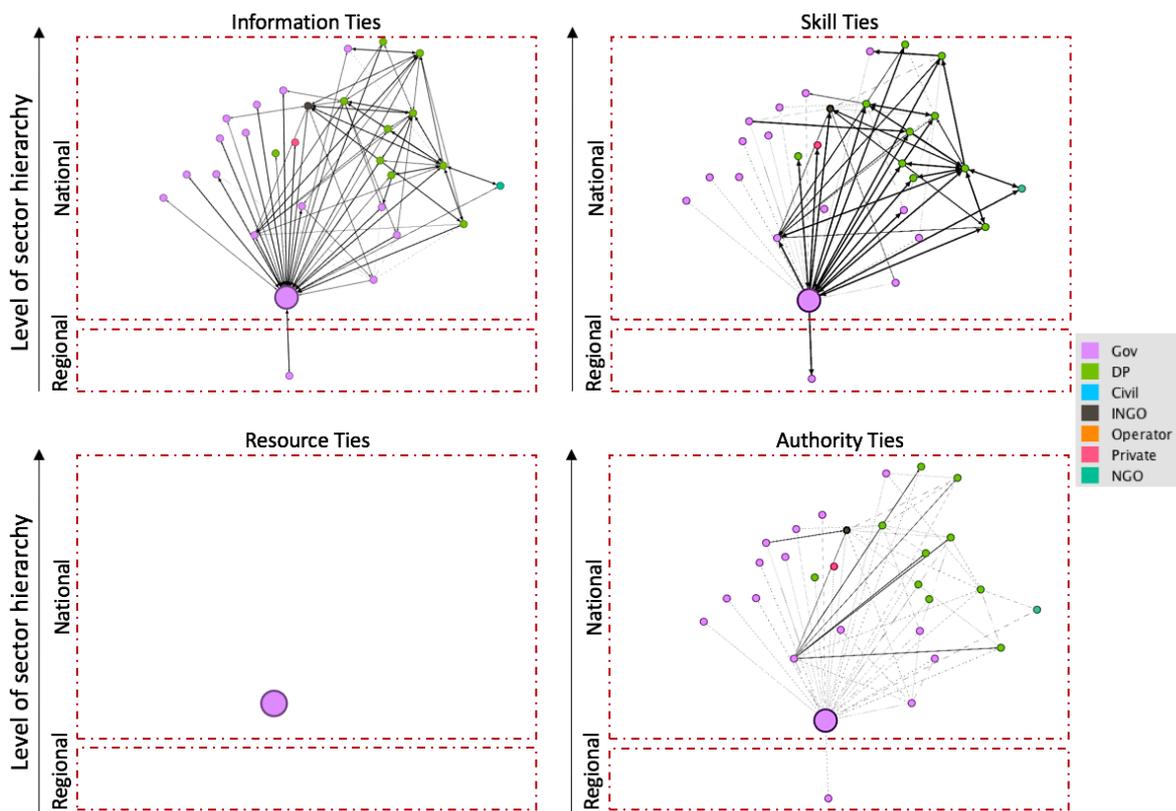


Figure 24 - Ego networks for different tie types of the Tajikistan case study institution

Investigating ego networks by individual tie type shows considerable differences. Despite the presence of numerous information and skill ties, no resource ties were reported either to or from the case study ego in any of the interviews. This signals that the primary functions of this institution relate to information, skills, and authority, and that resources are handled by different government entities or organisations, but do not directly pass through the case study institution.

5.1.5 Analysing Ego Networks

Four types of ego network numerical analysis are conducted in this chapter: size, homophily, multiplexity, and reciprocity. Each is a specific network measure that will be defined in the subsequent sections. These measures include common ego network characterisations of ego to alter ties and alter attributes (Crossley *et al.*, 2015). UCINET software is used to analyse quantitative properties of all ego networks in this chapter (Borgatti *et al.*, 2002), and visualisations are produced using Gephi (Bastian *et al.*, 2009).

5.2 Network Size

Network size quantifies the number of alters in an ego network. Network sizes are first calculated for the case study institutions, and these values are then compared to the ego networks of other stakeholders interviewed in each country. The process is repeated for each of the four tie types.

5.2.1 Network Size Example

An example illustrates how network size is calculated. The ego in this network of skill ties is a case study district government from Ghana. There are thirteen alters in the network, therefore the size of the network is thirteen.

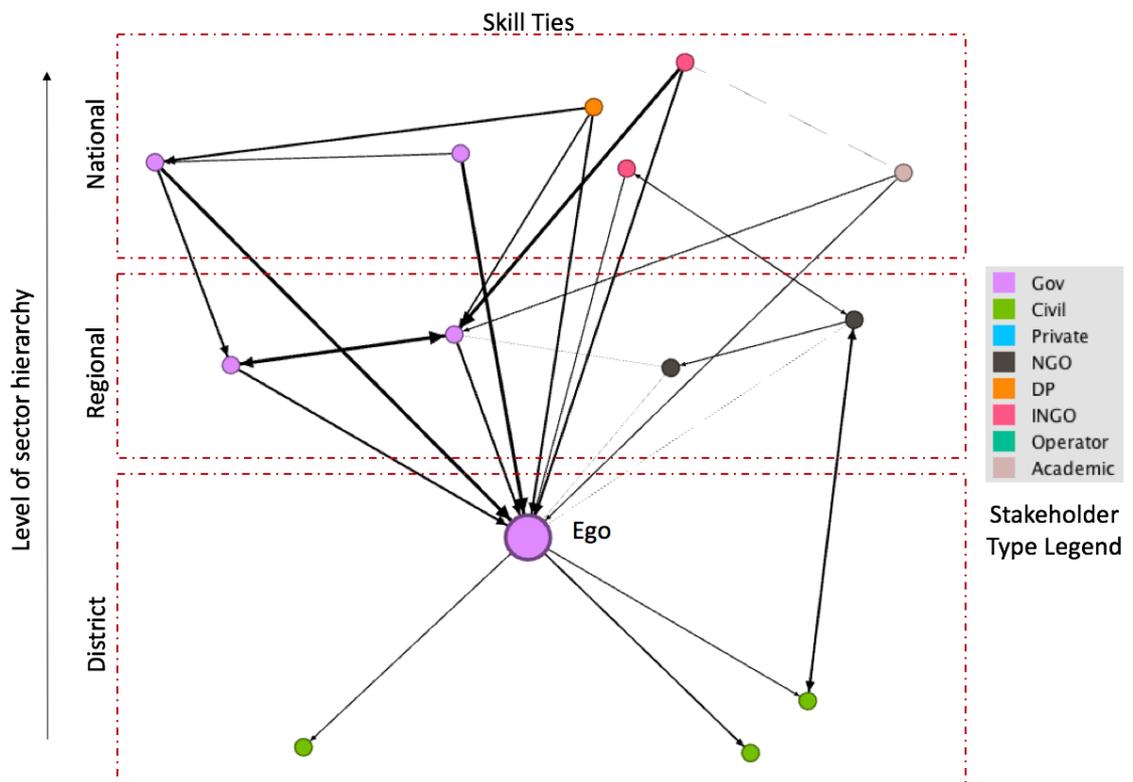


Figure 25 – Skill ego network for a municipal government in Ghana with a network size of thirteen

5.2.2 Information Network Size

The type of analysis presented in the example (Figure 25) is repeated for each case study institution to show how information network sizes compare to each other across countries. The information network size of each case study institution in each country is quantified and plotted in Figure 26.

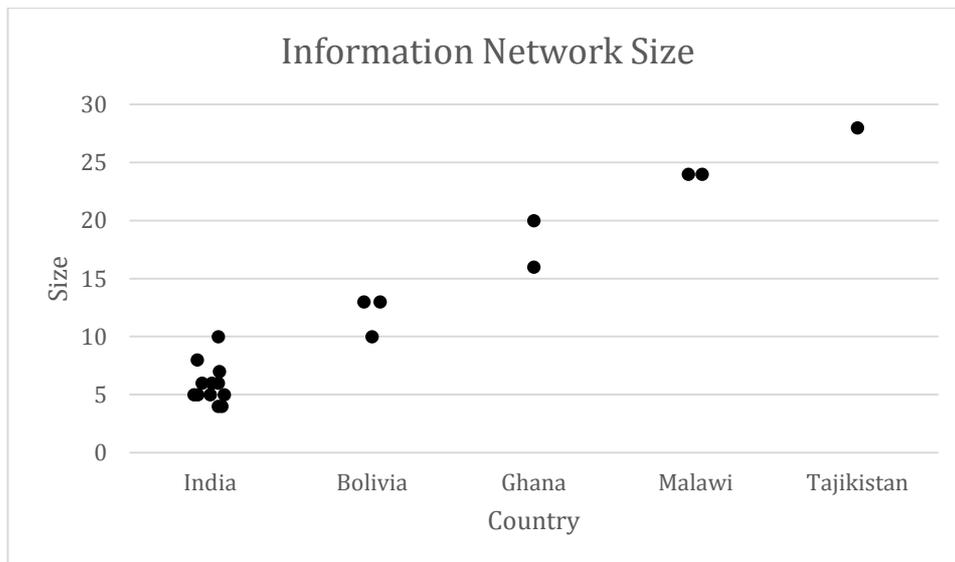


Figure 26 – Information network sizes for case study institutions by country

Figure 26 plots the size of each information ego network for each case study institution by country. The plot shows that Indian case study institutions have information network sizes between four and ten, meaning that four to ten alters are in each information ego network. Information ego network sizes for all other countries show ten or more alters in their respective ego networks.

Adding analysis of ego networks for other stakeholders interviewed allows comparison. The distribution of these values is added in box plots that represent how case study institutions compare to median, minimum, and maximum values. Figure 27 illustrates how box plots are used in this chapter to compare the values of case study institutions to other stakeholders interviewed in their respective countries. Figure 28 then presents the comparison for information network sizes.

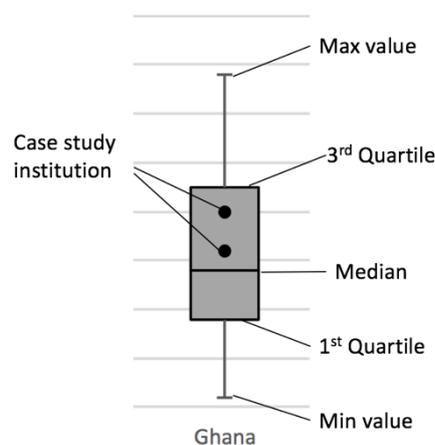


Figure 27 – Legend for box plots presented in this chapter

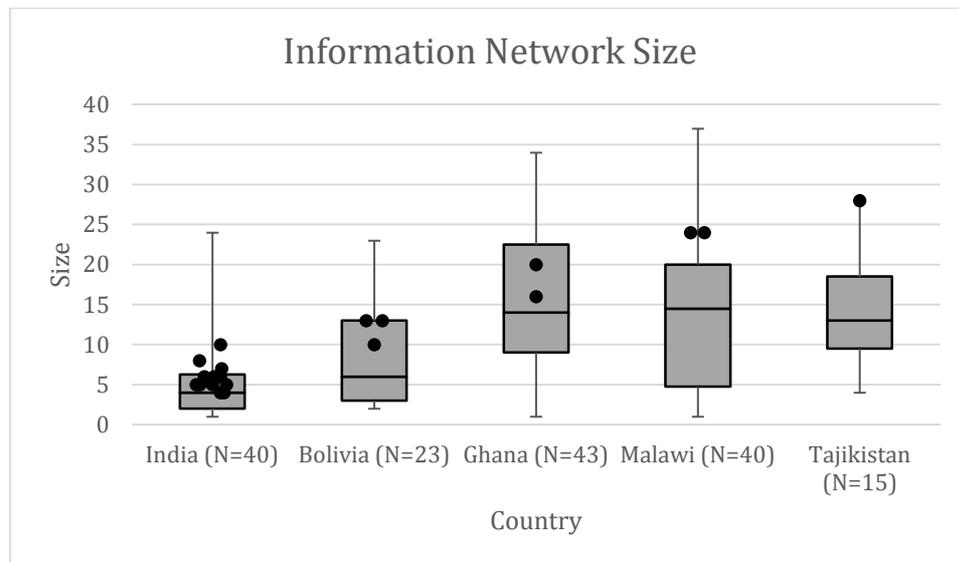


Figure 28 – Information network sizes of case study institutions compared to other stakeholders interviewed in the same country

Information network sizes for almost all case study institutions are above the median in all countries when compared to ego networks of other stakeholders interviewed. This indicates that the number of alters in these information ego networks is relatively large compared to their peers. This, however, assumes that all stakeholders in the network are equal and can be compared. Analysis is therefore potentially improved by controlling for level of sector hierarchy. Controlling for hierarchy ensures that, for example, district governments are compared to other stakeholders at the district level instead of comparing them to large authorities such as a national ministry.

The performance of these other stakeholders is not known, however. All that is known is that these stakeholders are based at the same level of network hierarchy as the case study institutions. The size of their ego networks can therefore provide perspective on what is typical for stakeholders at this level of network hierarchy, but should not be misinterpreted as a comparison between higher and lower performing stakeholders.

Controlling for level of sector hierarchy further highlights the relatively large information network sizes of the case study institutions. Figure 29 presents the findings. All case study institutions are either at or near the top of the box plot distributions. This means that they have relatively large numbers of stakeholders in their information networks when compared to peer stakeholders at the same level of sector hierarchy.

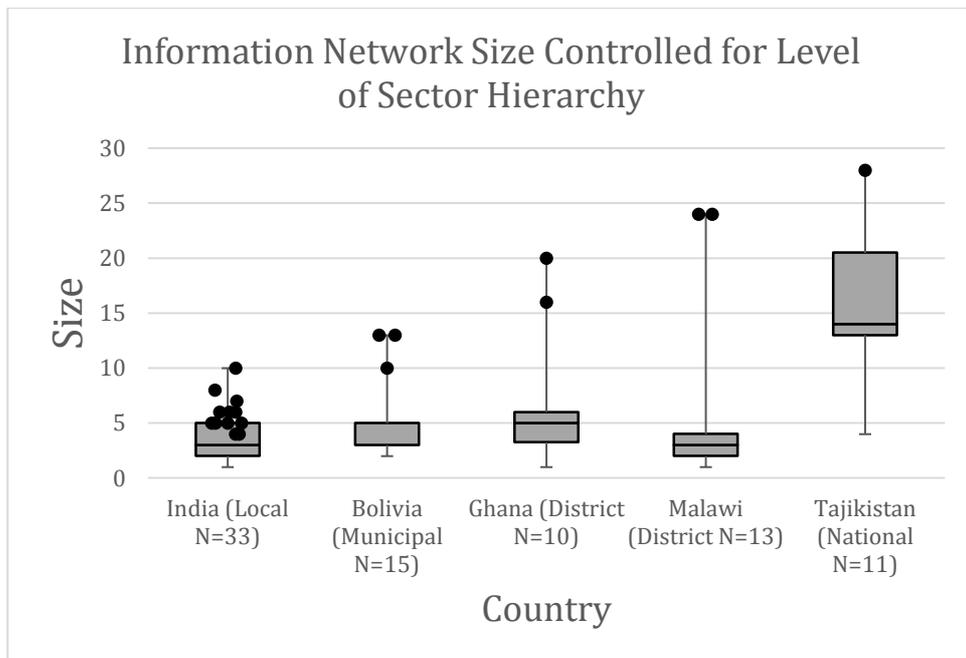


Figure 29 – Information network size comparison controlled for same level of sector hierarchy

5.2.3 Skill and Authority Network Sizes

Analysis of network size is applied to the other tie types, and similar findings are observed for skill and authority ego networks. Skill and authority network size distributions show relatively high values for case study institutions compared to others in the sector (Figure 30 and Figure 31).

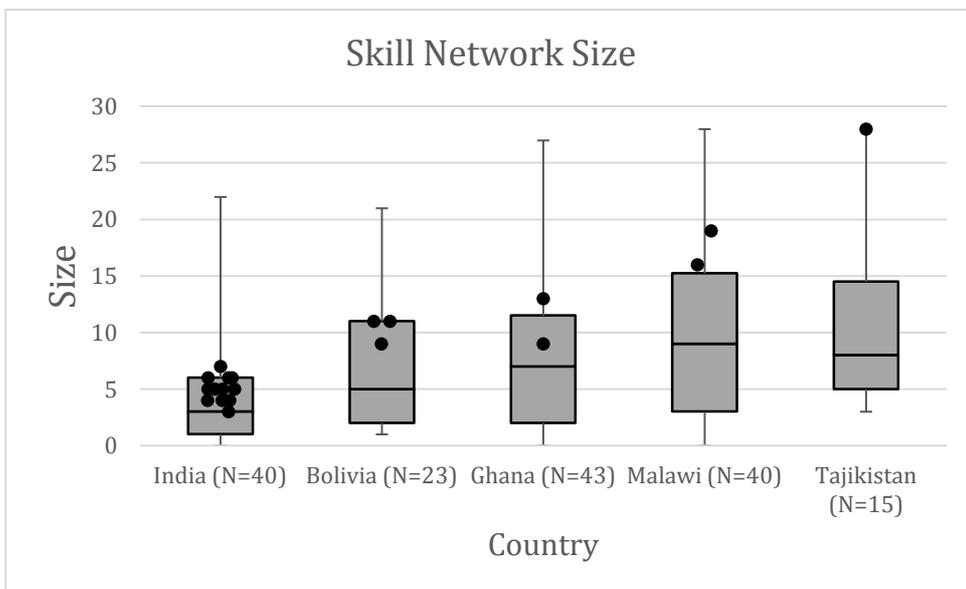


Figure 30 – Skill network sizes by country

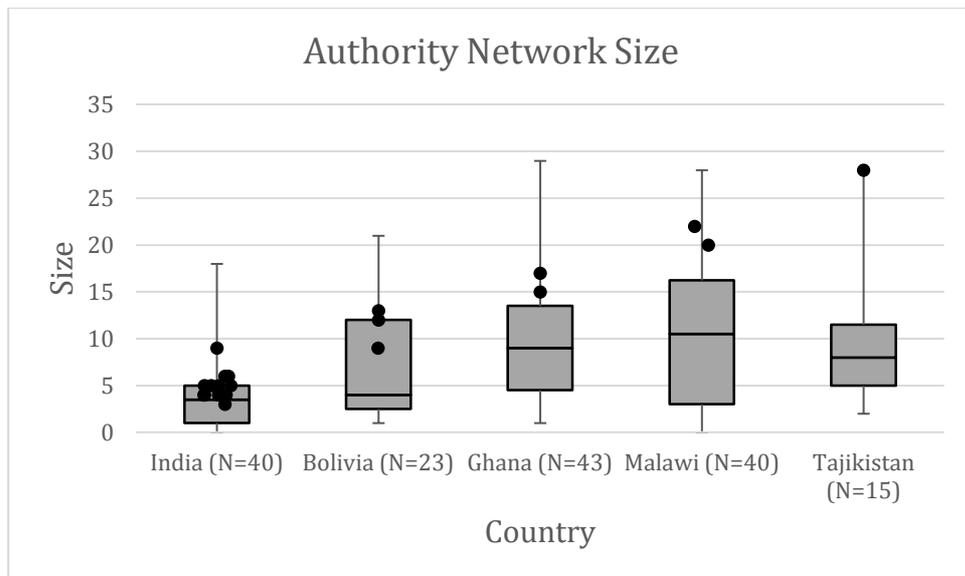


Figure 31 – Authority network sizes by country

These findings are similar to results of information network sizes, but with slightly lower values for some countries. Indian case study institutions have between three and nine ties. Case study institutions in other countries have nine or more alters in their authority ego networks.

The same results become clearer when controlling for level of sector hierarchy, as shown in Figure 32 and Figure 33. Controlling for level of sector hierarchy reduces the number of stakeholders in the analysis, and median and quartile values consequently overlap in some cases. This is the case for the skill network size in Ghana and the authority network size in Malawi that creates narrow or overlapping parts of box plots.

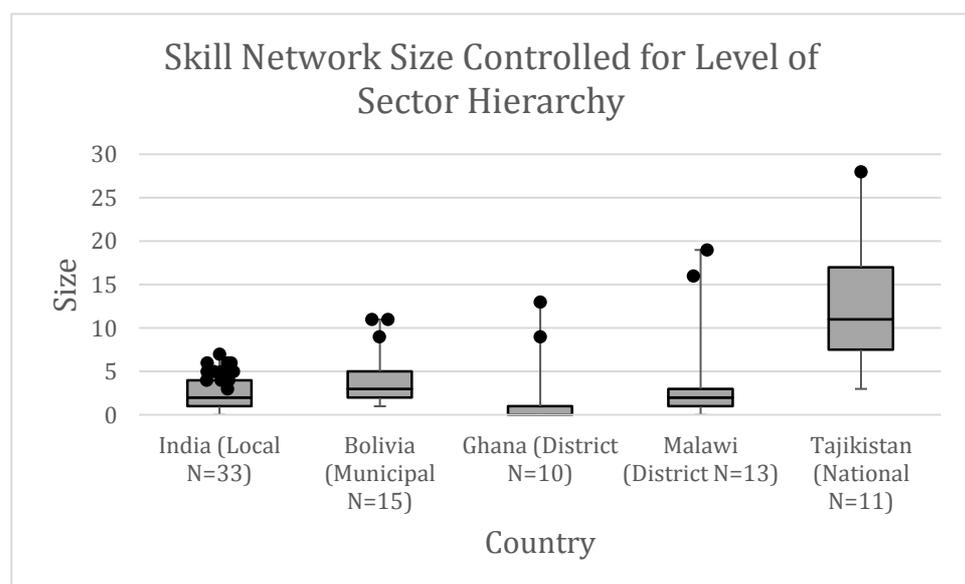


Figure 32 - Skill network sizes controlled by level of stakeholder hierarchy

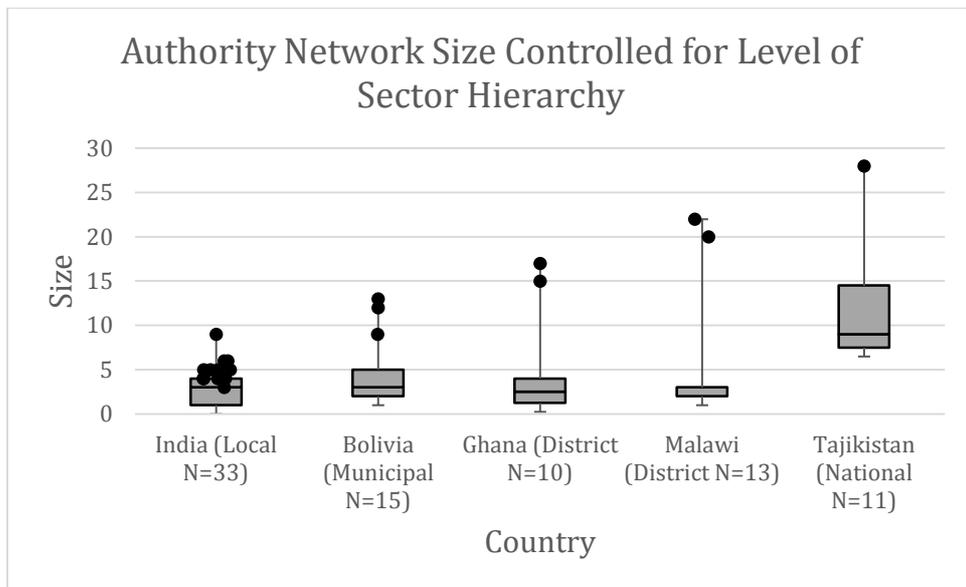


Figure 33 – Authority network sizes controlled by level of stakeholder hierarchy

Controlling for level of sector hierarchy shows that all case study institutions are in the upper quartile, with the exception of some Indian case study institutions that are above the median but not in the top quartile. This shows that, as with information networks, skill and authority networks are relatively large for the case study institutions that are improving performance.

5.2.4 Resource Network Sizes

Resource ties are the least common of the four tie types, and some stakeholders interviewed did not describe any resource ties at all. Not every stakeholder participating in the rural water sector is actively handling financial resource flows. The relative rarity of resource ties is easily seen by quantifying the number of directional ties observed in each country snowball network for each tie type (Figure 34). Directional ties mean that a two-way tie is counted as two ties.

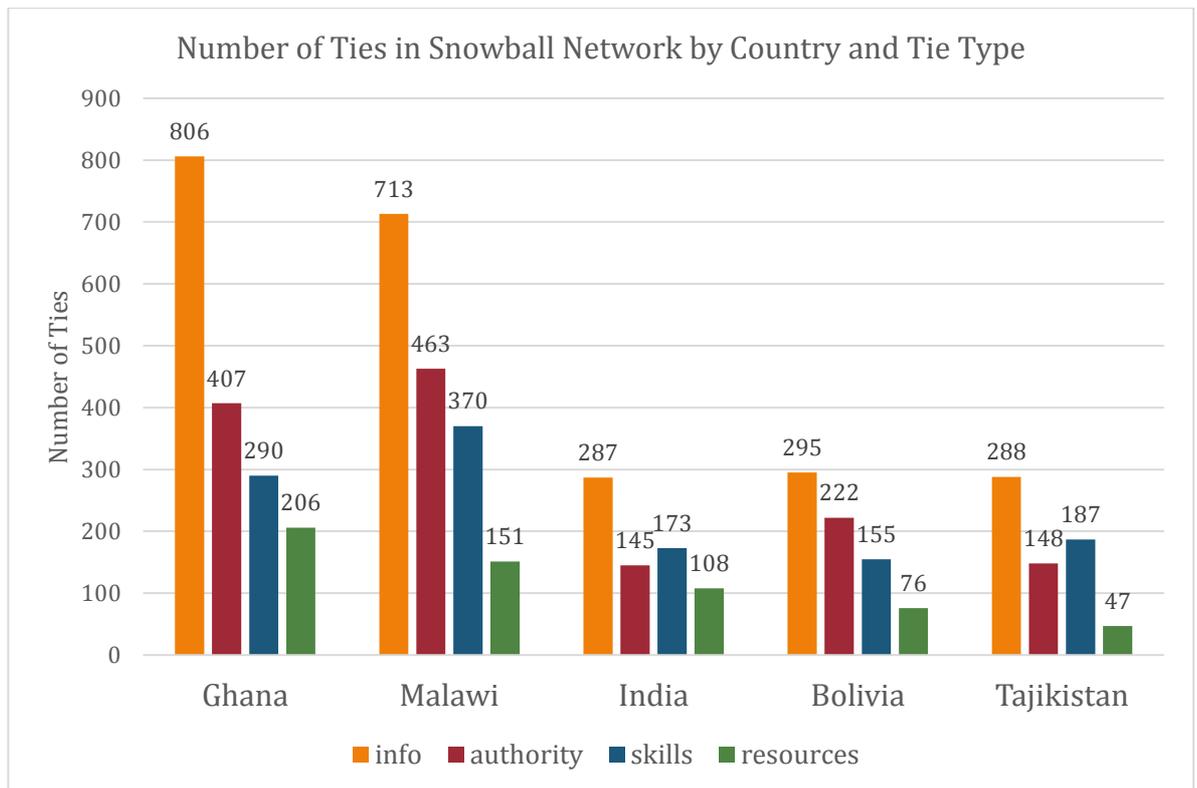


Figure 34 – Number of ties in snowball networks by country and tie type

One possible reason for resource ties being relatively uncommon is their definition in this research as the physical transfer of financial or otherwise fungible resources from one stakeholder to another. This practice was described by interviewees as less common than assets being purchased on behalf of another stakeholder, or being investing directly in infrastructure development. The flow of resources throughout a sector is therefore not a complete representation of resources related to service delivery because infrastructure itself is not included as a node in the ego networks. For example, an international donor might invest in a project in coordination with local government but without channelling the funds directly through the government itself. The government might provide in-kind contributions to the project that would not appear as financial resource transfers between stakeholders. This example is particularly relevant for the case study institution in Tajikistan that identifies no resource ties in its ego network.

Resource ties remain important, however, even if they do not provide a complete picture of infrastructure investments. A single large financial resource transfer between stakeholders would change the nature of their relationship. Analysis of resource ego networks is therefore important to conduct, even if the resource networks contain fewer ties. Analysis of resource network sizes proceeds exactly as with previous tie types.

Figure 35 and Figure 36 illustrate the distributions of resource network sizes overall and when controlling for level of hierarchy, respectively.

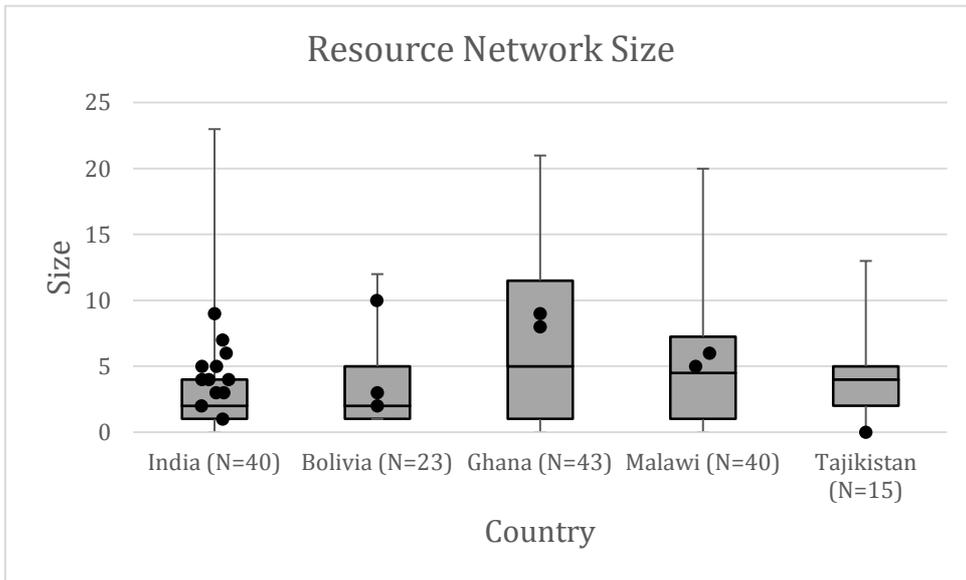


Figure 35 – Resource network sizes

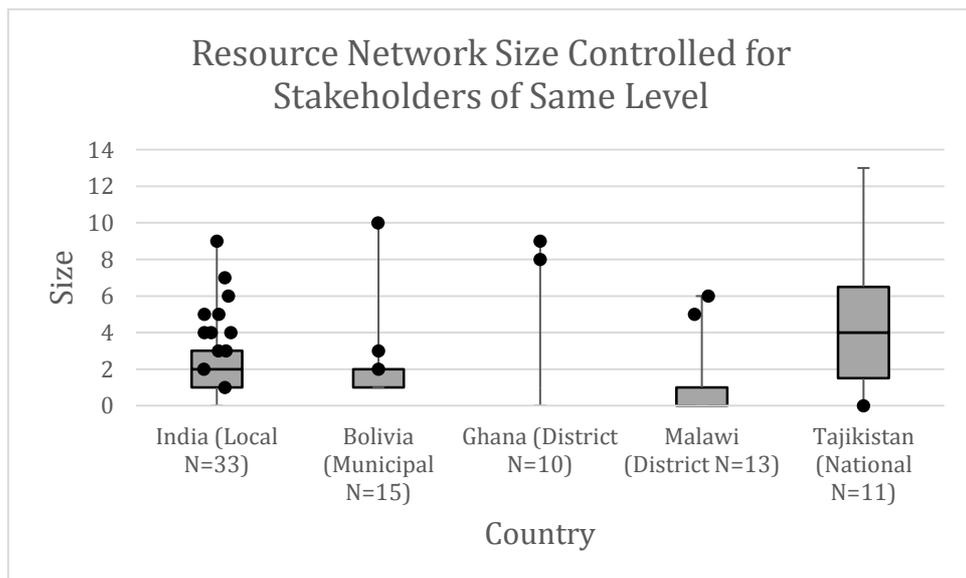


Figure 36 – Resource network sizes controlled for level of stakeholder hierarchy

Findings for resource network sizes are not consistent across different countries. India shows a relatively broad range of resource network sizes while the case study institution in Tajikistan has a resource network size of zero. This means there are no resource ties in this institution’s ego network. Controlling for level shows that case study institutions in Bolivia, Ghana, and Malawi have relatively large resource network sizes, but it is important to note that overall analysis is limited by the relative infrequency of resource ties in the ego networks.

5.2.5 Network Size Summary

Analysis of network sizes finds that all institutions improving performance are connected to numerous alters through relationships of information, skills, and authority, while resource network sizes are smaller. Information, skill, and authority ego networks sizes of case study institutions are also relatively large when compared to other stakeholder ego networks in their respective countries.

The overall finding is straightforward: institutions that are improving performance are well connected in both an absolute and relative sense. The nature and importance of these connections cannot be inferred from network data alone, however, and requires qualification from the perspectives of those actively experiencing these networks. As with the subsequent sections in numerical analysis, qualification of the network characteristics is presented in the next chapter on Qualitative Analysis (Chapter 6).

5.3 Homophily

Homophily characterises the properties of alters in an ego network. It quantifies the proportion of ties that an ego has to alters with similar versus dissimilar attributes. Whereas size looked at number of alters, homophily looks at the diversity of alter properties from the perspective of those that are similar to versus different than the ego.

Homophily can be characterised in two dimensions because data are available on stakeholder *type* and stakeholder *level of sector hierarchy*. From one perspective, stakeholder type allows investigation of the tendency for, say, governments to connect to other government agencies versus other stakeholder types such as private sector, civil society, or multi-lateral organisations. The second perspective explores the tendency to connect with stakeholders of the same level versus other levels of sector hierarchy. For example, this could be the tendency of a national level stakeholder, such as a ministry, to connect with other stakeholders operating at regional and local levels of sector hierarchy. Investigation of both homophily by type and homophily by level of sector hierarchy are conducted in this section.

5.3.1 Homophily Example

An example from Tajikistan illustrates the concept of homophily from the two perspectives of type and level of sector hierarchy. The example in Figure 37 illustrates how these two perspectives can produce different findings using information ties for the case study institution in Tajikistan. The abundance of ties with national level

stakeholders and relative rarity of ties to non-national level stakeholders is easily observed, as is the approximately even number of ties to both other government stakeholders as well as different stakeholder types.

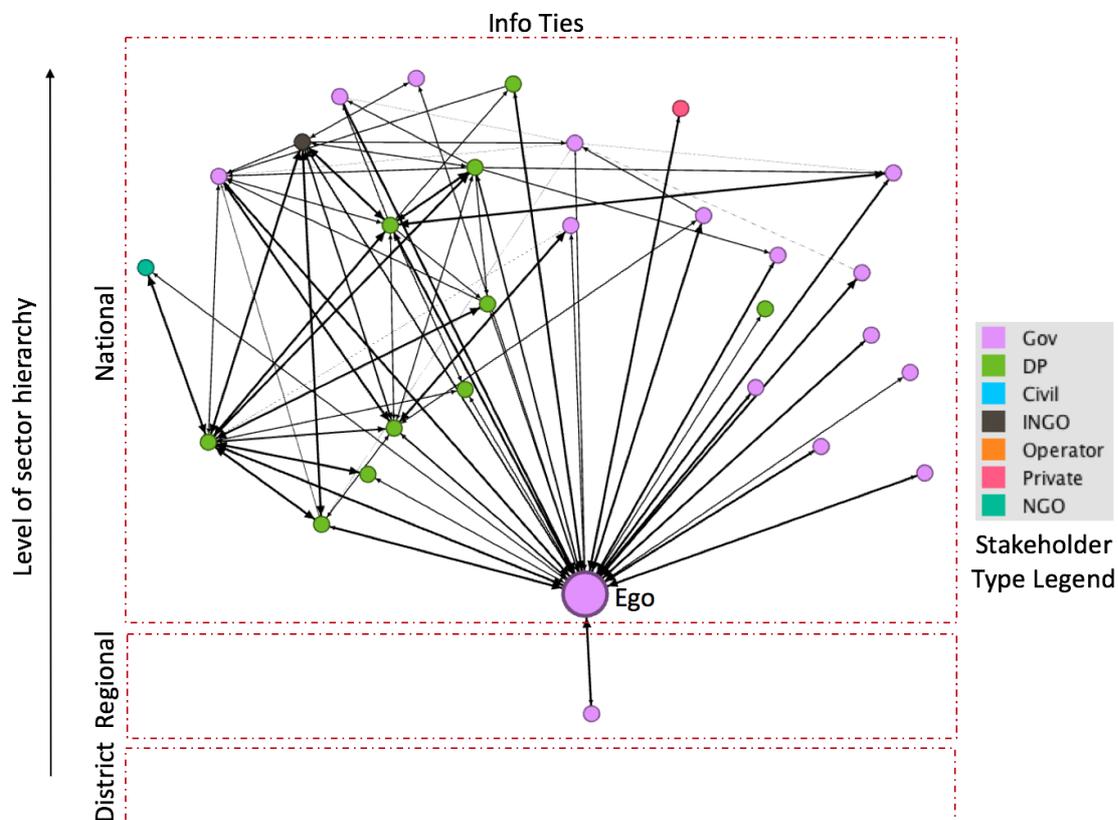


Figure 37 – Tajikistan information ego network by stakeholder type and level of sector hierarchy

Homophily is calculated using an EI index (Krackhardt & Stern, 1988). ‘E’ stands for the number of ties to *external* (i.e. different) nodes; ‘I’ stands for the number of ties to *internal* (i.e. similar) nodes. The EI index is found by subtracting the number of stakeholders similar to the ego from the number of stakeholders that are different, and dividing the result by the total number (Equation 1).

$$EI = \frac{E - I}{E + I}$$

Equation 1 – Calculation of the EI index as a measure of network homophily

The calculation provides a normalised value between one and negative one that represents the tendency of the ego to engage with alters that are different versus similar to itself. An EI index of one indicates exclusive engagement with different alters; an EI

index of negative one indicates exclusive engagement with like alters; and a value of zero represents an equal number of alters with similar and different properties than the ego in the network (Crossley *et al.*, 2015).

An EI index is used to characterise the ego network in Figure 37. Homophily by type has an EI index of -0.071 and homophily by level has an EI index of -0.929. Depending on the lens through which stakeholder categories are viewed, this ego is either marginally homophilic, or extremely homophilic. This same analysis is then applied to all case study institutions to identify characteristics of homophily for both type and level.

5.3.2 Homophily by Type

Homophily by type is considered for each tie type separately, except for resources. Resource ego networks are not considered for homophily calculations because EI values are more sensitive to changes when the total number of alters in an ego network is small, and the relatively rarity of resource ties skews results. Values for homophily by type are computed for each case study institution and plotted to show the distributions.

5.3.2.1 Information Homophily by Type

Information homophily by type is explored first. Values for case study institutions in all countries are presented first (Figure 38) on their own to show the degree to which their tendencies are towards connecting with like stakeholders, different stakeholders, or a mix between the two.

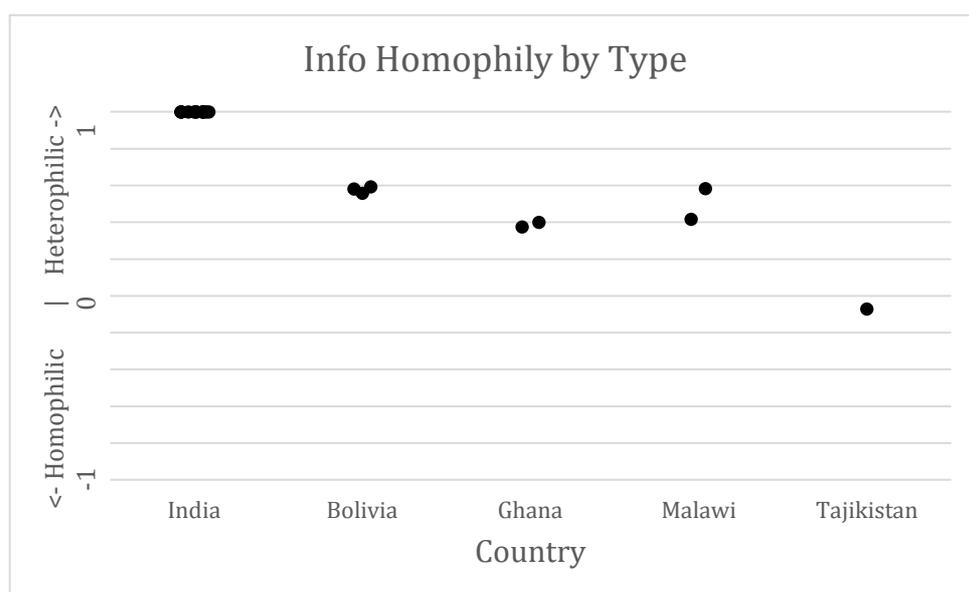


Figure 38 – Information homophily by type for each case study institution by country

Plotting homophily values for each case finds that most case study institutions have a positive EI Index, indicating a greater number of connections with stakeholders of different type than the ego. Tajikistan is a slight exception, having almost even numbers of ties to similar and different stakeholder types. Indian institutions studied show a strong heterophilic tendency, which indicates multiple connections to stakeholders such as community members and few connections to other water service operators.

Next, analysis of other egos is done for the purpose of comparison. Box plots illustrate the relative position of case study egos to other stakeholders in the network that were interviewed (Figure 39).

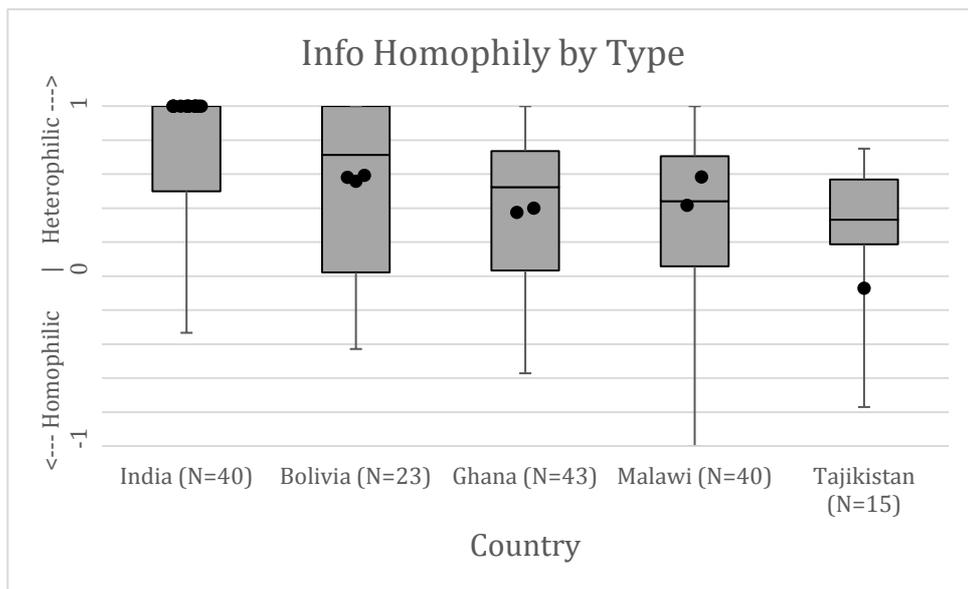


Figure 39 – Information homophily by type relative to other stakeholders

Comparison to other egos shows that other stakeholders interviewed are also typically heterophilic. Controlling for level of hierarchy does not distinguish case study institutions in any consistent way (Figure 40). Connections to different stakeholders may be important in specific cases, but information homophily by type does not numerically distinguish case study institutions from their peers in a consistent way across country case studies.

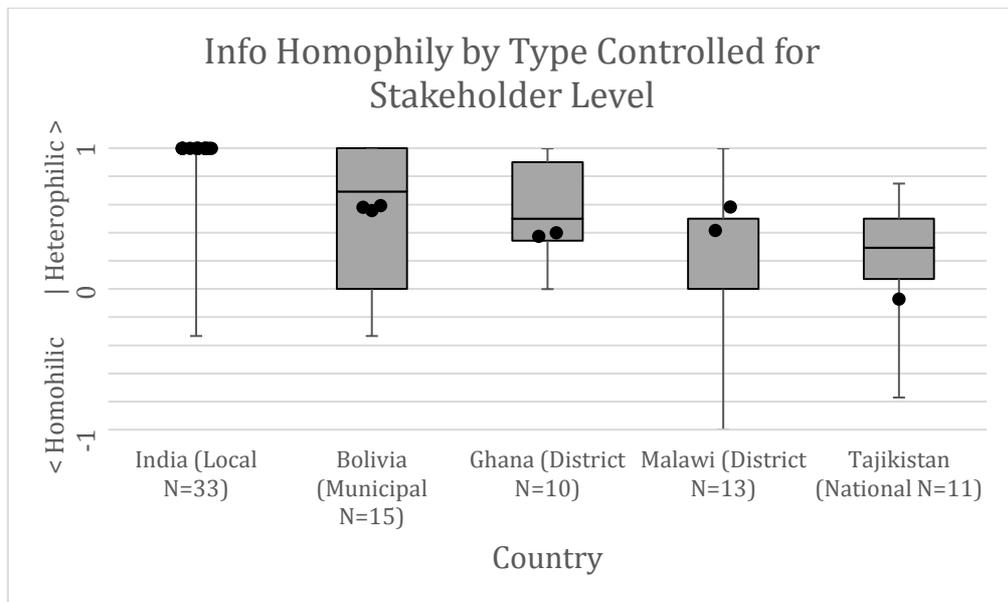


Figure 40 – Information homophily by type controlled for level of sector hierarchy

5.3.2.2 Skill and Authority Homophily by Type

Homophily by type for skill and authority ties yields similar findings to analysis of information ties. Box plots, both overall and controlling for level of sector hierarchy, show heterophilic tendencies that are not consistently distinct from other stakeholders (Figure 41, Figure 42, Figure 43, and Figure 44). India shows a higher tendency to connect with different stakeholder types because the case study institutions are operators. This indicates that they connect with other stakeholders but typically not with other community operator committees.

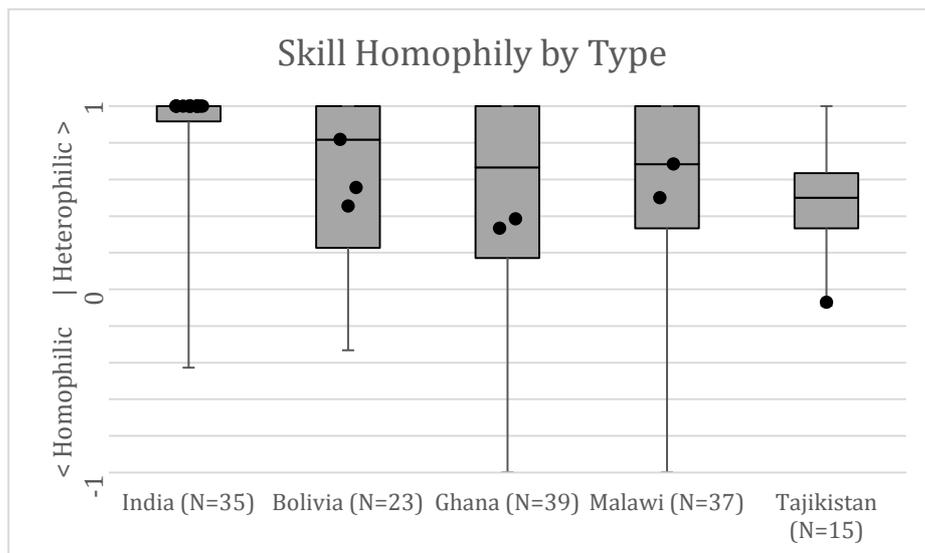


Figure 41 – Skill homophily by type

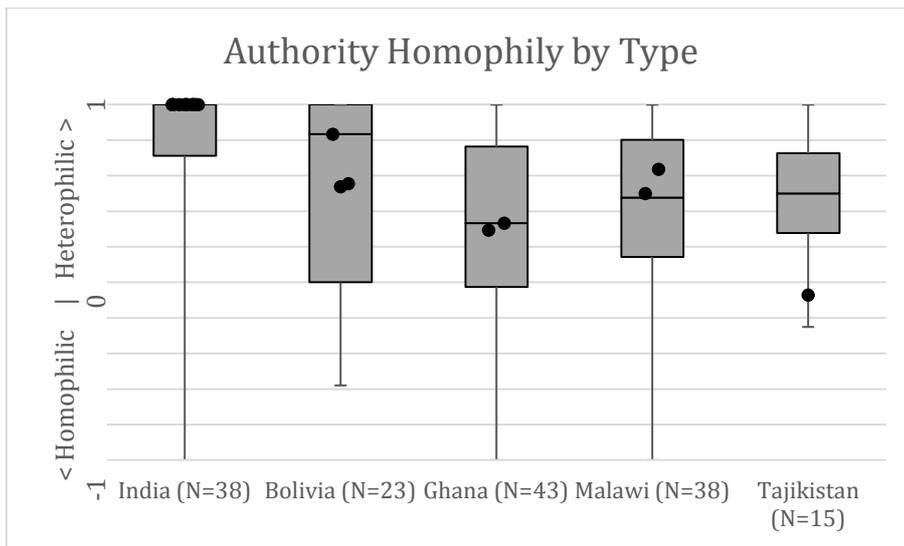


Figure 42 - Authority homophily by type

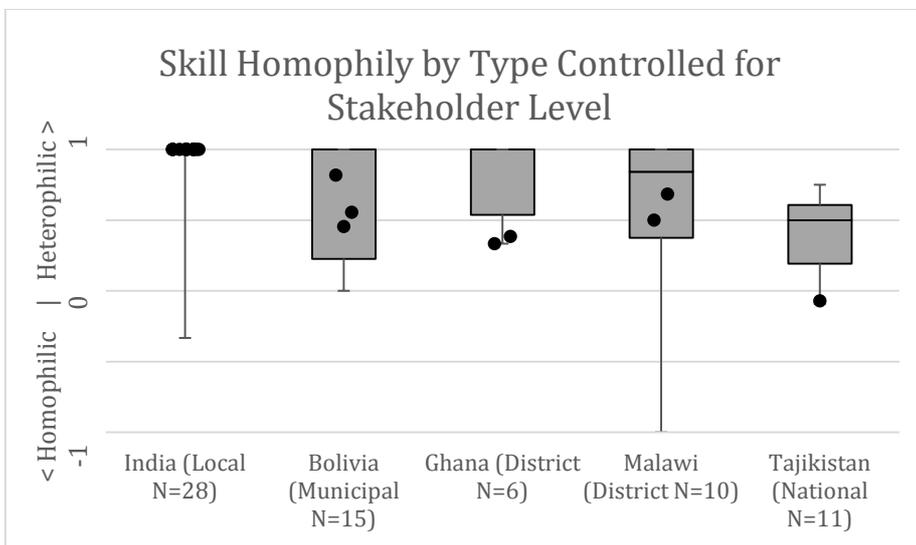


Figure 43 - Skill homophily by type controlled for level of sector hierarchy

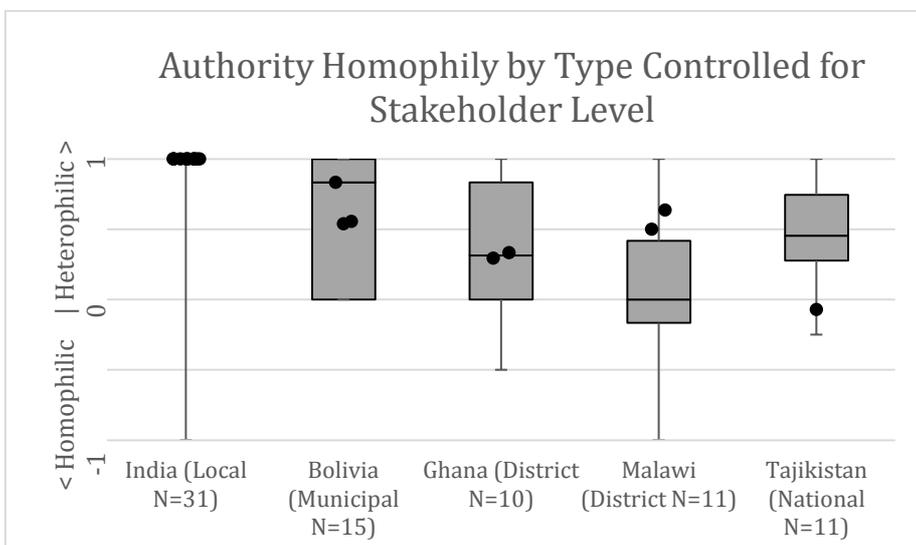


Figure 44 – Authority homophily by type controlled for level of sector hierarchy

5.3.2.3 Homophily by Type Summary

EI indices for case study institutions show a tendency towards connecting with stakeholders of different types. This is true for information, skill, and authority ties. Although this characteristic does not consistently distinguish case study institutions from others in their sectors, the defining characteristic is from an absolute sense. Case study institutions tend to engage more stakeholders of different types than stakeholders of similar types to themselves.

5.3.3 Homophily by Level

Analysis of homophily by level follows the same process as analysis of homophily by type. Homophily by level is the investigation of tendency to connect with different levels versus similar levels of sector hierarchy. This provides representation of how well a stakeholder is connected across different levels of a sector hierarchy. Again, the analysis of resource ego networks is excluded because of the sensitivity of EI index values when few alters are present in an ego network.

5.3.3.1 Information Homophily by Level

As with previous analysis, values are calculated for each case study institution in each country. Presenting values first without box plots for comparison to others allows easy identification of case study institutions as either heterophilic or homophilic (Figure 45).

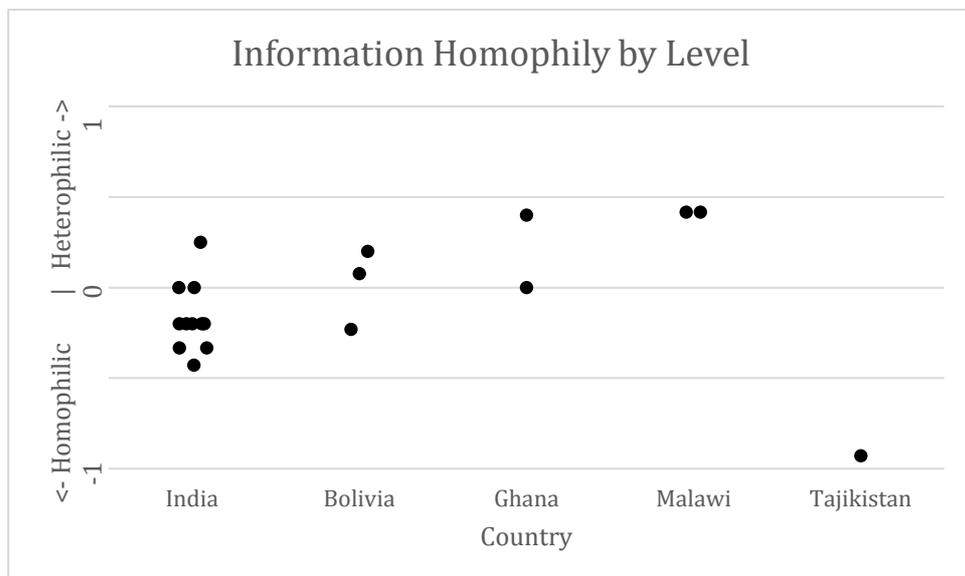


Figure 45 – Information homophily by level

Plotting information homophily by level does not reveal obvious characteristics across all case study institutions. Instead, three descriptions are apparent in the different countries studied. Case study institutions in India typically have homophilic tendencies,

suggesting they have more connections to local stakeholders than to higher levels of hierarchy. This makes sense for local operators who predominantly serve others in the community. All district governments but one have a slightly heterophilic tendency. This describes a mixture of connections to both local stakeholders, such as communities, and to higher levels stakeholders such as regional and national governments, large private sector stakeholders, and international organisations.

The case study institution in Tajikistan, on the other hand, is almost completely homophilic. This shows nearly exclusive connections to stakeholders that are also at the national level. Comparing EI indices of case study institutions to other stakeholders interviewed shows that, with the exception of Tajikistan, case study institutions tend to be slightly more heterophilic. Figure 46 shows the values of case study districts relative to the distribution of other stakeholders in their respective countries. Institutions with the exception of Tajikistan appear to be even more comparatively heterophilic by level when controlling for hierarchy (Figure 47).

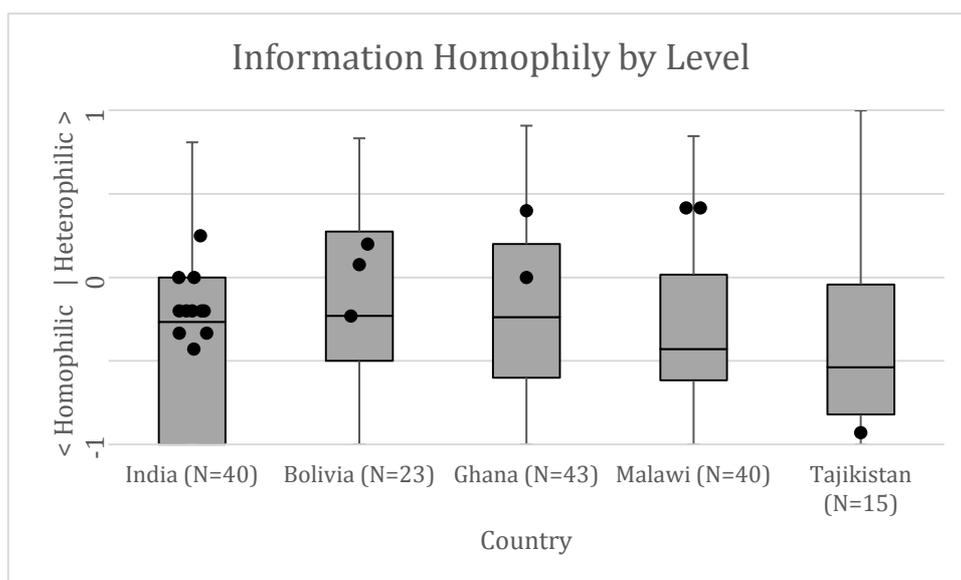


Figure 46 – Information homophily by level

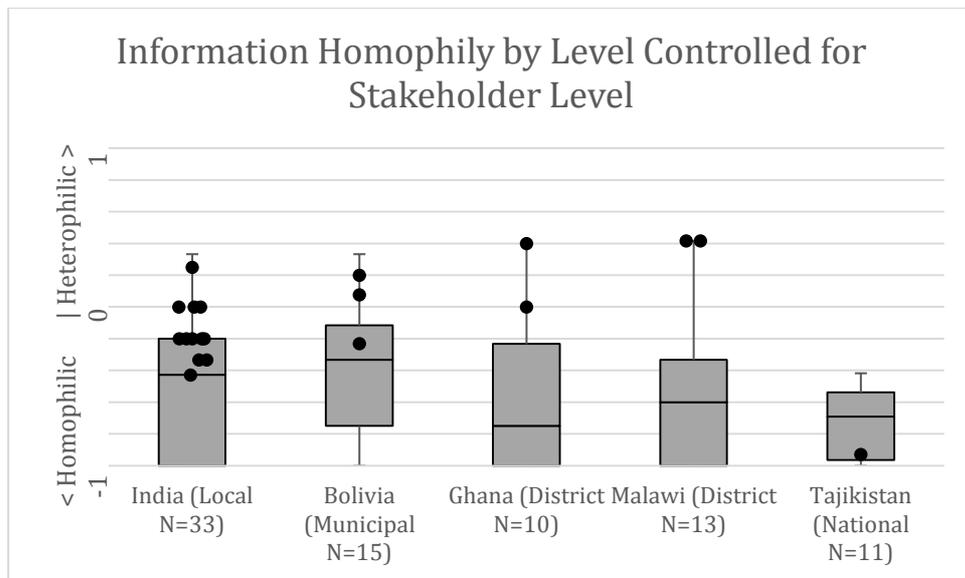


Figure 47 – Information homophily by level controlled for level of sector hierarchy

5.3.3.2 Skill and Authority Homophily by Level

Homophily analysis of skill and authority homophily by level does not produce consistent groupings of characteristics across case study countries. Figure 48 and Figure 49 present the results for skill and authority ties respectively.

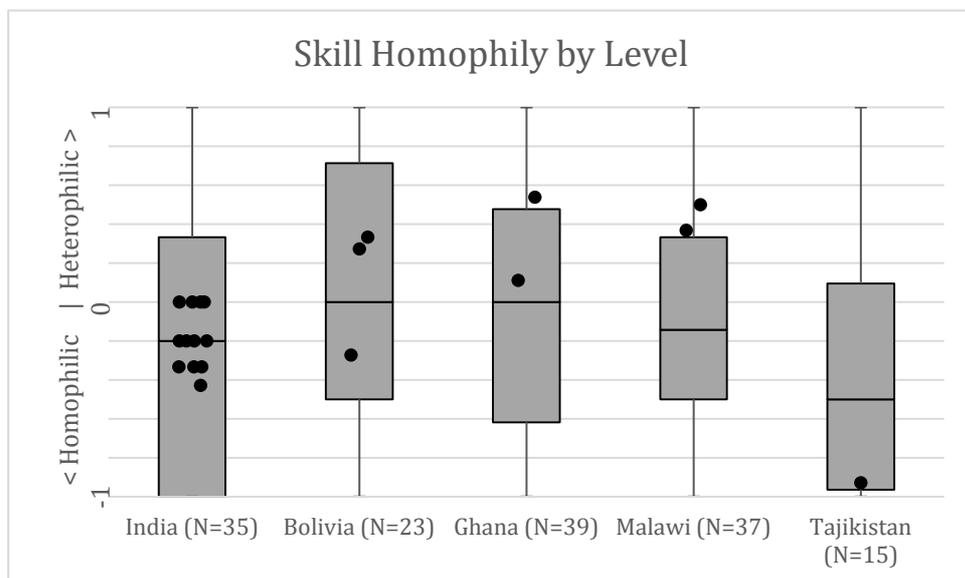


Figure 48 – Skill homophily by level

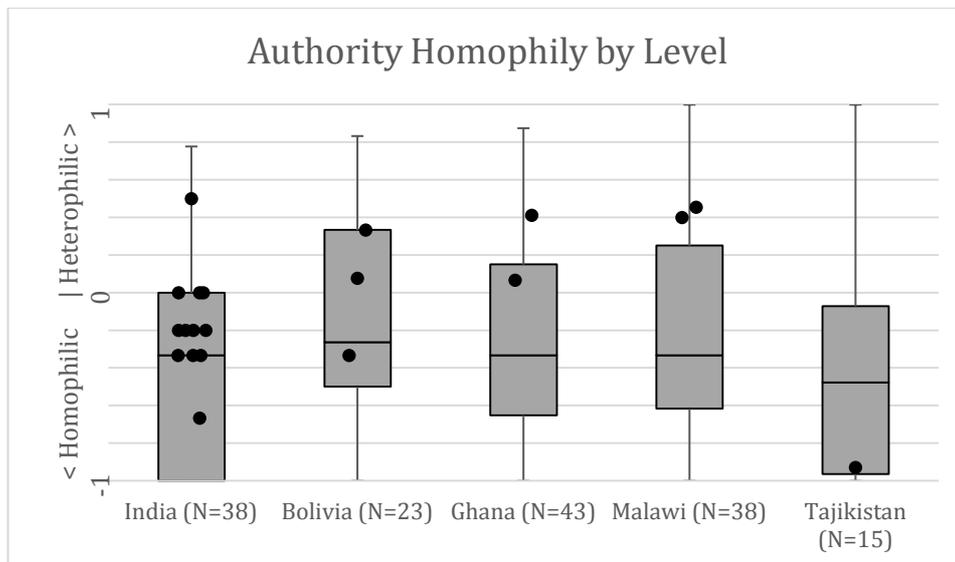


Figure 49 – Authority homophily by level

Findings show similar results for skills and authority networks, again with three apparent groupings related to stakeholder types across the different countries studied. The Indian institutions studied show a mixture of homophilic and heterophilic ego network properties, with an overall homophilic tendency. Most district governments show a heterophilic tendency, but not in all cases. Tajikistan remains strongly homophilic.

Findings remain consistent when controlling for stakeholder level of sector hierarchy in box plot distribution analysis (Figure 50 and Figure 51). As was the case with information ties, comparison by level shows stronger heterophilic tendency than other stakeholders.

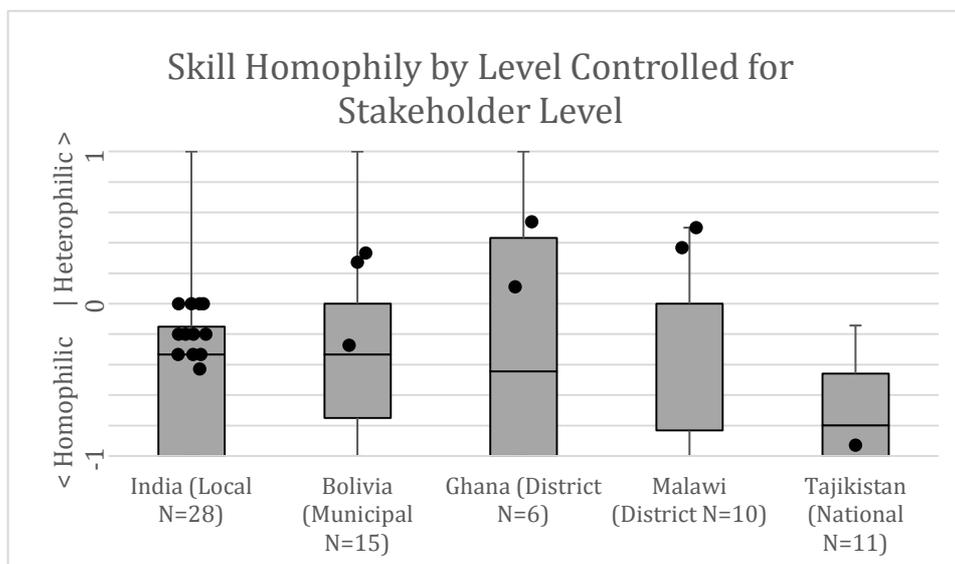


Figure 50 – Skill homophily by level controlled for level of sector hierarchy

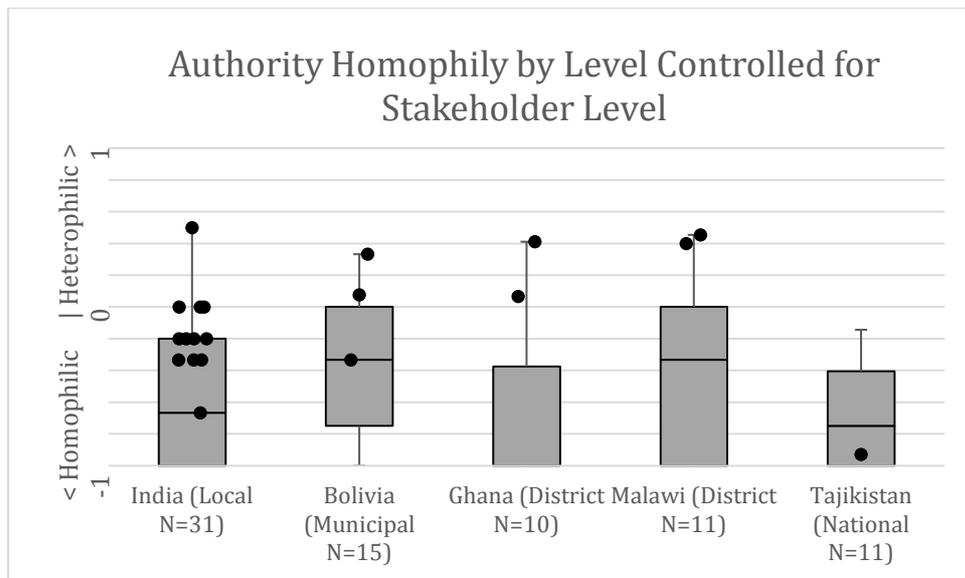


Figure 51 – Authority homophily by level controlled for level of sector hierarchy

5.3.4 Homophily Summary

Homophily analysis finds that case study institutions are connected to multiple stakeholder types at multiple levels of sector hierarchy with information, skill, and authority ties. The case study institution in Tajikistan is the only exception to this; homophily by level analysis finds that it almost exclusively connects to other stakeholders at the national level of sector hierarchy. It is possible that this characteristic is related to the nature of the policy reform that this institution is managing, possibly requiring strong engagement with national level stakeholders, but this explanation is speculative. Overall, the principal finding from homophily analysis is that case study institutions are connected to stakeholders of different types and levels of sector hierarchy, and further explanation of the significance of this characteristic requires qualification from stakeholder narratives in the next chapter on Narrative Analysis (Chapter 6).

5.4 Multiplexity

Analysis thus far has considered ties individually, but many of these ties exist in parallel. Multiplexity studies the overlap of different exchanges in a relationship (Verbrugge, 1979). Combinations of multiple tie types can be quantified to identify the most common sets of parallel ties both inbound to and outbound from the ego networks of the case study institutions that are improving performance. Analysis in this section counts the number of different outbound and inbound tie combinations for each case

study institution in each country, and the section concludes with a summary of the total number of tie combinations observed in the snowball networks of each country studied.

To recap, the four tie types are: information, skills, resources, and authority. Each type can exist on its own, or in combination with other tie types in parallel. A total of fifteen combinations are possible. All figures in this section use the same nomenclature to note tie combinations. Information is 'I'; skills are 'S'; resources are 'R'; and authority is 'A'. For example, a combination of information, skills and authority would be labelled 'ISA'. The order of the letters is not important because the multiplex ties represent combinations, not permutations. The frequency of different tie type combinations is plotted for each case study institution in each country.

5.4.1 Ghana

Information ties, either on their own or combined with skills and authority, are the most common tie combinations observed in the ego networks of case study district governments improving performance in Ghana. Figure 52 shows the distribution of different tie combinations observed in the case study district government ego networks. Both ego networks also report at least one incoming tie combination of all four tie types. Tie combinations that exclude information ties are absent, however. This indicates that all alters in these two ego networks can be identified from graphing information ties alone.

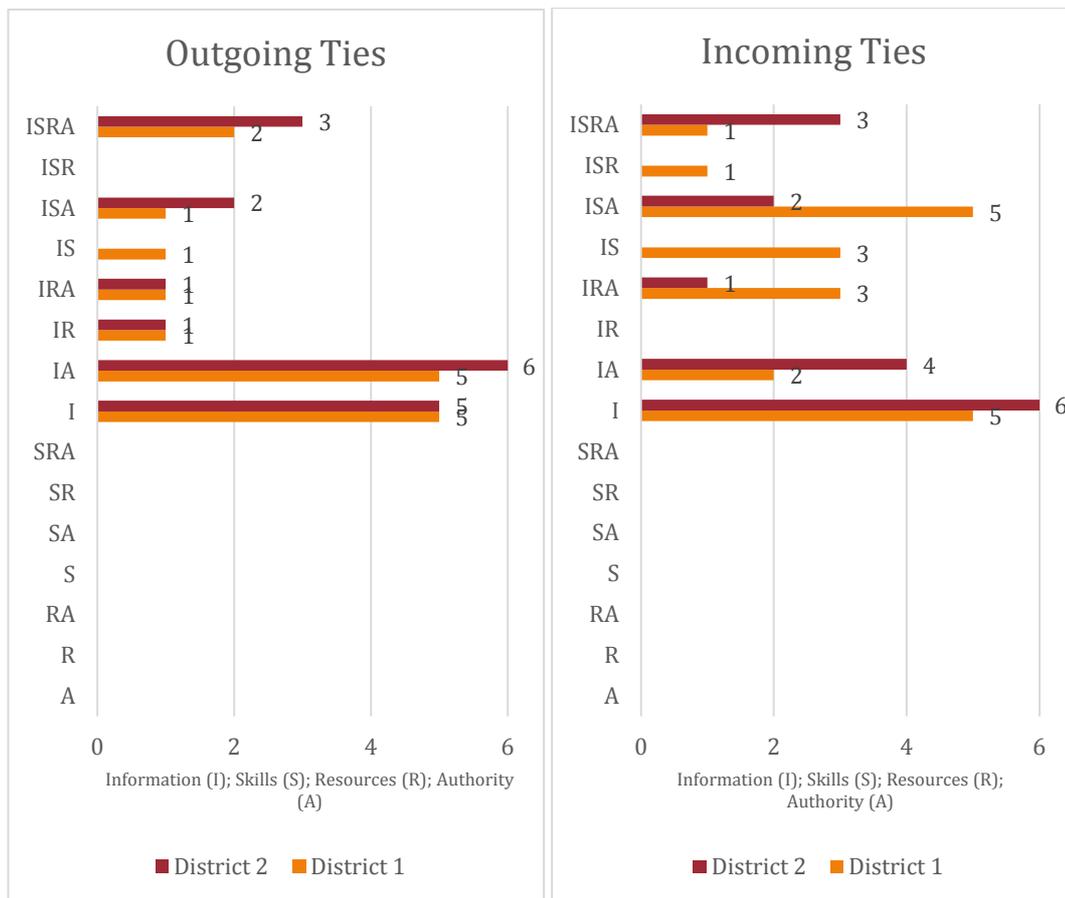


Figure 52 – Number of outgoing (left) and incoming (right) tie combinations by type for each case study district ego network in Ghana

5.4.2 Malawi

Both case study district governments in Malawi also show information ties as the most common type, and these ties are sometimes combined with skill and authority ties. Figure 53 shows the distribution of different tie combinations observed the case study district government ego networks. Resource ties are less common, but both ego networks report multiple incoming ties that combine all four tie types. Both egos also exhibit some ties that exist in the absence of information ties, but these are a minority; the majority of alters in the ego network can be identified using only information ties.

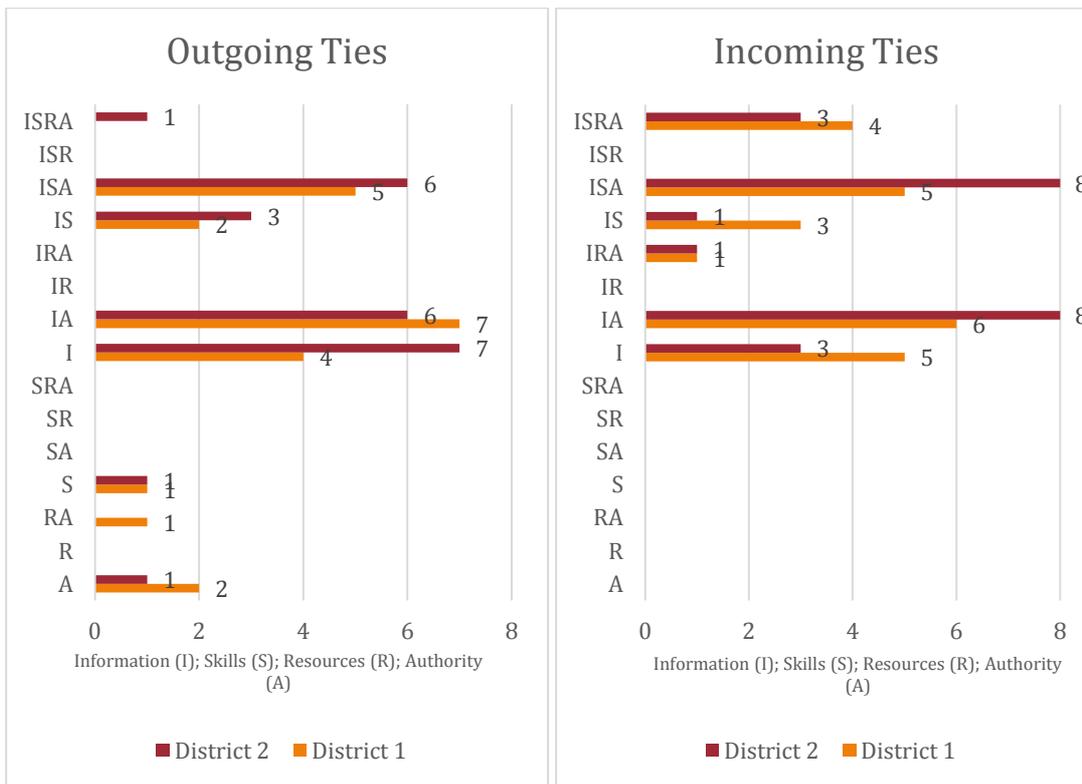


Figure 53 - Number of outgoing (left) and incoming (right) tie combinations by type for each case study district ego network in Malawi

5.4.3 India

Case study community operator committees in India show mostly multiplex ties in their ego networks. Figure 54 shows the distribution of different tie combinations observed the case study community operator ego networks. Few tie combinations exhibit only a single tie type. As with other case study countries, most combinations include an information tie, and this most commonly combines with a skill tie, an authority tie, or both. Again, ties in the absence of an information tie are few in number, suggesting that the majority of alters in ego networks might be identified by only graphing information ties.

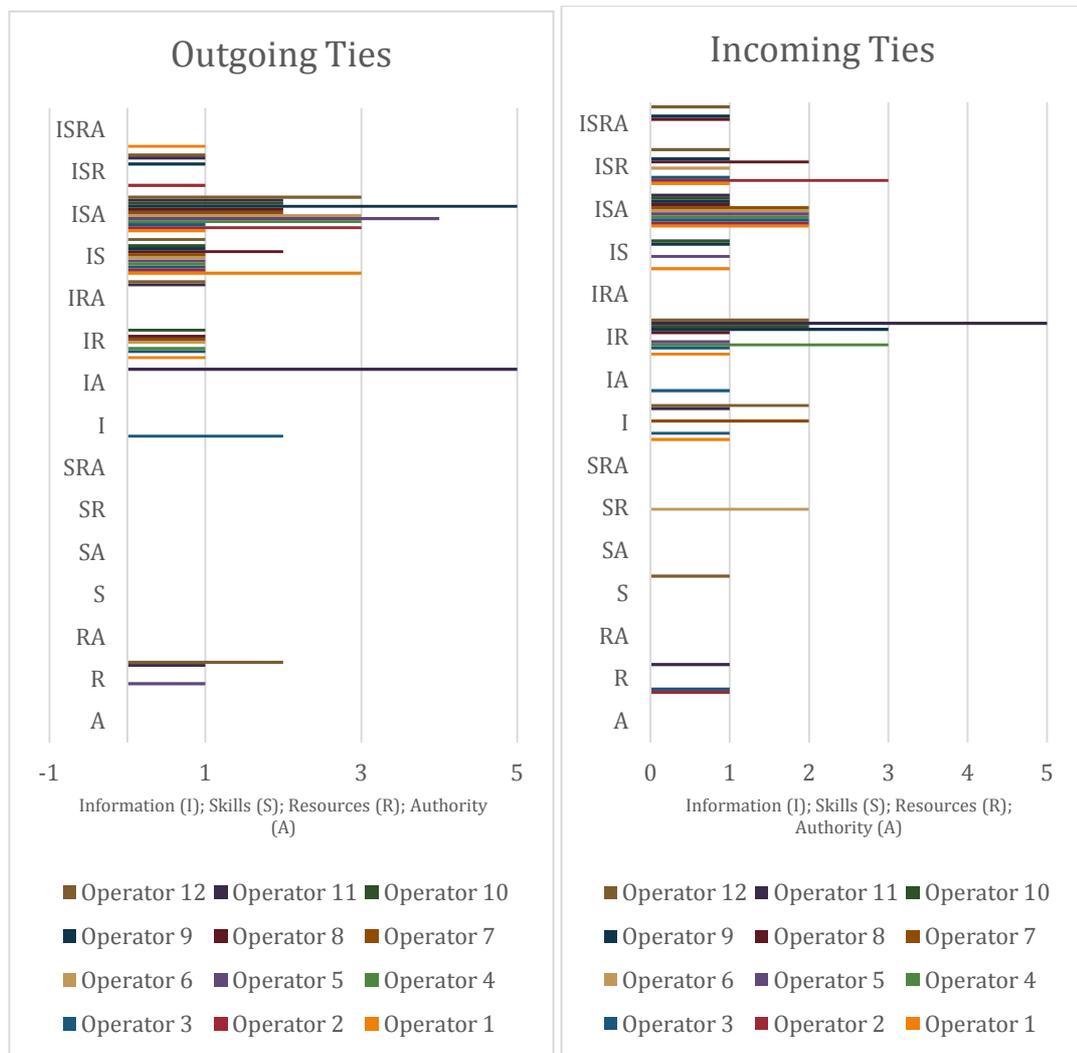


Figure 54 – Number of outgoing (left) and incoming (right) tie combinations by type for each case study operator ego network in India

5.4.4 Bolivia

Information is the only tie type that exists on its own in the ego networks of Bolivian case study institutions. Figure 55 shows the distribution of different tie combinations observed the case study municipality ego networks. All other tie types have at least one other tie in parallel, that usually includes an information tie. The most common outgoing multiplex tie for all municipalities combines information, skill, and authority ties, whereas the most common incoming tie combinations differ by municipality. All, however, show multiple tie combinations that include all four tie types of information, skills, resources, and authority.

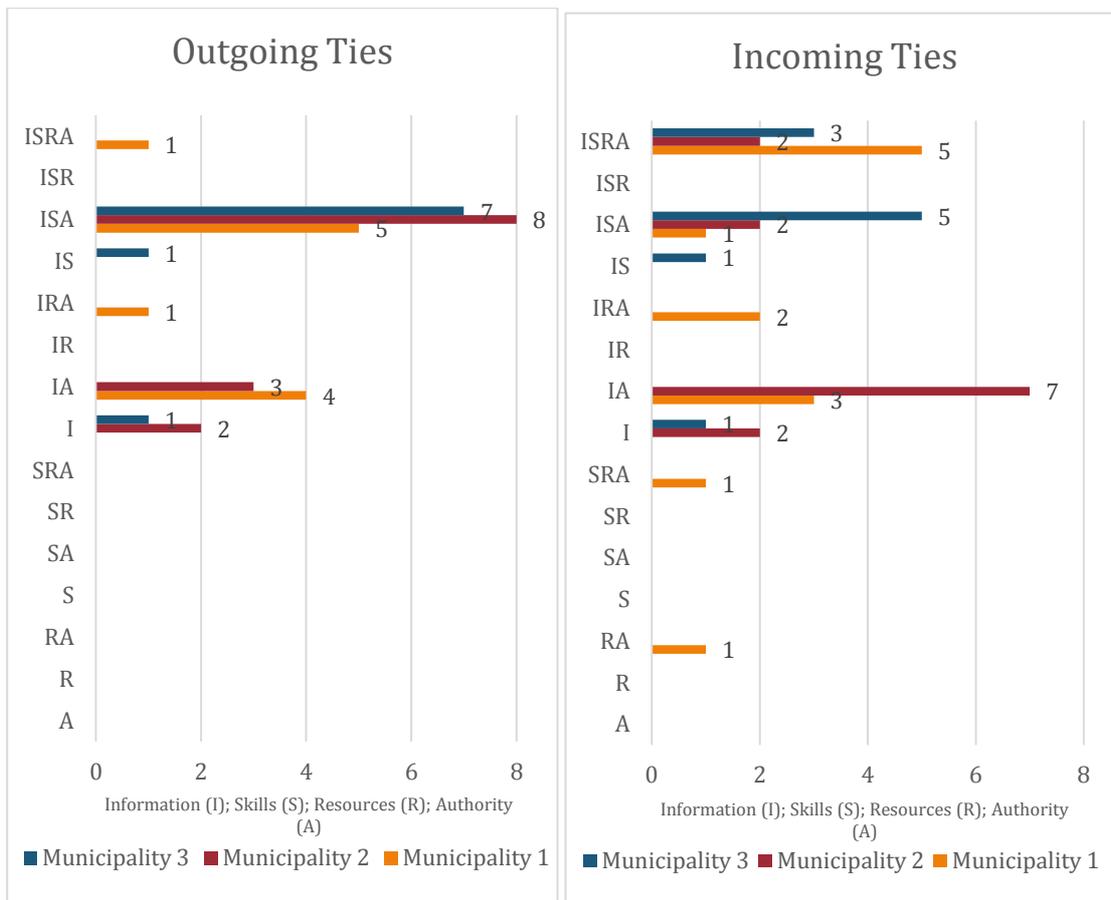


Figure 55 – Number of outgoing (left) and incoming (right) tie combinations by type for each case study municipality ego network in Bolivia

5.4.5 Tajikistan

The national government institution studied in Tajikistan shows remarkably little diversity in the tie combinations identified in its ego network. Figure 56 shows the distribution of different tie combinations observed the case study authority ego network. Information and skill ties existing in parallel are the basis of all combinations. Some incoming ties, however, also include an authority tie in addition to the information and skill ties. This indicates that the relationships of this authority are defined by two-way information and skill ties in parallel, and that the alters present in this ego network could be identified by through information or skill ties only.

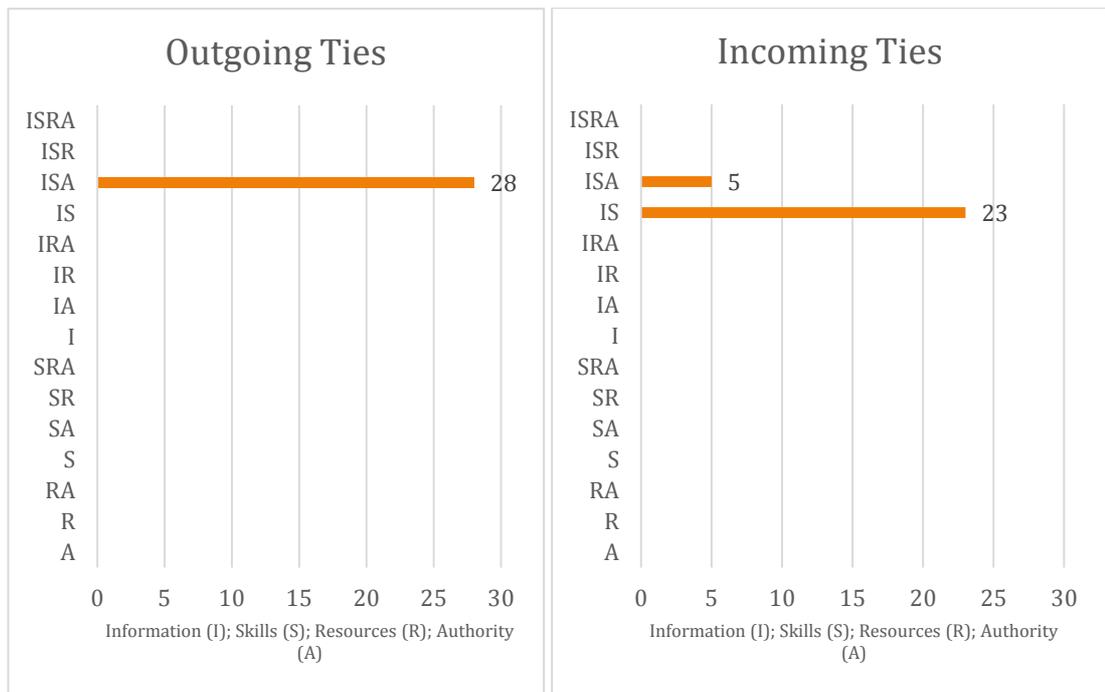


Figure 56 – Number of outgoing (left) and incoming (right) tie combinations by type for the case study institution ego network in Tajikistan

5.4.6 Multiplexity Summary

All tie combinations identified in the snowball networks of each country can be quantified to further explore two emerging findings (Figure 57). Firstly, the majority of relationships are multiplex, meaning that multiple tie types exist in parallel. Secondly, information ties are the most common tie type present. As such, by identifying information ties, one might identify the majority of stakeholders in a network.

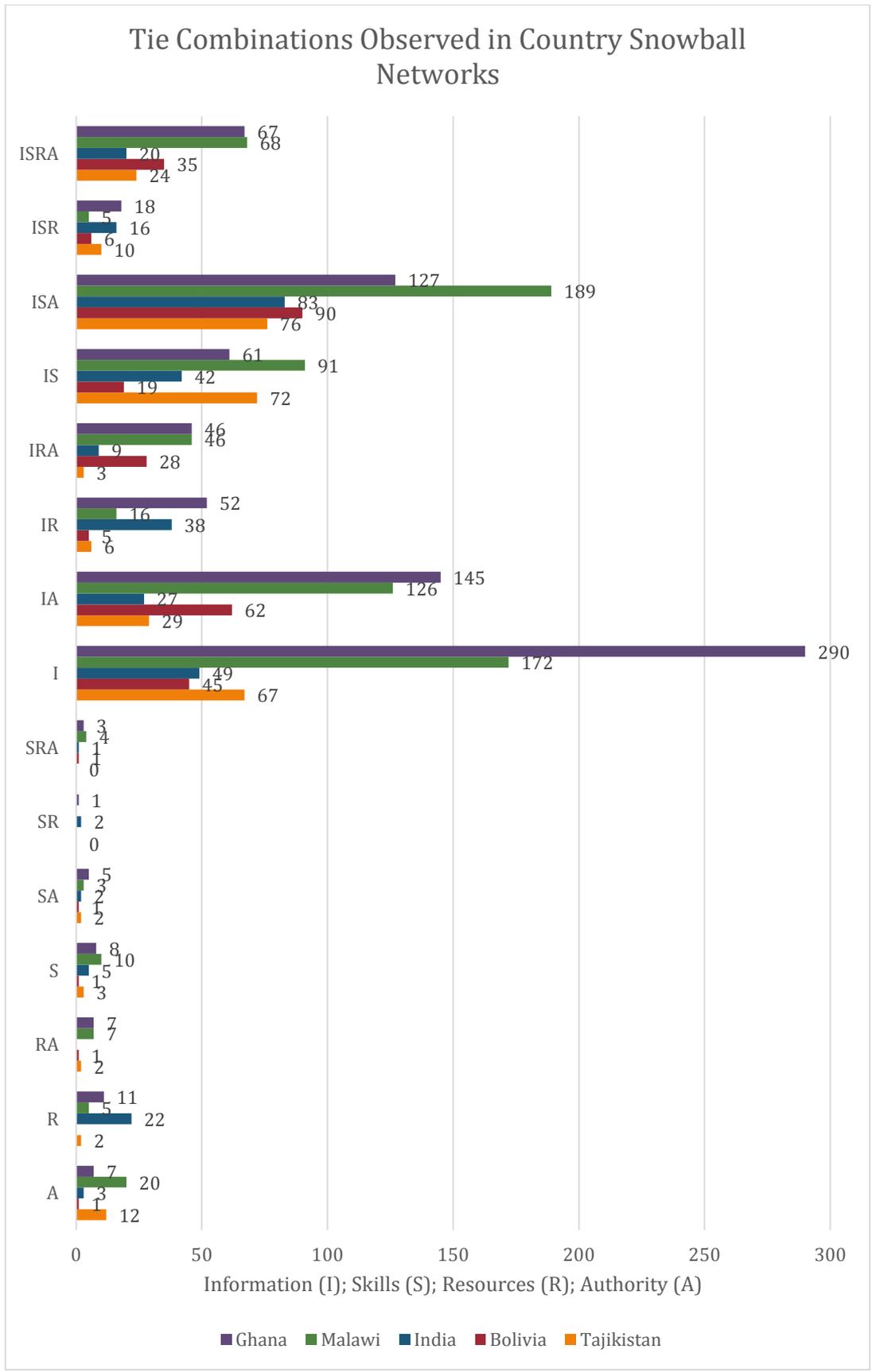


Figure 57 – Prevalence of all tie combinations by type each country studied

Aggregate data of all tie combinations observed in country snowball networks indicate that most relationships consist of multiple tie types (62.7%), or only contain an

information tie (34.2%). Most multiplex ties also contain at least an information tie (97.0%). Because information ties exist in the majority of relationships observed (95.0%), it is possible that future research might identify almost all stakeholders in by graphing only information ties. It is therefore reasonable to conclude that studying information ties should be a leading line of inquiry for identifying alters in an institution's ego network.

5.5 Reciprocity

A final type of quantitative analysis considers the percentage of ties that are reciprocated. This quantifies the proportion of ties that are two-way versus one-way. This analysis was performed on the ego networks of all case study institutions. It uses both data from interviews with the respective egos and data from interviews with alters that described direct ties to the case study institutions. Whereas multiplex analysis separated inbound ties from outbound ties, reciprocity looks at both directions simultaneously.

Percent reciprocity is calculated by dividing the number of two-way ties by the number of alters in an ego network for each tie type. For example, if the information size is 10 – that is, ten alters having direct information ties with an ego – and the number of two-way ties is 5, then 50 percent of the information ties are reciprocal. These calculations were performed for each case study institution that is improving performance in each country, and for each tie type (Table 13).

Table 13 – Prevalence of reciprocal ties in the ego networks of each case study institution by tie type.

Country	Ego	Tie Type							
		Info		Skills		Resources		Authority	
		Ties	% Reciprocal	Ties	% Reciprocal	Ties	% Reciprocal	Ties	% Reciprocal
Ghana	District 1	20	90%	13	15%	9	11%	17	35%
	District 2	16	100%	9	0%	8	0%	15	27%
Malawi	District 1	24	75%	16	25%	6	0%	20	55%
	District 2	24	96%	19	21%	5	0%	22	55%
India	Operator 1	6	100%	6	50%	3	33%	4	0%
	Operator 2	5	100%	5	100%	5	0%	5	0%
	Operator 3	6	83%	4	25%	4	0%	4	0%
	Operator 4	5	100%	5	20%	4	0%	5	0%
	Operator 5	6	50%	6	33%	2	0%	6	0%
	Operator 6	5	60%	5	80%	4	0%	5	0%
	Operator 7	4	100%	4	25%	1	0%	4	0%
	Operator 8	5	100%	5	60%	5	0%	4	0%
	Operator 9	7	100%	7	57%	6	0%	6	17%
	Operator 10	4	75%	2	50%	3	0%	4	0%
	Operator 11	10	60%	3	33%	9	0%	9	0%
	Operator 12	8	50%	6	33%	7	14%	5	0%
Bolivia	Municipality 1	13	69%	11	18%	10	10%	13	85%
	Municipality 2	13	100%	11	9%	2	0%	12	83%
	Municipality 3	10	90%	9	89%	3	0%	9	67%
Tajikistan	National	28	100%	28	100%	0	n/a	28	18%

Values are coloured on a scale from red (0%) to green (100%) for visual clarity

Each tie type presents different findings. Information ties are the most commonly reciprocated. Analysis finds that all case study institutions improving performance in all countries studied have reciprocal information ties of at least 50%, and often a great deal higher. This degree of reciprocity stands in contrast to the three other tie types. Skill tie reciprocation differs by both country and case studies within countries. Resource ties were even less commonly reciprocated; fifteen case study ego networks show no two-

way resource ties at all. Authority ties do not present a clear pattern across all case study countries. Although there appears to be some grouping within countries, broad descriptions about authority reciprocity are not as easily made as they are for the other three tie types. In summary, information is commonly reciprocated, reciprocity of skill and resource ties are less common, and authority reciprocity depends on the country.

Reciprocated information ties suggest that case study institutions in all countries are commonly engaged in two-way information exchanges with the majority of their alters. These ties likely indicate the presence of feedback loops, and discussions that may be important for collaborative problem solving. The true nature and value of these ties is further explored through analysis of stakeholder narratives in the next chapter (Chapter 6).

Skills are less commonly reciprocated. The prevalence of lower reciprocity suggests that skill ties are commonly, but not always, one-way relationships. This relationship suggests an interaction of providing support through trainings or technical assistance where a skilled stakeholder might support a less skilled one. Tajikistan, and one operator in India are notable exceptions because these institutions exhibit reciprocal skill relationships for all skill ties. In most cases, however, reciprocity analysis shows that skill ties are commonly one-way relationships.

Resource ties are rarely reciprocated. This finding is not surprising; it is reasonable that financial resources would flow from one stakeholder to another instead of being passed back and forth. An exception to this might be something like a loan arrangement, where funds are received and repaid, but data indicate that resources flows are most commonly one-way.

Reciprocity of authority ties were the least consistent across country case studies, which suggests that power dynamics can differ depending on context. The findings also suggest that authority may be perceived differently depending on the context, and that ties reported by stakeholders during interviews might be less consistently identified than ties of information, skills, or resources. Overall statements about authority reciprocity may depend on the country context, and broad themes across case study locations are not easily summarised.

5.6 Chapter Summary

Four types of numerical analysis were produced from egocentric network analysis of case study institutions. The first two numerical properties are network size and

homophily. All case study institutions exhibit multiple information, skill, and authority ties in their ego networks, and these are often relatively large network sizes when compared to other stakeholders in their respective sectors. Properties of homophily show tendencies to connect to different stakeholder types, and to include at least some connections across levels of sector hierarchy for information, skill, and authority ties. Analysis of resource ties, however, did not produce consistent findings across case study countries. These findings are general properties that require further qualification from stakeholder interview narratives.

Multiplexity analysis then followed to quantify the prevalence of different combinations in which multiple tie types exist in parallel. Analysis of all case studies finds that most relationships in case study institution ego networks contain multiple tie types simultaneously, and information ties are the most common tie type. In all cases, it is rare for other ties to exist in the absence of information. Of the 848 relationships observed across all country snowball networks, only 5.0% of relationships did not contain an information tie. These findings suggest that that majority of alters and interactions might be identified in future studies by graphing only information ties.

Reciprocity quantified the prevalence of two-way versus one-way ties for each tie type in case study institutions ego networks. Findings indicate that reciprocity depends on tie type, and information ties are the most commonly reciprocated. Skill and resource ties were less commonly reciprocated, suggesting a difference in ability between the provider and the receiver, and the reciprocity of authority ties showed no broad pattern across all case study institutions. These findings suggest that reciprocal information ties are the basis of networks surrounding institutions that are improving performance, and that skill and resource ties highlight the providers of technical and financial support, respectively.

Numerical analysis characterises these ego networks, but is insufficient on its own for understanding the importance of specific network characteristics. Properties such as large information network sizes might be positive, negative, or neutral influences on the performance of an institution. Perspective on the value of these observed network characteristics is required.

Qualifying the importance of observed network characteristics is therefore an important next step that is conducted in the following chapter. Stakeholder perspectives are verified and compared against one another to highlight network characteristics that are both observable in the ego networks and perceived as important by those experiencing

these networks. These qualifications help to understand the relevance of observed network characteristics because simply observing these characteristics does not confirm their importance in supporting institutions to improve performance.

6 QUALITATIVE ANALYSIS

Commentary from interview participants is needed to qualify the importance of quantitative network characteristics. These narratives attribute significance to ego network characteristics identified in the previous chapter, and identify other network characteristics that stakeholders participating in these networks perceive as important, but that might not be immediately apparent from standard numerical analysis of ego networks. Newly identified network characteristics can then inform further analysis of numerical network data to qualify characteristics that are both quantitatively and qualitatively recognisable in the case institution ego networks.

Narratives are compared with each other to identify where different stakeholders independently describe the importance of a similar characteristic in the same part of a network. This occurs in a three-step manual coding process. The first step breaks interviews into fragments that are coded according to perceived value (positive/negative/neutral) and the part of the network the comment applies to, if relevant. Macro-economic factors such as currency inflation are an example of a commentary that might not relate to network characteristics specifically. The second step confirms that the stakeholder describing a characteristic is able to directly observe this part of the network. This step helps to ensure the validity of the statement by requiring the respondent to have first-hand experience on the subject. The third step groups together positive commentary about similar parts of the network to identify where multiple stakeholders directly observing a common part of the network perceive similar positive network characteristics. When completed, this analysis excludes characteristics that are mentioned only once, and focuses on characteristics described as

supporting institutional development – as is the intent of this research. The result is a list of verified network characteristics described as supporting institutional development for each case study (McNicholl *et al.*, 2017).

The coding approach described above is favoured over aggregate coding of themes identified from all interviews because it focuses on network characteristics that support institutional development and it considers the vantage point of the stakeholder providing commentary. Aggregate coding of themes from all interviews was experimented with using Atlas.ti software, and this approach was rejected because it did not easily consider the importance of which stakeholders provided which perspectives. For example, national stakeholders may describe their perception of coordination at local levels that they, personally, cannot verify directly, and the experienced reality in the respective part of the network could be quite different. It is therefore important to ensure that stakeholders commenting on positive network characteristics are actively interacting with these parts of the network, and this was achieved by manually coding and then sorting conversation fragments from interviews.

6.1 Narrative Analysis Example

An example from Ghana illustrates how multiple narratives combine to qualify a network characteristic perceived as supporting institutional development. Multiple stakeholders commented on the importance of information and skill ties between district government and stakeholders at higher levels of the sector hierarchy. Figure 58 illustrates what this looks like in an ego network. It shows how commentary provided by different stakeholders within the ego network can reference the same type of characteristic. In this case, both the institution and an alter in its ego network comment on a relationship between regional and district government that they perceive as beneficial. Their independent identification of this characteristic helps to verify it, as does their ability to directly observe this characteristic in the ego network. Speech bubbles in Figure 58 illustrate possible examples of commentary, and the red arrow highlights the relationship that these stakeholders describe.

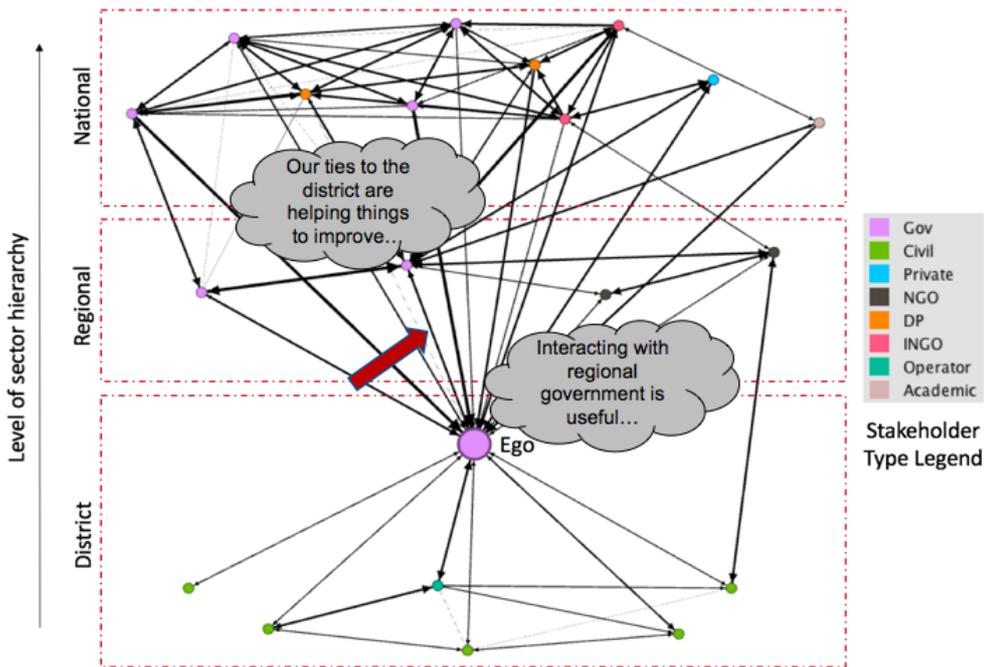


Figure 58 – Illustration of stakeholders independently commenting on a similar network characteristic in the same part of the ego network.

Figure 58 is only an illustration; actual comments from these stakeholders describe the characteristic in detail. For all comments, stakeholder names are anonymised, but their type and level of sector hierarchy is reported at the beginning of each quote using the following nomenclature:

[Stakeholder Type]/[Level of Sector Hierarchy]: [...quote...]

A full description of levels of hierarchy for each country and stakeholder types can be found in the Quantitative Analysis chapter (Section 5.1.4).

The following comment is from one of the case study local governments in Ghana. It describes an interaction with a stakeholder at a higher level of sector hierarchy providing support to the district. The language clearly describes this relationship as a positive benefit, and has been lightly edited for grammatical clarity.

Government/District: *So, for me, when it comes to rural water, the [support agency] has the bigger strength. They have the technical know-how, they have the people, they have the institutional structure to be able to deliver water at the rural level. And that kind of understanding is there. And for us, it's working perfectly. And we are doing even better than our colleagues in urban water supply.*

Identifying the specific part of the network in question is easy because the stakeholder is named directly and only anonymised in accordance with the ethical commitments of this research. The quote is an example of one stakeholder describing a positive network characteristic related to a specific part of the network that this stakeholder experiences directly. Commentary from the other stakeholder confirms this characteristic:

***Government/Regional:** With [this district], because of the intent of the relationship is to pilot a scaling up programme, get all the information, see all the areas to improve to be able to scale up coverage. It has been a very strong relationship and we are hoping to scale up in all the other districts to be able to do the same.*

This commentary adds further understanding to the nuance of this specific relationship. These stakeholders are working together to test approaches for managing rural water service delivery. It is described as a strong programme, and this description directly relates to the improved performance of the district government in question.

Other stakeholders are directly observing this relationship as well, and provide further commentary. For brevity, not all quotes are presented. These aggregated perspectives help to verify the importance of specific relationships for supporting institutional development. The described relationships can then be related to network properties, such as information and skill ties, to understand how the interactions can be observed through stakeholder networks.

The chapter is presented in three groups of findings. The first group includes common network characteristics that are both described as important for supporting institutional development and are observable in stakeholder networks in multiple case study countries. The second group includes uncommon network characteristics that only apply to a few case study institutions, and contain some perspectives that are not as strongly corroborated by multiple interviews. The final category is unconfirmed characteristics. These are factors that multiple stakeholders commented on, but cannot be investigated from the network perspective used in this research. They are presented for interest, and for consideration in future research, but are not findings that can be observed from a network perspective. The findings that will be emphasised as the output from this chapter are the common network characteristics that are identified in networks and perceived as important in the majority of case study locations.

6.2 Common Network Characteristics

Three network characteristics were identified as supporting institutional development in multiple case study countries. These characteristics are identified from interviews with case study institutions, and alters in their ego networks. The fact that similar characteristics are identified in multiple country contexts suggests that these are important influences that are easily perceived by stakeholders, and these influences can also be understood from a social network analysis perspective. Other characteristics described as important only appeared in some instances, and others still were described but could not be observed from a network perspective. These latter categories will be explored in subsequent sections, while this section focuses on the three commonly identified network characteristics.

6.2.1 Characteristic #1 – Information and skill ties with lower levels of hierarchy

This network characteristic describes information and skill ties between an ego and other stakeholders at the same or at lower levels of sector hierarchy. For a district government, this part of the ego network describes other stakeholders in the district, such as communities, private sector, and operators, but not stakeholders from regional and national levels such as government authorities or international organisations. For a local operator, this part of the ego network refers to other local stakeholders such as users and possibly local artisans. The characteristic therefore describes the local part of the network, and the importance of skill and information connections within this context.

Analysis in the previous chapter (Chapter 5) has already quantified properties of information and skill ties in ego networks. Numerous information and skill ties were found in the ego networks of case study institutions, and these network sizes are relatively large when compared to other ego networks in their respective countries. Homophily by level also provides an indication of the tendency to connect with stakeholders of similar versus different levels of sector hierarchy. These numerical properties are general, and the findings they suggest can be strengthened by analysing commentary from interviews that explicitly describes connections in the ego networks.

6.2.1.1 Ghana

The relationship of information and skill ties between case study institutions and local stakeholders appeared during the first case study on local governments in Ghana. The

importance of these local ties was referenced by multiple stakeholders of different types and levels of hierarchy. For brevity, a selection of quotes is presented to illustrate the concept in the words of stakeholders interviewed. Quotes are anonymised throughout this work in accordance with the ethical commitments of this research, and names are replaced with labels of stakeholder type and level of sector hierarchy.

Each quote describes an aspect of an information and skill relationship between district government and local stakeholders such as communities and local operators. Quotes describe the information connection from local stakeholders to the district governments for coordination and requests for support. These interactions are followed up by visits from district government to provide support, coordination to develop new projects, and technical audits of local capacity.

Total number of interviewed stakeholders describing the characteristic: 7 (4 shown)

Civil/District: *In fact, this thing, the water system, we got to know a lot, so many things from the rural water and sanitation. The engineer at the district, ...and the woman in charge... they help us a lot to have access of water. When any time we had any faults, we report to them. So they quickly come for the assistance.*

Civil/District: *So with district assembly the relation is they invite me, and then just like as you have come, maybe if they want to do any expansion, expansion work, or maybe they needed to find out maybe how they... how the system is operating. The operation of the system. So they invite me, and then I give them the information.*

Government/District: *In the sense that, for instance, when it comes to the [community management committees], and the assembly, we do annual auditing for them. We don't just do financial auditing, but we do technical auditing of the system. So that helps us to put them on their toes for them to make sure they operate the system very well. So in so doing we realise that always there is safe water being delivered to the communities.*

Government/District: *And what we also do is that there is that constant monitoring or technical support to the [community water and sanitation management teams]. So when we go there and we realise maybe the system is not working this time.... also the same applies to the system operators. Because normally they are doing this you know as I said earlier on, the*

system is for the assembly, but we have vested it in their care, for them to take care of it. So we do comprehensive monitoring and auditing of the system as well. When we realise the system is not being operated well, we do away with such operators, and bring in a new operator who can operate it very well.

This commentary describes both a relationship of local government providing support to local stakeholders, and in the process learning about what needs to be done. These relationships would logically inform local governments about which activities to prioritise, and which capacities to develop. The descriptions also suggest that information and skill ties would provide the clearest indication of these relationships in network data.

Numerical analysis of Ghana ego networks identified several characteristics that describe these interactions quantitatively. Analysis found multiple information and skill ties, and homophily by level analysis finds a mixture of connections between local stakeholders and those at higher levels of sector hierarchy. These numerical values are consistent with the narratives described by interview participants, and these relationships can be investigated in the ego network by looking specifically at the information relationships in the ego network that are within the districts. Figure 59 and Figure 60 depict the network graphs of these local relationships.

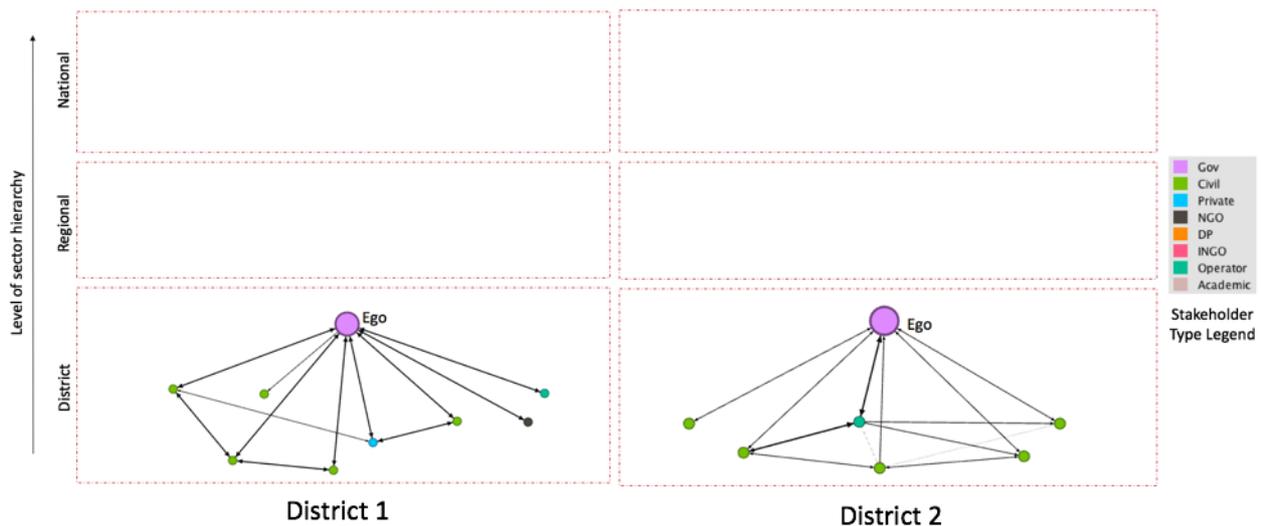


Figure 59 – Information ties to local stakeholders in ego networks of Ghana case study district governments (McNicholl *et al.*, 2017)

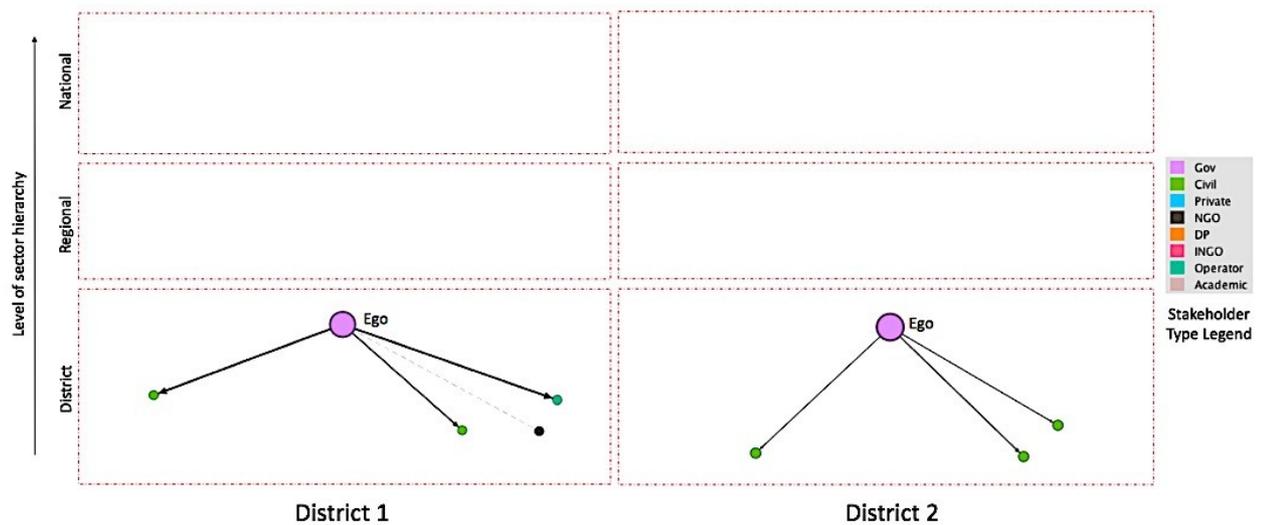


Figure 60 - Skill ties to local stakeholders in ego networks of Ghana case study district governments

Investigation of ego networks related to local stakeholders confirms the presence of information and skill relationships that are described as important by the stakeholders involved in these networks. This indicates that connections between district government and stakeholders that rely on it for support is an important influence in Ghana for district government improving its role in supporting rural water service delivery.

6.2.1.2 Malawi

The importance of network characteristics related to skill and information ties were also described by multiple stakeholders in Malawi. Eight stakeholders provided commentary on this topic. They represent a diverse set of stakeholder types and levels of hierarchy, ranging from local to national, and stakeholder types including civil, government, and international organisations. A selection of some of their interview transcripts are provided here to illustrate the most salient points.

Total number of interviewed stakeholders describing the characteristic: 8 (4 shown)

Government/District: *So all these communities are being trained and we also train the [community governance committees], how they can identify the gaps from these areas.... Because the information we get, it's what we use from the communities. So we have got the systems which have put in place to get this information. As you have seen, we get information from the [community governance committees], and that is our entry point to know where exactly there is need for water supply.*

Operator/District: *There is a change because we do coordinate in working with the stakeholders. One. Two, if there is information we also exchange information.... In short I can say through the network we have, we work together, and our association improves. In all corners, because we work in a network with the stakeholders.*

INGO/National: *Yeah, it's strengthening the citizens' voice and also strengthening the systems in which planning, implementation, and monitoring is taking place. And that's the other side, which is the district council level. Because you have to prepare – if you are creating demand at community level, it means you also have to prepare the supply side to be responsive. So it's working at both ends rather than just creating trouble on the ground, or strengthening the system that is not accountable to anyone. You know, it doesn't work; it has to be both ways.*

NGO/National: *Because the network is much more in terms of sharing of information to ensure that the water supply and other services that are effectively delivered to the end user in this particular case, the people. Also, the network is to promote issues of transparency and accountability through engagement. So it's much more of engagement to ensure that agreed frameworks for ensuring that water, clean water is available, to ensure that waterpoints are being managed well in terms of clean water. And so forth.*

These quotes describe a two-way relationship between district government and local stakeholders to share information and strengthen systems for water management. One of the stakeholders makes specific reference to community governance structures that help to discuss issues and coordinate efforts within the district.

These perspectives add substance to some of the findings from numerical analysis. Network size analysis found multiple information and skill connections for district government stakeholders in Malawi; homophily by level analysis found a mixture of connections to different levels of sector hierarchy, including local connections; and homophily by type found connections between district governments and other stakeholder types such as communities and operators. Numerical analysis is therefore broadly consistent with the descriptions provided by stakeholders during interviews. Analysis of the ego networks becomes more specific by visualising the local interactions in each district government ego network (Figure 61 and Figure 62).

Information and skill connections to other local stakeholders become apparent when filtering the ego network for this property.

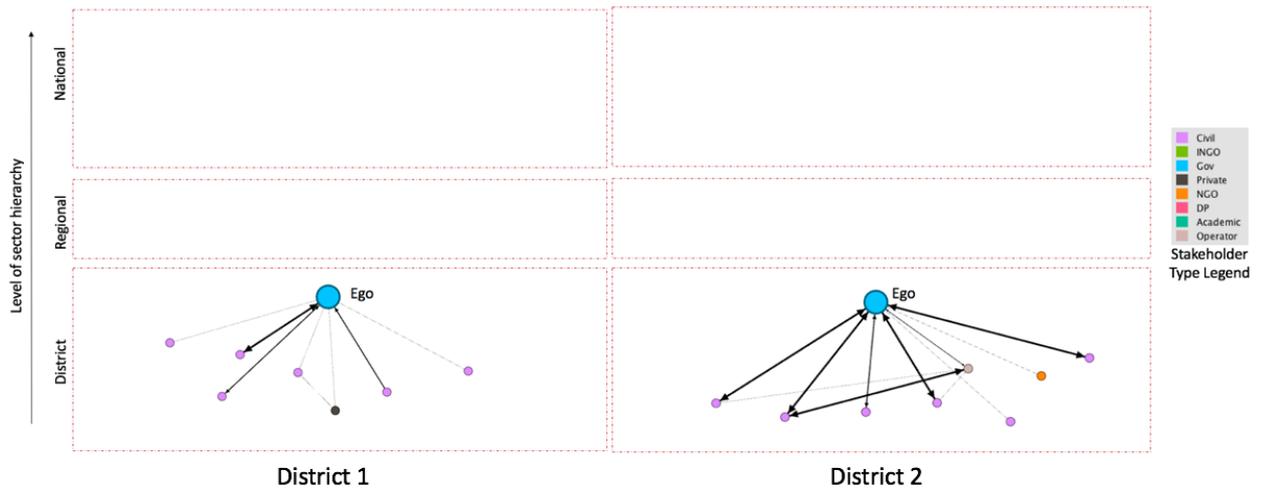


Figure 61 - Information ties to local stakeholders in ego networks of Malawi case study district governments (McNicholl *et al.*, 2017)

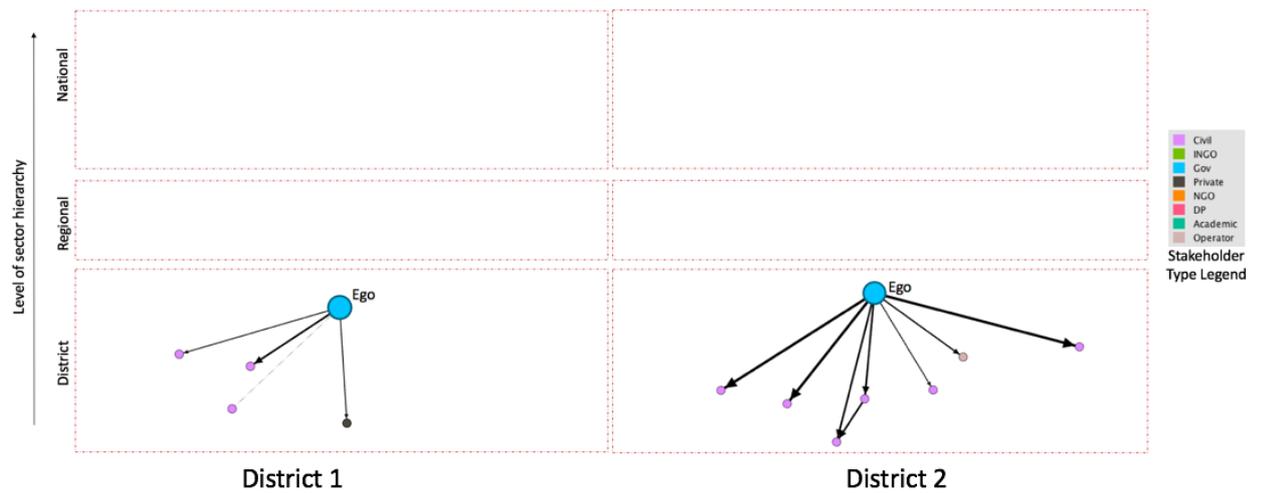


Figure 62 - Skill ties to local stakeholders in ego networks of Malawi case study district governments

6.2.1.3 India

Community operators managing community arsenic removal facilities were the centre of network analysis in India. These operator ego networks differ from district government ego networks studied in other countries, but still exhibit the common theme of local information and skill connections. Commentary from stakeholders involved in these networks describe the importance of these connections in the context of communities in West Bengal. The majority of this commentary comes from either community members or facility operators.

The two quotes selected to illustrate this network characteristic are translated from Bengali to English by an interpreter, and are collected from the same ego network around a specific operator.

Total number of interviewed stakeholders describing the characteristic: 6 (2 shown)

Operator/Community: *What he is saying is that he arranges a meeting every month, so like, at that meeting he calls upon everybody at the meeting and he listens to the solutions and problems they are facing. Like what are the... how they can do better in the future. So he listens to the problem and if there is a solution so he can do the solution either by spending money or by spending people in the system. So this is how it works.*

Civil/Community: *So he is telling that he gives the water to the consumers and then if the consumers give the feedback to him, then he reports it back to the operator.*

These quotes describe a feedback relationship from consumers to the facility managers. This characteristic was further supported by reference to a related but slightly different concept of ‘good local relationships’. Eight stakeholders mentioned this characteristic. An interview quote from one of them illustrates the idea that is also exhibited through information and skill tie types.

Total number of interviewed stakeholders describing the network characteristic: 8 (1 shown)

Civil/Community: *See basically you can see our relationship, he is the person who is giving the water to the family, to the local families, and he is our very close neighbour. So we are maintaining a very healthy relationship with our consumers. Because you can say everyone is our club member. So in that case we are very close to each other.*

These quotes represent a relationship that is different than district government ties to communities, yet bears similarities from a network tie perspective. Quantitative analysis of Indian case study operator ego networks indicated that multiple information and skill network ties are present, as is to be expected from the stakeholder quotes. Analysis also found these ego networks to be more homophilic by level than the case study institutions in other countries, which indicates multiple ties between the Indian case study operators and other local stakeholders. This quantitative property is again consistent with the quotes about network characteristics that support institutional development.

Filtering ego networks for case study institutions in India to show local ties helps to visualise these characteristics further. Operators are depicted as the largest nodes in Figure 63.

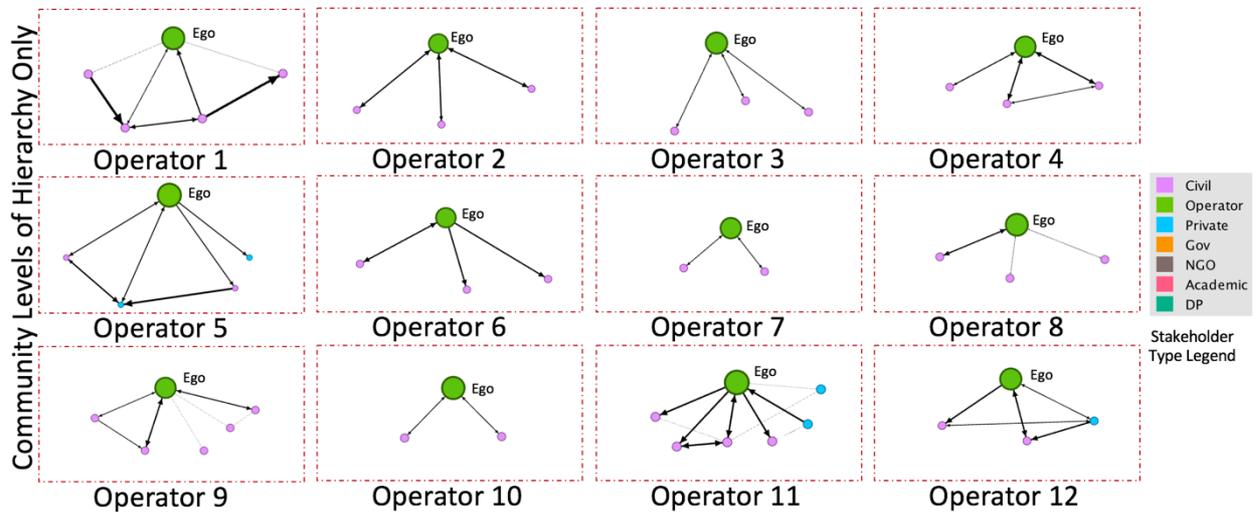


Figure 63 – Information ego networks of case study operators in India showing ties to other community stakeholders

All ego networks for community operator committees improving their performance in India show numerous information and skill ties to local stakeholders. Each network contains at least one general community node that represents users in the network that were not interviewed. The ego networks are appropriate for comparative representation, but actually represent a larger number of local stakeholders. Information ties are commonly two way relationships that would correspond to the feedback relationships between customer and operator described in some of the quotes. It seems logical that a property of an effective water service operator would be to have active relationships with its customers.

6.2.1.4 Bolivia

The importance of connections to local stakeholders also emerged from interviews in Bolivia. These perspectives describe such connections as supporting performance improvements in the respective municipalities. Quotes below are selected to illustrate the concept, and are sometimes described in the same breath as commentary about the broader network of information and skill ties. Four of eleven stakeholder perspectives are presented to highlight key points that are echoed by others. All quotes are translated from Spanish.

Total number of interviewed stakeholders describing the characteristic: 11 (4 shown)

Government/Municipality: *And the system it is related with everything. Before there was nothing with the economic resources but since then we have been given tools and capacity that [an NGO] are giving us. We give them to the [community operators]. So with the capacity, we give this capacity to the community. So everything is related, and connected.*

Civil/Municipality: *And we also have to build more capacity to socialise. For me, the workshops are to know what they are bringing to us. We need to see the situation, if there is water or if there is not. Some things, according to that to improve and to learn. So we know where to go.*

Operator/Municipality: *They are helping [community operators] with the information and tools and capacities...I think everything is okay. There is nothing else to help improve the system because everything is being implemented for now... By this time we are going very well. If there is something that happens, we will solve it.*

Operator/Municipality: *The technical assistance, we will need that constantly. Workshops, vigilance, from [multiple stakeholders].*

Commentary from multiple interviews describes the importance of interactions between municipalities and local stakeholders. Numerical analysis indicates the presence of multiple information and skill ties around municipalities in Bolivia. Like other countries with case study institutions at the district level, homophily by level analysis shows engagement of stakeholders at different levels of sector hierarchy, including those at the local level. Numerical analysis is therefore broadly consistent with the narrative provided by stakeholders, and ties specific to local stakeholders in the ego network visualises these relationships further detail (Figure 64 and Figure 65).

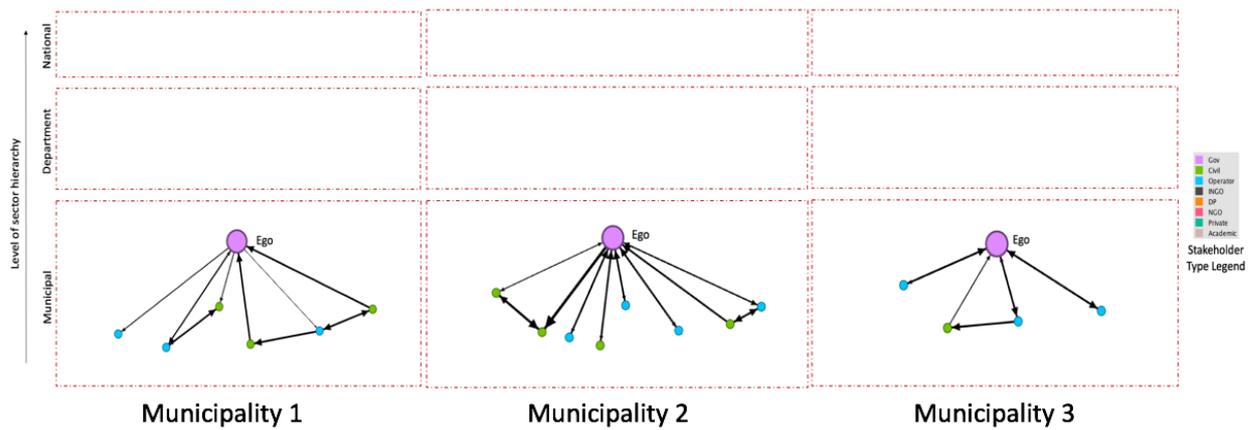


Figure 64 - Information ties to other municipal stakeholders in ego networks of Bolivia case study municipalities (McNicholl *et al.*, 2017)

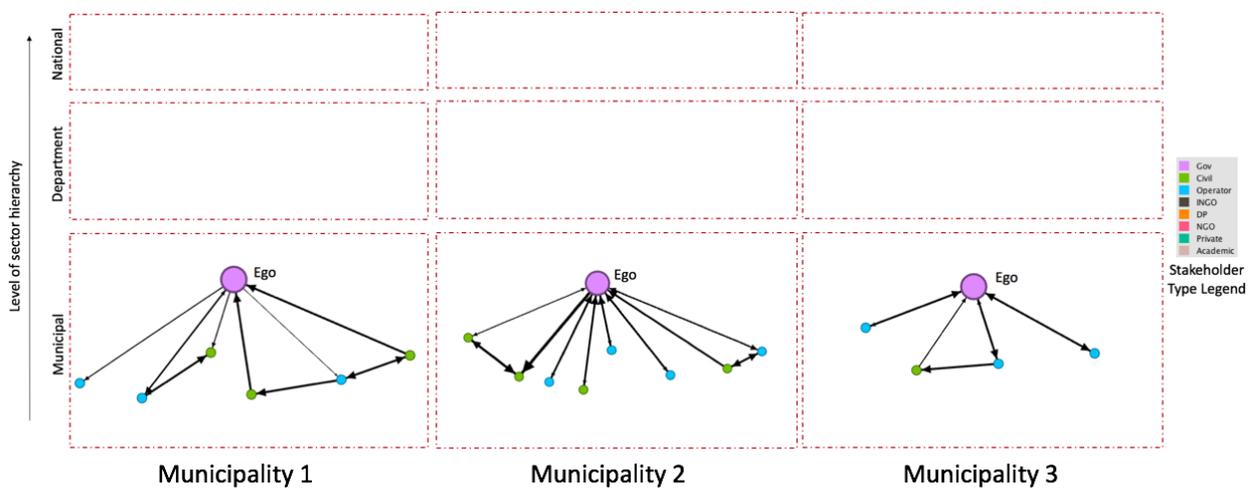


Figure 65 - Skill ties to other municipal stakeholders in ego networks of Bolivia case study municipalities

These ego networks are filtered to show only local stakeholder information and skill ties, and these local ties illustrate how the characteristics described during interviews are observable from a network perspective. Multiple ties of each type are visible for each case study municipality. From the network graphs alone the content of skill and information ties is unknown, but it is logical that these connections help the municipalities to understand local needs and respond appropriately.

6.2.1.5 Tajikistan

Tajikistan is a notable exception compared to the other four case study locations. While the others exhibit numerous ties to stakeholders at lower levels of hierarchy, the case study

institution in Tajikistan does not. The case study institution in Tajikistan has many ties to peer stakeholders, but has almost no connections to lower levels (Figure 66). This is quantified in analysis of its homophily by level that finds that the ego relates almost exclusively to other stakeholders at the national level.

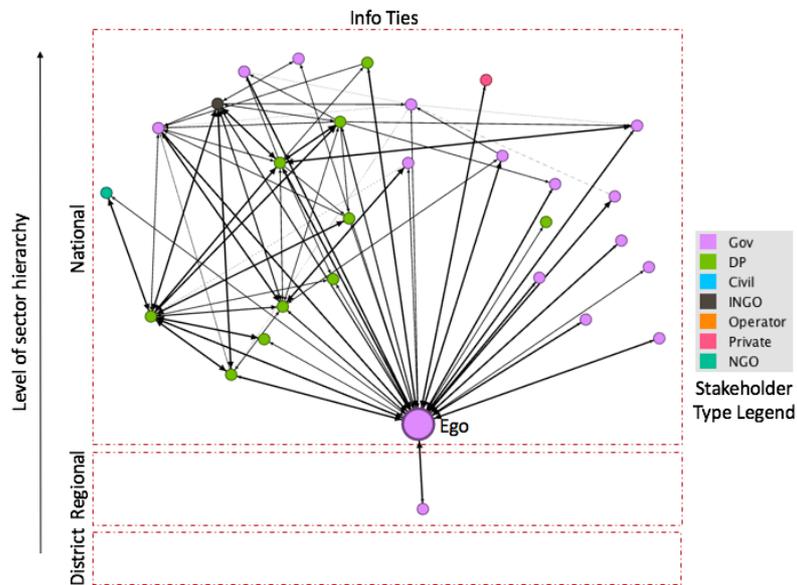


Figure 66 – Information ties by level of hierarchy for the Tajikistan case study institution

Reference to network characteristics describing the importance of ties to lower levels of the sector hierarchy were not mentioned. This is not likely due to issues with methodology; fieldwork in Tajikistan included multiple interviews with local stakeholders in two districts. Ties between the case study institution and other stakeholders at the national level were mentioned as important, however, and these are explored in detail in analysis of ties to higher level stakeholders in sector hierarchies (Section 6.2.2.5).

6.2.1.6 Summary of Information and Skill Ties with Lower Levels of Hierarchy

Commentary from interview participants in four out of five countries described connections to stakeholders at lower levels of sector hierarchy as important for supporting institutional development. No two countries are identical, but their themes bear similarities. The key characteristic is that case study institutions are engaging stakeholders at lower levels of sector hierarchy in order to provide information and technical support to those who need it, as well as receive feedback on how services are operating and what can improve. These relationships can help institutions to both play their role effectively and develop understanding of how they can improve performance.

Investigation of ego network properties around case study institutions confirmed the presence of information and skill ties mentioned during interviews. All case study institutions, with the exception of the case study institution in Tajikistan, exhibit multiple information and skill connections to lower levels of sector hierarchy. This characteristic is also apparent from quantitative analysis of network size and homophily by level, and confirmed by visualisation of the specific parts of ego networks that connect to stakeholders at lower levels of hierarchy.

Overall, it is a logical that skill and information ties with local stakeholders could help an operator or government authority to understand issues and improve performance. This characteristic can be observed from network properties in part by investigating the presence of information and skill ties between a key stakeholder and local stakeholders who depend on it. The presence of these ties does not, however, necessarily guarantee that institutional development is happening. Qualitative understanding of how the relationships are experienced in practice remains important for assessing how relationships are supporting desired outcomes.

6.2.2 Characteristic #2 – Information and skill ties with higher levels of hierarchy

This characteristic describes the other half of ego networks: connections to stakeholders at higher levels of sector hierarchy. The characteristic also relates to information and skill ties, and it was present in every case study country to varying extents. Some differences exist because of the nature of different case study institutions types, levels of sector hierarchy, and the number of other stakeholders that happen to be active in those areas. The number of alters at higher levels of hierarchy can therefore differ depending on the context, and this section explores the nature of the relationships with these stakeholders instead of focusing on the number of relationships.

6.2.2.1 Ghana

In Ghana, five different stakeholders described the importance of the technical support, and the importance of information provided by regional and national sector levels to the district governments. The nature of the relationship is straightforward, and can be investigated by describing the information and skill relationships inbound to the case study districts from this higher level of sector hierarchy.

Total number of interviewed stakeholders describing the characteristic: 5 (4 shown)

Government/Regional: *We are rather assisting. Yeah, we are assisting them. Yes. It's only few districts that they are able to drill boreholes on their own. Without us coming in.*

Government/National: *The fourth point is that the good working relationship with the assemblies. [The District Governments] have a very good working relationship with the assemblies. You remember that they don't have structures here [at the district], but they provide facilitation role for the assemblies to deliver the system.*

Private/National: *And then the whole structure, by that I'm talking about the [regional authority] structure, they've been there as coordinators and facilitators and then they have their regional offices who also give support, technical support, to the districts.*

Government/Regional: *Between [a regional authority] and the districts we have come a long way, so there's a lot of coaching, a lot of co-development we are giving the districts and it's helping them to be the implementers of these facilities.*

These narratives demonstrate information and skill ties linking to higher levels of sector hierarchy, which in this case is national and regional levels. These relationships make up the other part of the ego networks explored in the previous section (Section 6.2.1). Quotes describe a relationship of support to local governments that is helping them to develop new approaches and to play their roles effectively.

Network size values for information and skills partially described these relationships quantitatively. Homophily by level indicated that case study districts are connected to higher levels of sector hierarchy, and homophily by type indicated the presence of ties to other stakeholders beyond government. Ego networks filtered for ties to stakeholders at higher levels of sector hierarchy allows more detailed investigation of the described network characteristics.

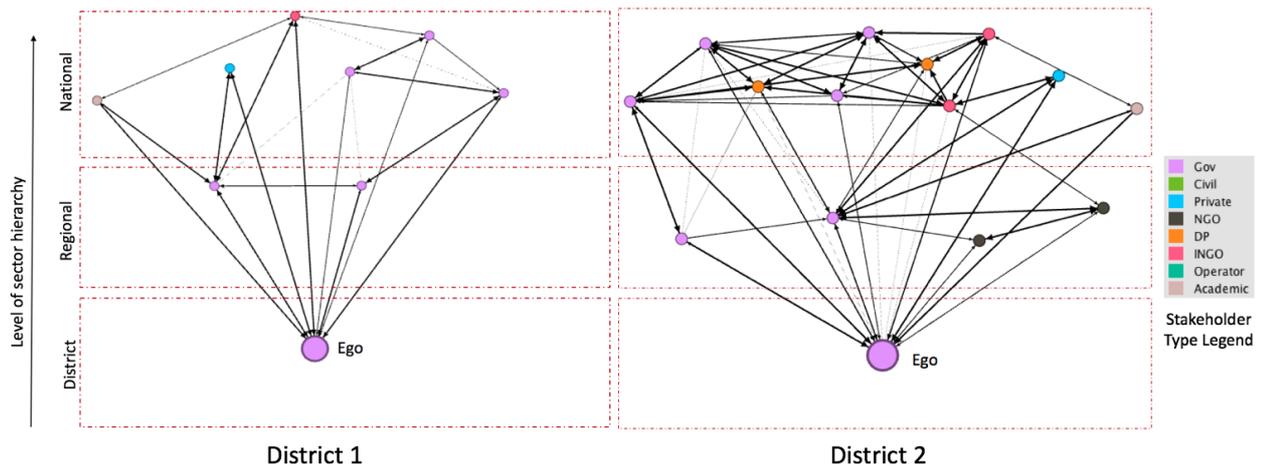


Figure 67 – Information ties to higher levels of sector hierarchy for case study district government ego networks in Ghana (McNicholl *et al.*, 2017)

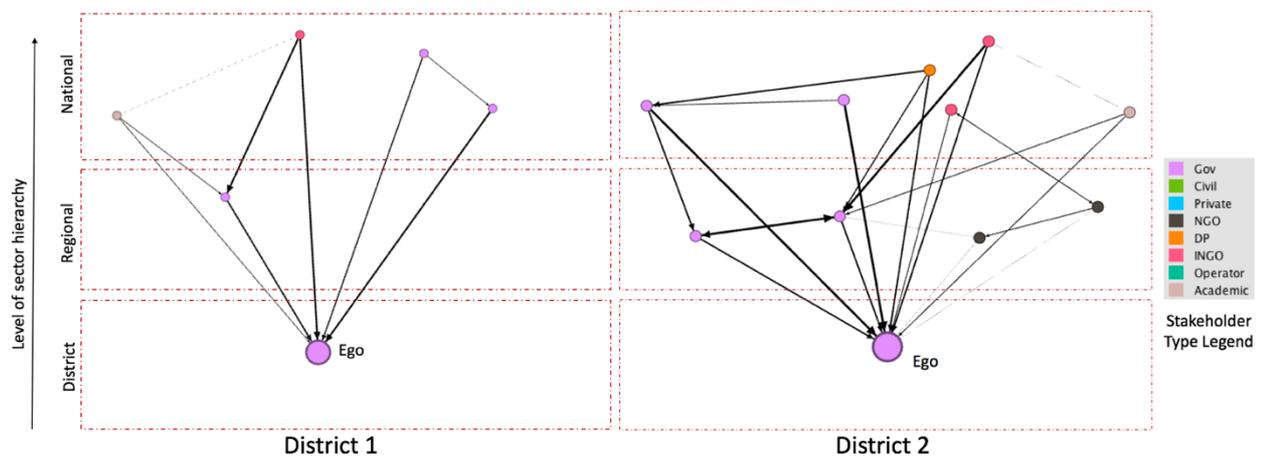


Figure 68 - Skill ties to higher levels of sector hierarchy for case study district government ego networks in Ghana

Multiple information and skill ties to higher levels of sector hierarchy are apparent for each case study district. Alters in these ego networks are at both regional and national levels, and also represent a range of stakeholder types. In both cases, the ego is the recipient of relatively strong information and skill ties from government and non-government alters.

6.2.2.2 Malawi

Multiple stakeholders in Malawi also described the importance of information and skill connections between case study district governments and higher levels of sector hierarchy. Some of these comments also distinguished between support from permanent institutions, such as government, and impermanent stakeholders such as international development organisations that are not mandated to remain in the network indefinitely.

Commentary on this characteristic was provided in thirteen different interviews, and a selection of their quotes highlights the common themes perceived by different stakeholder types and from different levels of sector hierarchy.

Total number of interviewed stakeholders describing the characteristic: 13 (4 shown)

INGO/National: *So if we do capacity building of the district teams, we know we are going to actually deliver more if we partner with them as compared to us working alone.*

Government/District: *...and even the trainings in capacitating the human resource at our district level. Right from the [district government] up to the structures lower or below, below the [district government]. Trainings, coaching, whatever. It's there. Sure. I think all of them are helping us to improve our service delivery in water supply, and it's both at governance level, financial material level, and even at, what, governance level, financial material level, and the, yeah, I think mostly at these two levels.*

INGO/National: *And what is also very important from that case is, the leadership that the district council takes in ensuring that there is a plan in place, and also ensuring that everything else that is happening in the district is also responding to the plan. And even for the leaders to actually say: "We don't need this support. And this is the kind of support that we need at this point in time." Which is something very unique; I'm not sure how many districts in Malawi are actually operating the way [this district] has been operating.*

Government/National: *In each and every district that we go, we also try to improve the institutional capacity by giving them office blocks, and actually even development of the water users associations, giving them the capacity at district level and so forth. So yes, there's institutional capacity... Capacity building, both accommodation as well as the training to the staff members, maybe water monitoring assistants and so forth.*

Multiple stakeholders from both district government and higher sector hierarchy levels talk about deliberate engagement to strengthen local government capacity. Another quote also describes a process of local government providing feedback to influence what type of support it receives. Information and skill ties would be the logical expressions of these relationships in network data, and from the descriptions it is

reasonable that these relationships could support local government performance improvements. These described characteristics are consistent with the quantitative analysis that found numerous information and skill ties, as well as connections to stakeholders across different levels of hierarchy. Information and skill ties to higher levels of hierarchy can also be observed in the ego networks of these case study local governments (Figure 69 and Figure 70).

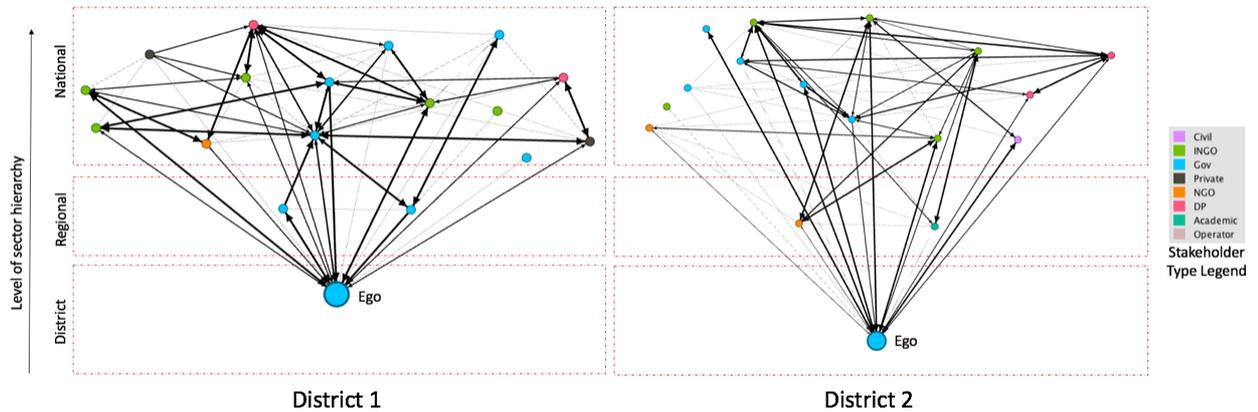


Figure 69 - Information ties to higher levels of sector hierarchy for case study district government ego networks in Malawi (McNicholl *et al.*, 2017)

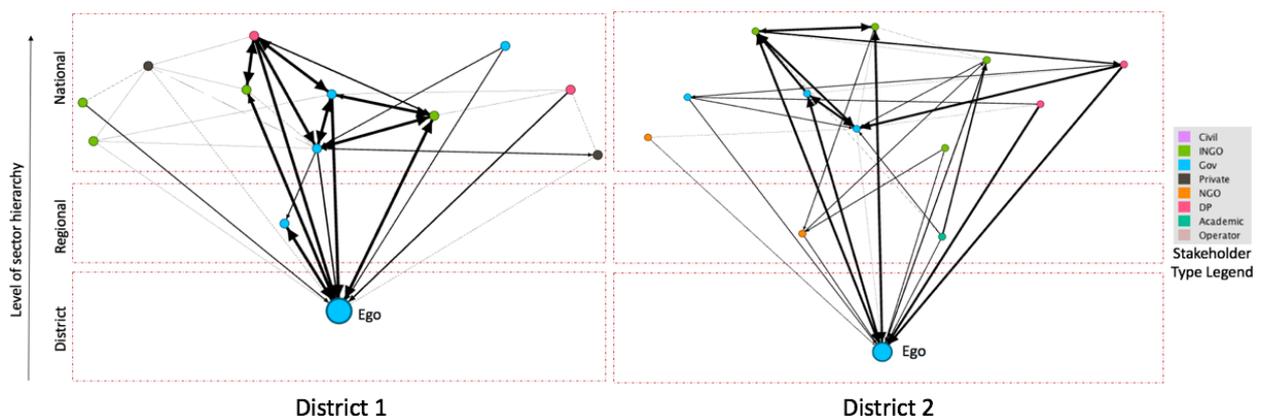


Figure 70 – Skill ties to higher levels of sector hierarchy for case study district government ego networks in Malawi

Multiple information and skill ties to higher levels of hierarchy are apparent in the ego network of each case study local government in Malawi. The difference between the described characteristics and the network graphs is that many information connections can look similar from a network perspective, and even be of similar weight, but the nuance of each particular relationship can differ. For example, the concept of a district government being able to provide feedback to influence the kind of support it receives describes an important characteristic that is not fully characterised by network data

alone. For this reason, it remains important to supplement quantitative network data with qualitative descriptions to interpret the significance of particular relationships.

6.2.2.3 India

Information and skill ties to higher levels of sector hierarchy were described as important in India, although less frequently than in other case study countries. An important distinguishing characteristic of case study institutions in India is that these are local operators with no formal obligation to be connected to other stakeholders at higher levels of hierarchy. This mandate stands in contrast to district governments who, at least on paper, should be connected to both those who depend on their support and the national institutions that govern them.

The fact that connections to higher level stakeholders are described as important amongst local operators in India is therefore interesting. These relationships are qualified by a few examples from the eight different operator ego networks where stakeholders commented on aspects of this characteristic.

Total number of interviewed stakeholders describing the characteristic: 8 (3 shown)

Operator/Community: *And also he reports back to [the support organisation] if any technical error or technical assistance is required then he report back to [them].*

Private/Community: *Then the club members will give information to us [from the support organisation] if anything faulty happens. It helps to take action.*

NGO/State: *And yes I also have the relationship of the plant owners with the existing plant... So that we can engage, we can maintain the system, we can get proper reports from those plants. Like how the plant is running. If something wrong happens, then I concern, I discuss with my other members or other persons of [my organisation]. So, like if any requirements or any system enhancement is required, then we provide consulting and also to the plant owners.*

These stakeholders describe a relationship of technical support from a stakeholder at higher level of sector hierarchy that helps operators to overcome technical challenges. Maintenance of the filters is important because the media that removes arsenic degrades over time. Water quality monitoring is necessary to ensure that water remains safe to

drink, and both monitoring and maintenance can be supported by stakeholders at higher levels of hierarchy as required.

Quantitative analysis of Indian case study operators provides an initial understanding of the described characteristics. Network size values for information and skill ties showed the presence of numerous relationships. Homophily by type numerical analysis showed connections to other stakeholder types, and homophily by level showed that operators do not exclusively connect to local stakeholders, even if these ties constitute the majority in the ego networks. Ties to higher levels of hierarchy are visualised in Figure 71 where both information and skill ties are shown simultaneously.

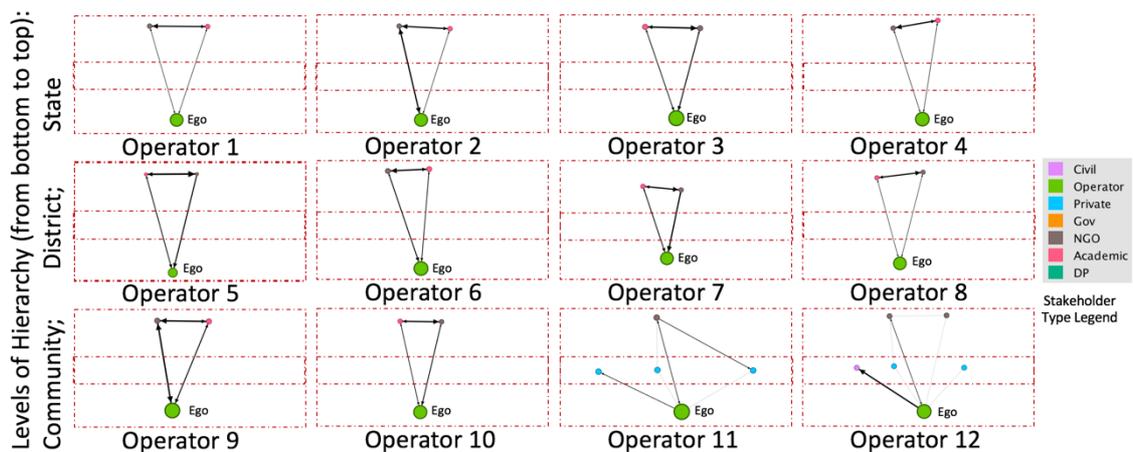


Figure 71 – Combined information and skill ego networks of case study operators in India showing ties to stakeholders at higher levels of hierarchy

Reviewing ego networks for these local operators finds connections that are few in number, but nevertheless present. This characteristic suggests that support from other stakeholders at higher levels of sector hierarchy provides value to these operators.

6.2.2.4 Bolivia

Nine interview participants in Bolivia referenced the importance of skill and information ties between case study municipalities and higher levels of the sector hierarchy. These quotes describe activities such as workshops to build capacity, and ties that provide information on approaches for managing service delivery. A selection of quotes describing these characteristics is presented here:

Total number of interviewed stakeholders describing the characteristic: 9 (5 shown)

Government/Municipal: *Of these institutions that are supporting us, most of all will be [an INGO]. Talking about investment and workshops and trainings to solve the water systems and sanitation.*

***Operator/Municipal:** Just the way they are doing now. Some consultants that come here to the community to help us to prepare the annual programme of operations.*

***Operator/Municipal:** All that we work with these NGOs and with the institutions and the institutions from the government is to improve the quality of life. To improve the systems and to build the systems.*

***Academic/Department:** So we do this through advice to the users, to the technicians who work here and also work with the authorities. Those are the levels.*

***NGO/Department:** So it can be an NGO like [ours], it can also be the government the municipality it can be another institution, but there should be someone who gives them technical assistance permanently. To develop capacities in this network that we mentioned.*

These quotes describe how ties between upper levels of sector hierarchy and the municipalities are supporting local improvements. Network characteristics that specifically relate to improvements in municipal performance are often mixed with reference to infrastructure investments, and infrastructure is discussed later in this chapter (Section 6.3.4).

A particularly nuanced network characteristic finds one stakeholder encouraging municipalities to develop a stronger internal organisational structure for managing service delivery as a precursor to partnership. The idea is that these municipalities can qualify for technical support and investments in infrastructure if they, in turn, invest in developing their internal capacity for managing services. The approach appears to be influencing the behaviour of the case study municipalities.

***INGO/Department:** At the meeting last Tuesday there were the six [municipalities]. And there were three more municipalities. We are enforcing them in order that they build and create [district management units for water and sanitation]. Once they have a [district management unit] we will start working with them. It is a previous condition.*

This characteristic describes using infrastructure investment as leverage to influence the development of management structures within municipalities. These management units are then the same entities referred to in the characteristic describing connections to local stakeholders that provide information and skill support to local operators and

communities. This is perceived as a valuable arrangement that is having tangible effects on the capacity of the case study municipalities in Bolivia.

More broadly, these described characteristics are consistent with the numerical findings of skill and information network sizes, and homophily by level. These properties indicate multiple connections that span levels of sector hierarchy. As with ego networks in other case study countries, these ties are expected to be visible in network visualisations of these municipalities. Filtering municipality ego networks to show connections to higher levels of sector hierarchy confirms the presence of these network characteristics (Figure 72 and Figure 73).

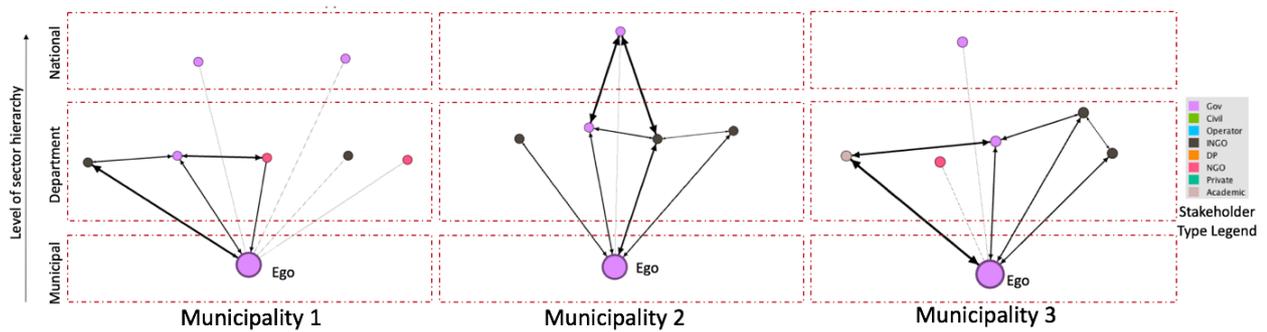


Figure 72 – Information ties to stakeholders of higher level of sector hierarchy for case study municipalities in Bolivia (McNicholl *et al.*, 2017)

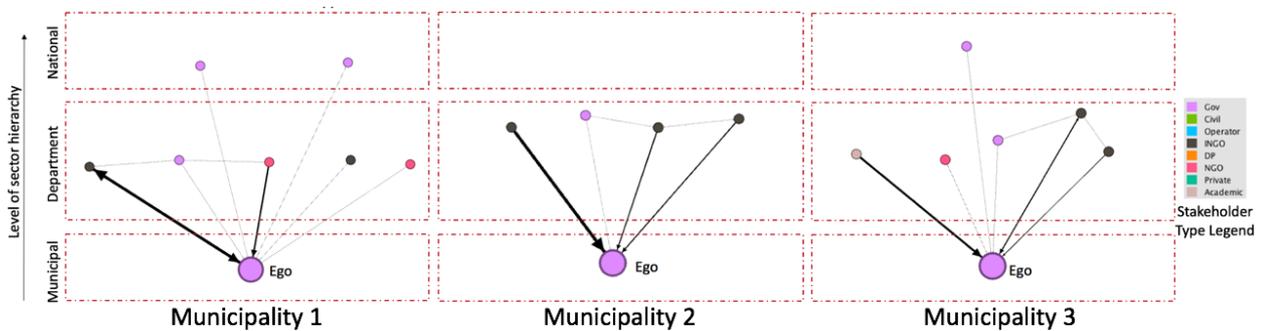


Figure 73 – Skills ties to stakeholders of higher level of sector hierarchy for case study municipalities in Bolivia

Investigation of these ego networks finds that support is coming from multiple stakeholders at higher levels of sector hierarchy in each ego network. Narrative analysis of stakeholder commentary finds that there are different strategies for providing support to municipalities, but many of these stakeholders have specific intentions to build municipal capacity. Development of municipal management structures is then likely important for passing on support to the operators and communities identified in the other half of these ego networks (Section 6.2.1.4).

6.2.2.5 Tajikistan

The case study institution in Tajikistan is at the top level of sector hierarchy in the country, and therefore has no higher level to engage with. Ties between national level stakeholders were reported as important, however. The characteristic of ties to upper levels of hierarchy can instead be explored by looking at relationships across the national level between the institution and other stakeholders at the national level.

Influences from international organisations were identified in particular. Perspectives from multiple stakeholders indicate that international donor organisations are actively supporting the reform, and that dialogue platforms improve the interface between government and international organisations. These international organisations are comprised mainly of bi-lateral and multi-lateral organisations that work in Tajikistan. Five stakeholders described how international organisations interact with the institution studied, and their quotes are paraphrased from handwritten notes.

Total number of interviewed stakeholders describing the characteristic: 5 (3 shown)

DP/National: *Since January this year [several Development Partners] are helping to implement the reform... Period of convincing was crucial leading up to now. At present, the reform has yet to get under way... but the process of getting everyone on board has been formalised and is moving forward.*

Government/National: *[A Development Partner] hired a consultant to identify who is doing what in ministries in terms of authority and influence... First reform project began in 2006 with all stakeholders creating a working group... Another platform was also created, the national policy dialogue. This second platform then gathered all stakeholders.*

DP/National: *A coordination unit was proposed, similar to what had existed previously. They would look at monthly progress and how donors are responding. They would implement programmes such as to support reforms. Different donors would support different basins and sub-basins. The coordination meetings are now ongoing. They've had three of them so far in 2016. Trying to reaffirm reform priorities and donor contributions to these. [He is] surprised it is working this time.*

Homophily by type analysis found that the case study government institution engages an approximately equal number of organisations that are similar and dissimilar to itself. This initial characterisation, combined with the identification of large information and

skill network sizes, suggests active engagement with the international organisations described in the quotations. The international organisations engaging the ego are easily identified by colour coding stakeholders by type (Figure 74).

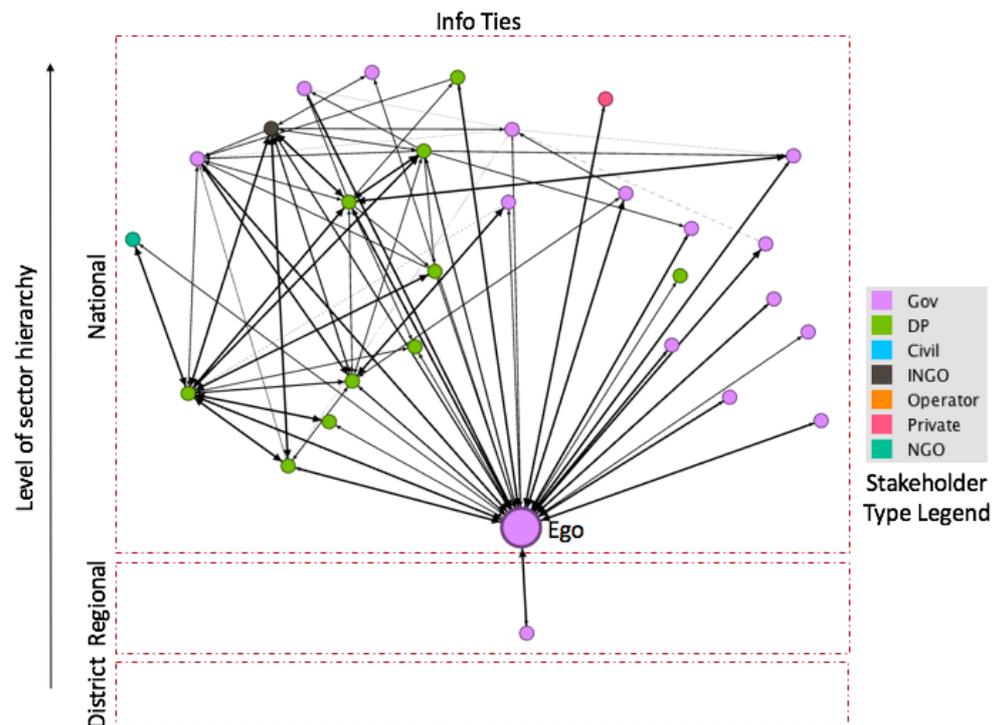


Figure 74 – Information ties with stakeholders at national level of sector hierarchy in Tajikistan in the case study institution ego network

Numerous information ties between international organisations and the case study institution ego are easy to identify in the network graph. These findings confirm the presence of engagement amongst stakeholders at the national level, and qualify some of the importance of these network characteristics. This coordinated effort to engage the central authority on policy reform is perceived as beneficial in Tajikistan.

6.2.2.6 Summary of Information and Skill Ties with Higher Levels of Hierarchy

Examples in every country described information and skill connections with higher levels of hierarchy that are supporting the case study institutions to improve performance. In the case of district governments, these can be connections with regional or national level stakeholders. In Tajikistan, the institution is already at the highest level of the sector and therefore engages with other stakeholders also at the national level.

The network characteristic is not particularly surprising. It seems logical that higher level stakeholders would support more local ones to develop their roles in service delivery. The advantage from a network perspective is the ease with which this

characteristic can be visualised to understand if this type of support exists, and where it is coming from. Even if the network characteristic seems obviously beneficial, it is possible that support from higher levels of hierarchy could be weak or absent, without being recognised as such by stakeholders in the network. Investigation of the full breadth of ego network characteristics provides potentially useful information on the types of engagement from higher levels and where these are coming from.

6.2.3 Characteristic #3 – Coordination between higher-level hierarchy stakeholders providing strong information and skill support

This third and final network characteristic commonly identified across several country case studies explores coordination between stakeholders strongly supporting an ego from higher levels of sector hierarchy. Coordination was a theme referenced by stakeholders in each country. What coordination means from a network perspective, however, is unclear because not every stakeholder equally engages everyone else. Interview quotes on this characteristic are combined with quantitative findings to understand how coordination between stakeholders is observed in the ego networks of the case study institutions in the five countries.

The analytical methods used in this section combine information and skill ties to investigate coordination because these tie types were identified as significant in the first two common network characteristics. Ties presented in analysis in this section will therefore refer to instances where both information and skill ties exist in parallel. These combined ties will be used to identify the stakeholders that are most strongly engaging the ego, and to quantify the strength of ties between these alters.

Specifically, the two alters most strongly engaging the ego with combined information and skill ties are investigated because of the unit of analysis produced by looking at three nodes, and because follow up interviews with these alters were conducted in all cases. These interviews therefore captured data on alter-to-alter ties between the two alters most strongly engaging each case study institution. Including the ego and the two alters most strongly engaging it creates a basic unit of network analysis called a triad. This is considered to be the smallest coalition possible in a network, and analysis of triads has been the basis of extensive sociological research and the development of network theory (Caplow, 1968; Simmel, 1964; Stryke & Psathas, 1960). Analysis in this section will therefore consider the two alters most strongly engaging the ego to see if the two alters are also linked by information and skill ties to form a coordination unit.

Analysis first identifies the two alters most strongly engaging the ego with both information and skill ties. Information ties are weighted from 1 to 3 and skill ties are weighted from 1 to 4 (Section 4.3.1). Alters identified for analysis are defined as strongly engaging the ego if their combined information and skill tie weights are each greater than the minimum value of 1, meaning that alters with the weakest possible ties are excluded. Incoming tie strength is taken from the perspective of the ego because, logically, the ego can distinguish relative tie weight differences from the same perspective. The second step then quantifies the average strength of information and skill ties between these two alters as reported by them during follow up interviews. These alters were directly interviewed in all cases.

Applying these two steps produces a triad between the ego and two alters for analysis (Figure 75). Specifically, this process identifies whether there are at least two alters strongly engaging an ego with both information and skill ties, and identifies whether strong information and skill ties also exist between these alters. Identifying and quantifying the strength of these alter to alter ties is expected to help interpret coordination between stakeholders engaging the ego from a network perspective.

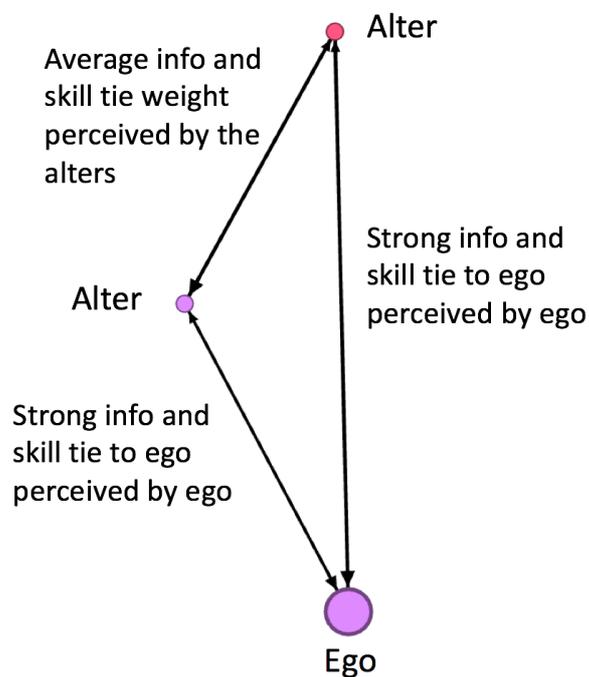


Figure 75 – Example triad showing the ego and the two alters with the strongest combined information and skill ties to the ego

6.2.3.1 Ghana

Coordination amongst stakeholders at higher levels of hierarchy was described as important in Ghana. These descriptions of coordination relate specifically to the ego networks of the case study districts, where both local governments are receiving support from stakeholders at higher levels of sector hierarchy, as was explored earlier in this chapter (Section 6.2.2.1). The next step explores from a network perspective how these stakeholders engaging a case study district engage each other. Four stakeholders in Ghana described the triad of information and skill ties between district government, a regional authority, and an International NGO.

Total number of interviewed stakeholders describing the characteristic: 4 (3 shown)

Government/District: *And then I think for the [work we have done] has empowered the assembly in a way. We now know the water situation in the district, so if the church organisations, or their [inaudible] comes to the districts they want to assist you in borehole maintenance or borehole we know functionality that was done by the project has been able to tell us how many facilities are functioning.*

INGO/National: *Okay, so all the three figures from the three points. And what we realised from the three points was that sometimes the key challenge is actually that the management teams that are supposed to monitor the systems are defunct. So, once the management teams are not in place then you cannot guarantee the service levels. Depending on how we've worked with our partners, depending on what kind of problems we have found together, then we work out solutions together.*

Government/District: *Now we understand we use this life cycle cost approach, where we comprehensively budget for water and sanitation activities. Yes. So, everything is really budgeted for. And for instance we have this composite budget. So once it's been in there, we have a reason to spend on such activities. So those are some of the things helping us to really work as it is.*

These comments describe how certain relationships between an ego and its alters are stronger than others, and that working together as a triad has produced solutions. The quotes refer to specific stakeholders that were evident from the context of the interview, even if these are not named explicitly in the quotes. Analysis of the case study district

government ego networks can clarify what these characteristics look like from a network perspective.

The following analysis of each district government ego network quantitatively identifies the properties of ties between stakeholders engaging districts from higher levels of sector hierarchy. Identical analysis of triads is repeated throughout this section to investigate coordination between alters in ego networks of case study institutions. The first step identifies the two alters in the ego network that are the source of the strongest combined inbound information and skill ties from the perspective of the ego. The ego perspective is important because it can define what it perceives as strongest relative to all types of engagement it experiences. For this analysis, strong ties are defined as stronger than the most basic possible tie strengths for information and skills. The next step investigates ties between these two alters. The result quantifies coordination between the stakeholders most strongly engaging a case study institution.

The two alters with the strongest combined information and skill ties to the ego are shown for each case study district government ego network in Figure 76. Also shown are the weights of the information and skill ties between these two alters. These ties show a triad of strong information and skill ties between all three stakeholders in each case.

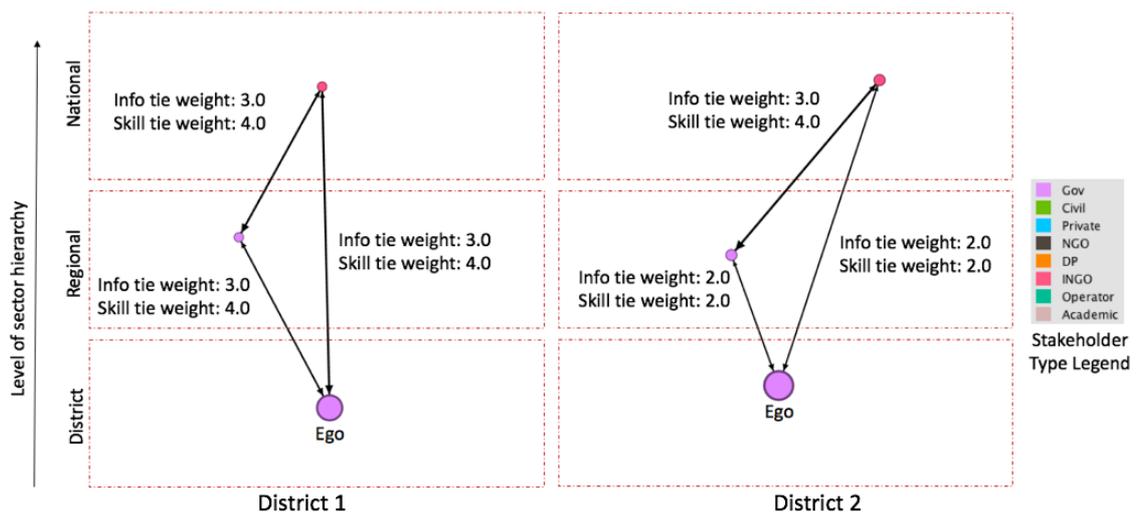


Figure 76 – Visualisation of the network triads in Ghana between case study local governments and the alters with the strongest information and skill ties to the ego. Analysis finds strong information and skill ties between these alters in each ego network. (McNicholl *et al.*, 2017)

First, the ego network is filtered to show the two alters at higher levels of hierarchy most strongly engaging the ego with information and skill ties. Information and skill ties between these two alters can then be identified. The filtered ego network shows that the two alters most strongly engaging a case study district are also strongly engaging each other.

The importance of coordination as a network characteristic is logical. Stakeholders strongly engaging a district government will likely influence it. Multiple stakeholders need to be working towards common outcomes if they are successfully going to influence district performance improvements, and these supporting stakeholders therefore strongly need to engage each other. This engagement could help to align efforts and complement each other's work.

6.2.3.2 Malawi

Commentary on coordination between stakeholders at higher levels of sector hierarchy also emerged in Malawi. These comments sometimes referred to specific stakeholders and interactions, and sometimes offered a more general perception of everyone working together.

Total number of interviewed stakeholders describing the characteristic: 6 (3 shown)

***Academic/Regional:** I think one of the things that's helping improve services for water supply is that we have several partners, both government stakeholders such as [a regional authority], but also large and small NGOs, and they're all working with us in some capacity. So they may not be working with us on a specific project, but because they interact with us, there's always tea break conversations on other topics, and I think that's a big change from when the centre first started... I mean they may not all do the same approach, but it's important that everyone knows kind of what everyone's doing in the area. Because as we discussed there are some smaller NGOs here that are not necessarily working in the proper way, but by working through us we can encourage them to work through the districts or to do their training in a different way for example.*

***NGO/National:** So basically the network is enhanced through the forums, what we call the citizens' forums. Which brings in the people themselves as end users of water, and then various service providers. It could be NGOs, [INGOs], and through it could be the local councils who are supplying*

water in those areas. And in those local areas there also committees, like water and sanitation committees, which oversee that water is being supplied that is clean.

INGO/National: And of course also these other organisations like [...], just to mention a few. They are also able to understand that water is important for the communities that we are serving and they are able to provide that particular water. Based on the findings that we have, sometimes there could be an organisation that has got resources to provide that water service, but they might not be aware of where exactly they would bring that water to. So when we are coming in, engaged in dialogue with these colleagues, they have been able to understand that there is a need here and let's provide.

These quotes touch on themes of collaboration between the stakeholders, sharing information, awareness of their respective intentions and achievements, and support for each other's work. Analysis of these stakeholder interactions follows the same process as investigation of coordination in Ghanaian ego networks. The two alters most strongly engaging the case study district governments with combined information and skill ties from the perspective of the ego are identified first. The strength of information and skill interactions between these alters is then quantified. This process characterises coordination between the alters most strongly engaging the ego. Ego networks for the first and second case study district governments are presented in Figure 77 and Figure 78 respectively.

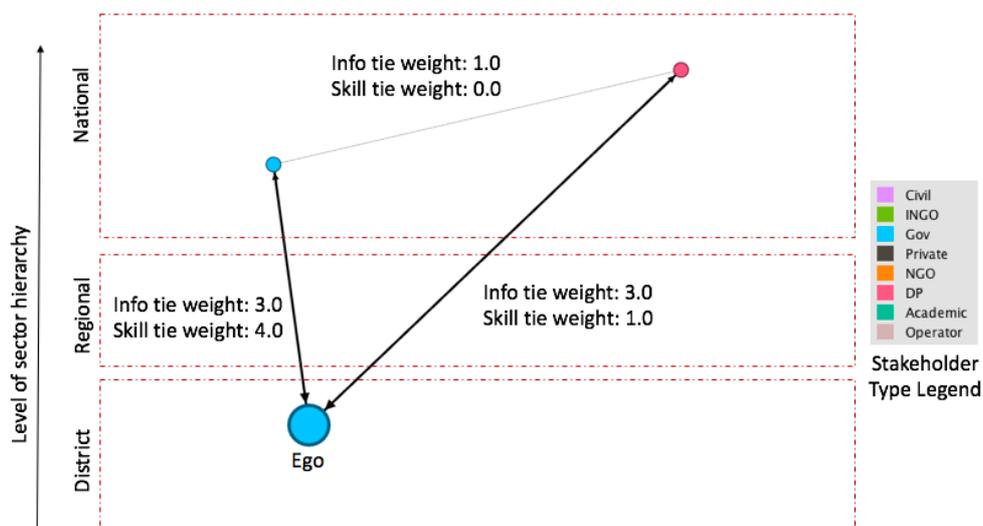


Figure 77 – Visualisation of the network triad in Malawi between District 1 and the alters with the strongest information and skill ties to the ego. Analysis shows a weak information tie between these two alters.

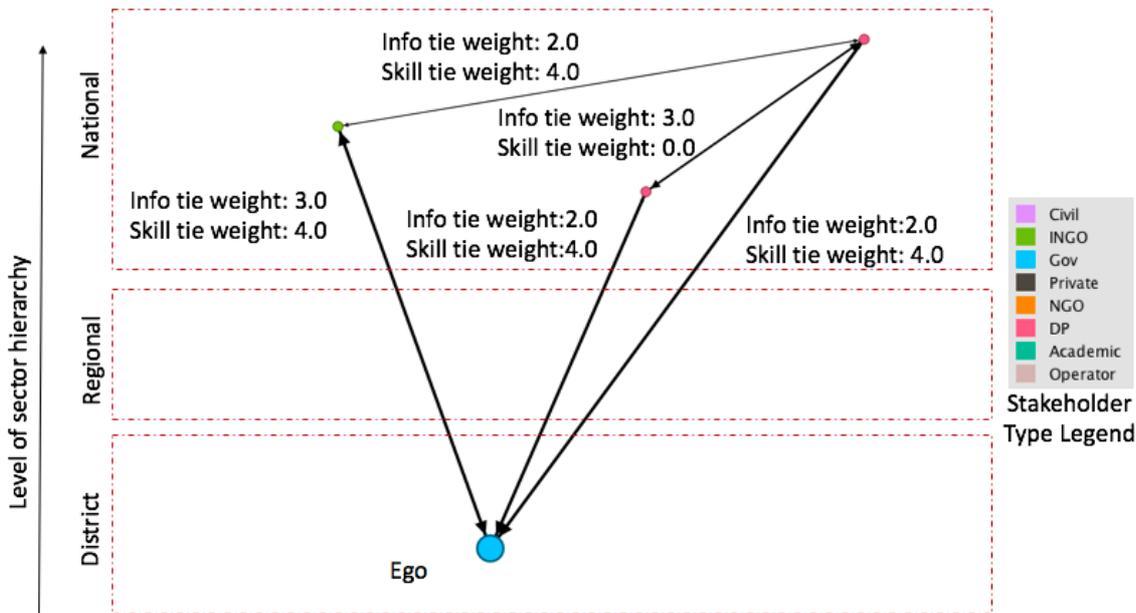


Figure 78 - Visualisation of the network triad in Malawi between District 2 and the alters with the strongest information and skill ties to the ego. Analysis shows three alters because two have equal strength ties to the ego. These alters are not all directly connected.

Coordination is incomplete between alters strongly engaging case study institutions in Malawi. The first case study district government (Figure 77) shows a weak information tie between the two alters most strongly engaging that district government. The second case study district government (Figure 78) has three alters included because two of these engage the ego with information and skill ties of equal weight. One of the ties is missing between the INGO alter and the DP alter. The second case study district government ego network does show some strong engagement between these alters with information and skill ties to the district government, but not all alters are directly connected. It is reasonable that some stakeholders would mention alignment and coordination as important aspects of network interaction, but analysis of the specific ego networks around case study district governments does not find strong ties between alters in all cases.

6.2.3.3 India

Case study institutions in India are community operator committees that have relatively few connections to higher levels of sector hierarchy. The relatively small number of stakeholders at higher levels of hierarchy in operator ego networks corresponds to less commentary about relationships between these higher level alters. Only one stakeholder commented on the importance of this network characteristic, but the detail of the

description suggests that the coordination tie is important, and analysis is conducted in this section to be consistent with analysis of other case study countries.

Total number of interviewed stakeholders describing the characteristic: 1 (1 shown)

Academic/State: [Our] present role for the units that have been installed is not direct because [the NGO] is now technically competent and so they can provide service. Administration also can provide the service for all kind of stakeholder needs.... So that way we thought this kind of a system where an NGO is there is technically capable and specialised in this kind of filter operations is in place, and the committees, and the school administration are eager to see their filter serving their respective communities for years.

This quote describes a relationship between an academic institution and an NGO both playing roles in supporting the case study community operator committees. The academic institution played a leading role in developing arsenic filtration technology, and their coordination with a local NGO allows technical support to continue being extended to community operator committees. This relationship is important because the academic institution does not have the mandate or capacity to directly provide all types of support to the community operators. This arrangement therefore creates a mutually supportive set of relationships that benefits all three stakeholders in the triad: the academic institution, the NGO, and a case study operator.

Analysis of operator ego networks illustrates how coordination is observed in the India case study. In ten of the twelve operators studied, the same pair of stakeholders – the academic institution and an NGO – are the only alters engaging the operators from higher levels of sector hierarchy with both strong information and skill ties. The other two operators identify only one alter. Because analysis of alter-to-alter ties is the same for many of these egos, two figures can be used to visualise the ego networks of all case study operators in India that are improving performance (Figure 79 and Figure 80). Ten of the twelve case study operators that are improving performance exhibit coordination between strongly engaged alters in their respective ego networks.

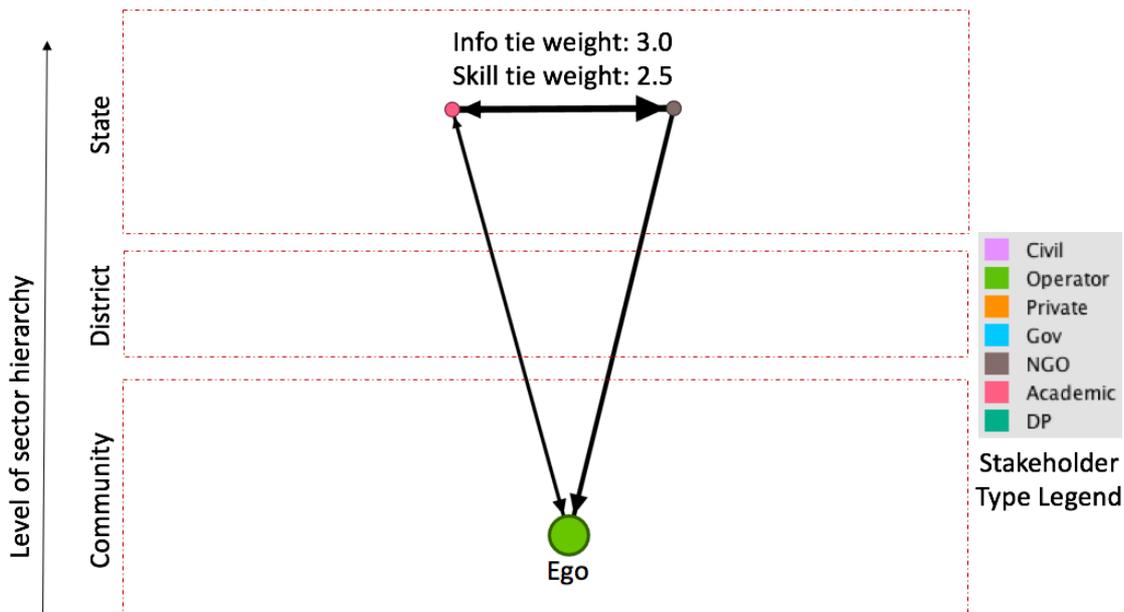


Figure 79 – Visualisation of the network triad for ten case study operators showing the alters with the strongest information and skill ties to the ego. Analysis shows strong information and skill ties between these two alters.

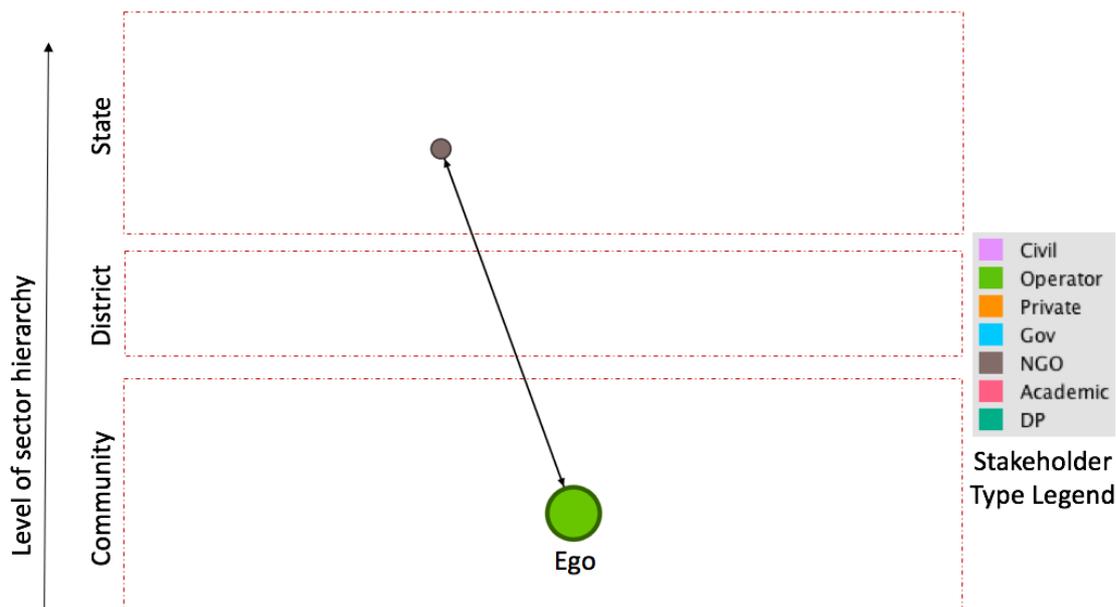


Figure 80 - Visualisation of the network triad for two case study operators showing the alters with the strongest information and skill ties to the ego. Only one alter is identified as strongly engaging these two operators with both information and skill ties from higher levels of hierarchy.

6.2.3.4 Bolivia

Coordination was mentioned as important by only two stakeholders interviewed in Bolivia. These comments refer to ego networks around local governments, but relatively few stakeholders are engaged in these ego networks from higher levels of sector hierarchy as compared to other local governments studied in Ghana and Malawi. This may be a reason why this characteristic was mentioned less frequently in Bolivia. Two quotes describe coordination amongst stakeholders at a higher level of sector hierarchy who are strongly engaging municipalities.

Total number of interviewed stakeholders describing the characteristic: 2 (2 shown)

Government/Department: *All of the relationships are to set relationships of coordination in specific objectives to help us to visualise, to solve, to get clear to discuss, and others. So we decided to identify first of all, to all the actors public and private, and the other entities too to identify them to see how many of them work, in the water topics...And in order to be more effective in the interventions and not to waste our efforts. And not to make the investments useless. So all of these actions and all of these entities we have the same objectives: to improve the systems and to give the people adequate service in water and sanitation.*

INGO/Department: *There is good coordination between these institutions. The sector has a good structure and there are many different levels. Municipal, national, international cooperation, NGOs, society in general, department. There is good participation between them.*

Both commentaries cite coordination as important, but details of these interactions are vague. Analysis of case study municipality ego networks investigates coordination between stakeholders at higher levels of hierarchy in these ego networks to explore this characteristic from a network perspective. In Bolivia, however, only one alter at higher levels of hierarchy is identified as engaging each case study local government with both information and skill ties stronger than the minimum possible weight (Figure 81). The coordination network characteristic is therefore not identified in the Bolivian case studies.

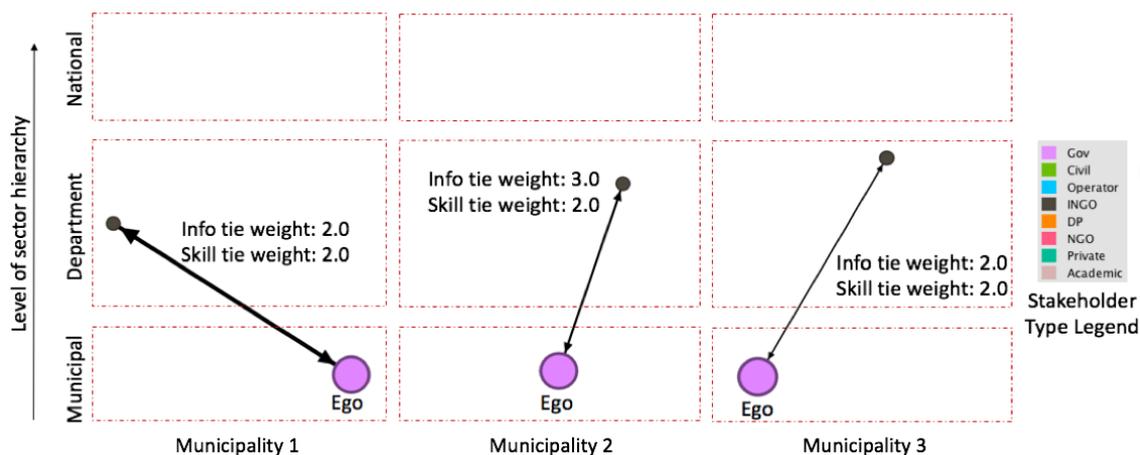


Figure 81 – Bolivian case study municipalities information and skill network ties to higher levels of sector hierarchy filtered for the strongest tie weights from the perspective of the ego

6.2.3.5 Tajikistan

In Tajikistan, interview commentary highlights the importance of coordination amongst stakeholders supporting the case study institution that is leading the policy reform. Some commentary refers to a particular stakeholder that is playing a coordination role amongst development partners. This is something more specific than just coordination: it is a characterisation of a specific stakeholder taking a lead role in assisting the reform process on behalf of other international organisations. Comments from stakeholders in interviews illustrate this concept in greater detail.

Total number of interviewed stakeholders describing the characteristic: 5 (3 shown)

INGO/National: *Both donors manage to have the same line in front of the government. That really helped. And that's thanks to the two of them who really pushed to have a common view... the donors getting together, and it took a while to get the same position. But the eventually to put everything together, to delegate to [specific stakeholders], to represent them in front of the government, and that really helped.*

Government/National: *[The facilitator] is paid by [a donor] but hired to lead the reform process from the donor side.*

DP/National: *[Donors] requested [a facilitator] ... to help approve and implement the water reform...in December 2015 the government approved the reform. [The government] appointed... a coordinating unit in the ministry... [the facilitator] wanted to be based in the [government] instead*

of at the head office.... Overall, it's time, patience, and resources. These are needed to convince of the benefits through a consultation process. Need to understand, for everyone, what's in it for them?... Tajikistan needs heavy mediation between donors and government. [The facilitator] plays a role as a mediator between them to understand needs and identify solutions. Dialogue is a process to achieve consensus on both sides.

The stakeholder described as the 'facilitator' can be identified from analysis of the strong incoming information and skill ties perceived by the ego. The facilitator is evident as one of the alters engaging the ego with the strongest weights of skill and information ties. Only one other stakeholder across the entire ego network does likewise, and analysis of the ties between these two alters find strong information and skill ties (Figure 82).

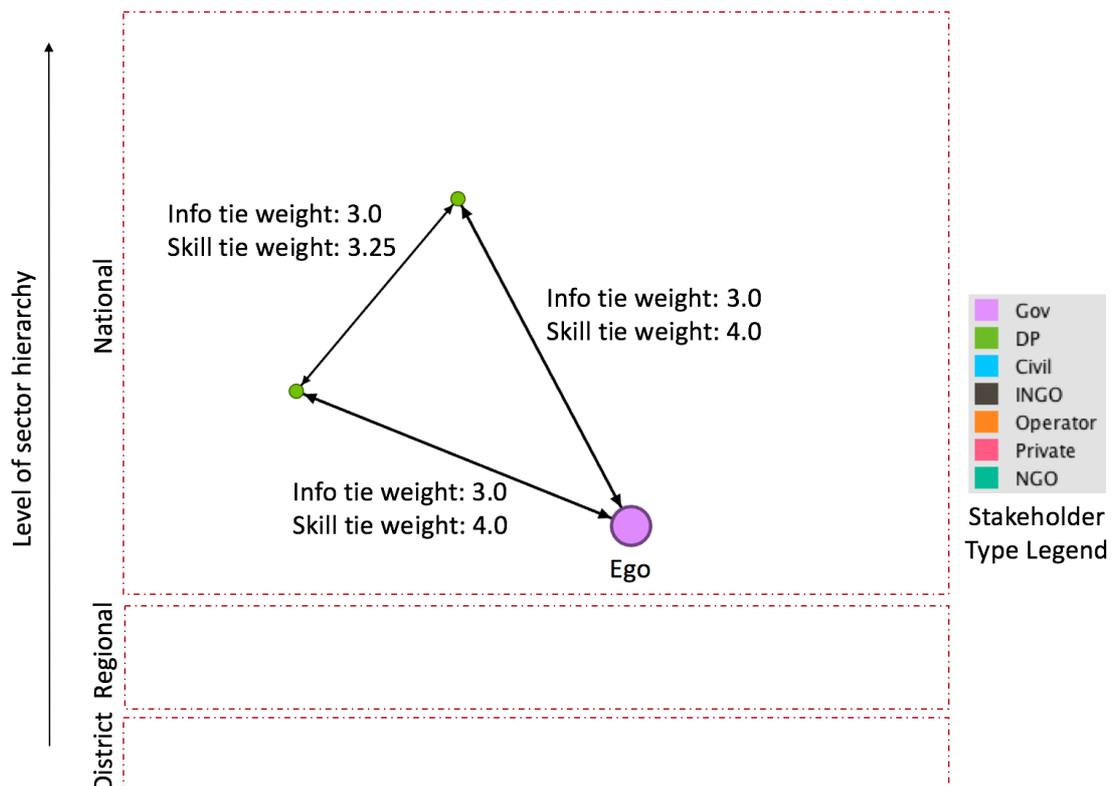


Figure 82 – Visualisation of the network triad in Tajikistan between the case study institution and the alters with the strongest information and skill ties to the ego. Analysis finds strong information and skill ties between these alters.

These properties provide a more detailed picture of the facilitator, its relationship to the case study institution, and its relationship to the other alter most strongly engaging the institution. These indicators, as described from a network perspective, might help

identify the presence – or absence – of facilitators in other such networks, or help to strengthen the roles of facilitators trying to play similar roles.

6.2.3.6 Summary of Coordination between Higher-level Hierarchy Stakeholders Providing Strong Information and Skill Support

Coordination amongst stakeholders was referenced as important by stakeholders in each country. The word ‘coordination’ is imprecise, however, because not every stakeholder has equally strong ties with every other stakeholder in an ego network. Triad analysis can therefore be used to identify where engagement is strongest, and how these stakeholders relate to each other. This analytical approach offers a specific description from a network perspective of how coordination happens in practice between a few key stakeholders who strongly engage a case study institution.

This network characteristic of coordination can be identified in two steps. The first step is to identify, from the perspective of the ego, the strongest information and skill ties coming from higher levels of hierarchy. The second step is to quantify the strength of the information and skill ties between these alters. In the cases where this network characteristic was observed, these alter-to-alter relationships were described as important for coordinating efforts when engaging an institution.

The coordination network characteristic is less present in Bolivia and Malawi. In these cases, there are either few alters strongly engaging case study institutions with both information and skill ties, or relationships between these alters are weak or missing. These findings suggest that the absence of this network characteristic does not necessarily halt institutional development, but a lack of relationships between alters strongly engaging an ego might be a missed opportunity for strengthening support for institutional development. It seems logical that weak ties between stakeholders strongly engaging an institution could lead to redundant or even conflicting efforts, and it is therefore reasonable that the importance of coordination between stakeholders supporting an institution was identified as a supportive influence on institutional development in multiple case studies.

6.3 Uncommon Network Characteristics

Some network characteristics that reportedly support institutional development were described in a small number of instances. Some of these influences may only apply to specific types of stakeholders, may be contextually dependent, or may not be perceived as important elsewhere. These network characteristics were described as positive

influences on institutional development in specific cases, but these characteristics are less ubiquitous than the common characteristics described previously.

6.3.1 Water Tariffs

A tariff is what users pay for water services, and at least some mention of the importance of appropriate water tariffs was made in every case study country. Tariffs do not emerge as a common characteristic, however, because only the Indian case study institutions were operators who have a direct relationship to water tariffs. Operators directly interact with tariffs when users pay for water, but tariffs do not apply to other institutions such as local governments that are not directly providing water services to users.

Commentary related to the local operators in India provides the clearest quotes about the importance of water tariffs. A selection of these perspectives is presented here. All of these quotes refer to a specific local operator that is improving its performance.

***Private/State:** Other than this I told you for sustenance, for sustainability, they collect a small amount of money from every household family and with that fund they manage to run their plant. Manage to pay the electricity bill. Manage to pay for chemicals. And also operator's salary. So with these ideas basically, and with these kind of implementation, I guess it has been successful.*

***Civil/Community:** [From translator] So what she is saying is that the price of the water is very less, so it is for everybody. Like she can afford it, and also her servant, her maid servant, she can also afford it because just a nominal amount of 40 rupees for the whole month of regular delivery of water.*

***Operator/Community:** [From translator] So this is how the community is getting developed and also getting help by the money the consumers is paying for that water.*

These quotes describe a resource tie that helps to sustain services while still being affordable for users. From a network perspective, this relationship is expected to be visible in the form of a resource tie between consumers and operators. The investigation is straightforward because it simply notes whether a tie exists or not. Tie weight is expected to be small and therefore unimportant in analysis because the forty-rupee monthly tariff was less than 50p equivalent at the time of research.

Resource ties are easy to identify in ego networks. Visualising a few of these Indian operator resource ego nets illustrates the concept. Figure 83 shows the local resource network for one of the case study operators. These resource ties show consumers paying directly for water, as well as consumers paying through a water delivery agent who acts as a middleman.

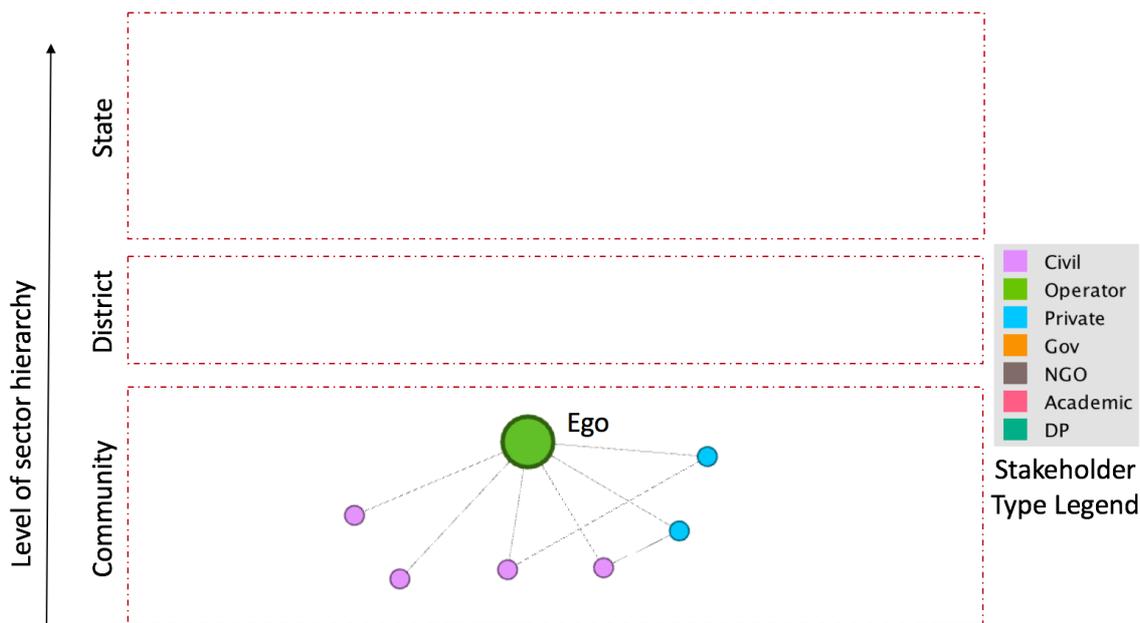


Figure 83 – Local resource network for one of the case study operators in India

These networks show payment of tariffs from consumers to either the operator or management committee, or alternatively to a delivery agent who then passes the payment onto the operator. Replicated analysis for all networks of successful operators in India finds this characteristic present in all cases but one.

It is unsurprising that an affordable tariff structure is linked to almost all operators in India that are improving performance. The exception is an ashram that provides its services as a public good and maintains operations through charitable revenue streams instead of tariffs, and resource ties therefore appear differently in its network. Revenue logically helps to sustain and potentially improve operations. Conversely, the absence of income could eventually bankrupt facilities and force them to close. Even though the tariffs are relatively small, the network perspective identifies these relationships and identifies who is being paid by whom.

6.3.2 Dedicated Operator

Having a dedicated system operator was another network characteristic that most clearly emerged from the Indian case study. These operators were typically paid for their

services. Dedicated operators were mentioned as important in other countries such as Bolivia and Tajikistan, but performance data on these operators was not captured because these were not the focus of the case studies.

This characteristic is described by multiple stakeholders in India, some in greater detail than others.

***Operator/Community:** Everything we have to pay it. And paying to our caretaker. Our backwasher, then their bonus. Everything we have to pay.*

***Academic/State:** And also what happened in many of the locations or most of the locations where filters are installed, the committees appointed a caretaker. Caretaker may be a local unemployed youth, or in some cases there is. So it helped those families of the caretaker. Because it is kind of source of income for them. So we have seen in many of the locations the caretakers themselves are very interested to maintain the units properly so that more and more people come, and they are whatever income is coming, that is also staying for many years. Because they are interested for their families...And the appointed caretaker in most cases they pay an honorary amount to the caretaker from the committee fund.*

The network perspective of this characteristic offers little insight because the characteristic is an intrinsic node property. This means that the operator is one of the members of the management committee, which in this research is represented as a single node. The key point is that, regardless of how the network is represented, a specific individual within the institution is playing a dedicated role in managing the services. All case study operators that are improving performance in India have a paid person managing the arsenic removal facility as a member of the community operator committees.

6.3.3 Cost-Recovery Support

One characteristic identified in India suggests a particular type of relationship for sustaining engagement between an institution and stakeholders at higher levels of hierarchy. Information and skill ties to higher levels of hierarchy were described as important in all countries (Section 6.2.2), including local arsenic filter operators in India. For the case of the operators that were improving performance, all were receiving some information and skill support from a stakeholder at a higher level of sector hierarchy that these local operators compensated financially. Network ties show a

resource tie from operators to these support organisations in return for information and skill engagement.

This arrangement was identified in descriptions of network characteristics during interviews. Some stakeholders directly commented on the importance of this arrangement for sustaining the interaction, which is then important for supporting operators to sustain community water supply services.

***Operator/Community:** And during these ten years I think five or six times I paid. Yes. I think six years. I think six times I paid to [the supporting organisation]. Not only this. For maintenance of this water pump.*

***Academic/State:** But many of them prefer [the supporting organisation], so they contact [the supporting organisation]. They collect the sample, and they pay the charge for that...You know perhaps about that. Regeneration also being charged.... So that way we thought this kind of a system where an NGO is there is technically capable and specialised in this kind of filter operations is in place, and the committees, and the school administration are eager to see their filter serving their respective communities for years. So now a synergistic system is coming up. So they need [the supporting organisation] support, [the supporting organisation] goes to meet their order so they can sustain themselves.*

This relationship is observed in ego networks by noting the presence of a resource tie that runs parallel to the information and skill ties received from the supporting organisation to the local operators. The resource ties show operators paying for a service. As described in an interview quote, this creates a ‘synergistic’ relationship that helps both stakeholders to sustain their activities. Compensation for support providers is a characteristic that exists for all local operators studied that are improving performance.

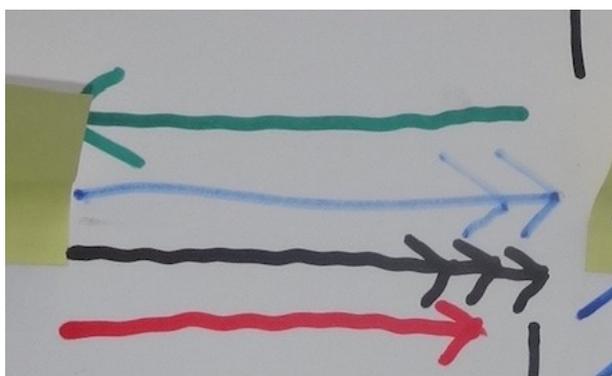


Figure 84 – Relationship drawn in an operator’s ego network during an interview. Skill (black), information (blue), and authority (red) ties from a support organisation (left) to a local operator (right) reciprocated by a resource tie (green) from the operator to the support organisation.

6.3.4 Channelling Investments Through Local Governments

Channelling financial resources for infrastructure construction through local government is happening in Bolivia, Ghana, and Malawi to different extents. Some stakeholders see this as important, but both the goal and the effect of this approach are difficult to fully understand from the network perspective that this research provides.

Quotes from Malawi and Bolivia describe how channelling investments through district governments are perceived by different stakeholders, and how these relationships relate to the development of long-term capacity for supporting service delivery. These quotes draw on different countries, and the country name has been added to beginning of the quote labels.

***Malawi/DP/National:** We provide funding for quite a lot of staff – water monitoring assistants. And they’re not just for our programme, but for district use as a whole. So that I think, plus we provide them with mobility, through motorcycles and fuel. So that allows them to visit more of... they’re much more out there than they were before. So the numbers and the mobility is meaning that they get much better reports from the district and can actually follow up on complaints.*

***Malawi/INGO/National:** Well I think the way we work with the local government now, especially we give them more than \$100,000 US dollars a year, what that is doing is that we are trying to mimic their [monthly discretionary funds], their operational costs, because they don’t get as much money. So that particular relationship in terms of giving them*

resources, trying to offer the skills transfer and support and coaching, to enable them to actually do their work – it's giving them the wings to fly; to actually do the stuff they've not been able to do because they lack the money.

Malawi/Government/District: *And on the financial and material level then we have the donors who are there... Giving us the financial resources and even the trainings in capacitating the human resource at the district level.*

Bolivia/Government/Municipal: *We administer the direct admission. We have a budget for example of this year from [...] of 387,000 Bolivianos. And from the municipality 332,000 Bolivianos. We decide where the money goes. We administrate the money in projects. And then we execute the projects. So everyone has a part. [The NGO], the municipality, and the [community management committees].*

Bolivia/INGO/Department: *...it is a unity that secures the success of all this network. I think the financial part, the investment, the norms, the trainings and the workshops, the relationships. Because these relationships go to the community, these go to the people. If this doesn't exist, it doesn't go to the people. A lot of financial help, a lot of norms, a lot of coordination, a lot of platforms, very good. But how do we get here [to the people]. If it doesn't exist, it's really hard.*

Resource ties are easy to identify in ego networks, and these ties commonly exist in parallel with information and skill ties, as shown in multiplexity analysis (Section 5.4.6). The presence of information ties existing in parallel with resource ties is unsurprising since giving money to someone logically necessitates at least an information connection. The characteristic can be explained as supporting institution development either by supposing that handling resources builds internal capacity, or by handling resources necessitating information and skill engagement in parallel that helps to improve institutional performance. The reality is perhaps somewhere between these two explanations, and perhaps manifests differently depending on the context and specific institutions involved.

6.4 Influences Unconfirmed by Network Data

Network analysis is only one way to understand influences on institutional performance, and commentary from some stakeholders made clear that other factors are at play.

These factors are not readily observable from the network approach of this research. These additional influences are highlighted in this section because they are described as important even if they are beyond the observational capability of social network methods used in this research.

6.4.1 A Champion Leading the Reform

Some interview participants in Tajikistan described the importance of a specific institution, and an individual within it, taking responsibility for the reform process. This factor is specific to Tajikistan, but could reasonably apply elsewhere.

***DP/National:** No more foreign techs writing reforms. [He] read the documents and became the champion of them.... Took about 1.5 years to read, tweak, and take on board what was being proposed in the reform. Now, he owns it.... Needed lots of signatures from other institutions. Involved lots of tweaking and redrafting.*

***DP/National:** The beauty with [a central individual within the authority] is that [he] really understands the issues and implications. He might not have all the details of implementation, but he can seek that support from donors or technical assistants.... There is a group of institutions including [the authority and others] that then liaise with the other relevant ministries.*

What is not captured by network perspectives is the commitment and motivation of key individuals. Important offices could be well connected but unmotivated. It is not a given that the presence of connections will automatically lead to the level of commitment described in the interview quotes, even if network ties can provide some indication of who is being engaged.

6.4.2 Convening Organisation

Some stakeholders aspire to influence the shape of the overall sector network by working as a broker or convenor. The concept is straightforward: introducing specific connections can reduce the degrees of separation between stakeholders, thereby potentially improving coordination and knowledge sharing.

The Tajikistan Water Supply and Sanitation (TajWSS) programme, initiated by Oxfam, aims to provide such a knowledge sharing platform in Tajikistan. The programme appears to be successful. Stakeholder commentary indicated perceived utility of the platform, and the meetings are well attended by a diversity of stakeholders in the sector.

It has explicit networking goals of connecting stakeholders in the Tajikistan WASH sector, and therefore should be investigable from a network perspective.

***DP/National:** This network is a powerful instrument. Now the network is for ongoing discussion on policy. Then this can lead to policy change. Then international coordination grows.*

***Government/National:** The network helps to get information across the sector. What is happening, and so on.*

***INGO/National:** Overall the network is very good. We learn from other organisations. Good to exchange from different experiences. Gathers information about other organisations and what they are doing.*

The challenge with investigating the properties of this network is related to the type of network data collected. Interviews used a name generator approach whereby participants listed stakeholders they work with without being prompted. This method was appropriate because a complete list of sector stakeholders was not available at the outset of data collection. It is adequate for the specific goals of this research, but makes investigation of the effect of the TajWSS network more difficult. Performing whole network analysis on the TajWSS network would require asking each network member about every other member to ensure that no one is omitted.

The inability of participants to choose from a specified stakeholder lists disqualifies the use of network data for whole network analysis because recollection errors could possibly omit ties that change the overall structure of the network. This effect is not important for ego networks, however, because they are not investigated using whole network properties such as network diameter. The snowball data collected from sequential stakeholder interviews provides some indication of the overall network, but these data are insufficient for rigorous whole network analysis.

The importance of sector platforms for information sharing and coordination is therefore presented as an unconfirmed network characteristic. From analysis of available network data, the platform appears to reach a large number of stakeholders, and quotes from stakeholders in the network add further credibility to its value. The full network effect of this platform is unconfirmed, however, even if stakeholder commentary suggests that the practice provides value for the sector overall.

6.4.3 Water Quality

Perception of water quality in India was identified as important, particularly because the case study institutions were local water service operators. This issue surfaced in other countries, such as Bolivia, but was not directly connected to the institutions that were improving performance. In India this factor was described as important by both users and operator committees.

Consumers naturally want good water. Their demand for clean water directly affected their relationship with local providers in India, and their perception of water quality could directly influence consumer willingness to pay for water services. Several consumers interviewed identified affordable clean water as the only thing that mattered from their perspective.

Civil/Community: That is very healthy and tasty. It is cheaper.

Civil/Community: And he also told that this quality is very good. This water is very precious in this area.

Operator/Community: First time the media is very good, and last one to two years firstly this is good activated. But then he regenerated the media and this quality is very low. And for this reason user numbers are decreased.

The final quote provides perspective on what happens when water quality declines. Other positive network characteristics might exist, but the quote suggests that a decline in quality corresponds to a decline in customers. This is an example of a non-network factor that might override even supportive network characteristics.

6.4.4 Executive Power

Stakeholders in each case study country would occasionally reference the importance of executive power. The presidential office was a common example: a directive from the top office carries power that can override the effects of other network characteristics. This poses a challenge from a network perspective because executive offices rarely appeared in ego networks, but have the potential to influence them significantly.

Specific quotes about this influence were not provided during interviews. Executive power was often discussed indirectly or at a time outside of the formal interview where quotes were recorded. This makes the influence harder to characterise because, even if it is recognised by multiple stakeholders, its manifestation can be subtle and inconsistent.

This suggests a conditionality for interpreting network data. Interactions in ego networks could represent how these interactions typically function, while still being vulnerable to external influences that may not be immediately visible from the perspective of the immediate network around an institution. External influences include macro-economic factors such as currency devaluation, or political directives from high up that might be out of sync with how technocratic services typically function. Here, executive power presents a challenge for understanding how networks function because it can have little presence until it manifests suddenly with significant implications for all stakeholders involved.

The implication is that networks can potentially be interpreted on different frequencies of interaction. Presidential directives may be infrequent – perhaps once per year or even less. In the meantime, ongoing local interactions dominate in the day-to-day. Such modelling of these networks would allow the incorporation of strong but infrequent influences alongside weaker but more consistent ones. Future research could characterise stakeholder interactions that exist at different frequencies such as yearly, monthly, and weekly to understand when different network characteristics are experienced.

6.5 Qualitative Analysis Summary

This chapter has introduced qualitative analysis to interpret the significance of quantitatively observed network properties in cases of institutional development. Three common network characteristics were identified in multiple countries that are both visible in network data and described as important by stakeholders active in these networks. The three network characteristics are: information and skill ties to lower hierarchy stakeholders; information and skill ties to higher hierarchy stakeholders; and strong information and skill ties between higher hierarchy stakeholders that have strong information and skill ties with an institution. Not every network characteristic is present in each country, but these characteristics appear in multiple cases despite the different contexts and types of institutions studied. Table 14 summarises these observations by network characteristic and country.

Table 14 – Summary of common network characteristics and where they were observed.

Country	Network Characteristic		
	#1 – Information and skill ties with lower levels of hierarchy	#2 – Information and skill ties with higher levels of hierarchy	#3 – Coordination between higher-level stakeholders providing strong information and skill support
Ghana	✓	✓	✓
Malawi	✓	✓	
India	✓	✓	✓
Bolivia	✓	✓	
Tajikistan		✓	✓

Qualitative analysis also identified other influences on institutional development that are either less common or difficult to confirm from available network data. These factors may be important as well, although their ubiquity and manifestations in network data are difficult to confirm. Uncommon network characteristics related specifically to institutions who are operating services include the importance of a water tariff and the importance of a dedicated system operator. One characteristic related specifically to stakeholders from higher levels of sector hierarchy that are providing information and skill support to lower levels. This characteristic described a cost recovery mechanism where recipients of information and skill support pay for services that help the stakeholder at higher level of sector hierarchy to sustain operations. A final characteristic considered the role of infrastructure investment being channelled through institutions as a means of building their capacity. All of these characteristics were identified as positive influences on institutional development in some instances, and network ties related to these characteristics can be identified, even if these characteristics were not equally identified in all cases.

Four characteristics unconfirmed by network data were also presented because of their perceived importance by stakeholders interviewed. These influences include: a

champion leading institutional development from within an institution; the presence of a convening organisation that strengthens ties across a sector; the importance of good water quality; and the potential influence from executive power that can upend the typical functioning of a network. These factors are perceived as important, even if they are not immediately identified from network characteristics. Network analysis may provide some insight into conditions that support institutional development, but it does not capture everything. The combined methodology that incorporates qualitative analysis of stakeholder perspectives, however, helps to capture more.

7 COMPARATIVE ANALYSIS

Comparative analysis investigates how network characteristics identified in ego networks of improving institutions are expressed in the ego networks of similar institutions that are either not improving or declining in performance. Institutions that have declined or failed to improve from low levels of performance in India and Bolivia offer the opportunity for comparative analysis. These cases can be used to consider differences in network characteristics between institutions that are improving and those that are failing to improve in similar contexts. Although comparative analysis was not the original intent of the research, and the number of cases is too small to offer conclusive findings, this chapter is used to consider how comparative analysis might be performed in order to develop hypotheses that might be tested in future research. The analytical process in this chapter will look at each country in turn to explore how the common network characteristics identified in the previous chapter are observed in institutions with different trends in their performance.

7.1 India

7.1.1 Differences in Institutional Performance

The presence of multiple community arsenic filter operator committees in the same district allowed for comparison in India. Case study institutions were local arsenic removal facility operators in the 24 North Parganas District of West Bengal, India, where numerous communities in close geographic proximity are affected by high levels of naturally occurring groundwater arsenic. Multiple filtration units managed at the community level have been developed to respond to this need.

The number of community operator committees in the area made it possible to compare between committees that are either improving or declining in performance. Three groups of operator performance levels are compared in this section:

1. The first group includes three lower performing operators that show different stages of performance: two have failed; and one is declining in performance. These are referred to in this section as ‘low performers’.
2. In the second group, the community operator committee was previously declining in performance and had begun to improve at the time of research. Because it is improving performance, this operator was included amongst the case study operators in previous chapters, but here it is separated to provide an instance of middle ground between high performing and low performing operators. This one is referred to in this section as ‘recently improving’.
3. The third category of operators includes the ones that are improving performance that were analysed in previous chapters. These are referred to in this section as ‘high performers’.

7.1.2 Comparison of Common Network Characteristics

Three common network characteristics described as supporting institutional development were identified in the previous chapter as existing in multiple case study countries, including India (Section 6.2). These three characteristics become the basis for comparative analysis in this chapter for both India and Bolivia. The three common network characteristics are: connections to local stakeholders; connections to stakeholders at higher levels of hierarchy; and coordination between strongly engaged higher-level stakeholders. Each is explored in turn.

7.1.2.1 Information and Skill Ties to Lower Hierarchy Stakeholders

Operators in India that are improving performance were found to have numerous skill and information ties to local stakeholders. This analysis can be applied to lower performing operators both visually and quantitatively, and the latter is presented in this section. The quantitative analysis compares the number of ties to lower hierarchy stakeholders present in ego networks of higher and lower performing operators.

Ties to local stakeholders in ego networks can be quantified to produce a histogram for higher and lower performing operators respectively (Figure 85). The distributions of the number of ties suggest a difference in the number of local information ties between higher and lower performing operators. Operators that are improving performance typically have more information ties to local stakeholders in their ego networks (Figure 85). The quantification is only illustrative, however, because the number of cases is insufficient to produce statistical findings.

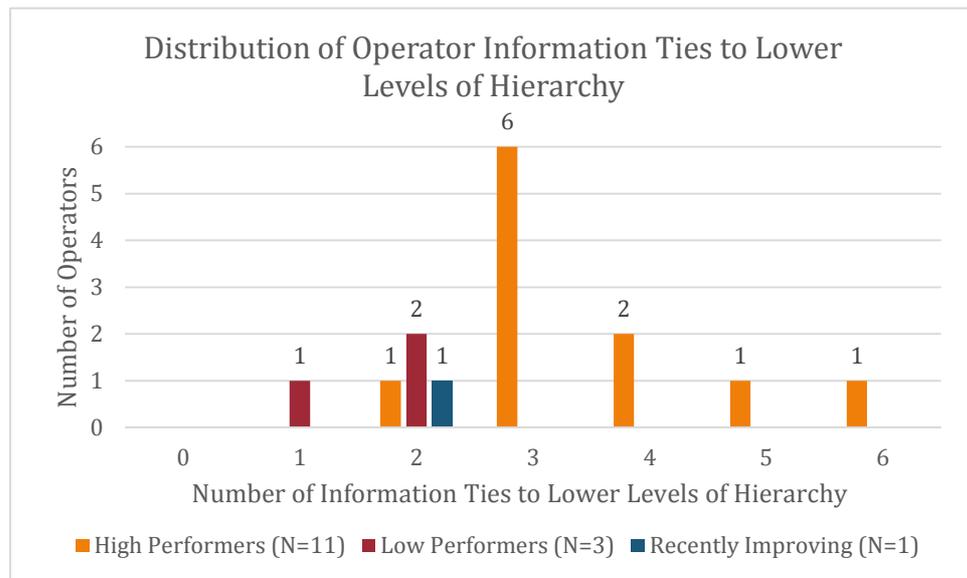


Figure 85 – Distribution of local information ties for higher and lower performing operators in India

Comparative analysis suggests that operators that are not improving have fewer local information ties. The implications of the number of local information ties on performance are logical. Receiving feedback could help operators to respond to customer needs and improve performance. Some interview participants specifically described the importance of information ties with local stakeholders, as presented previously (Section 6.2.1.3).

Skill ties to local stakeholders are also investigated, and analysis finds no local skill ties present in the ego networks of lower performing operators (Figure 86). In comparison, the operator that had recently improved performance shows skill ties in its interactions with other local stakeholders. Operators that are improving performance all exhibit multiple local skill ties in their ego networks.

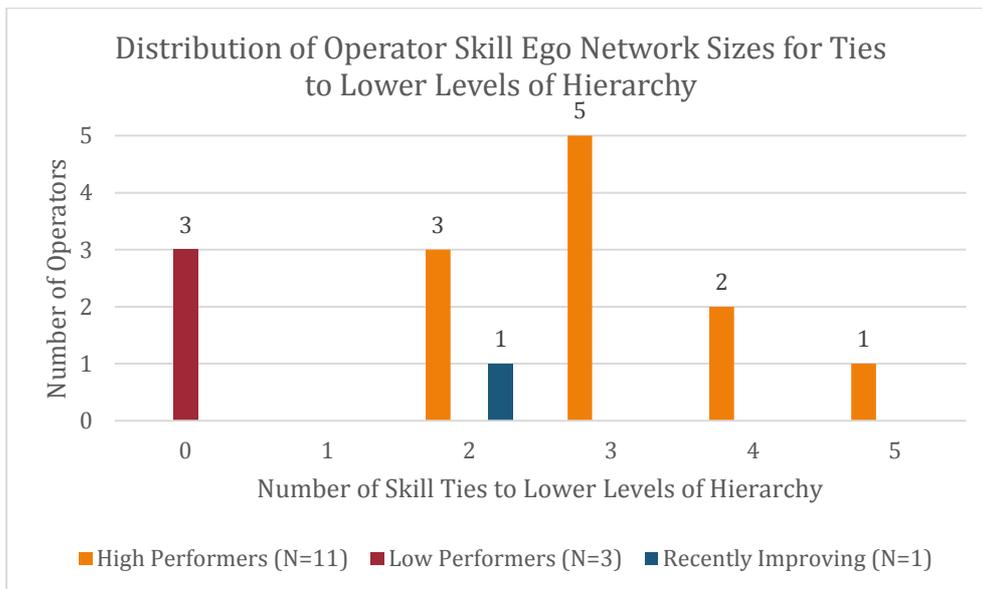


Figure 86 – Distribution of local skill ego net sizes for higher and lower performing operators in India

Findings from comparative analysis for local skill networks echo the findings from local information networks. Lower performers have the fewest number of information and skill ties to local stakeholders, high performers have more numerous information and skill ties to local stakeholders, and the recently improving operator is between the two groups. The finding that lower performers generally have fewer ties is not statistically confirmed, but is supported by the available evidence.

7.1.2.2 Information and Skill Ties to Higher Hierarchy Stakeholders

The second common network characteristic is information and skill ties to higher levels of sector hierarchy. Analysis investigates how this characteristic is observed between high performing, low performing, and recently improving operators studied in India. The first step quantifies the number of information and skill ties that lower performing operators have with higher levels of sector hierarchy. Summaries for higher and lower performing operators are presented in Figure 87.

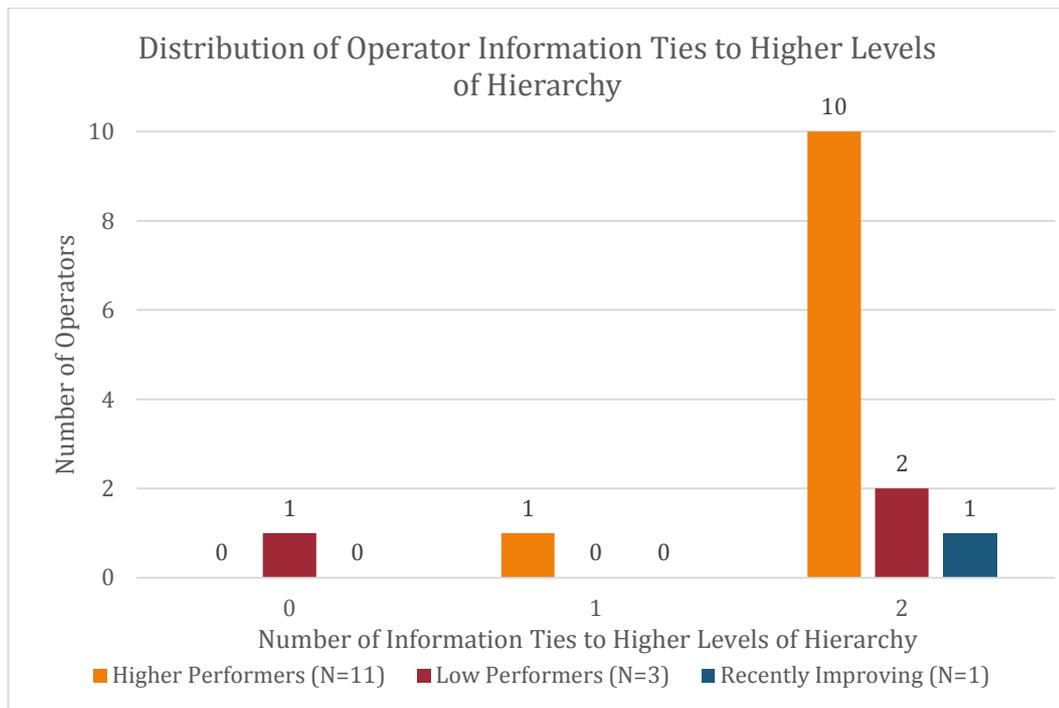


Figure 87 – Information network ties to higher levels of sector hierarchy for higher and lower performing operators

Comparison of information ties to higher levels of sector hierarchy finds that lower performers are not necessarily different than high performers. The most common number of information ties to higher levels of sector hierarchy for high performing operators is the same value exhibited by the ego networks of two lower performing operators. The operator who has recently begun to improve also has two information ties to higher levels of sector hierarchy. The number of information ties to higher levels does therefore not immediately distinguish high performers from low performers.

One difference stands out between the two groups: one of the lower performing operators, one who has ceased operations completely, exhibits no ties to higher levels of sector hierarchy. This operator is unique. The characteristic suggests that the complete absence of information ties to higher levels of sector hierarchy is a unique characteristic of a failed operator.

These findings offer an interesting consideration even if they are not statistically significant. Borrowing language from the field of Qualitative Comparative Analysis, connection to higher level sector stakeholders may be an example of a necessary but insufficient condition. This means that the characteristic may have a positive benefit for operators improving performance, but it is an insufficient guarantee of success on its own. Other factors may need to exist in tandem. Conversely, without this characteristic

of ties to higher sector levels, performance might not improve even if other conditions are met. Ties to higher levels of sector hierarchy may be a supportive network characteristic, even if they are unable to drive performance improvements on their own. These possibilities are speculative, however, and data on more cases would be needed to test these hypotheses.

Analysis of skill ties to higher sector hierarchy levels yields similar findings (Figure 88). The figures are the same except for a slight difference in the number of ties in ego networks of high performing operators. The number of skill ties in the recently improving operator is also two.

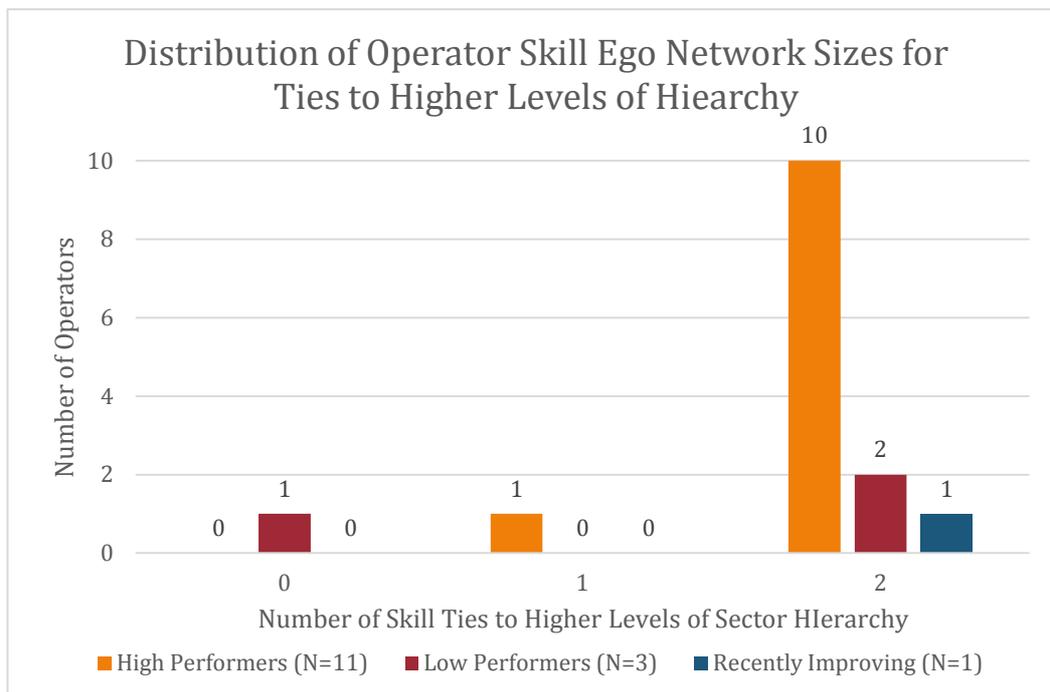


Figure 88 - Skill network sizes for ties to higher levels of sector hierarchy for higher and lower performing operators.

The findings are consistent with the findings from information ties. Multiple information and skill network ties do not necessarily indicate a higher or lower performing operator. The complete absence of these ties might, however, be linked to lower performance. Analysis finds that a failed operator is the only ego network exhibiting no information or skill ties to higher levels of sector hierarchy.

7.1.2.3 Coordination Between Higher Hierarchy Stakeholders Providing Strong Information and Skill Support

This characteristic describes the connection between stakeholders strongly engaging a case study institution from a higher level of sector hierarchy, and the strength of

information and skill ties between these stakeholders. Testing for this characteristic first considers who is strongly engaging case study operators from higher levels of sector hierarchy, and then investigates the strength of information and skill ties between these alters. An example illustrates this characteristic in one of the improving operator networks (Figure 89).

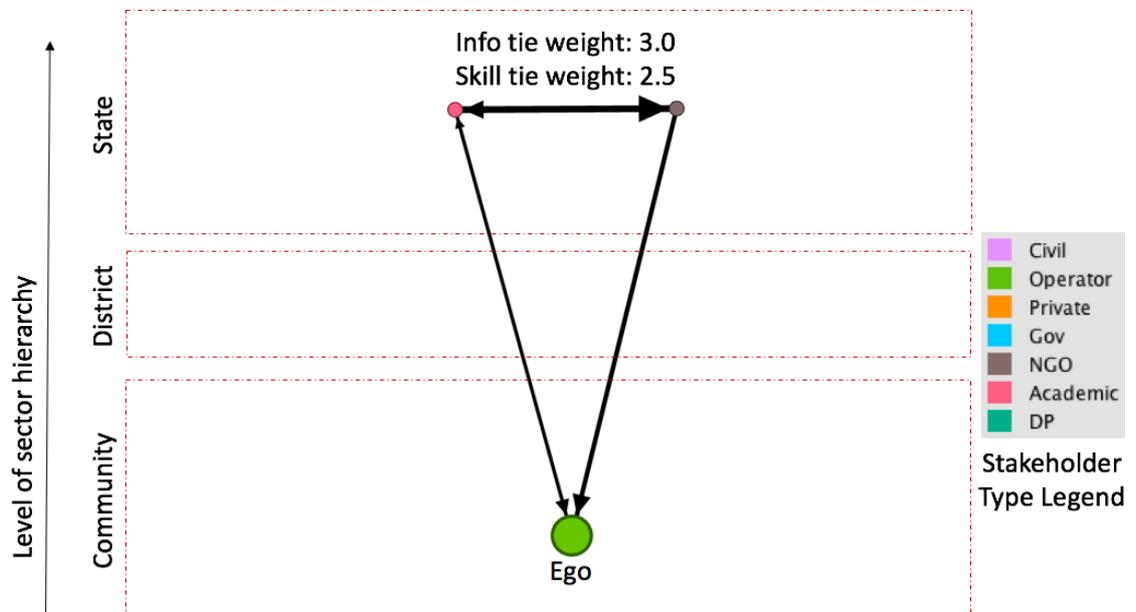


Figure 89 – Combined information and skill ties between two higher level stakeholders that are strongly engaging a case study operator

This network characteristic is not present in all operator ego networks. There are three reasons why coordination between higher level stakeholders might not be observed, depending on the number of alters in the ego network. The first possible reason is that no stakeholders engage the operator with strong information and skill ties from higher levels of sector hierarchy. The second possibility is where only one alter exists, and there is no other stakeholder strongly engaging an ego with both information and skill ties. The third possibility is where multiple alters are strongly engaging the operator but are not coordinated. This third possibility is not observed in India. Each case where multiple alters at higher levels of hierarchy engage an operator with strong information and skill ties also report strong information and skill ties between these alters. The distribution of these different possibilities for each operator type is presented in Figure 90.

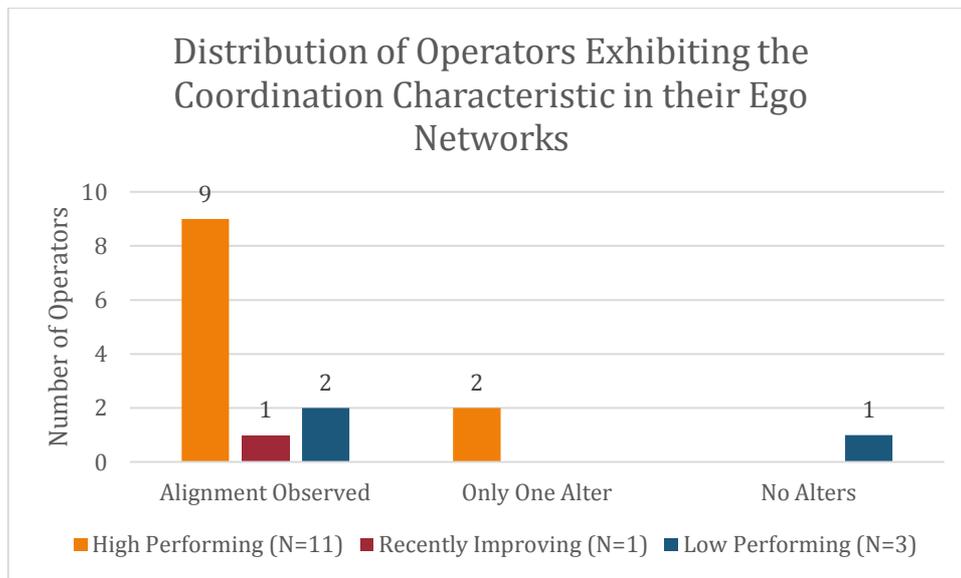


Figure 90 – Summary of coordination observed for each operator performance group

Operators from all performance groups exhibit coordination between alters at higher levels of hierarchy that are supporting the operator. There are no examples of what happens when multiple stakeholders are strongly engaging an operator without engaging each other in the Indian context, which makes it difficult to confirm the effect that the absence of this network characteristic would have. More cases would be needed to study how absence of coordination relates to institutional development in the Indian context. In all cases, alters are either coordinated, or there are fewer than two alters engaging the ego with strong information and skill ties. Future research might be able to study this characteristic in more detail by identifying cases with a greater diversity of coordination in institutional ego networks.

7.1.3 Summary of India Comparative Analysis

Investigation of the three common network characteristics in the ego networks of case study operators in India shows slightly different characteristics between higher and lower performing operators. Analysis finds that the presence of each network characteristics corresponds to improved performance, and the absence of a characteristic is only observed with lower performing operators. The presence of a positive network characteristic, however, can also be associated with some lower performing operators. This suggests that any one network characteristic on its own might be insufficient to support performance improvements, even if it has some benefit to the operator. Future research could therefore be viewed through the lens of Qualitative Comparative

Analysis to better understand how different combinations of certain characteristics support performance improvements (McNicholl, 2016). Overall, findings are inconclusive because of the small number of cases studied, but analysis of available data suggest that future research could consider how the absence of certain network characteristics impact the performance of these community operator committees.

7.2 Bolivia

7.2.1 Differences in Institutional Performance

Case study institutions were rural municipalities in the Cochabamba Department of Bolivia. Three of these municipalities that are improving performance were analysed in previous chapters, and analysis of a fourth that has not been improving performance is included in this chapter for comparison. The municipality shows no evidence of improving its capacity to support management of rural water services. To quote this municipality directly: “The truth is that there is nothing that is improving.” In contrast, the three municipalities that are improving performance have all formed dedicated management units that include the hiring of new staff and additional budget allocations to support community operators that manage services. As with the comparative analysis of Indian operators, this section investigates differences between the three municipalities that are improving performance and the lower performing municipality from the perspective of the three common network characteristics. These two groups are referred to in this section as ‘high performing’ and ‘low performing’ respectively.

7.2.2 Comparison of Common Network Characteristics

7.2.2.1 Information and Skill Ties to Lower Hierarchy Stakeholders

The first common network characteristic is the presence of numerous information and skill ties from the ego to alters at lower levels of sector hierarchy. In this case the egos are the municipalities, and the local stakeholders include community operators and users. Previous analysis found multiple information and skill ties to local alters in improving municipality ego networks (Section 6.2.1.4). By comparison, performing the same analysis on the low performing municipality finds no such connections. A distribution of information and skill ties to local stakeholders in municipality ego networks illustrates the difference (Figure 91).

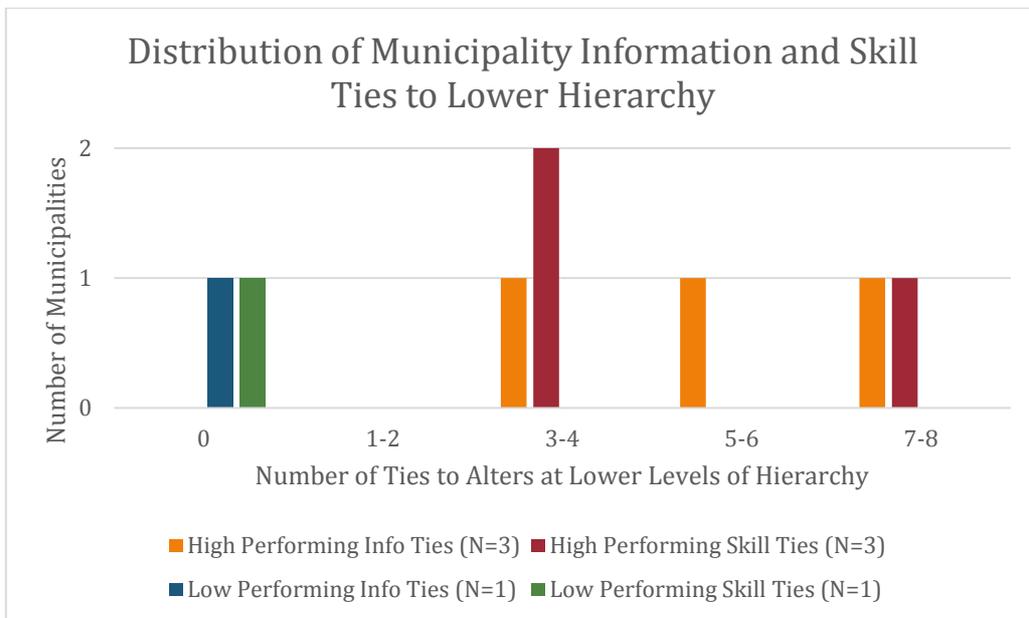


Figure 91 – Distribution of municipality information and skill ties to lower levels of hierarchy by municipality performance

The distribution shows that all municipalities that are improving performance have multiple information and skill ties to lower levels of hierarchy. The numerous information and skill ties of higher performing municipalities stand in contrast to the lack of ties exhibited by the low performing municipality. The available data suggest that a lack of local information and skill ties appears to be an indication of lower performance, but the number of cases is too small to state any finding conclusively.

7.2.2.2 Information and Skill Ties to Higher Hierarchy Stakeholders

Filtering for information and skill ties to higher levels of sector hierarchy similarly investigates the presence or absence of this characteristic in the four case study municipalities (Figure 92).

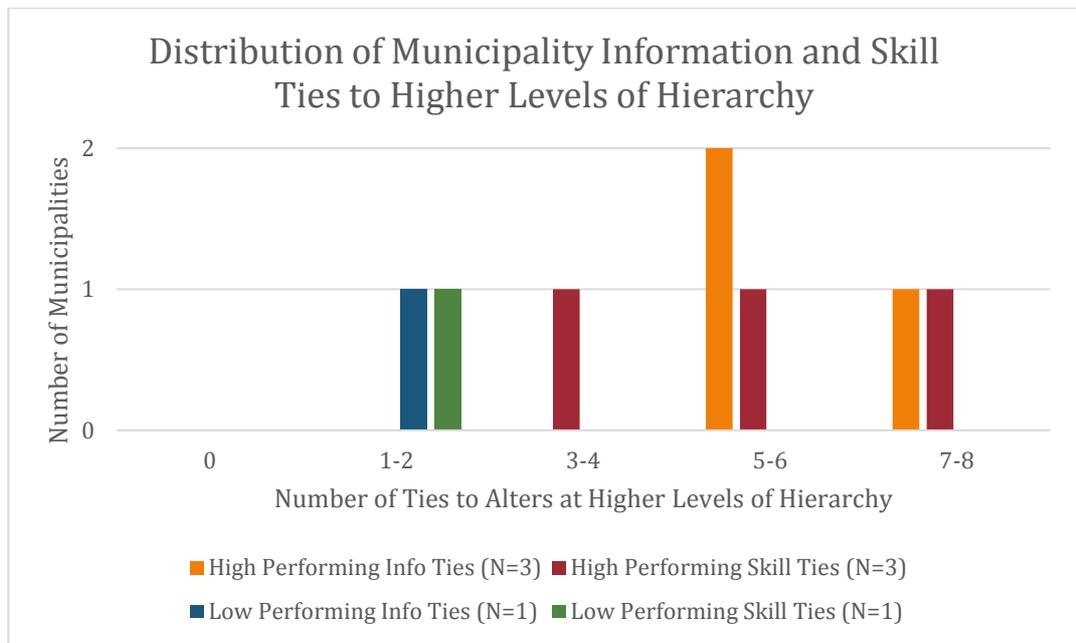


Figure 92 – Distribution of municipality information and skill ties to higher levels of hierarchy by municipality performance

Quantifying the number of information and skill ties to higher levels of hierarchy shows that the lower performing municipality has fewer alters in its ego network than higher performing municipalities do. This suggests that relatively few information and skill ties to higher levels of hierarchy may also indicate a missing characteristic that might support institutional development. This network characteristic on its own, however, may not be enough to guarantee performance improvements, and additional case studies would be required to see how these influences operate independently in the absence of other network characteristics.

7.2.2.3 Coordination Between Higher Hierarchy Stakeholders Providing Strong Information and Skill Support

The coordination network characteristic is not explored in detail because it was not found to be strongly present for any municipality in Bolivia. Furthermore, coordination is not present in the ego network of the low performing municipality because only one alter from higher levels of hierarchy engages the municipality with both information and skill ties. Coordination between stakeholders engaging from higher levels of hierarchy therefore cannot be investigated because it is not relevant to this ego network.

7.2.3 Summary of Bolivia Comparative Analysis

Comparing Bolivian case study municipalities finds that two common network characteristics present in high performing municipalities are either absent or relatively weak in the underperforming municipality. Higher performing municipalities exhibit multiple information and skill ties to both higher and lower levels of sector hierarchy; the underperforming one does neither. The third common characteristic, coordination between strongly engaged higher level stakeholders, was not found to be strongly present in either higher or lower performing municipalities.

7.3 Chapter Summary

Ego networks of institutions that are not improving or are declining in performance in India and Bolivia were investigated to explore how the three common network characteristics identified in the previous chapter are observed in these ego networks. Properties of ego networks for the non-improving institutions were compared to the higher performers from the perspective of the three common network characteristics. The small number of cases mean that findings are not conclusive, and comparative analysis is performed chiefly to consider how social network analysis might provide testable hypotheses for future research.

Information and skill ties with local stakeholders was the first common characteristic investigated. Although some underperforming institutions in India also exhibited this characteristic in their ego networks, all institutions lacking this characteristic in both India and Bolivia were not improving performance. This suggests that the presence of the network characteristic is not a guarantee of success, but its absence might be an indication of an institution that is either not improving or is declining in performance.

The second network characteristic describes multiple information and skill connections to higher levels of hierarchy. Analysis finds that all institutions improving performance in India and Bolivia have information and skill ties with alters at higher levels of hierarchy in their ego networks, and that the absence of this characteristic may be an indicator of lower performance. The underperforming municipality in Bolivia has few information and skill ties to alters at levels of sector hierarchy when compared to the number of ties exhibited by higher performing municipalities. In India, some lower performers exhibit ties to higher levels of hierarchy, along with all the higher performing operators, but the absence of these ties is only observed with an operator that has failed. These findings suggest that the absence or weak presence of information

and skill ties to higher levels of sector hierarchy describes lower performance. While the presence of the characteristic does not necessarily guarantee higher performance, its absence is linked to cases of lower performance.

Comparative analysis of the third common network characteristic explores coordination between strongly engaged stakeholders at higher levels of hierarchy. The characteristic describes strong information and skill ties between the alters that are most strongly engaging the ego with both information and skill ties as perceived from the perspective of the ego. In India, this characteristic is observed in the ego networks of both high and low performing operators. One of the low performing cases, however, has no higher level connections, and the analysis therefore does not apply. In Bolivia, the characteristic is not observed at all because multiple alters at higher levels of sector hierarchy are not engaging any of the municipalities with strong information and skill ties simultaneously. The effect of this characteristic is therefore unconfirmed because there is no clear distinction between improving and non-improving institutions.

Overall analysis finds that the first two common network characteristics may not be sufficient to indicate improving performance on their own, but their absence might indicate a lack of support of institutional development. The findings add credibility to the importance of the characteristics identified in the previous chapter to the extent that available comparative data allow. Future research might further investigate the importance of certain characteristics, possibly to a degree of statistical significance. These comparative findings should therefore not be considered conclusive, but rather seen as reasonable hypotheses, with some basis in available data, that could warrant exploration in future work.

The next chapter, Discussion, explores relationships between the network characteristics identified in this research and other literature on conditions that support institutional development in the water sector. The intent is to consider findings in the context of other research, while considering the added value of interpreting influences on institutional development from a stakeholder network perspective. A visual representation of key findings is also proposed. The Discussion is meant to highlight where this research either confirms or challenges current thinking in this field, and how findings might be used in both practice and future research.

8 DISCUSSION

This chapter considers the main research findings in light of existing literature, potential applications, research limitations, further reflections on the case studies, and concludes with recommendations for further research. These considerations situate this project in the broader context of research on water service delivery to reflect the potential value of the research contribution. Specifically, this chapter aims to characterise the added value that social network analysis brings to understanding environments that support institutional development in rural water service delivery. A visualisation of key research findings is also proposed as a set of network characteristics to look for when applying social network analysis to similar challenges in other countries.

Further reflections on the research also consider how influences from stakeholder networks might apply differently to institutional development at different levels of sector hierarchy, and the potential effect of these developments on service delivery itself. These reflections are considered important because they capture additional perspectives of the researcher's experience from each country that are not easily reflected in formal data analysis. The chapter aims to provide the reader with a sense of how the research might be applied, its limitations, and further considerations for influencing stakeholder networks in rural water service delivery.

8.1 Relationship Between Findings and Other Research

The primary findings from Qualitative Analysis (Section 6.2) are considered first to explore how these findings relate to current understanding of influences that support institutional development in rural water supply. The main findings from this research

are the three common network characteristics observed from this research in multiple countries. They are: connections to local stakeholders; connections to stakeholders at higher levels of hierarchy; and coordination between strongly engaged higher level stakeholders. Further review of literature considers how these findings compare to related research from perspectives other than social network analysis to see how existing research supports the primary findings of this project.

8.1.1 The Importance of Being Connected

The most straightforward finding is that it matters if an institution is connected. This applies to two of the common network characteristics – connections to local stakeholders and connections to upper level stakeholders – particularly for information and skill ties. Many stakeholders interviewed described the importance of these characteristics for sharing information, developing new approaches, accessing or providing technical support, and receiving feedback. These ideas can be related to existing literature describing the importance of connectivity for skill and information sharing in a service delivery context.

Technical assistance and training, represented in this research by skill ties, is identified as important in the literature. Depending on the frame of reference, this can mean either connections between higher level sector stakeholders and an ego, or connections from the ego to lower levels. A consideration of six key roles of NGOs in infrastructure services identifies technical assistance and training as an important set of services that can assist both governments and local operators (Cousins, 1991). Support from NGOs is one possible origin of information and skill ties, however, and other stakeholders such as the private sector might participate in similar relationships.

A more general investigation of system dynamics also finds ties between government and communities to be important for improving the management of water services. A proposed model identifies connections between government and communities as a positive influence, and that government and communities both directly and positively influence the management of services (Walters & Javernick-Will, 2015). These factors all relate to the long-term functionality of water systems.

Backstopping is another term used to describe information and skill ties between stakeholders. This implies a type of backup support from higher to lower levels of hierarchy to help lower levels overcome various challenges. The concept translates equally well to local government receiving help from higher levels, such as with the

Technical Support Units in Uganda (Nimanya *et al.*, 2011), or local government providing support to lower levels such as communities (Lockwood & Smits, 2011).

Connections between stakeholders may also play important roles in the capacity of local systems to solve problems. Ties between different levels of hierarchy may be indicative of an environment suited to identifying and addressing challenges (Pahl-Wostl *et al.*, 2007). This may culminate in the development of new approaches suitable to local contexts that emerge from the process of interaction, similarly to the process of interactions such as Problem Driven Iterative Adaptation (Andrews *et al.*, 2012).

The advantage provided by social network analysis is a straightforward means of visualising and quantifying these influences from stakeholder networks. It becomes easy to identify which institutions are connected and which are not. Even if qualification is still needed to understand the nuance and value of particular relationships, social network analysis can show where ties are absent. For practitioners, the benefit may become greater still if stakeholder identities are known and can be used to identify specific gaps in network structures.

8.1.2 The Importance of Being Coordinated

The third common network characteristic describes coordination between stakeholders that are strongly engaging the same institution. The importance of working towards common objectives in a coordinated manner is intuitive. Duplication or active counteracting of measures taken by another would naturally pose a challenge to realising any objective. It is therefore no surprise that the importance of coordination is referenced in both academic and practitioner grey literature.

Academic literature identifies the importance of coordination in both a generic sense and in application to specific case studies. The importance of coordination is sufficient for one paper to propose understanding organisational typologies by the formalisation of their coordination efforts (Mintzberg & Srinivas, 2009). Even if coordination is seen as important, some argue that the important area for investigation is not the intent to coordinate, but the ability to efficiently assess the degree of coordination, its gaps, and possibly prioritising amongst which stakeholders coordination needs to be improved (Koestler *et al.*, 2010). This is echoed by another study that notes “a particular challenge is to identify potential partners to collaborate with” (Stein *et al.*, 2011). Other studies also reference the importance of coordination, such as an investigation into multi-stakeholder interactions present at multiple levels of sector hierarchy in Ethiopia (De

Cosmi & Reed, 2009), but these examples do not explore precise definitions of how these influences manifest from a network perspective.

Practitioner literature from development agencies and think tanks is also important because it considers the relevance of coordination in practice. Harmonisation and alignment has gained widespread recognition following the Paris Principles (de la Harpe, 2011). The precise understanding of how these apply to the water sector is unclear, however, and there is some uncertainty about who should be included and how these principles are operationalised in practice (de la Harpe, 2011). The importance of mechanisms for coordination and partnership have also been highlighted by others as important institutional instruments for water sector governance (Plummer & Slaymaker, 2007). There exists a recognition of the importance of responsibilities needing to be mapped out, assigned, and agreed upon (Danert, 2014). In addition to formalising roles and responsibilities, coordination is also recognised as important in the context of creating an enabling environment that can help service authorities to perform their functions effectively (Lockwood & Smits, 2011).

Despite the prevalence of existing literature, both academic and grey, definitions of coordination are imprecise from a network perspective. This ambiguity creates space for a possible discrepancy between the coordination perceived by stakeholders and the actual network structures observed. It is unclear whether the different definitions of coordination mean that stakeholders are strongly connected and actively working together, are merely in touch to ensure efforts are complementary, or perhaps something else.

A unique value of this research is therefore to provide a straightforward network test to understand coordination between stakeholders around a particular ego of interest. For example, if a group of stakeholders are interested in supporting performance improvements in a local government, network investigation could inform the current strength of coordination, who might be insufficiently connected to this network, and identify specific relationships to strengthen between particular stakeholders. A nuanced understanding of particular points of coordination may help these sectors to achieve coordinated efforts in a practical way.

8.1.3 Summary of Relationship Between Findings and Other Research

Existing literature suggests that the main research findings are reasonable. The three common network characteristics identified relate to the importance of stakeholders

being connected to one another for skill and information exchange, as well as being coordinated to support common outcomes. The findings do not produce major conflicts with trends in existing literature on similar thematic areas.

The contribution of this research is the ability to describe these influences from a social network perspective. This research provides specific methods for investigating the nature of these characteristics quantitatively in order to understand concepts such as coordination with greater rigour. Furthermore, network mapping methods allow a diagnostic investigation of relationships as they exist in practice that might challenge how stakeholders in a network assume coordination to be working. From this perspective, the research offers a potentially tangible contribution to the existing understanding of stakeholder relationships that support institutional development for rural water supply.

8.2 Research Applications

If the findings are reasonable in the light of existing literature, the next consideration is how research findings might be applied in practice. This section does so from two perspectives. The first provides a visual representation of how the three common network characteristics can be conceptualised; the second considers how research methods might be used by others to generate network data.

8.2.1 Framework for Considering Network Characteristics

The three common network characteristics can be visualised through a conceptual framework. The most common network characteristics relate to intuitive concepts that have an existing basis in the rural water sector. The framework is a tool for visualising stakeholder interactions around a particular institution of interest, and for considering the presence or absence of certain network characteristics that might support this institution to improve performance.

The framework (Figure 93) has potential utility because it is visual, intuitive, and allows practitioners to consider somewhat abstract concepts of technical backstopping support and coordination amongst stakeholders through a visual thought exercise. It is possible that not all network characteristics will apply in every context, and the framework would allow practitioners knowledgeable of the local context to consider which network characteristics exist, which ones might be missing, and which ones might be desirable to strengthen in a specific network of interest. Ultimately, the framework still has to be

considered critically in any new context, but considering these common characteristics may still be useful for developing practical insights. Although network relationships still require qualification to understand if ties between stakeholders are achieving their intended purpose, considering relationships from a network perspective can help identify where characteristics that might support institutional development are missing.

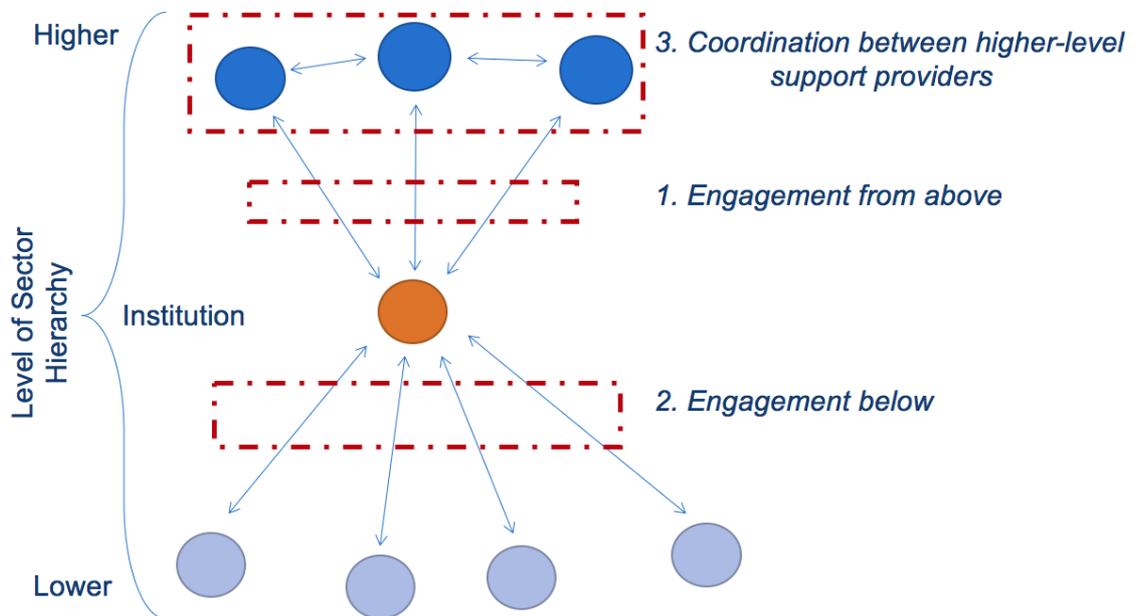


Figure 93 – Visual representation of the three common network characteristics (McNicholl *et al.*, 2017)

The framework identifies three levels of hierarchy with the institution as the ego in the middle, and refers specifically to ties of information and skills. This allows the ego of interest to be any institution in the rural water sector and for other stakeholders to be characterised relative to the stakeholder of interest. Network mapping, as conducted in this research, can be used to identify who the ego interacts with at levels of hierarchy both above and below it. The three numbered points describe the common network characteristics to look for in an ego network.

Even without network mapping, the framework can be used conceptually as a tool for dialogue amongst stakeholders to intentionally shape network relationships. The framework can be used to consider current interactions, and how these might differ from a desired reality. Consideration would proceed by identifying an ego, identifying its alters, and then considering whether the three network characteristics are present or absent. Findings from this research suggest that the presence of these characteristics support institutions to improve performance, and stakeholders using the framework can consider if these characteristics apply in their specific context. They might realise that

the improvement of a particular institution's performance is desirable, that certain characteristics are missing from its ego network, and decide to strengthen or introduce these relationships into the network.

The framework can also be used over time. In a project timeline, for example, different stakeholders and relationships might enter and exit the network at different stages. The framework could be considered at different points in time to develop a strategy for how an ego network around a specific institution might look before, during, and after a project. For example, a municipal government in Bolivia might initially have an ego network with few local ties (Figure 94).

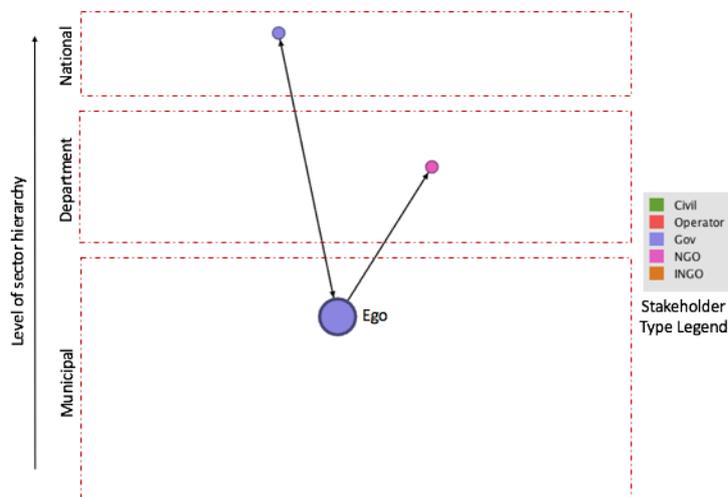


Figure 94 – Example of ego network change over time: phase 1

During early phases of the project, an INGO might begin supporting the municipality to develop its network to expand support to local operators in the area (Figure 95).

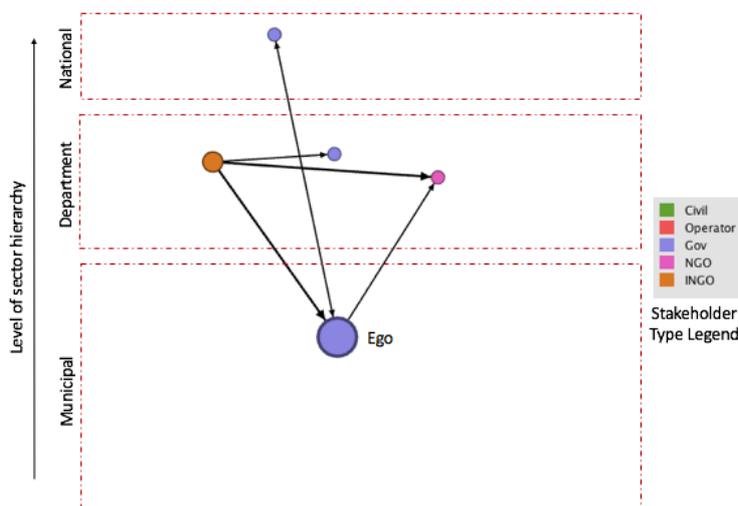


Figure 95 – Example of ego network change over time: phase 2

In the third phase, local support networks are developed and the municipality grows into its role as a support provider to local operators. Simultaneously, the INGO works with the Department Government to help it take over the type of support role that the INGO has been playing with the municipality (Figure 96).

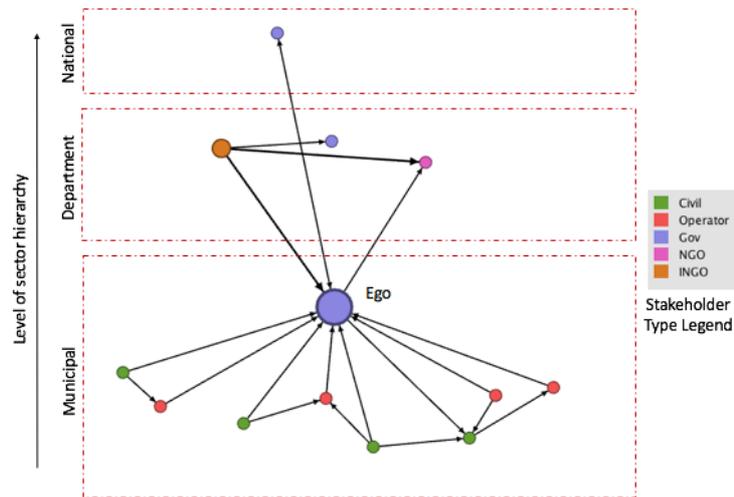


Figure 96 – Example of ego network change over time: phase 3

In the final phase, the INGO phases out of working with the municipality, leaving in place a stronger local support network, and ongoing support to the municipality from the department level of hierarchy, and coordination between key stakeholders at the department level who are engaging the municipality (Figure 97).

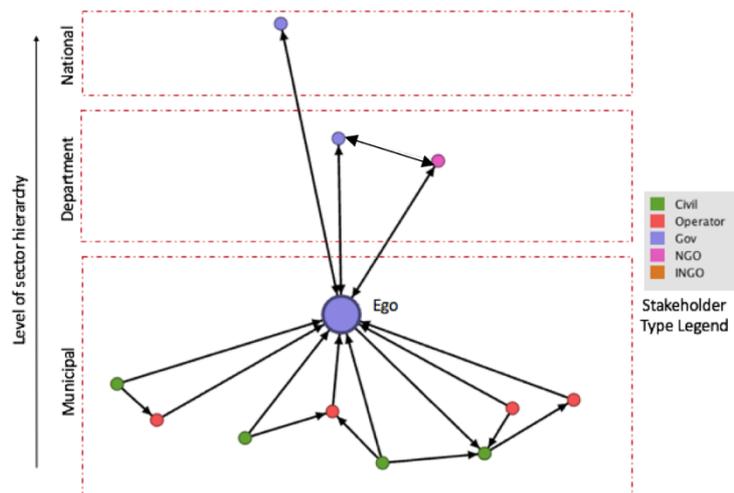


Figure 97 – Example of ego network change over time: phase 4

Considering network characteristics in this way might help to intentionally create supportive relationships so they remain in the network over time, and help specific institutions to improve performance. Network analysis might also be valuable for monitoring and evaluation, as well as communicating how institutional relationships

change over the course of a project. These figures are only an illustrative example, but there seem to be opportunities for the practical application of network methods that are worth exploring in future work.

8.2.2 Methodology for Developing a Stakeholder Network Map

Data collection methods used in this research offer an approach for generating detailed stakeholder network maps relatively quickly, and feedback from stakeholders that participated in interviews identified three types of value that the methods and findings might offer. The first type of value is reflection on an organisation's own relationships. Some participants described the network mapping exercise as a new kind of reflection for them that offered potentially useful and actionable insights. A quote from an interview in Malawi illustrates this viewpoint:

***Malawi/INGO/National:** I think it's been a valuable exercise because it's clarified a few things for me looking at this particular process... One of the things that leapt to my mind when we did this exercise is here, [points to a stakeholder in the ego network] because one of the things I have said is that they are a huge player and they do a lot of influencing, but for now I mean... we respect each other, but I think we need to move a step further into true collaboration, which we haven't really invested time in trying to do. So I mean just looking at it I thought okay, we acknowledge these guys are big players, then why don't we collaborate with them much more closely? And actually, seeing this now, I'm thinking we should be doing a lot of collaborating here to influence things here to go here. So we've been doing a lot here, and yet I know there are links happening here all the time [laughs]. And we're not part of that. So it just made me notice that.*

The interview participant quoted above describes the reflection that the egocentric network mapping triggered for him. Even though he did not draw ties beyond his organisation's immediate connections, he was able to consider how interactions beyond his immediate network probably exist, and how this might influence his prioritisation of who to strongly engage within the ego network. This type of reflective value is interesting because all data from the exercise come from the participant. It is the new framing of existing information that helps this interview participant to see his work from a new perspective that creates value for him.

The second potential type of value is opportunities for improved coordination and strategy development if whole networks are known. Although snowball networks do not capture data on whole networks, the ability to quickly identify stakeholders and their relationships has practical value for organisations seeking to work strategically in these networks. Multiple international organisations approached the researcher following discussions and conference presentations to ask about how these stakeholder network maps might be adapted to different contexts and how quickly such data could be collected. Simply identifying stakeholders and their relationships in a sector appears to have practical value for a variety of stakeholders in these networks.

A third application is investigation of the presence or absence of specific network characteristics around particular institutions. This is particularly relevant for institutions considering their roles, and how these relate to the functions of others in the network. A government official in Ghana provided commentary on this type of potential value:

***Ghana/Government/Regional:** Because this is the stage we are at the moment. In this new perspective where we are decentralising service delivery at the district level and these donors, NGOs... directly we deal with these to scale up service delivery. What do we want [ourselves] to be doing to keep that scaling up moving and manage the sustainability and the running of these fields? Your course is too timely. You do understand that. [We] would have been interested in your thesis and what you come up with. And your experiences in the other countries and maybe we can borrow something from you.*

Network analysis might help this official to understand institutional relationships as they currently exist in order to develop strategies for shaping these relationships and institutional roles in the future.

8.2.3 Research Applications Summary

The types of value identified by other stakeholders suggest that the research and its methods can be useful for different applications involving different amounts of effort. The most basic application is an institution considering its egocentric network and using this as a reflective tool for managing its relationships. A higher level of effort involves mapping stakeholder interactions in a sector to improve strategy development and coordination. The third type of potential value is analysis of ego networks around specific institutions to identify the presence or absence of specific network

characteristics that might support institutional development. This involves both a detailed understanding of the findings of this research, and multiple primary interviews to identify both ego-alter ties and alter-alter ties. Through direct collaboration with interested organisations, this research has the potential to be adapted to meet multiple needs and generate new lines of inquiry about the value of applied social network analysis in service delivery sectors.

8.3 Research Limitations

This research harboured aspirations to identify more nuanced influences on institutional development that might be less intuitive, perhaps something described by a complicated set of relationships in parallel that, when combined, supported institutional development. This section explores some limitations of the research to consider both the uncertainty of the key findings and the reasons why more sophisticated network characteristics did not clearly emerge.

8.3.1 Limitations of Methods

Research methods encountered practical limitations that arose from how data were collected. In particular, asking individuals within specific stakeholders to describe network characteristics they perceive introduces challenges. These challenges include the ability to recall network influences, the ability to perceive the effects of network characteristics on institutional development, and the ability to visually represent dynamic networks that change over time. Although these challenges are deemed to be acceptable, their presence should be clearly recognised.

Asking individuals, as representatives of specific stakeholders, to describe network interactions necessarily involves approximations. The first approximation is the individual representing a larger organisation or group, and the second approximation is using the visual ‘snapshot’ of network relationships created during a network mapping interview to approximate dynamic interactions.

Another challenge is participant memory at the time of the interview. The most obvious network characteristics are naturally the easiest to recall, but describing subtler influences depends partly on how frequently an interview participant considers their role from a network perspective, and depends partly on the types of things that the network drawing exercise prompts them to recall. People might forget important relationships. The research methodology is partly insulated from this challenge by

asking multiple stakeholders for their perspectives and only requiring a network characteristic to be mentioned twice for verification. The challenge remains, however, that an interesting network characteristic might be important but is not easily perceived or highlighted during interviews.

Participants may also struggle to perceive the value of network characteristics. Institutions and individuals within them are shaped by both obvious and subtle forces, and the latter of these might be less easily appreciated. It is possible that some interview participants were benefitting from network characteristics that they lacked the ability to perceive from a network perspective, or perhaps lacked the language to communicate. The implication is that, again, more obvious characteristics are more easily highlighted, and subtler ones may be present but unconfirmed by this research.

The researcher would sometimes spot what was considered to be an interesting network property, but the significance of these characteristics could not be verified. One example is instances of strong feedback relationships existing across lines of authoritative power. This is interesting, since one might assume that strong power dynamics might inhibit open dialogue. Another example is the presence of what seemed to be a broker that could relay information around strong power ties. A third example is attempts to develop a typology of stakeholders that interact with an institution based on the types of relationships in a stakeholder ego network. Perhaps there might be patterns in the types of stakeholders that interact with institutions that are improving performance. A typology was created, then used to quantify the number of stakeholders engaging each case study institution to produce a Venn diagram (Figure 98). The conclusions, however, were unclear. Even if the researcher saw something potentially interesting, there is no basis for confirming the importance of a network characteristic that the researcher alone perceives.

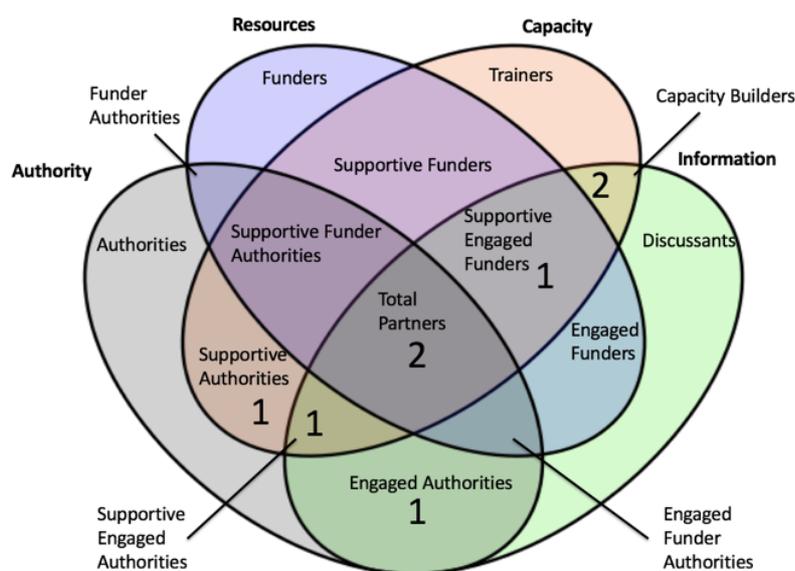


Figure 98 – Abandoned framework for categorising stakeholders based on their outgoing ties

Speculations about characteristics that were not confirmed by others were ultimately abandoned. The significance of a potential network influence could not be known if no one had commented on it. Stakeholder networks involve complex dynamics, and the chosen analytical approach is designed not to draw conclusions that may be only weakly substantiated by data.

8.3.2 Limitations of Findings

Field research also found that factors beyond stakeholder network relationships were influencing institutional development, and narratives helped to identify these factors. While there seems to be unique value in social network methods, this perspective needs to be combined with other lines of inquiry to produce a fuller understanding of influences on institutional development. Some important aspects not included in this research on social network analysis are technology, financing arrangements, geography, politics, and history. The implication is that social network analysis provides useful perspective on stakeholder interactions, but only captures some of the factors affecting service delivery.

Even the characteristics of social networks identified will not necessarily describe all cases. In some case studies, including India, network characteristics were identified that applied to a specific context but were not highlighted more generally. Findings from this research are not intended to suggest that there is one ‘correct’ network that applies to all institutions. Different relationships are likely to be important in different contexts,

and the main findings from this research therefore do not describe all network characteristics in all cases.

Network characteristics identified in this research as supporting institutional development will also not necessarily guarantee successful outcomes. It is possible that an institution may not improve performance even if supportive network characteristics exist. This may be due to factors beyond the influence of the network, or perhaps if the supportive network characteristics are not strong enough to influence change. Institutional development remains a complex process that cannot be distilled to deterministic cause and effect formulas, even if social network analysis can offer insight into the nature of stakeholder interactions around institutions.

8.3.3 Implications of Limitations

The main research limitations relate to the challenge of interpreting which network characteristics support institutional development within a broad range of stakeholder interactions. The net result is that the most obvious influences are cited most frequently, as are the ones that most directly affect the stakeholder providing commentary. This does not preclude the identification of more nuanced factors, but the individual vantage points of stakeholders might limit their ability to observe and interpret the full scope of interactions across a sector. These limitations do not undermine the findings that are presented, but instead speak to the limits of what social network analysis as applied in this research can achieve on its own. Supplemental qualitative evidence will continue to be needed to understand how particular relationships influence institutional development. Factors beyond network characteristics are also likely to be critical for supporting processes of institutional development. Despite these limitations, social network analysis appears to offer unique value in understanding stakeholder interactions that support institutional development in rural water sectors, and these methods might be complemented with other approaches in future research to more holistically understand influences on institutional change.

8.4 Reflections on Research Findings and Applications

The quantitative and qualitative analysis applied so far does not tell the full story of each case study, and experiences the researcher gained through fieldwork should not be completely discounted. Even when combining quantitative network data with qualitative interview quotes, analysis lacks certain aspects of context, nuance, and consideration of how improved institutional performance links to improved service

delivery. Spending between a few weeks and a few months working within these case studies provided perspective not easily synthesised through research methods and not easily generalised across cases. For these reasons the perspectives of the researcher are also worth considering. The researcher is able to provide commentary from almost an ethnographic perspective of having lived within these systems, and experienced them from the many different vantage points of stakeholders interviewed. Researcher perspective is therefore used in this section to comment on characteristics of changes observed at each level of sector hierarchy, and how these possibly relate to service delivery outcomes.

8.4.1 Change at National Level: Tajikistan

8.4.1.1 Network Characteristics Influencing National Institutional Development

The Tajikistan case study explored the reform of the national water policy as led by the central government institution for the water sector. Social network analysis has highlighted the importance of ties with stakeholders around this institution, but has done little to illuminate the broader political context that make such a reform possible. This context is considered essential, because the social network might only become relevant for supporting such a change when the context makes it possible to initiate such a reform effort.

Tajikistan faces political pressure to improve management of its water resources. These pressures are both internal, and international amongst regional powers. Internally, Tajikistan requires water to grow its primarily agriculturally-based economy and to generate hydroelectric power. Unlike neighbouring powers, Tajikistan is not endowed with sufficient fossil fuel energy resources to meet energy demands. These factors combine to make management of water across multiple sectors important for Tajikistan. Regionally, responsible management of water resources affects downstream countries including Uzbekistan, Turkmenistan, and Kyrgyzstan. These transboundary watersheds have direct ties to the economy of each country, heightening the potential for regional conflict. Effective watershed management, and all the sectors that fall within this, therefore becomes important for Tajikistan in ways that may be less acute for other countries.

Responsible water management is also backed by broader geopolitical interests. International organisations promoting responsible transboundary water management, such as the United Nations, have a vested interest in seeing Tajikistan succeed both

internally and regionally. Mismanagement and possible regional conflict would undermine the international water cooperation agenda as a case for why this does not work. Conversely, success would bolster the international water cooperation agenda by demonstrating that responsible water resource management can work across both sectors and borders. The international community wants to see Tajikistan succeed in a water sector reform.

These factors combine to create a favourable context for reform, but individuals still need to lead the process. Government is strongly hierarchical in Tajikistan, and large reforms necessarily have to come from high up. Successfully initiating the reform therefore appears to have stemmed from one motivated individual of rank who could lead the process. It was frequently noted during interviews that much of the outcome hinged on the capability and conviction of one influential bureaucrat, although the importance of his individual role is not easily captured from the social network analysis alone.

These two factors of favourable context and motivated individuals relate to concepts of windows of opportunity (Tavakoli *et al.*, 2013) and political will (UNDP, 2004). It was the experience of this research that valuable insight came from identifying specific nodes and links in a network to uncover the variety of motivations and opportunities – sometimes down to the level of an individual. Political will is not monolithic, and opportunities are not open-ended. The context in Tajikistan that helped to initiate a reform involved a motivated individual in a position of power, and a broader recognition of the importance of reform in the Tajikistan water sector. It is the view of this researcher that the initiation of the national water policy reform required detailed understanding of the realpolitik down to the level of individuals within organisations and how appealing to their different interests, mandates, and resources could initiate a major policy reform. How the presence of multiple influential actors that could affect a policy reform is a consideration that can then be explored from a social network perspective.

Specifically, the institution and individual leading the reform needs to coordinate and act as a broker to negotiate between other powerful actors. Coordination between development partners was supported in Tajikistan by the presence of a facilitator who helped to represent their combined interests when engaging and supporting the institution managing the reform. This facilitator possessed a combination of skills, experience, and relationships that allowed him to play a trusted brokering role between

multiple large donors and the government, helping to align interests around common goals. This also relied on the unique capability and conviction of a specific individual in a particular role. Between the engagement of the individual leading the reform within his institution, and the coordinated effort of development partners, the reform was eventually developed and approved.

From the perspective of the researcher, change in the national water policy in Tajikistan proceeded as follows. Firstly, the country context necessitated a policy reform based on both national and international interests. The need for this reform was recognised by an individual with sufficient influence and formal authority to lead the process, and he committed to pursuing it. He provided leadership to develop and negotiate the structure of the reform amongst government agencies, while international development partners created a coordination structure amongst themselves to provide support to the reform in a unified manner. The result is an approved reform at the national level. Although reform is a long process that will take time to fully implement, these factors appear to be important ones thus far in Tajikistan.

8.4.1.2 Relationship to Service Delivery

The relationship of the reform to rural water service delivery is distant, but important in the long-run. Implementing the reform will directly impact the functions and capacities of the institution studied that will, in turn, affect multiple sectors, including rural water supply. Competing interests for irrigation, drinking water, and energy needs will shape the development of Tajikistan in coming decades, and there is pressure to get this policy reform right because of its effect on multiple sectors.

Having the right policies developed and implemented, however, does not guarantee that safe water access will improve. Sound policies are important but insufficient for achieving universal safe water access. Policy reform is part of a bigger picture that only affects service delivery to the extent that it is implemented and results in meaningful changes at the point of service access. In the long-term, water scarcity itself may become a limiting factor, but in the near term there are likely more pressing challenges for Tajikistan in terms of rural water services specifically that the policy reform is unlikely to directly address.

8.4.1.3 Implications for Reforms Elsewhere

A favourable context is important for a major government institution to undertake a policy reform or other internal change, and this context is shaped partly by necessity. It

is worth considering how directly a reform might affect service outcomes, and who benefits – politically or otherwise – from a successful reform because of how these incentives might affect individual motivations. Actually approving and implementing reforms poses additional challenges. If there is little appetite in the context to change national institutions, it may be worth considering if such changes are essential to achieving service delivery outcomes. Improvements in service delivery may still be possible even if national institutions function imperfectly.

If reforming national policies is an essential step for improving services, certain outcomes might be framed to directly appeal to influential policy makers. These individuals may stand to benefit politically from successful initiatives. Appealing to their interests is likely crucial, as someone needs to manage the process who has sufficient power and initiative to see it through.

Social network analysis can play a role to help identify gaps in coordination and information relationships around key stakeholders. Influences on national government institutions can be complicated by the competing interests of multiple powerful donor agencies, and this can be partly addressed by developing a unified approach to supporting a reform. In Tajikistan, a specific individual was selected to represent the international agencies supporting the reform and to help facilitate interactions. The presence of this facilitator helps coordination without requiring everyone to be directly connected to each other in the network.

Even with favourable context, a champion leading the change within the institution, and coordinated support, the process of change remains tenuous. A sudden change of the ruling political party, for example, could suspend the reform process indefinitely. The approval of a reform does also not guarantee its successful implementation. It is a long and uncertain process to successfully support a reform to conclusion where service delivery benefits are realised, even if supportive network characteristics are observed for the time being. This assumption – that policy reform and other national level changes will lead to service benefits – should be considered carefully when deciding how much effort to put into national institutional development versus more direct efforts closer to the point of service access.

8.4.2 Change at District Government Level: Ghana, Malawi, and Bolivia

8.4.2.1 Network Characteristics Influencing Local Government Development

Case studies in Ghana, Malawi, and Bolivia examined local governments. The combination of these cases considers network characteristics that support local governments to improve performance, and how these performance improvements might relate to improvements in service delivery. Local governments perform multiple functions in rural water service delivery. These functions include both managing projects to build infrastructure and supporting service operations after construction, but typically not managing services directly. The division is not completely clear cut. For example, experience implementing projects may provide further opportunities for developing relationships and skills relevant to ongoing service delivery support. As a result, stakeholders describing influences on local governments during interviews often referenced factors affecting both project implementation and ongoing service delivery without clearly distinguishing between the two.

While infrastructure can be constructed with or without local government participation, ongoing interactions to support local service provision are most easily supported by local stakeholders, and it is here where local government has the opportunity to play a long-term supporting role. Interaction between local governments, communities and operators is where direct technical support and information is provided in the form of technical audits, community sensitisation, or other types of support. These activities can have valuable indirect benefit for service delivery by helping operators to improve their services and overcome challenges.

Understanding the types of support that local stakeholders require can help local governments to develop their capacity to provide this support, and support from higher levels of hierarchy can help local governments to grow into their support providing roles. This was apparent in Bolivia where the decentralised municipal structure had the most autonomy to allocate resources to support water service delivery by hiring staff, and funding transportation and trainings. In Bolivia, pressures from both international NGO projects and government authorities were encouraging these municipalities to form management units that could actively support community water operators to sustain service levels in the long-term. Municipalities studied were responding to these influences.

From a network perspective it is easy to identify ties between local governments and other local stakeholders. The key considerations involve ensuring that the right types of

support are being provided frequently enough to local operators and communities, and that local government is able to respond to the challenges faced by these local stakeholders. Support from higher levels of hierarchy can help local government to develop these capacities, but only if the vision for service delivery is clear. Building capacity to manage projects might involve different skills that do not achieve the same long-term objectives. This is where the concept of coordination between higher level sector stakeholders is important. If local governments are being encouraged to perform different functions by different stakeholders, the result might become a confused blend of these roles.

Potentially conflicting interests of multiple stakeholders at higher levels of hierarchy were more apparent in Ghana and Malawi than in Bolivia. There are more nodes active in Ghana and Malawi stakeholder networks, and the international investment in developing water infrastructure has placed focus on project implementation capacities more so than the development of functional service models. This means that, although local governments studied in these two countries are improving relative to themselves, these improvements may have more to do with capacity for helping to implement infrastructure than supporting operators to manage services.

Relationships with local stakeholders appear to be the crux of what helps local governments to play the right roles and improve their support over time. These relationships involve communities and service providers that can benefit from information and technical support. It is the view of the researcher that these relationships are critical for both improving services as well as institutional performance.

Interactions with stakeholders at higher levels of hierarchy can also support and possibly incentivise local governments to grow into their support roles, but only if the vision for these roles is clear for all involved parties. Contradictory approaches and focus on projects over services can distort incentives in ways that undermine the development of local government in its service support role. Support to local government from higher levels can therefore be beneficial, provided that the risks of distorting incentives are understood and that the focus remains on developing the local relationships that will sustain services over time.

National mandates are also worth mentioning. All local governments studied are compelled by national guidelines or policies to form some type of water and sanitation management team, often in collaboration with multiple local government departments.

The consistency of membership, meeting schedule, and efficacy seems to vary by jurisdiction. This suggests that, although central institutions have direct authority, they are not necessarily able to exercise power directly to ensure practices are implemented as envisioned. A good idea in a ministry may not reach all corners of a country. National mandates can be important for validating practices, because local staff may be reluctant to do things not explicitly sanctioned by authorities, but these mandates still need to be translated into practice at local levels.

8.4.2.2 Relationship to Service Delivery

Beyond supporting infrastructure development, local government performance affects long-term service delivery to the extent that it helps operators or community management bodies to succeed in providing services. These can be system operators or waterpoint committees, depending on the management structure. Since local government is unlikely to have the capacity to directly manage all services in its jurisdiction, supporting others managing services to succeed becomes imperative.

It is worth considering how fully a local government can play a support role with its existing capacity, and how flexible its capacity is. Local governments in Bolivia have autonomy to hire new staff and restructure resource allocation within municipalities to create management units with the explicit purpose of supporting local operators and infrastructure development. Local governments in Ghana, and Malawi in particular, have less flexibility. Districts in Malawi are also bigger, which stretches local government resources even further. Stronger local governments in Bolivia appear to be benefitting service delivery outcomes across their jurisdictions, but it is possible that even significantly stronger local governments in Malawi would still be insufficient to effectively support service operations across their larger districts. If local government is unable or unwilling to play required support roles, it is worth considering if other stakeholders might perform such functions.

8.4.2.3 Implications for Similar Changes Elsewhere

Practitioners can consider the roles of local government, and the effect these would likely have on service delivery if performed flawlessly. In the case studies of this research, local government performance mattered to the extent that it could act as technical backstopping support for community operators, in addition to supporting infrastructure development. Technical backstopping provided by other stakeholders may also be an alternative if local governments are unable or unwilling to provide ongoing support functions after infrastructure has been developed.

If local government is a good option for long-term technical backstopping support to local service operators, then its relationships can be considered from a network perspective. Networks can help practitioners consider who a local government connects with, what types of support these relationships provide, and the strength of these ties. Visualising and strengthening these local network interactions might be a useful management strategy for these local governments. It can help them to consider the local relationships they have, which ones should be strengthened, and how to manage this network in the future.

Understanding these local government ego networks can also help to consider who supports these local governments to overcome technical challenges in their roles supporting local operators. Does local government need technical support, help developing management units, or information from higher levels of hierarchy? Findings from this research suggest that institutions without ties to higher levels of hierarchy might struggle to overcome challenges if they cannot access support.

8.4.3 Change at Local Level: India

8.4.3.1 Network Characteristics Influencing Community Operator Development

The community operator committees studied in India directly provide safe and affordable water that is especially important because of groundwater arsenic contamination. Some of the influences on their performance are straightforward. They firstly need to provide a good service that is reliable and affordable. In return, user payments for water help to sustain operations. This relationship provides a direct incentive for operators to perform, and several successful operators were further extending services by hiring delivery agents to carry water to customers by rickshaw. Growing the number of users is a sign of improving performance, and provides further incentive for these local institutions to develop further.

Beyond these strong relationships between operators and users, technical backstopping support from a larger organisation seems to be important. Local government was not identified as important for this role. Support providers are local organisations based in the state capital that operated support services on a cost recovery basis to provide technical assistance with facilities and education on arsenic issues to community members. This relationship helps local operators overcome difficulties when they struggle to resolve them independently, and to maintain specialised technical components. In return, payment from the operators to these support organisations helps

to sustain the relationship. This arrangement seemed to provide a more robust service model than simply leaving operators to manage the facilities independently.

The overall model is straightforward: operators provide a good and affordable service and users pay for it. At the same time, a technical support relationship between a larger organisation and these operators provides assistance when needed. This support could potentially be provided by local government if its internal resources allow it to sustain support, otherwise an independent stakeholder can provide this service on a cost recovery basis. The result is that local operators can manage services, and their continued operation can benefit from access to technical support when needed.

8.4.3.2 Relationship to Service Delivery

The relationship between operator performance and service delivery is direct. More customers mean more households accessing safe water, and more revenue supports continuing operations and possible investment in facility expansion. Developing effective operators is therefore a crucial component of water service delivery.

The trade-off is scale. Influencing national institutions could have a small, but far reaching effect on services within a country, whereas strengthening an operator committee only affects the users accessing that facility. The operators have a direct impact on services, but at a smaller scale that might be challenging and resource intensive to replicate.

8.4.3.3 Implications for Similar Changes Elsewhere

Practitioners can consider the quality of a service and the willingness of users to pay for it. Clean water at a reasonable price is appealing, especially with service conveniences such as home water delivery. A dedicated management system that is compensated for operating these services can, in turn, keep the quality of service delivery consistent.

Set up is perhaps the easy part. Challenges arise in the longer term when maintenance is required or when relationships between users and operators may deteriorate. Ideally, operators would be able to work with community members to overcome these challenges, but sometimes external support may be required. A relationship with external support may be critical to prevent operators from discontinuing services in the long run. Furthermore, this external support must be able to sustain its own operations, either from remuneration by operators or with another revenue stream. If these relationships are in place and can continue to exist, it seems more likely that operators will be successful.

Practitioners can also consider other stakeholders that are engaging and potentially influencing operators. This was not seen as a serious issue in the Indian context, but elsewhere conflicting stakeholder interests might undermine operator willingness to develop their own robust management systems. For example, operators might be unwilling to perform maintenance if they can access new infrastructure freely from NGOs. It is therefore important to understand the full scope of interactions in operator ego networks to ensure that interactions from higher levels of sector hierarchy are supporting the same outcomes.

8.4.4 Reflection Summary

In all cases, ego network mapping seems useful for understanding influential relationships, and relationships that perhaps should exist but do not. Follow-up interviews then help to understand connections between alters. The ego networks for different types of institutions can then be considered slightly differently depending on their level of hierarchy.

At national level, network understanding can be used to improve coordination and encourage a unified effort to improve policy and capacity development in key national institutions. It can help to consider if influential stakeholders are indeed coordinated around a common objective, and if particular stakeholders are excluded from processes that require their participation.

Changes at national level may require additional contextual pressures that encourage reforms in institutions or policies. There may need to be sufficient benefit for individuals involved in order to motivate their participation, and certain key members may need sufficient motivation to lead the process. If the context is not right, even favourable network structures might not be enough to facilitate the desired change.

At local government level, ego network mapping can help understanding of the connections to local stakeholders, as well as the stakeholders influencing the local authority from higher levels. This understanding can help to consider how this network would be expected to function in an ideal service delivery arrangement, and where relationships are missing and might need to be developed. Similarly, it can identify coordination gaps between stakeholders that could undermine the development of local government roles. Understanding the full scope of interactions from a network perspective can be a helpful way to envision the transition of a local government from current to future roles in its local service delivery system.

It is important to consider the reasonable scope of what local government will be able to do. It is possible that even substantial increases in capacity will still be insufficient for local government to fully support operators and communities. In this case, alternative stakeholders may be able to play similar roles, and it is worth considering how strongly to invest in local government as an exclusive support provider.

At the local operator level, ego net mapping can be useful to see who operators connect to, and how these stakeholders connect to each other. This can be used to assess connections to local stakeholders and to develop strategies for strengthening operator connection to users. It can also help assess who provides long-term technical backstopping and seek to reinforce this if needed. Support can come from government or any other stakeholder that can sustain this engagement in the long-term.

8.5 Future Research

This research has explored the potential utility of social network analysis to characteristics of stakeholder networks that support institutional development. Further inquiry can investigate how performance differs if some network characteristics are absent, and possibly different configurations of characteristics that achieve similar results.

In particular, future research could include more comparative studies. Comparison would require having more consistent and accessible data on institutional performance over time, and the ability to also monitor stakeholder networks over time. This would allow a better comparative analysis, both across levels of performance and longitudinally to understand different configurations of network characteristics that support institutional development.

It would also be desirable to define outcomes in terms of service provision. Obtaining reliable data on levels of service delivery was difficult, and therefore could not be used as the basis of positive outcomes defined in this research, but future opportunities might allow a more robust data collection framework through an action research approach facilitated by a larger organisation. Stakeholder networks might then be monitored to identify configurations of characteristics that correspond to different levels of service delivery.

The quality of future research could also be improved by applying a fuzzy set qualitative comparative analysis (fsQCA) approach that includes non-network conditions. This would allow including social network characteristics along with other

factors such as financing arrangements, policy decisions, and technology, for example, to identify configurations that support improved service delivery. Applying fsQCA to identify configurations of successful WASH service provision is not new (Chatterley *et al.*, 2014), but including conditions defined by social network analysis would be. Social network properties would fit well into fsQCA because these properties might be directly quantified from network data (McNicholl, 2016).

8.6 Chapter Summary

This research identifies three common network characteristics in multiple cases of institutional development, and each characteristic relates to existing literature that underlines the importance of these characteristics. The network perspective is valuable because it adds a specific quantitative and visual way of interpreting the presence or absence of these characteristics around an institution of interest. To this end, a framework is proposed to help others to consider stakeholder interactions and the effect of supportive network characteristics in an intuitive and visual way. Identification of these network characteristics has the potential to help practitioners create enabling environments that support the development of key institutions in rural water supply.

The research also contains several important limitations. These primarily relate to the ability of individual stakeholders to perceive larger system dynamics and to identify salient influences. It is possible that certain social network characteristics exist in the case study locations that are either not perceived or verified by these research methods. Furthermore, social network analysis cannot capture all influences on institutional development. The research offers unique value by applying social network analysis to this particular sector, but it is not a complete solution for understanding all influences on institutional development.

Despite these limitations, several stakeholders interviewed expressed their interest in the potential value of this research. Three types of value were identified. The first helps stakeholders to consider their relationships through the reflective exercise of egocentric network mapping. A second type of value would be to produce complete snowball networks that identify stakeholder names in order to develop strategies and improve coordination. This second type of value was not realised from this specific research, however, because of the anonymity of stakeholders in the final networks, but future work could identify specific stakeholders. A third potential type of value is in offering recommendations to service delivery stakeholder networks about specific types of

interactions that could be strengthened in order to support institutional development in critical parts of the sector.

Further reflections on the case studies were provided from the perspective of the researcher to capture ideas that emerged from experience conducting the research. These highlight elements that seem to be contributing to change in different institutions at different levels of sector hierarchy. Reflections further speculated on the likely links between improvements in these institutions and overall improvements in service delivery. These ideas offer some recommendations on how to facilitate change at different levels of sector hierarchy, and how these should be prioritised to support overall service delivery.

This chapter also identified opportunities for future research. Findings from this research have the potential to help practitioners rigorously consider enabling environments that help institutions managing services to improve performance, and intentionally manage relationships as a means of improving institutional performance for long-term rural water service delivery. Understanding complex stakeholder relationships from a social network has potential to make this complexity accessible to policy-makers and practitioners while maintaining rigour in the analytical methods. The full potential of future research applications remains to be seen, but preliminary interest from international organisations suggests there is an appetite for incorporating social network analysis into research for improving service delivery sectors.

9 CONCLUSIONS

This project studied institutions in five countries to identify characteristics of stakeholder networks supporting institutional development. Social network analysis was the principal research method because of its emphasis on ties between actors. Applying social network analysis to the context of rural water supply explored the potential of these methods for identifying influences which support institutional development in environments where many stakeholder relationships can exist simultaneously.

Existing social network data collection and analysis methods were adapted to the context of rural water supply and combined with qualitative methods for the study. These adaptations sought to identify relationships in stakeholder networks around specific institutions, to define characteristics of these networks, and to qualify the importance of these characteristics for supporting institutional development. Data were collected from 162 primary interviews in five countries and analysed to produce findings in response to the two research questions:

1. What are common characteristics of stakeholder networks around specific institutions relevant to rural water supply that are improving performance?
2. Which network characteristics are perceived by stakeholders in these networks as important for supporting institutional development?

Quantitative network analysis was used to identify characteristics of the case study institution ego networks from a purely numerical perspective. Analysis of network size and homophily, both by level and type, produced general findings, indicating that the case study institutions typically have multiple information, skill, and authority ties that

connect with different types of stakeholders at different levels of sector hierarchy. Resource ties, however, are less common, and characteristics of resource networks are less consistent across countries.

Multiplex tie analysis, another quantitative measure, explored how frequently multiple tie types exist in parallel. Information ties are the most common, and multiplexity analysis finds that the presence of any relationship likely includes an information tie. Another measure, reciprocity, explored how often ties are one-way versus two-way and found that information ties are commonly reciprocated. The implication is that identifying undirected information ties between stakeholders will identify most relationships in water sectors. Limiting data collection to identifying undirected information ties might increase the ease and speed of data collection in future research.

Qualitative analysis of commentary from interview participants was also combined with quantitative network findings to characterise network influences perceived as important for institutional development. Including qualitative analysis is important because quantitative characteristics are insufficient on their own for identifying the importance of network relationships for supporting institutional development. In this way, perspectives from stakeholders experiencing network interactions identify which network characteristics are significant.

Three network characteristics were observed in case study institutions from multiple countries. The first network characteristic described the importance of information and skill ties between institutions and stakeholders at lower levels of hierarchy. These ties can help, for example, a district government to provide support to local operators, and receive feedback on how it can develop its capacity for providing better support. The second network characteristic described the importance of information and skill ties to higher levels of hierarchy. These ties can help, for example, community operator committees to access support for overcoming technical challenges. The third network characteristic described the importance of coordination between stakeholders supporting an institution. This specifically relates to strong information and skill ties between the two alters at higher levels of hierarchy that provide the strongest information and skill support to an institution. Practically, this characteristic highlights the importance of support providers being coordinated so they can complement, and not undermine, each other's work. These three network characteristics emerged from network data in multiple countries, and were identified by interview participants as supporting institutional development.

Social network analysis on its own, however, does not offer holistic analysis. This research has identified multiple limitations pertaining to both data collection and analysis, and three limitations stand out in particular. The first is the contextual nature of specific influences, where network relationships that matter in one context might matter less in another. For this reason, this research has not identified all network characteristics that might apply to institutional development. The second limitation is the presence of factors that cannot be identified through network relationships alone. Broader contextual factors such as political freedom, for example, can influence institutional behaviour, and social network analysis can benefit from combination with other types of analysis to identify a broader range of factors. Finally, social network analysis still requires qualitative interpretation to understand the significance of specific relationships. The presence of a network tie does not necessarily confirm its value, and social network analysis can benefit from combination with other methods such as the coding of stakeholder commentaries that was applied in this research.

Social network analysis can, however, identify where relationships do not exist. Identifying missing links has the potential to offer considerable value for understanding environments that support institutional development from both academic and practical perspectives. Even if understanding existing relationships requires nuance and contextual understanding, missing network ties can indicate the absence of a relationship. From this perspective, social network analysis can be used to study the relationships of an institution to identify where certain network characteristics are missing. The absence of any of the three common network characteristics found in this research might indicate a missed opportunity for supporting institutional development. Practitioners might then intentionally create or strengthen particular relationships in the network.

Institutional development will continue to be a complex and contextually dependent process, but social network analysis can provide insight into this environment in a rigorous yet practical way. Mapping ties between network actors using different tie types and strengths can describe qualitative relationships in network structures that can even be analysed quantitatively. This research included a broad scope of case studies, and findings are necessarily general, but future research could identify network characteristics in specific cases that can be statistically compared by both performance and over time. This research has found that social network analysis, particularly when

combined with qualitative methods, is a rich field for inquiry into influences on institutional development in rural water service delivery that future work can build on.

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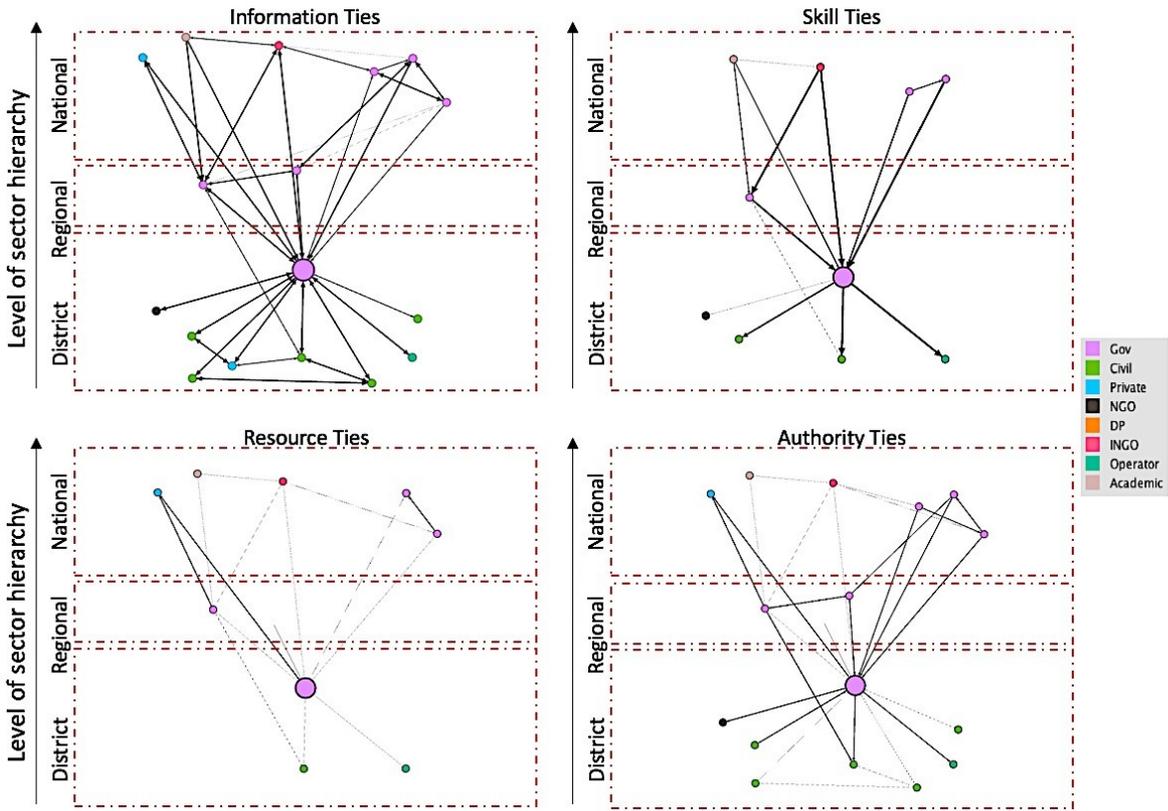
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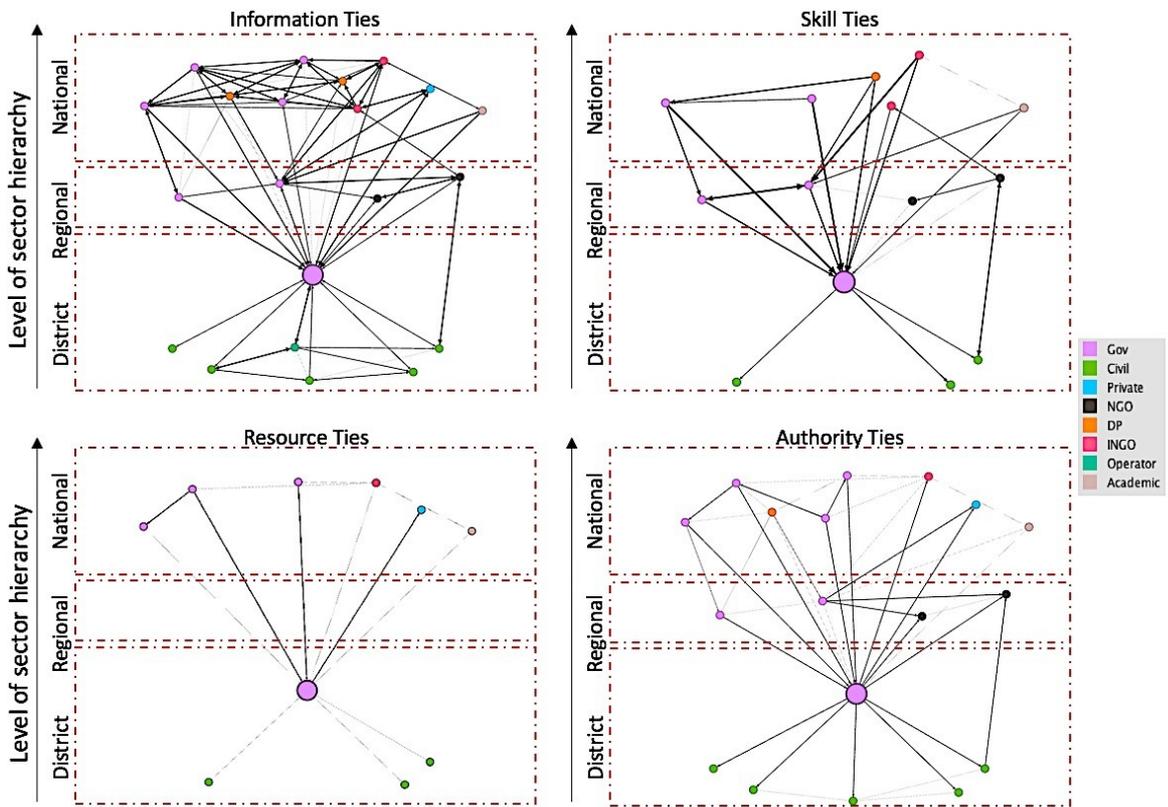
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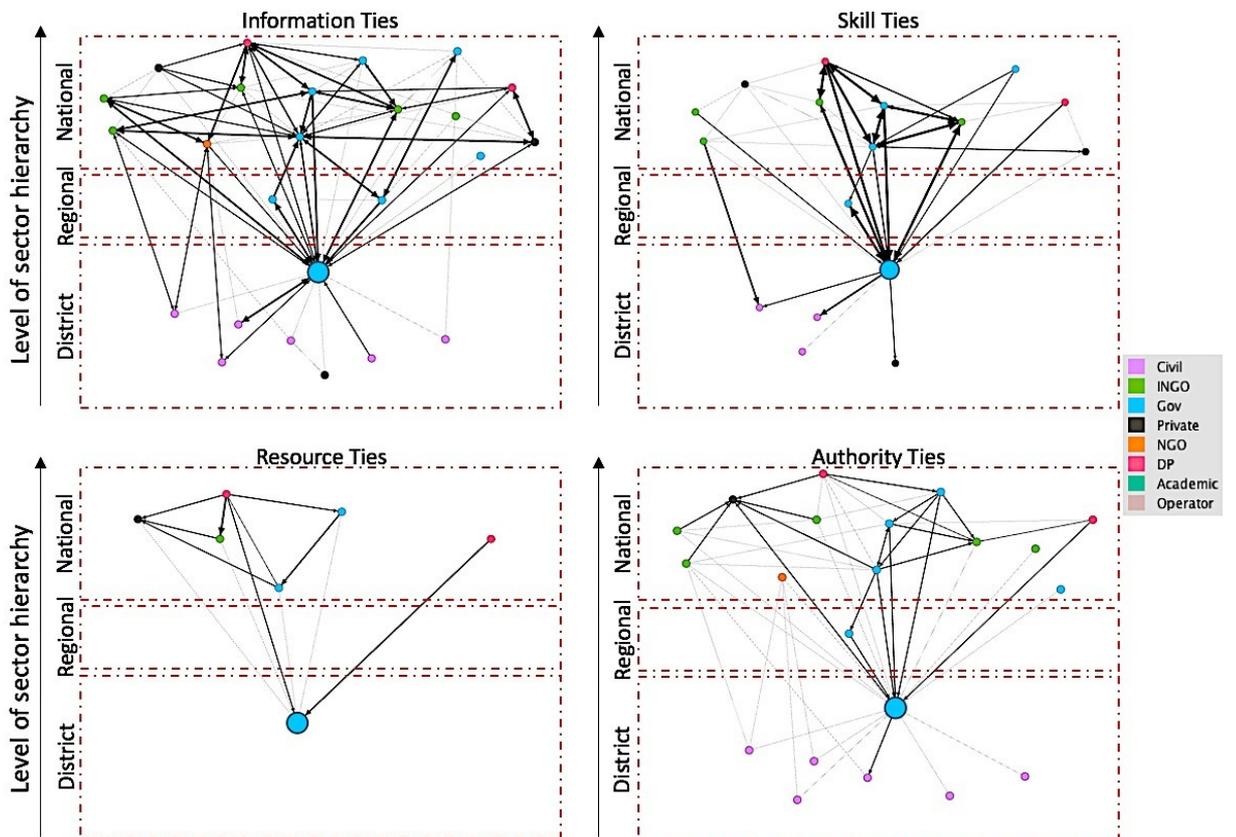
APPENDIX A: CASE STUDY INSTITUTION EGO NETWORKS



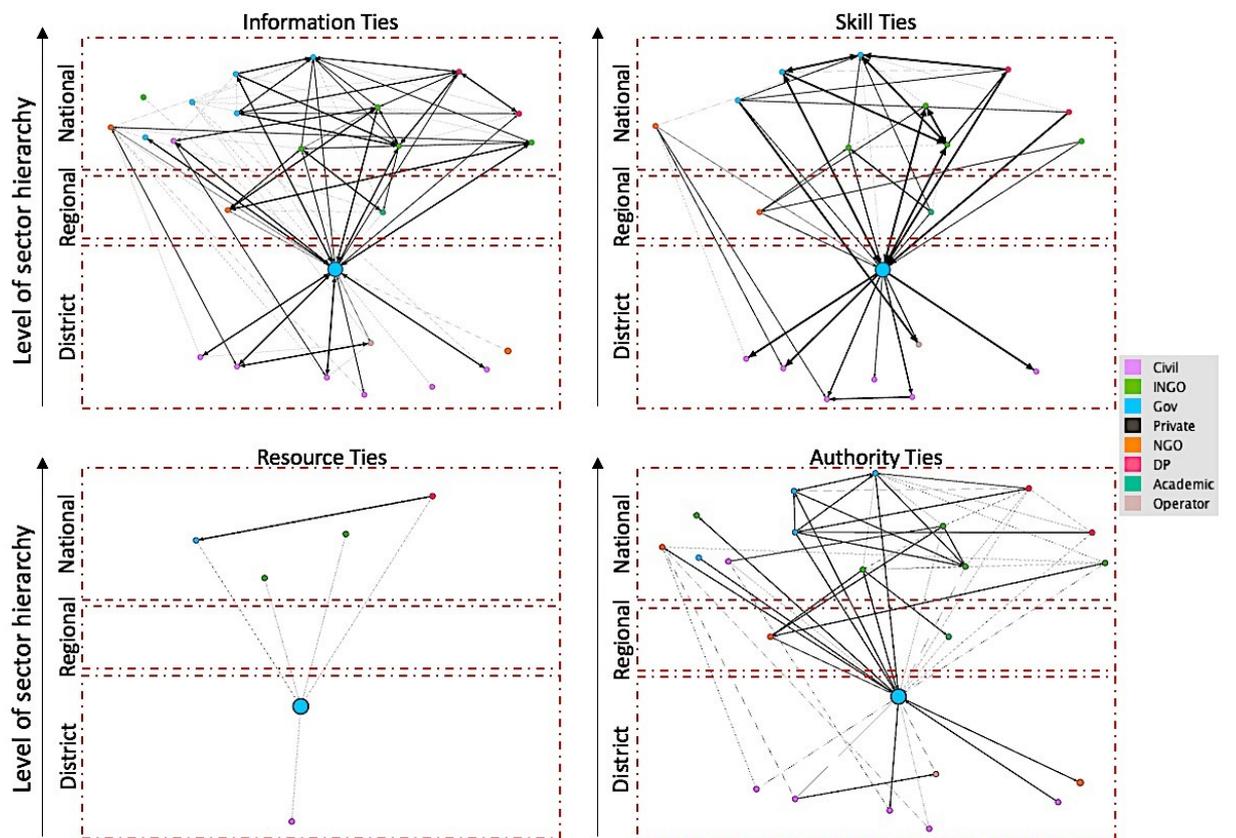
Ghana District 1 Ego Networks



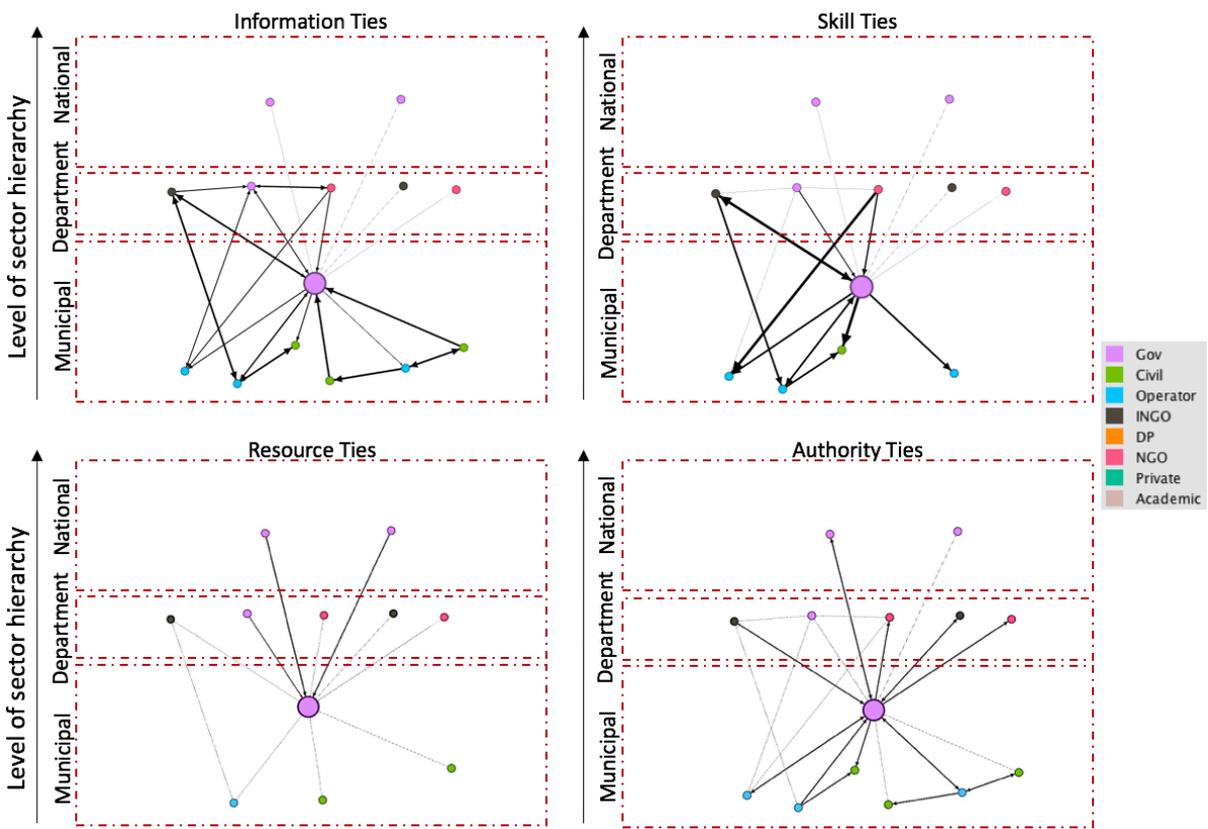
Ghana District 2 Ego Networks



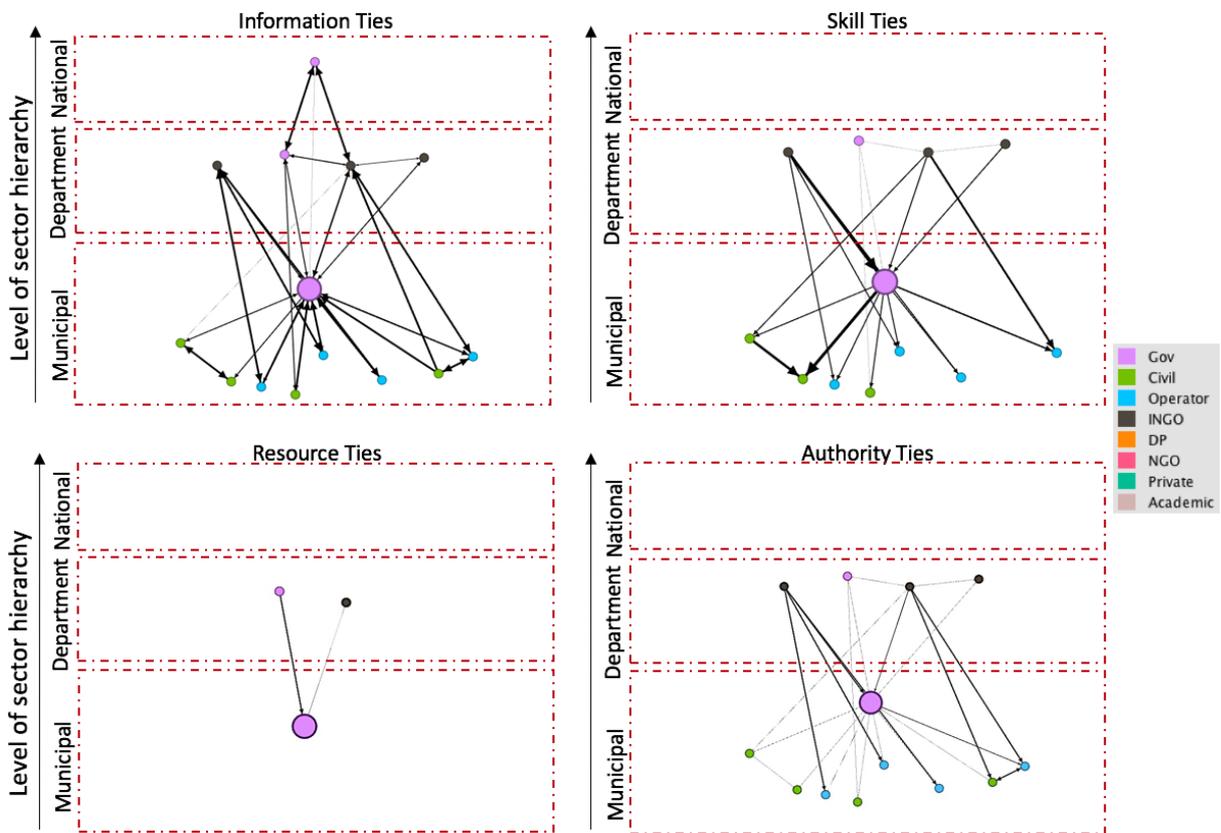
Malawi District 1 Ego Networks



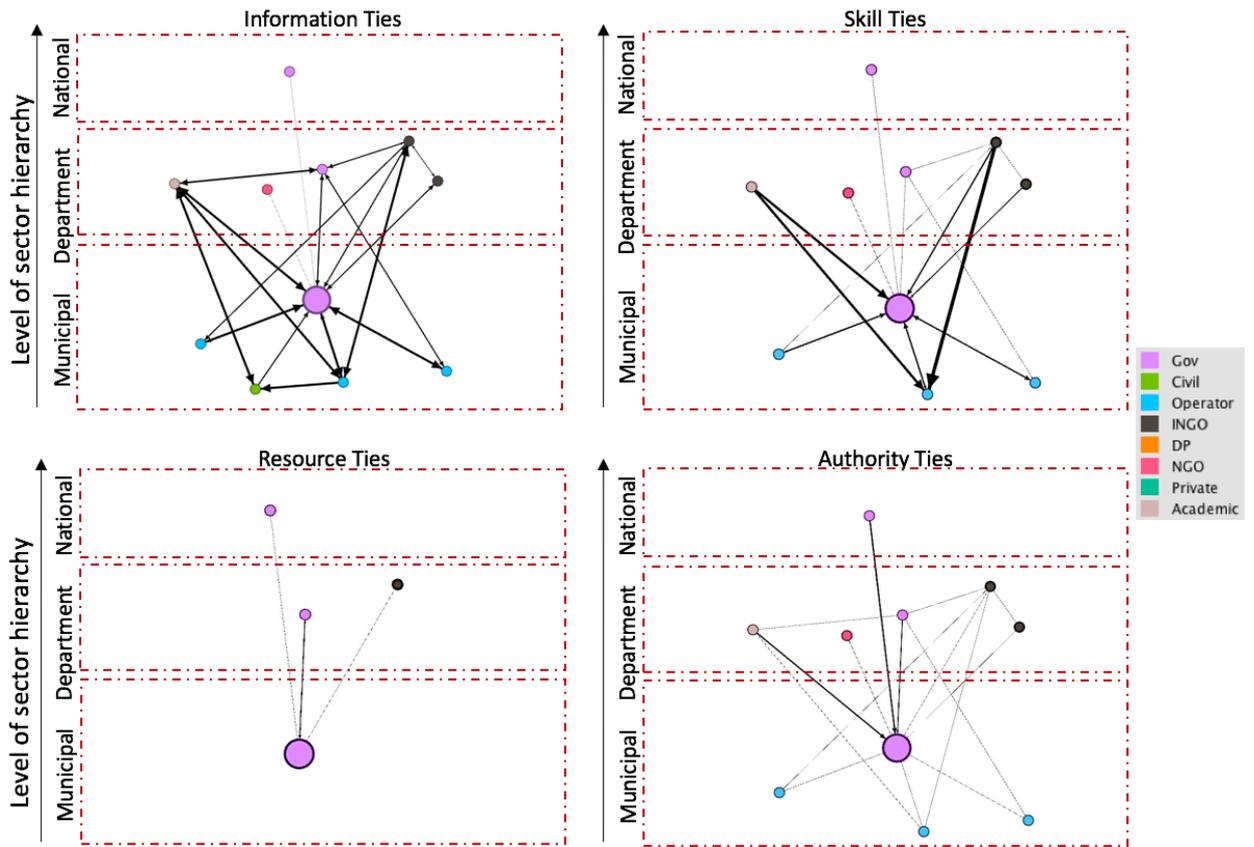
Malawi District 2 Ego Networks



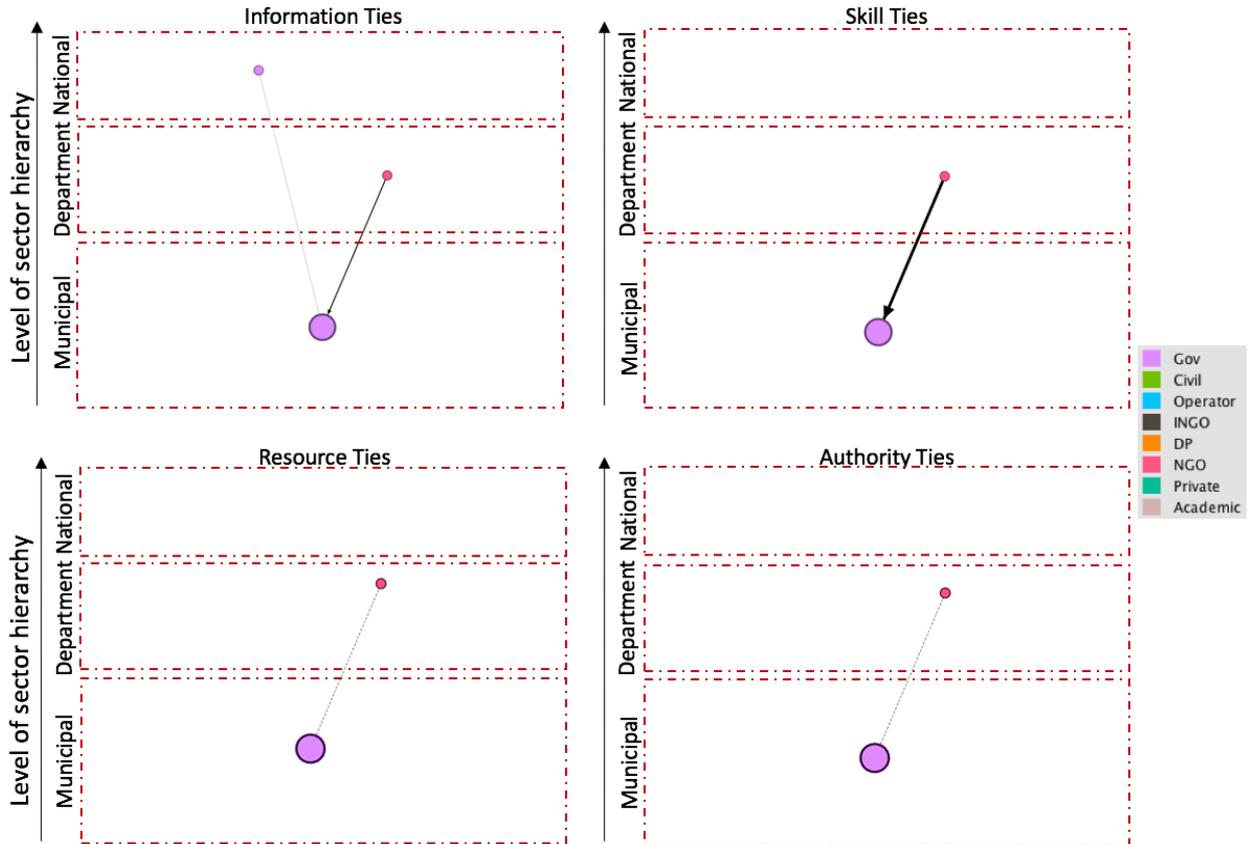
Bolivia Municipality 1 Ego Networks



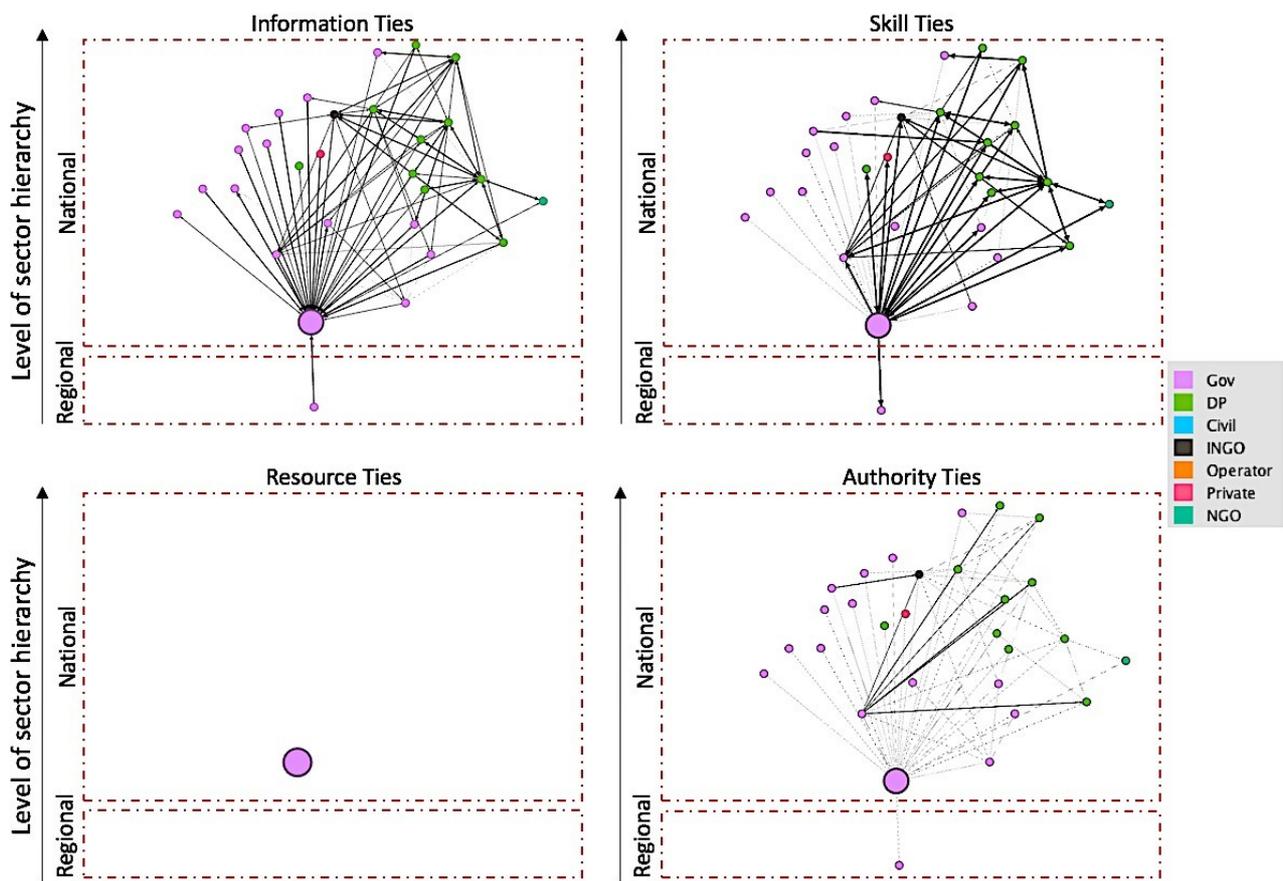
Bolivia Municipality 2 Ego Networks



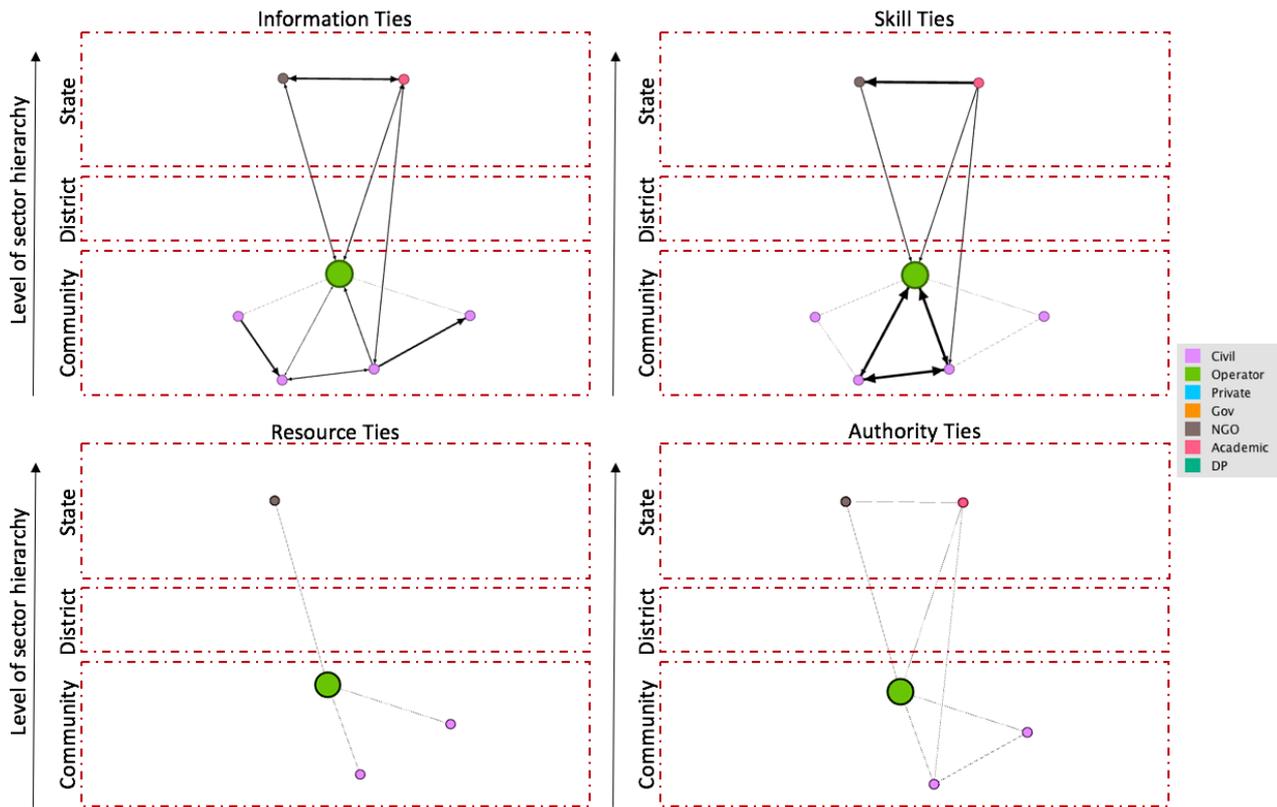
Bolivia Municipality 3 Ego Networks



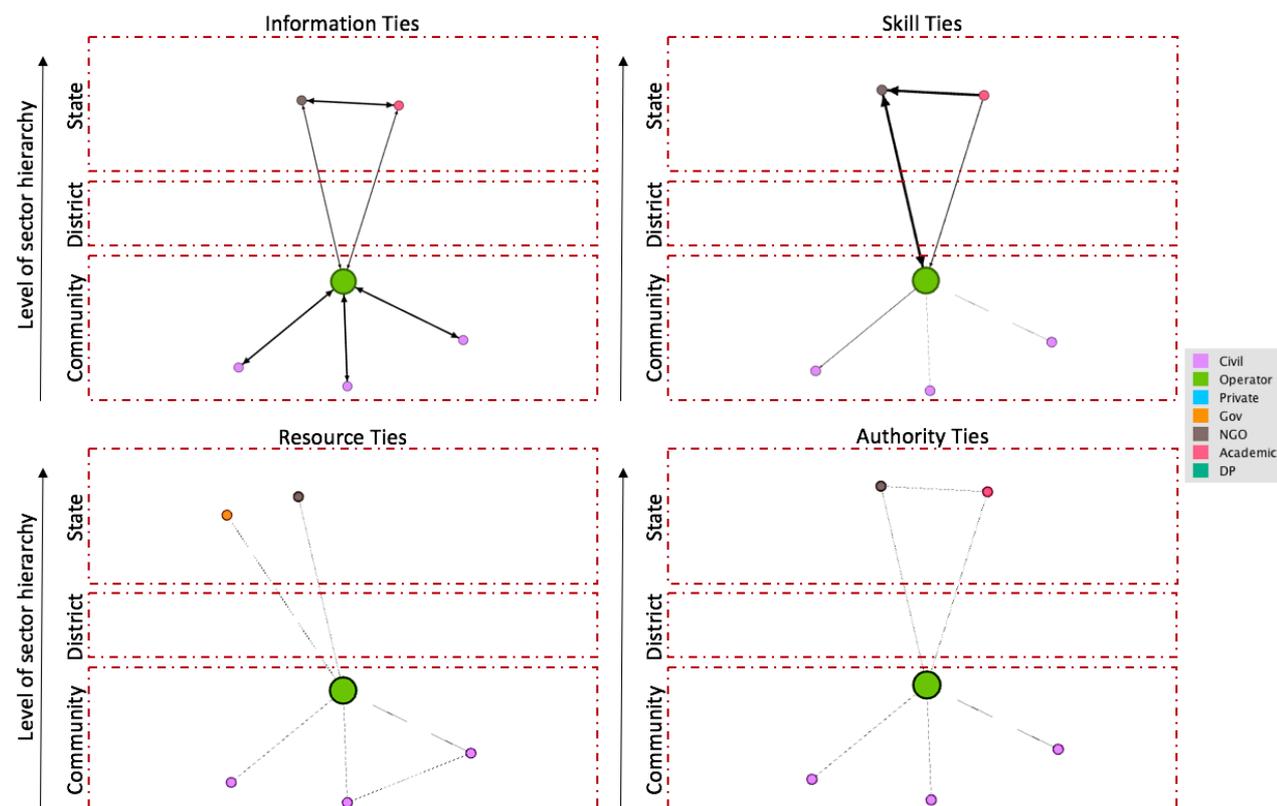
Bolivia Municipality 4 Ego Networks (Not Improving)



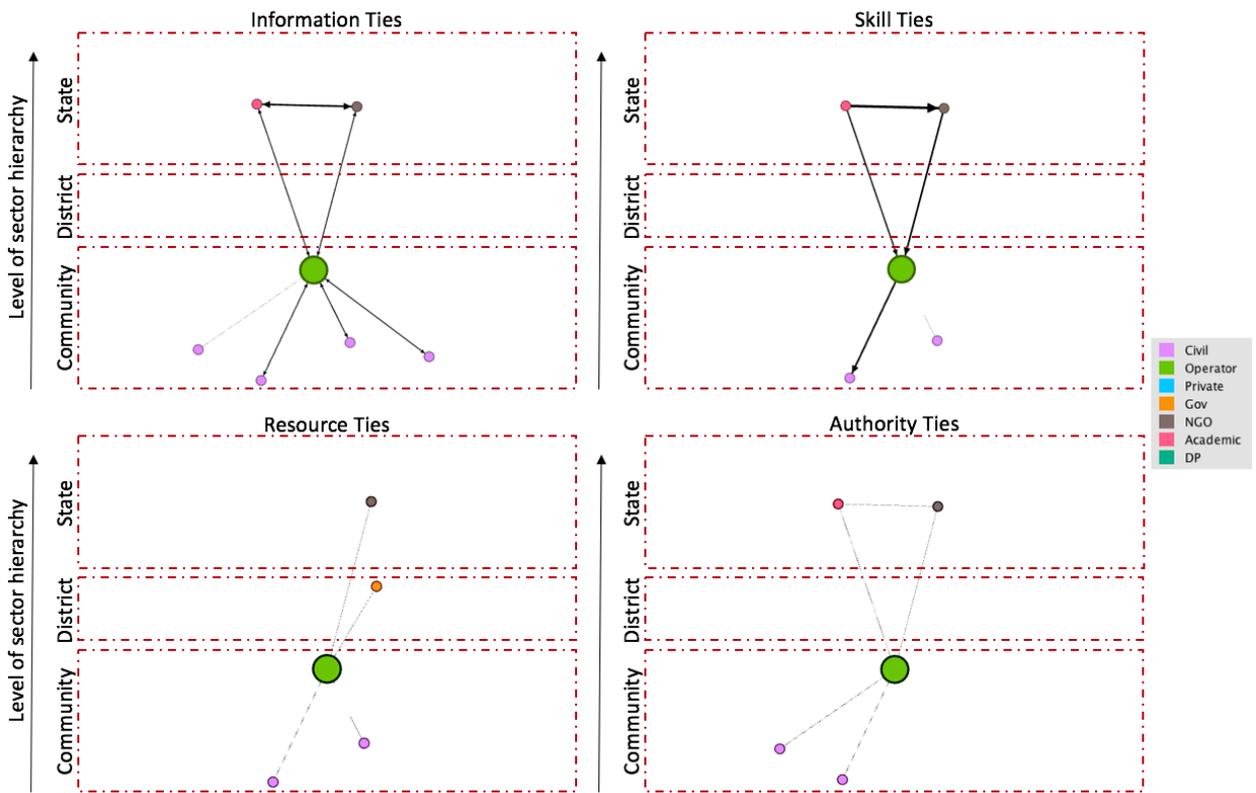
Tajikistan National Institution Ego Networks



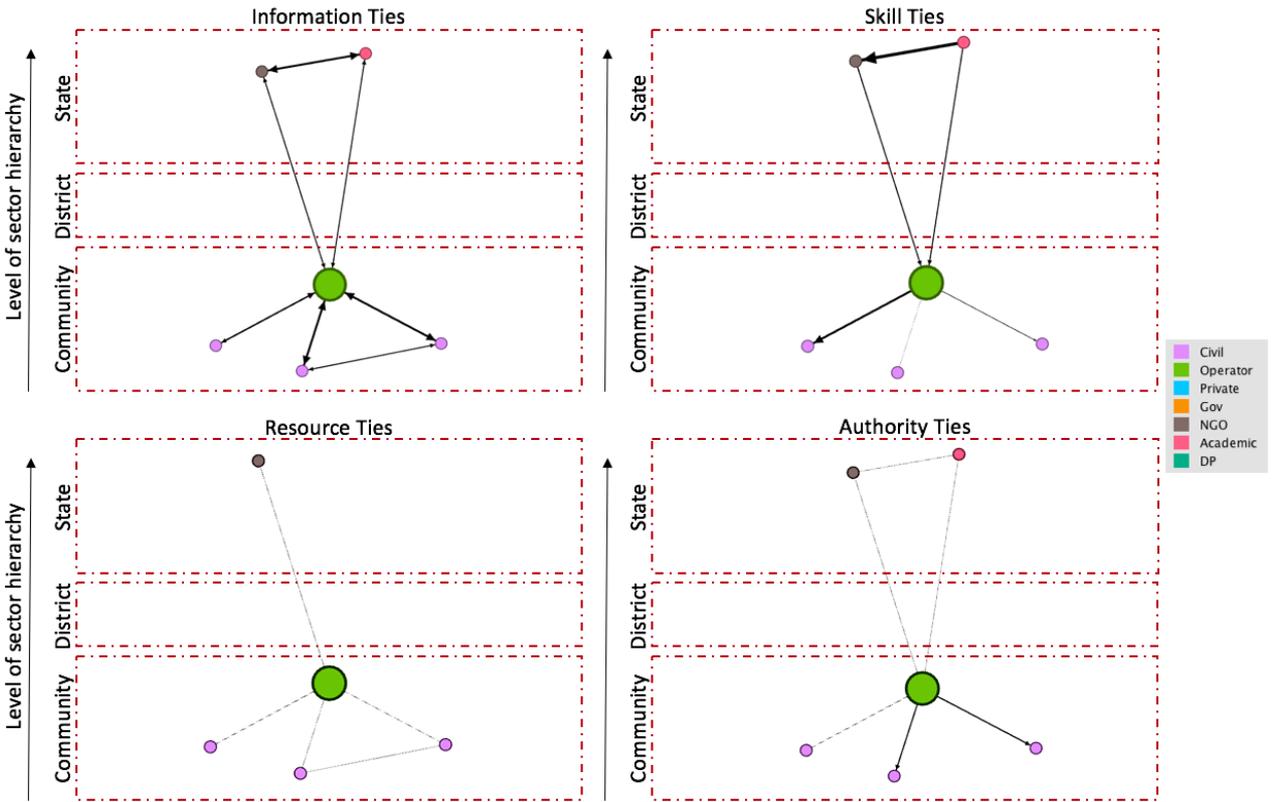
India Operator Committee 1 Ego Networks



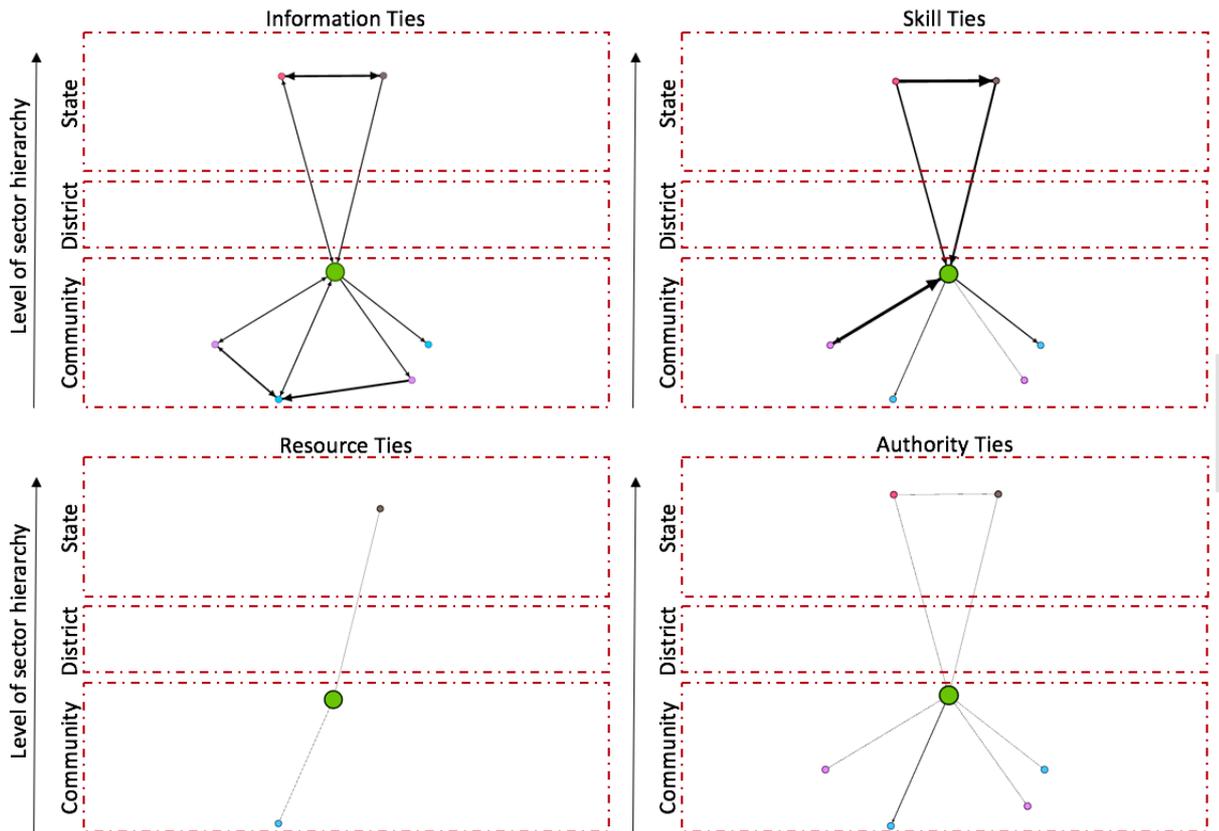
India Operator Committee 2 Ego Networks



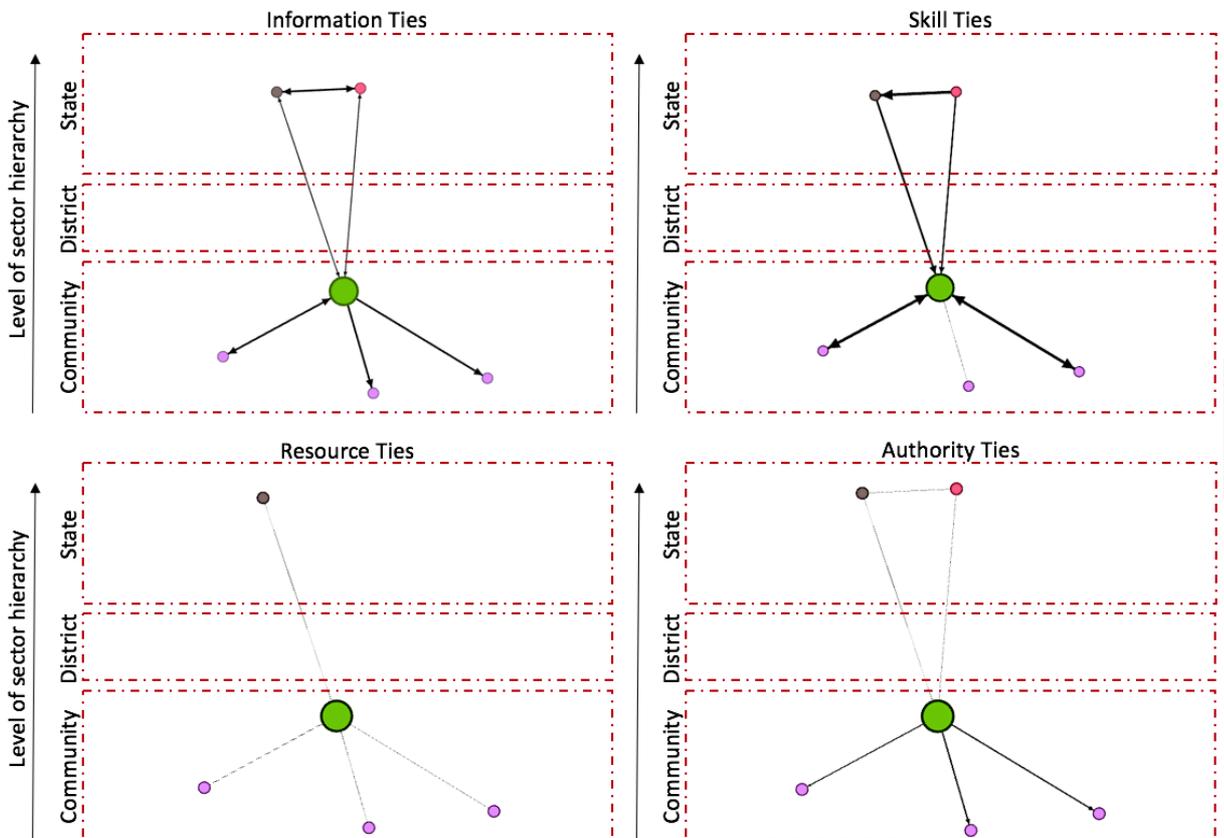
India Operator Committee 3 Ego Networks



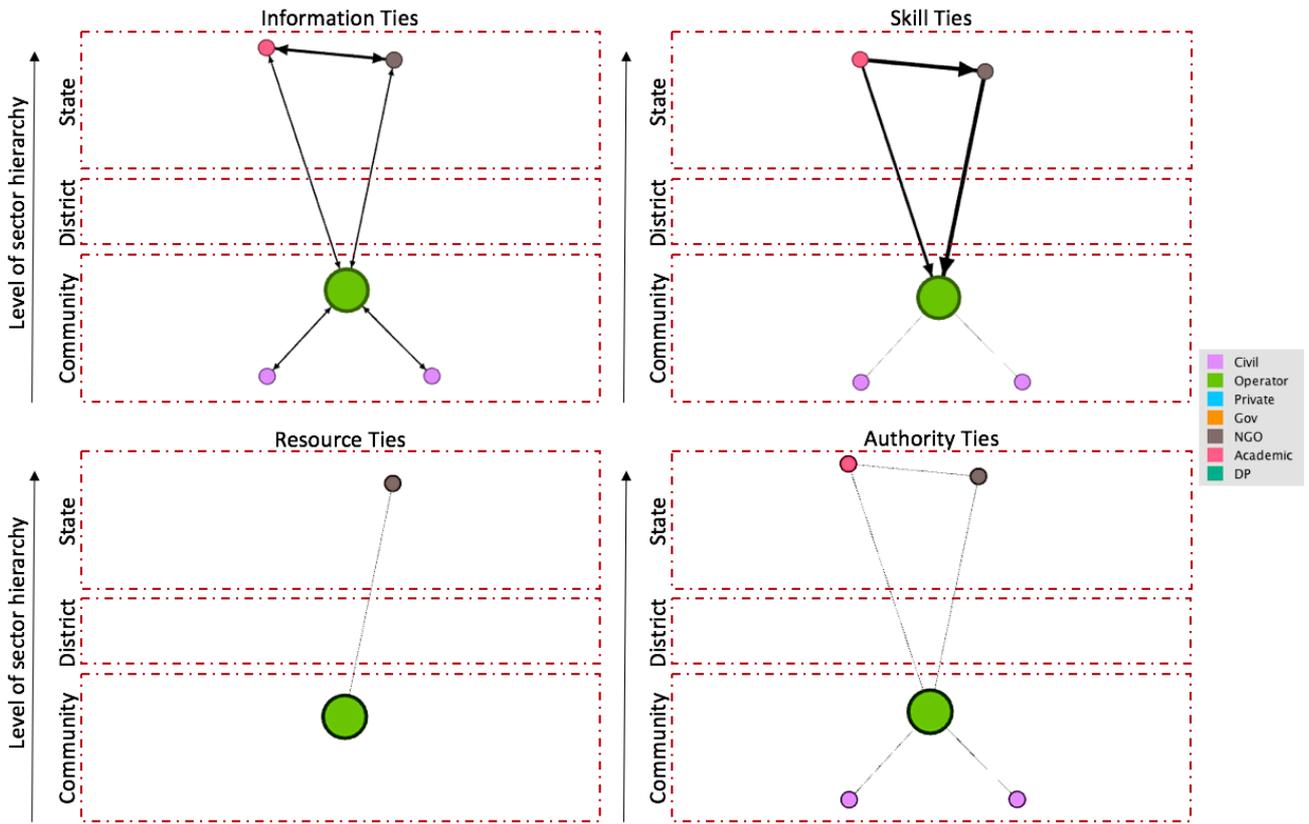
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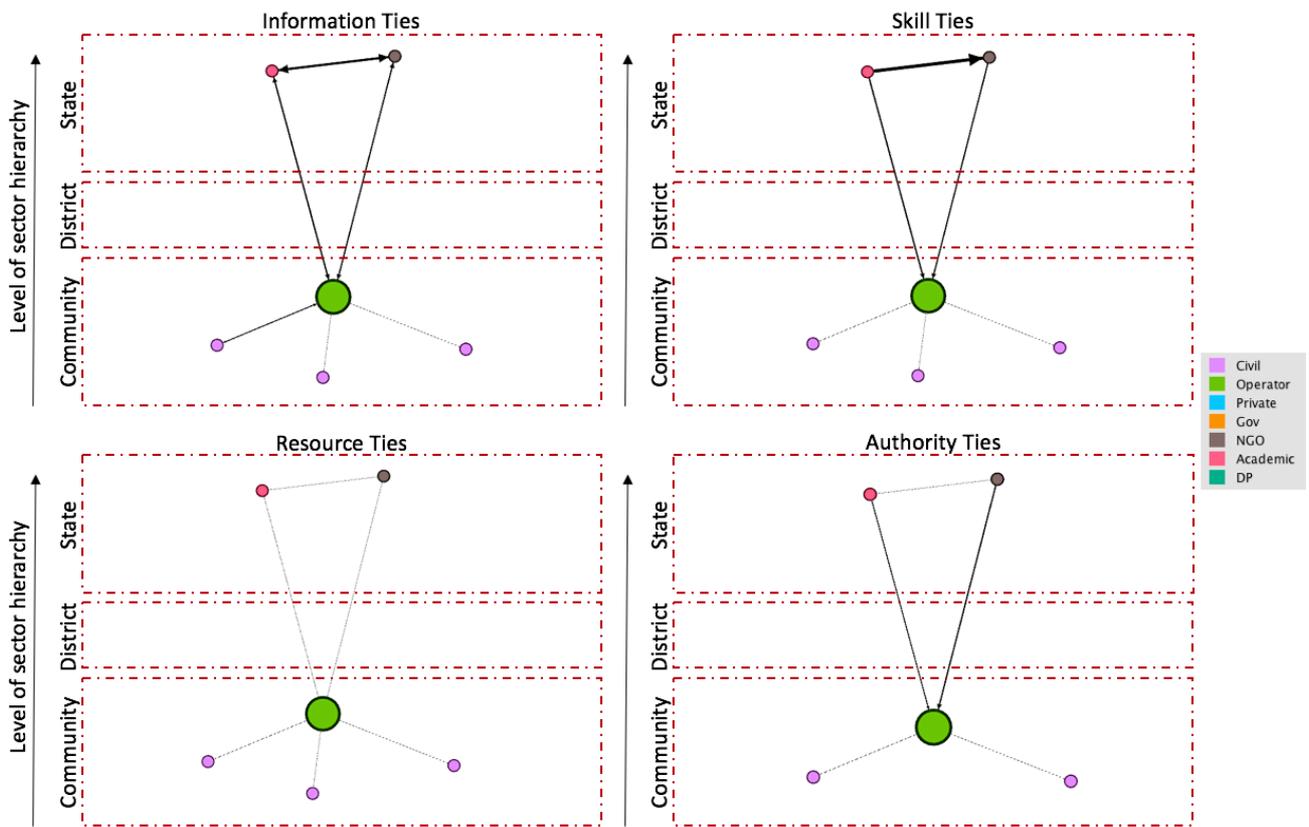
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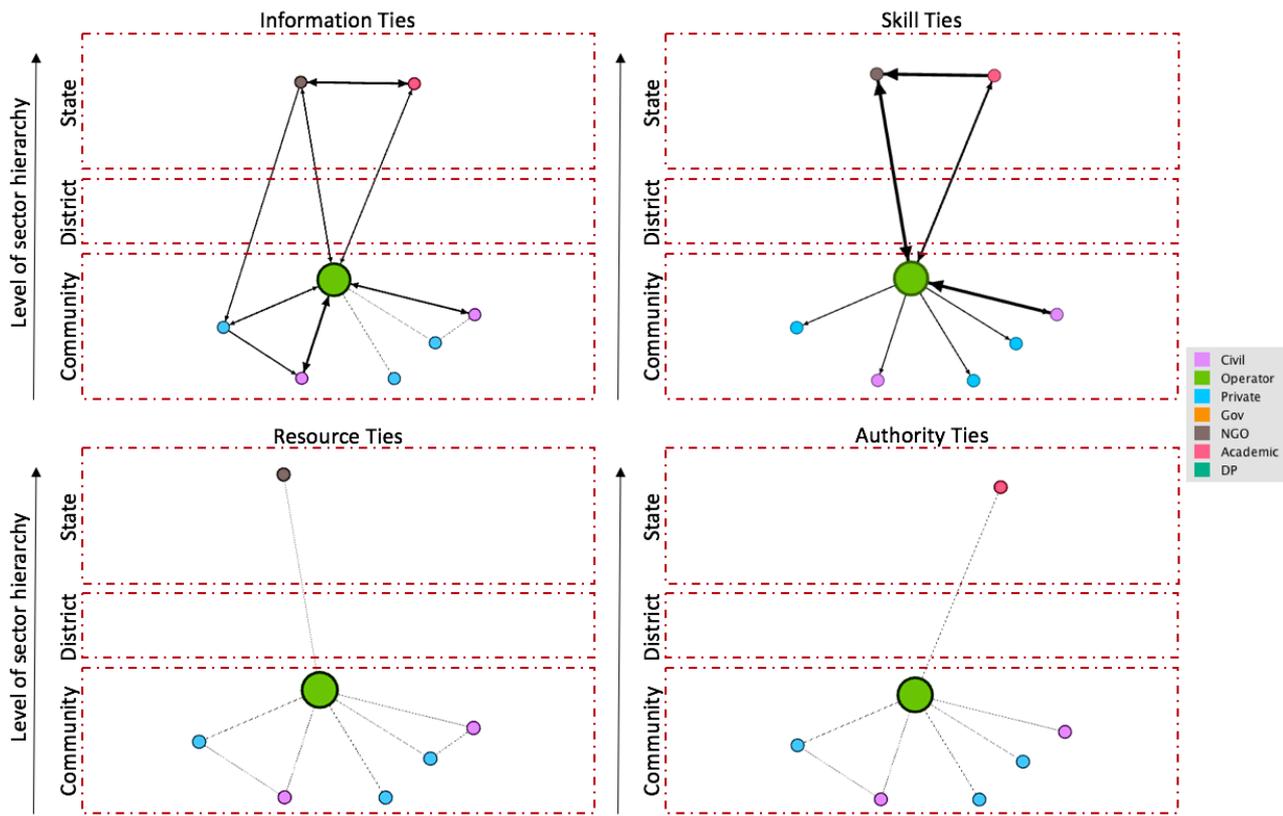
India Operator Committee 6 Ego Networks



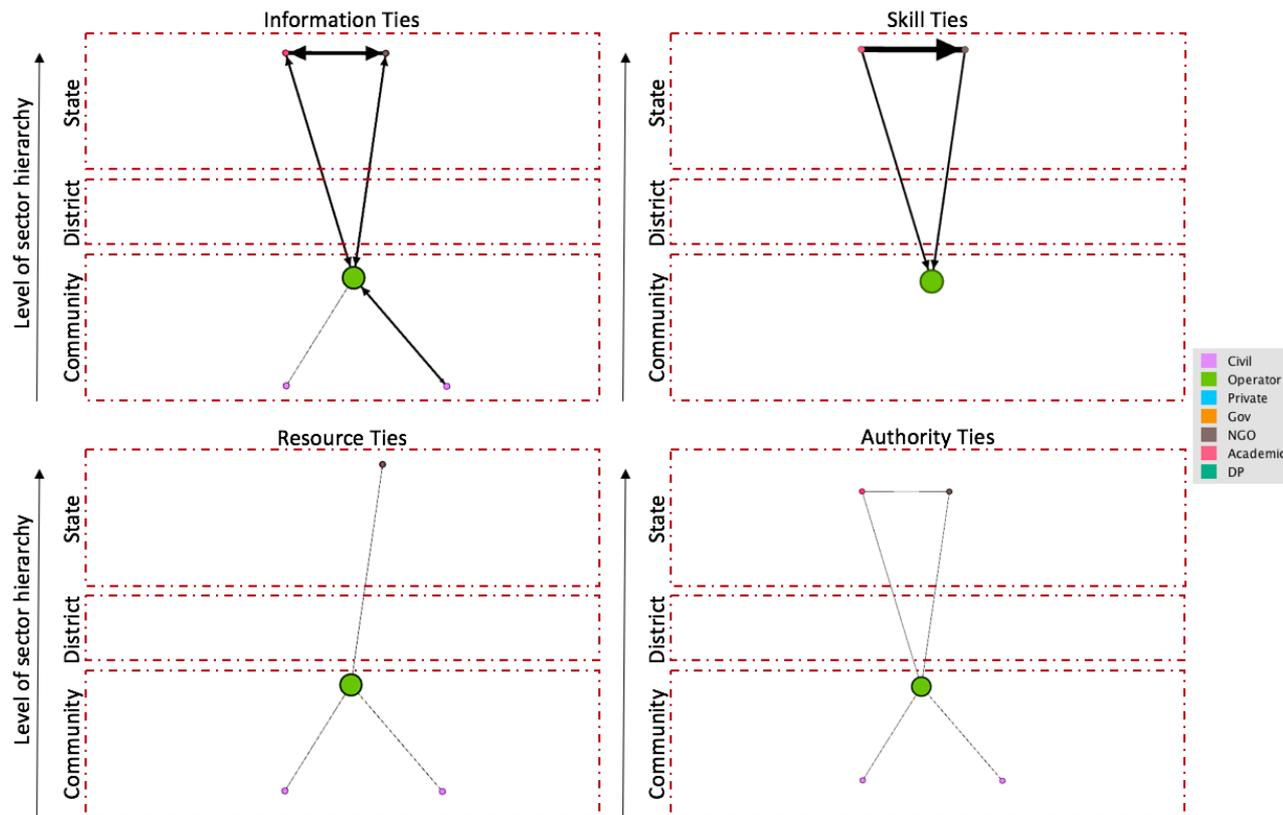
India Operator Committee 7 Ego Networks



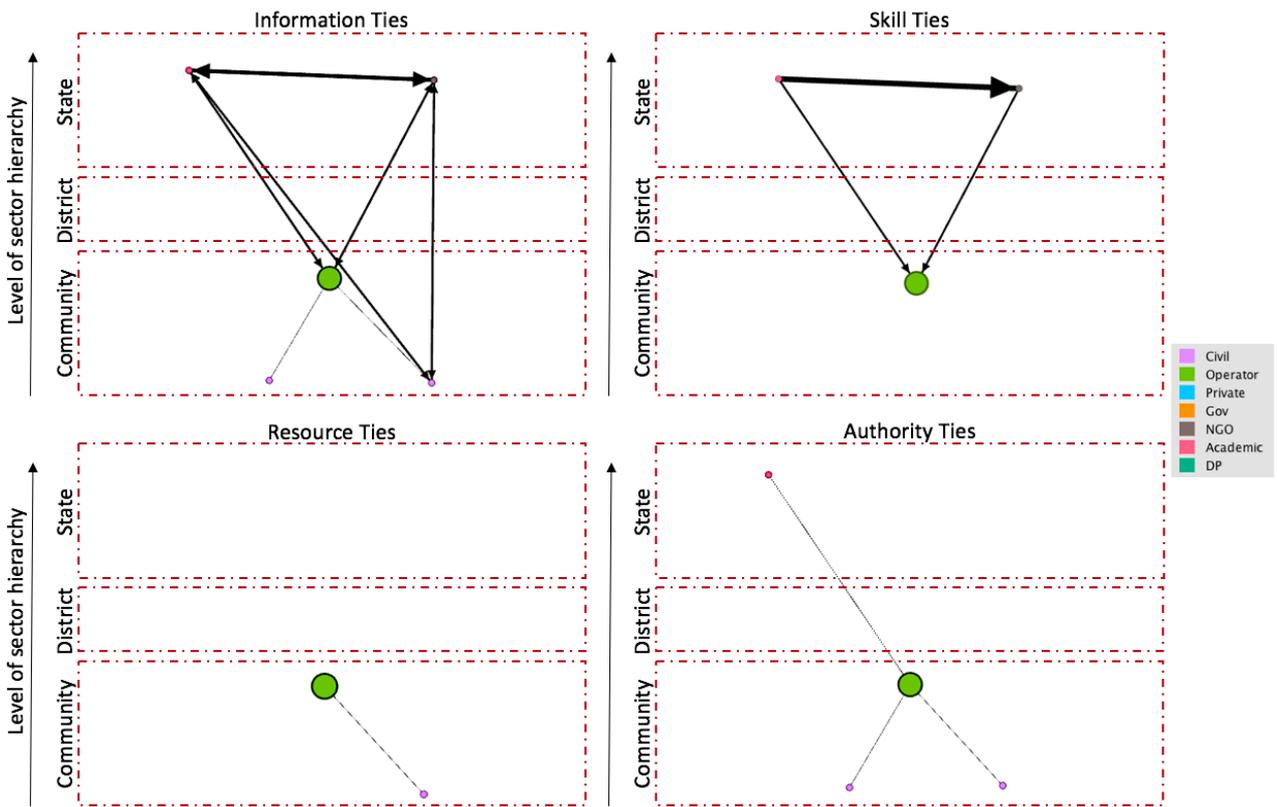
India Operator Committee 8 Ego Networks



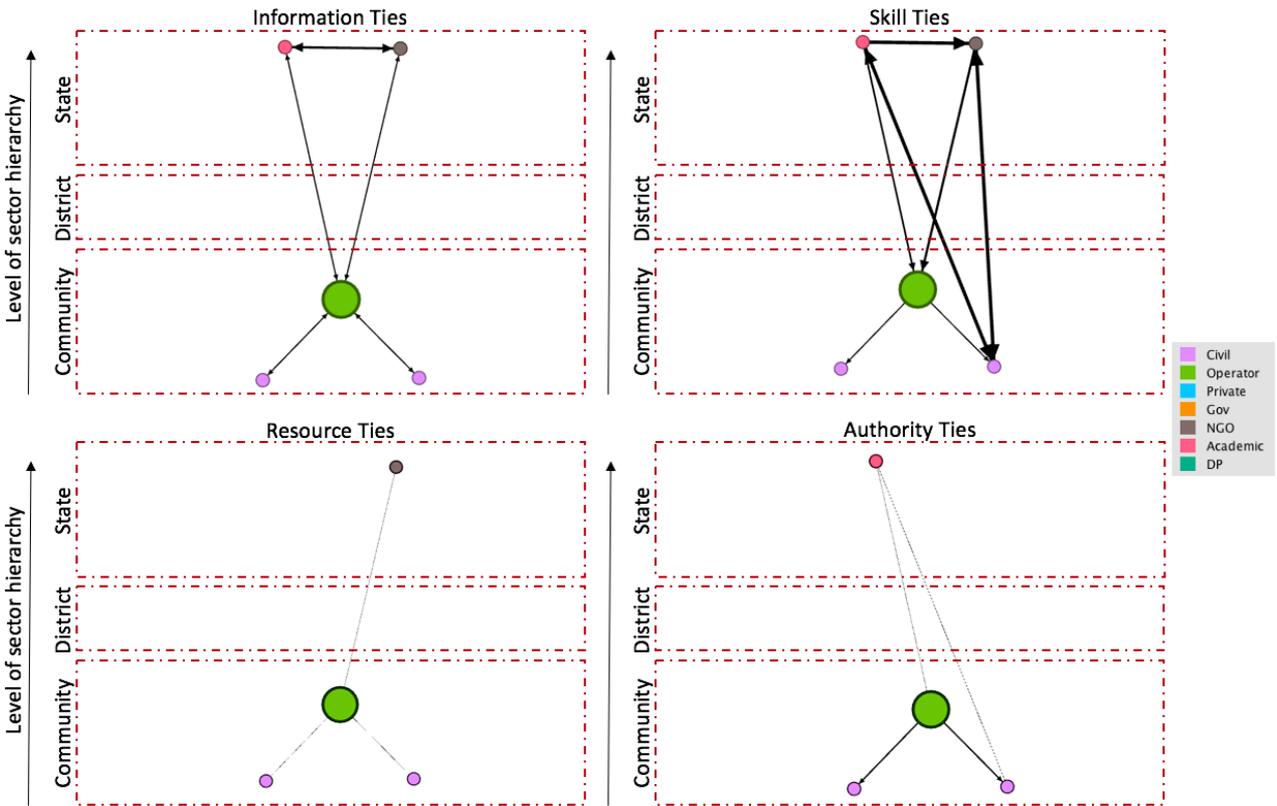
India Operator Committee 9 Ego Networks



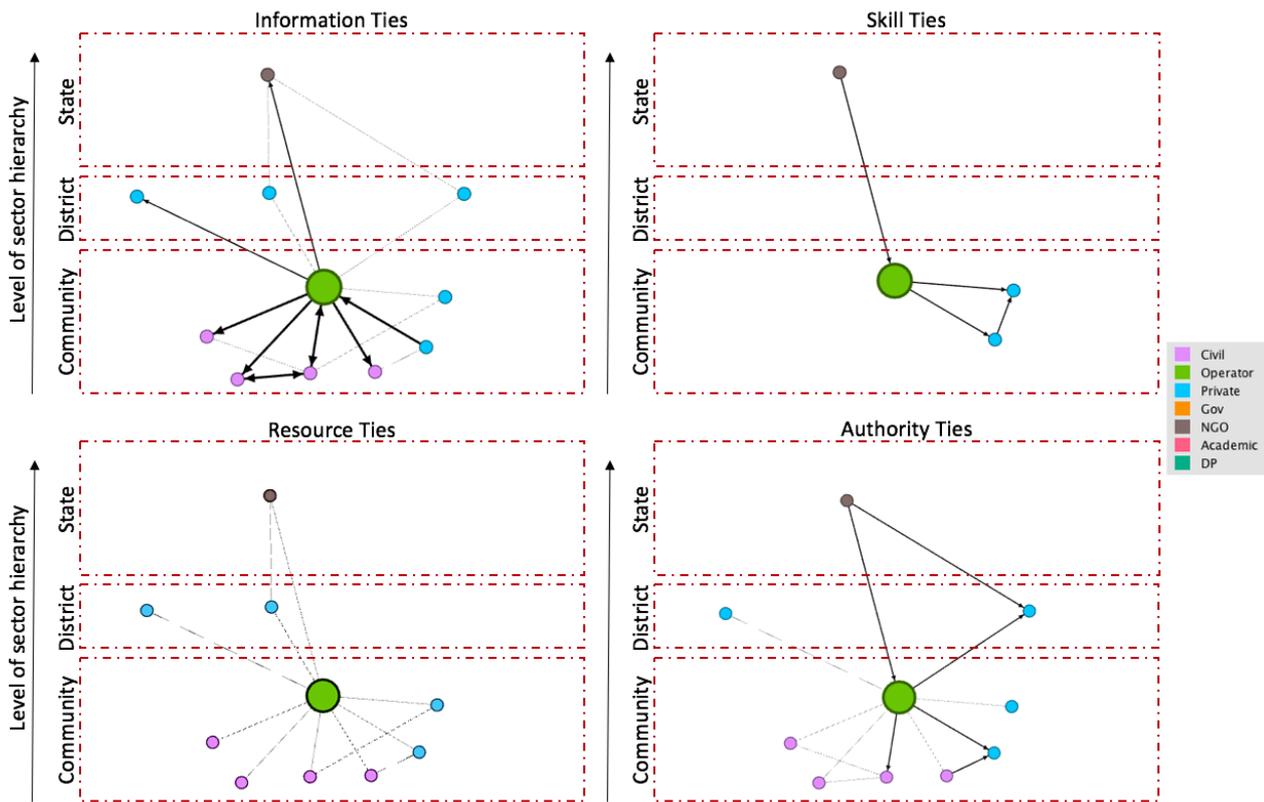
India Operator Committee 10 Ego Networks (Not Improving)



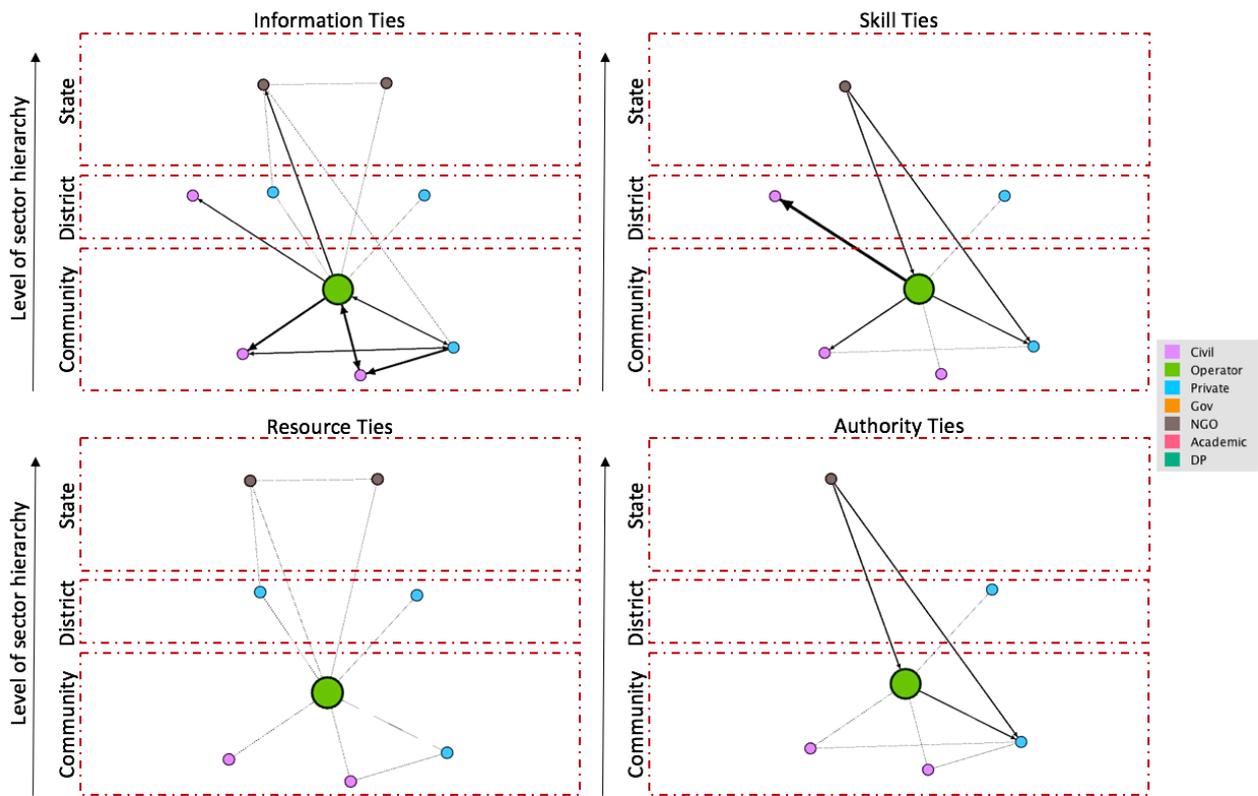
India Operator Committee 11 Ego Networks (Not Improving)



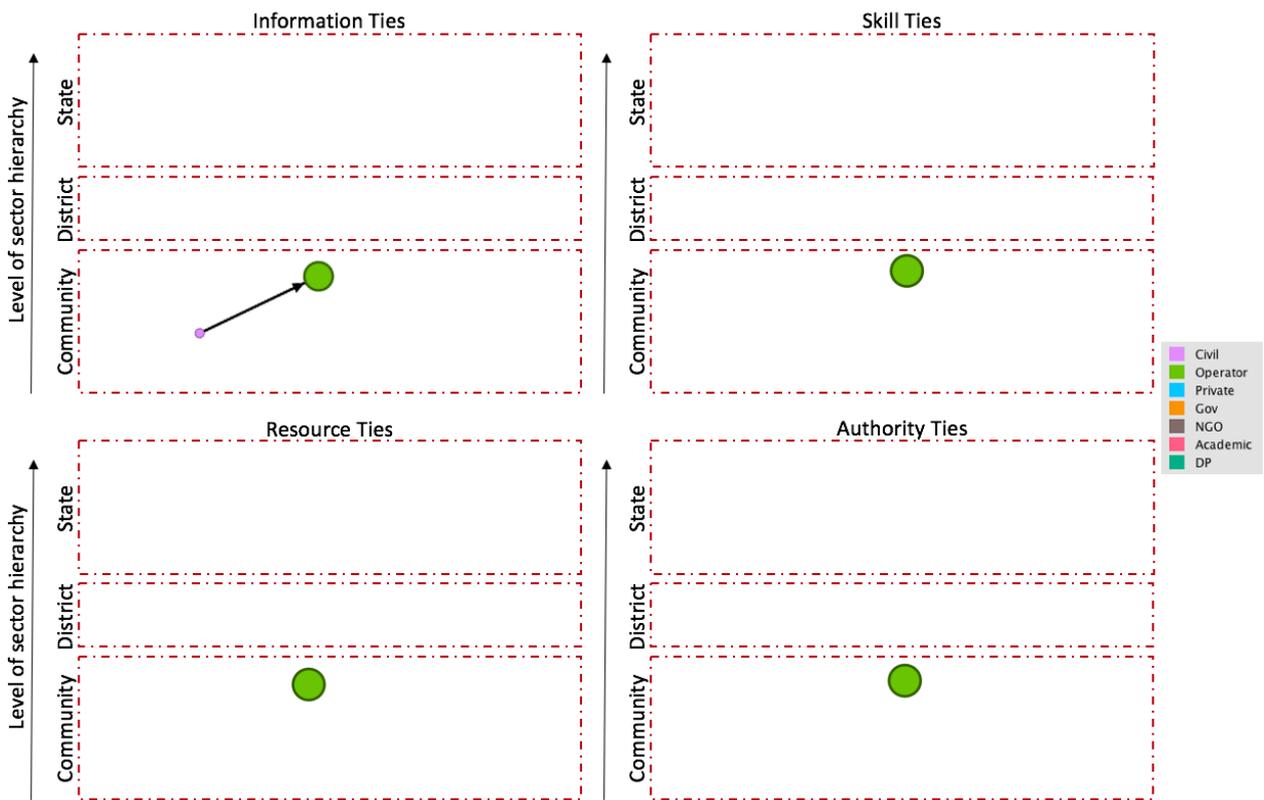
India Operator Committee 12 Ego Networks



India Operator Committee 13 Ego Networks



India Operator Committee 14 Ego Networks



India Operator Committee 15 Ego Networks (Not Improving)

APPENDIX B: CONSENT FORM



Participant Consent Form

Network and Narrative Characteristics of Institutional Development for Rural Access to Safe Water

Name of Lead Researcher: Duncan McNicholl

Please tick box

1. I have had the opportunity to ask questions about the research and have had these answered satisfactorily.
2. I understand that my participation is **anonymous** and voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.
3. I agree that parts of the interview may be audio-recorded and that notes can be taken.
OR I do not want any part of the interview to be audio-recorded.
4. I agree that data collected in the interview will be stored securely for 5 years
5. I agree to take part in the above study.

Name of Participant Date Signature
(Please print)

Name of Research Team member Date Signature
(Please print)