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ANALYSIS OF SUPPORT ARRANGEMENTS FOR COMMUNITY MANAGEMENT OF RURAL WATER SUPPLIES IN INDIA

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submitted by:
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Table of contents

Table of figures

List of tables

Abstract

Community management is the predominant approach to providing rural water supplies in low-income countries, but needs support to function effectively. This thesis investigates support arrangements in three of the least-developed states in India. It compares support by Gram Vikas, an internationally acclaimed NGO in Odisha, to support by government departments in Chhattisgarh and Jharkhand. Data was collected on the service users receive, the performance of support organisations and service providers, and the costs of support. The study found that service levels in Odisha are significantly higher than in the other states and comparable to those in much wealthier states. It identified two main reasons for success in Odisha: high-quality infrastructure and Gram Vikas' institutional performance. Full coverage with household connections and high service levels represent a transformative change from previous water sources, which leads to a high willingness to pay and participate in scheme operation. It is argued that the NGO's interventions are more effective than interventions by the state departments due to the organic structure of the organisation and the higher levels of investment made in the initial capacity building stages of projects. Both these factors, however, limit the potential for scaling up the model to an entire state.

Kurzfassung

Community Management ist die vorherrschende Organisationsform für die Bereitstellung von Wasser in ländlichen Gebieten von Entwicklungsländern, benötigt aber externe Unterstützung, um erfolgreich zu sein. Diese Masterarbeit befasst sich mit Unterstützungsmechanismen in drei der am wenigsten entwickelten Bundesstaaten Indiens. Unterstützung durch Gram Vikas, eine international ausgezeichnete NGO in Odisha, wurde mit Unterstützung durch staatliche Einrichtungen in Jharkhand und Chhattisgarh verglichen. Im Zuge der Arbeit wurden die Versorgungsqualität für Nutzer, die Leistung der dörflichen Wasserversorger und der Unterstützungsorganisationen, sowie die Kosten für Unterstützung analysiert. Die Studie zeigt, dass die Versorgungsqualität in Odisha signifikant besser als in den anderen beiden Bundesstaaten und vergleichbar mit der in weitaus reicheren Bundesstaaten Indiens ist. Zwei Hauptfaktoren für diesen Erfolg wurden identifiziert: die hohe Qualität der technischen Infrastruktur, sowie die institutionelle Leistungsfähigkeit von Gram Vikas. Die Bereitstellung von Wasseranschlüssen für jeden Haushalt sowie die hohe Versorgungsqualität wird als transformative Verbesserung gegenüber einer früheren Wasserversorgung wahrgenommen, was zu einer hohen Bereitschaft, für die Wasserversorgung zu zahlen und an ihr mitzuarbeiten führt. Die besseren Resultate der Herangehensweise von Gram Vikas werden auf die organische Organisationsstruktur sowie die höheren Aufwendungen für Kapazitätsaufbau in der Anfangsphase von Projekten zurückgeführt. Diese beiden Aspekte stehen jedoch einer schnellen Ausweitung dieses Konzeptes auf den gesamten Bundesstaat entgegen.

Abbreviations

BRC	Block Resource Centre
CapEx	Capital expenditure
CSP	Community Service Provider
DWSD	Drinking Water and Sanitation Department
ESE	Enabling Support Entity
GDP	Gross Domestic Product
HDI	Human Development Index
INR	Indian rupee
lpcd	Litres per capita per day
MANTRA	Movement and Action Network for Transformation of Rural Areas
NGO	Non-governmental organisation
O&M	Operation and maintenance
OpEx	Operating expenditure
OpExDS	Operating expenditure on direct support
OpExIDS	Operating expenditure on indirect support
PHED	Public Health Engineering Department
PPP	Purchasing Power Parity
QIS	Qualitative Information Systems
USD	United States dollar
VWSC	Village Water and Sanitation Committee
YSMD	Young Student Movement for Development

1. Introduction

Community management has been the predominant model for providing rural water supplies in developing countries for the last three decades (Harvey and Reed, 2006; Moriarty et al., 2013; Schouten and Moriarty, 2003) and is often cited as playing a major role in expanding access to water in rural areas (Lockwood, 2004). However, community management often faces issues of sustainability (Carter et al., 1999; Harvey and Reed, 2006; Moriarty et al., 2013). This is illustrated, for example, by the percentage of non-functioning handpumps in sub-Saharan Africa, estimated at 24% to 36% (Kleemeier, 2010; RWSN, 2009), and the rate of 'slippage' in India, describing water supply systems falling back to a lower level of service, which is more than 30% (Ratna Reddy et al., 2011). There is a growing consensus that ongoing support to communities is necessary for sustainable services (Hutchings et al., 2015; Kayser et al., 2014; Lockwood and Smits, 2011; Triple-S, 2012; Verhoeven and Smits, 2011). However, there is little clarity on the extent of support necessary, its delivery mechanism, and notably little clarity on its cost.

This thesis analyses three case studies of reportedly successful community managed rural water supplies in India with two different support models: two government-supported programmes in Chhattisgarh and Jharkhand, and one supported by the non-governmental organisation (NGO) Gram Vikas in Odisha. These three case studies were selected for this synthesis to analyse what 'best practice' looks like in a challenging socio-economic context and to show the level of success that can be achieved. The three states neighbour each other and share a number of characteristics: a history of political unrest and separatist struggle, a high proportion of marginalised castes, a large tribal population and widespread poverty. They are ranked 23rd, 22nd and 19th on the Human Development Index (HDI) of 23 Indian states (Government of India, 2011) and belong to the poorest states in India. Left-wing extremist groups operate in all three states, in a conflict that has been called *"the biggest internal security challenge facing our country"* by the former Prime Minister, Manmohan Singh (The Hindu, 2010). Chhattisgarh and Jharkhand only became separate states in 2000 and therefore face the additional challenge of developing new support systems and organisations.

NGOs are often innovative in their approaches and instrumental in promoting community involvement in large parts of the world (Lewis and Kanji, 2009). However, they don't have the resources or mandate to scale up to entire states or countries. Specifically, in India the government is increasingly living up to its responsibility to provide services such as water supply to its population, which will likely lead to NGOs playing a smaller role in the long term. In this context the decision was made to analyse an internationally renowned NGO and identify what led to its success, whilst comparing it to government departments with the aim of finding approaches that could be transferred to them. In sub-Saharan Africa, in particular, NGOs still play an important

role in providing rural water supplies, making the lessons learnt from this synthesis relevant for an international context.

Through the case study synthesis this thesis aims to answer the following research questions:

1. What are the current modalities of 'successful' community management and how do they differ in their degrees of effectiveness relative to varying technical modes of supply?
2. What supporting organisations are in place to ensure sustainable water service delivery relative to varying technical modes of supply?
3. What are the indicative costs of effective support organisations relative to varying technical modes of supply?
4. Does support by an NGO (such as Gram Vikas) lead to significantly better services, and what are the additional financial and human resources necessary for it?

Building on these questions, the thesis tries to explore to what extent the approach followed by Gram Vikas is a viable model to scale up to cover an entire state and how transferable it is to other institutions.

The thesis starts by giving a brief history of community management, its criticism and approaches to support it. Then, the research methodology is explained, and the three case studies are introduced and systematically compared, with parallels drawn to existing literature where possible.

The research was conducted as part of the Community Water *Plus* project, a three-year investigation into successful case studies of community management in India (Smits et al., 2015)[1]. Field work in India was undertaken from 23 May 2015 to 06 August 2015. This thesis is based on a paper written by the author as part of a Double-Degree Programme at Cranfield University.

[1] Further information on the project can be found at http://www.waterservicesthatlast.org/countries/india_community_water_plus_project

2. Background

2.1 History of community management

The concept of community management of rural water supplies first appeared in the United Nations' International Drinking Water Supply and Sanitation Decade in the 1980s (Schouten and Moriarty, 2003). The prevailing opinion was that rural water supplies fail because implementation and operation by a central government agency, or indeed local government entities is ineffective and too expensive (Arlosoroff et al., 1987). First steps towards involving communities in rural water supply, usually called community participation, meant that communities contributed labour and formed local groups that only ratified decisions made by external planners. This did not lead to increased local capacity or community empowerment and, in turn, did not improve programme sustainability (McCommon et al., 1990). Community management on the other hand was seen to mean that communities have control and authority over the water supply system; that external agencies provided support in terms of offering technical options, but key decisions were made by the communities; and that the community contributed significantly to construction and also ongoing operation and maintenance (O&M) of the system (Evans and Appleton (eds.), 1993). The end of the 1990s saw the emergence of what was called the demand-responsive approach (DRA), mainly championed by the World Bank (Katz and Sara, 1997; World Bank, 1997). In this approach, external agencies require communities to express a demand for improved services through contributions to capital costs before implementing projects. After construction, users are responsible for covering all operation and minor maintenance costs. To achieve this higher level of community involvement, more meaningful models of participation were advocated. Communities were expected to be able to initiate, plan, decide, manage and own their systems, with strong local water committees and women playing a key role in the planning and operation of schemes (Parker and Skytta, 2000; World Bank, 1997). By the 2000s, community management, combined with the DRA, became so accepted that it was called the 'default' way of implementing rural water supply projects by some authors (Moriarty et al., 2013).

In India, the government has attempted to institutionalise the community management model into rural water supply programmes in the context of its wider goals of decentralisation. The government did this in a very formal way by giving constitutional status to village, block[2] and district level bodies through the 73rd Constitutional Amendment (Government of India, 1993). The lowest level of this local self-government is called Gram Panchayat and is directly elected at the village level. The Gram Panchayat was made responsible for providing a number of services to its residents, including drinking water and sanitation. Community management in India therefore

[2] A block consists of several villages

is often done at the Gram Panchayat level, through a Village Water and Sanitation Committee (VWSC) as a subcommittee of the Gram Panchayat, with varying degrees of autonomy exhibited. A detailed account of the history and roles of Panchayat institutions can be found in the work of Jha & Mathur (1999) or Johnson (2003).

This move towards community management in India was further consolidated through the World Bank-aided Sector Reform Pilot Projects that started in 1999. These pilots were implemented in 26 states and then turned into a countrywide programme called Swajaldara in 2003. These programmes were defined as being based on the DRA with community management. They included community contributions to initial costs and the rule that communities should cover the entire costs for O&M (Government of India, 2003; James, 2004). The current policy set out in the National Rural Drinking Water Programme (Government of India, 2013) also strongly promotes community management and attributes responsibility for drinking water distribution in villages to the Gram Panchayat, or a VWSC as its sub-committee. The policy also incentivises states to increase the ratios of community-managed schemes through special grants.

2.2 Limitations of community management and the need for support

Although community management has become widely accepted, the concept has been subject to criticism. This section reflects on some of the points raised in the academic discussion.

One of the main assumptions in community management is that financial or labour contributions from communities lead to a sense of ownership, which in turn leads to a higher willingness to pay for O&M or repairs. Although this seems obvious, research shows that this automatic relationship is not necessarily present in reality (Harvey and Reed, 2003). Furthermore, Marks & Davis (2012) show that a high sense of ownership among users only occurs when beneficiaries contribute around one month’s income. In most projects however, the contribution is minimal (Jones, 2013) and often waived or reduced to token amounts due to poverty or to speed up the project process. In other cases, private contractors simply pay the community contribution in order to move ahead with the project (Moriarty et al., 2013).

Evidence suggests that legal ownership of assets increases the willingness to maintain infrastructure, however this ownership is often not transferred to communities or is only vaguely defined (Harvey and Reed, 2004; Schouten and Moriarty, 2003). Other authors argue that community-based-organisations being legally recognised as service providers, rather than just having ‘the sense of being a service provider’ is more important than legal ownership of assets. They argue that this formal recognition is often missing, which damages the authority and capacity of water committees (Lockwood and Smits, 2011).

Harvey & Reed (2006) criticise the implicit 'cultural idealisation' in the assumption that rural communities in low-income countries will co-operate and successfully manage their water supplies, when this is almost never the case in developed countries, or indeed for urban customers in both developing and developed countries. They also argue it should not be assumed that every community has a shared interest and the internal resources to actually manage their system (Harvey and Reed, 2004).

Lastly, the extent of choice communities have when deciding on a technology and management arrangement should also be questioned. Most communities do not have a full understanding of the subsequent responsibilities and costs when deciding on a technical solution and are often pushed towards a preferred solution by the facilitator (Harvey and Reed, 2004). Communities should also have the choice of not managing their own water supplies, but to delegate or outsource management to a private company or a utility. In reality this choice is almost never there (Harvey and Reed, 2006).

These limitations have lead many researchers to conclude that community management will only be effective in certain situations, most notably when communities receive ongoing support (Hutchings et al., 2015; Kayser et al., 2014; Triple-S, 2012). This need for ongoing support was identified as early as the 1980s; Arlosoroff et al. (1987, p. 32) for example wrote that, "*periodic monitoring and refresher courses […] will also help to assure reliable operation, and should form part of long-term extension support*". However, this support has often been missing in programmes or was delivered in an unsystematic, ad-hoc way (Lockwood et al., 2003). There is growing evidence of the benefits of systematic post-construction support and calls have been made for its inclusion in projects and programmes (Bakalian & Wakeman, 2009; Kayser et al., 2014; Schweitzer & Mihelcic, 2012; Smits et al., 2011; Triple-S, 2012; Verhoeven & Smits, 2011). Hutchings et al. (2015) systematically reviewed 174 case studies of community management over the last 30 years and identified what they called 'internal and external *plus* factors' leading to success. Of the internal factors, collective initiative was identified as most important initially, with leadership and transparency gaining significance with longer programme durations. The study also confirmed the importance of external support for long-term success. More than 90% of the reviewed high-performing case studies received financial support, whilst technical assistance and managerial advice were also found to be important for success. Over the longer term more complex support was found to be needed, in what the authors call a regulatory framework.

This thesis builds on the literature discussed above by focusing on these issues in the context of three of the poorest and least-developed states in East India.

3. Methodology

This thesis is based on three case studies conducted as part of the Community Water *Plus* project, therefore research for the case studies was carried out following the detailed project methodology outlined by Smits et al. (2015), which is summarised below. In total, 20 case studies of successful community-managed rural water supplies were selected for the Community Water *Plus* project, with the aim of covering the entire hydrogeological, geographical and socio-economical spread of the country. The three case studies in this synthesis were selected for their geographical proximity, socio-economic characteristics and to compare an NGO-supported programme against two government schemes. A map showing the location of the three studied states is given in Figure 1, with Odisha marked in blue, Chhattisgarh in orange and Jharkhand in green.

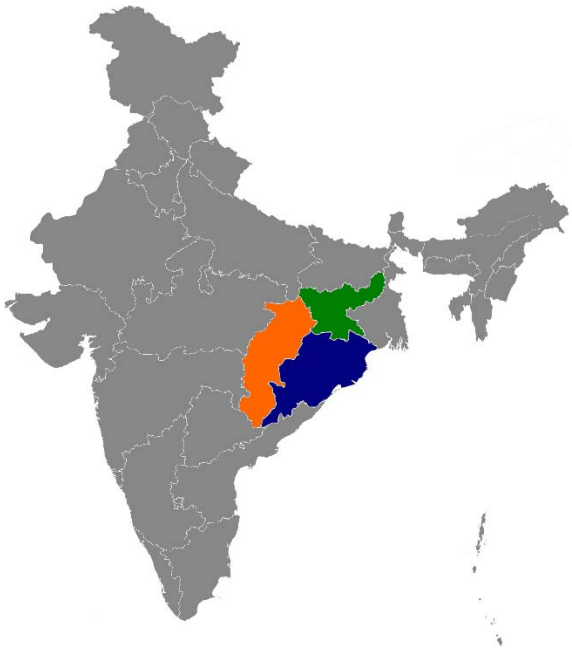

Figure 1: Map of India showing the three studied states (source: freevectormaps.com)

Figure 2 shows the elements of research. The main focus is on what is called the *'plus'*, or more rigorously, the 'enabling support environment'. This first level of analysis, containing the 'enabling support entities' (ESEs), fulfils functions such as planning, coordination, regulation, monitoring and oversight, as well as direct support such as technical assistance (Lockwood and Smits, 2011). The resources and costs associated with this support are a major part of this study and form the second level of analysis. The analysis at the community service provider (CSP) and household level primarily serves to validate whether or not the support from the ESE leads to a better-performing service provider and, in turn, to better services to the users.

Data from each of the case studies was collected in three 'best practice' villages that receive support from the ESE, and one 'control' village, which shares most characteristics but is not

supported by the ESE, or supported in a less effective manner. This enabled an assessment of the effect the support has on service provision.

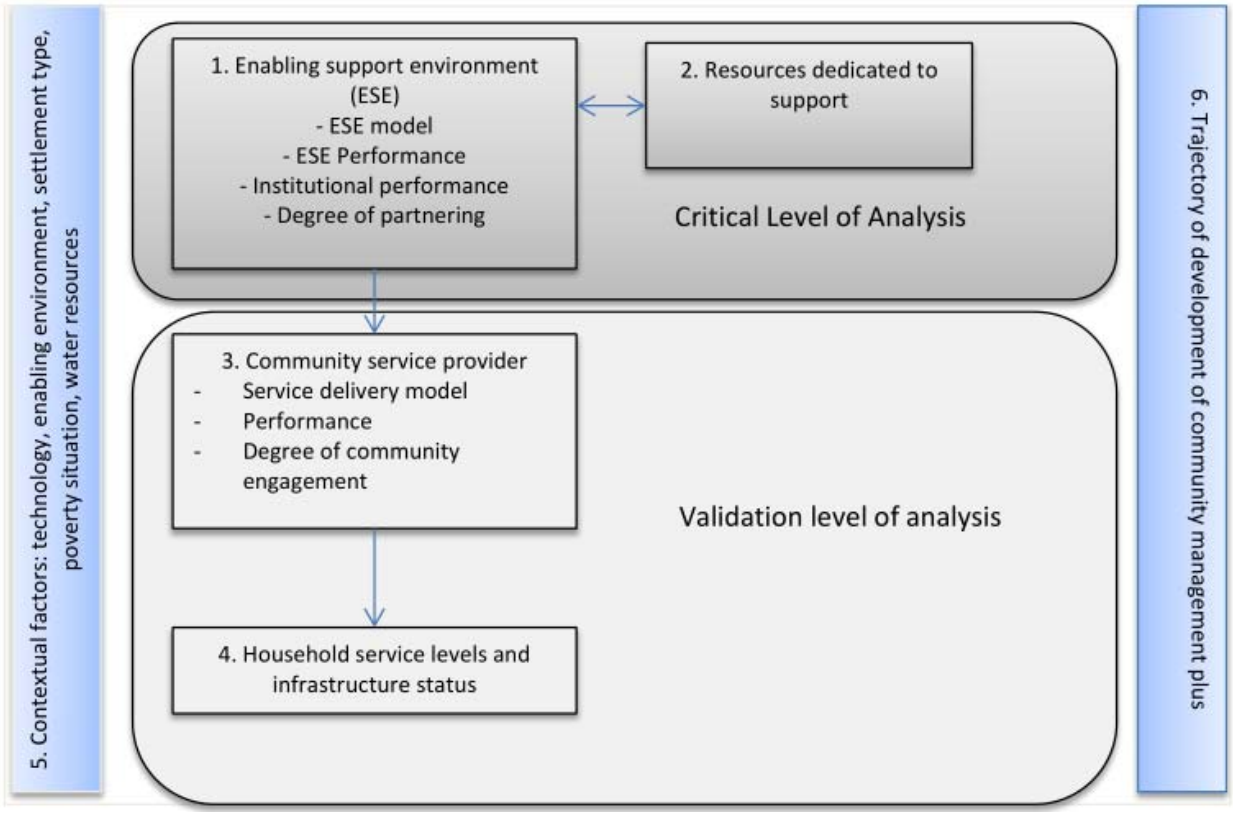

Figure 2: Elements of research in the Community Water *Plus* project (Smits et al., 2015)

In the Community Water *Plus* project, water supply is defined as an on-going service rather than a physical system, as suggested for example by Lockwood & Smits (2011) and Moriarty et al. (2013). Following this concept, called the service delivery approach, effective water supply means that users are provided with a flow of water that meets certain standards on parameters such as quantity, quality or accessibility, instead of just having access to infrastructure.

In this service delivery approach, four phases in the water service delivery cycle are defined, as shown in Figure 3. In the capital intensive investment phase, a new system is constructed and established. This is followed by the service delivery phase in which water is supplied to consumers and the system is kept running by O&M. The service provider is responsible for this O&M, supported by an enabling support environment. After a certain time, major repairs or replacements of physical assets become necessary in what is called the capital maintenance or asset renewal phase. The last phase, service expansion or enhancement, occurs if the service area expands or consumers demand a higher level of service, for example a move from standposts to a piped water system. This expansion or enhancement requires capital investments again, which closes the cycle.

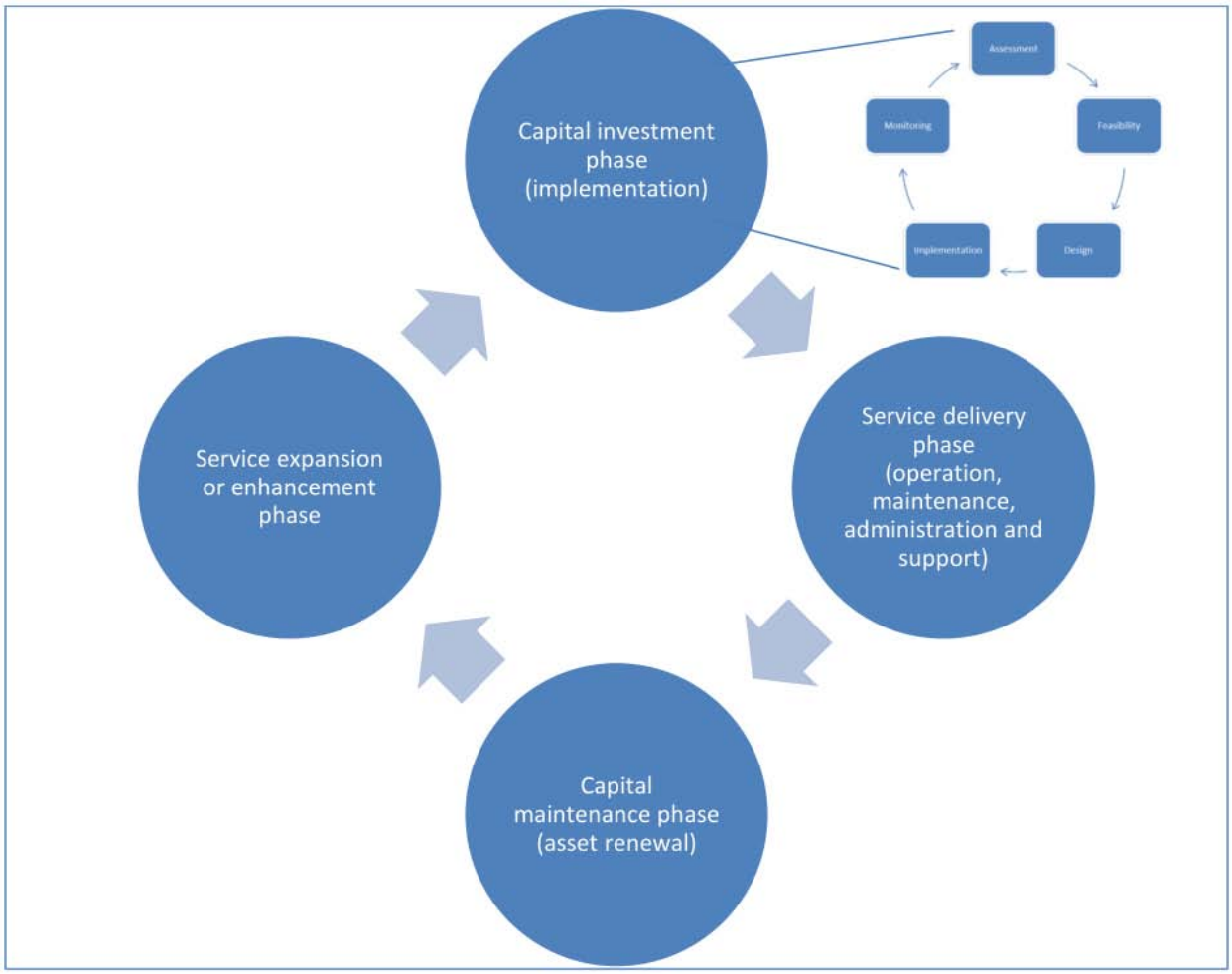

Figure 3: Service delivery cycle (Smits et al., 2015, based on Lockwood & Smits, 2011)

Data on the ESE level was collected and analysed using qualitative and quantitative tools. Secondary sources such as prior publications, annual reports and case studies provided background information, whilst most of the primary data was collected through key informant interviews with senior employees of the organisation and former employees or consultants who could provide an outside view. The ESE's performance, its institutional performance and the degree of partnering were assessed against criteria set out in the project methodology (Smits et al., 2015). Some of the criteria, for example the ESE's information management, are mostly qualitative in nature and were converted to ordinal scores using Qualitative Information Systems (QIS). These systems work by first defining a set of progressive 'ladders' with short descriptions, called mini-scenarios. The researcher then selects the scenario that best describes the situation and thus obtains the corresponding score (Postma et al., 2004). Institutional performance was assessed using an adapted version of the WASH 37 institutional assessment tool developed by Cullivan et al. (1988). Eight key performance areas were assessed using multiple questions with Likert-type scales, resulting in an average score for each performance area. Partnering between the support organisation and service providers throughout the service delivery cycle was assessed using a typology adapted from Demirjian (2002). Six types of partnering were defined,

according to the extent of transfer of ownership and risk, as well as the purpose of partnering. These types are not mutually exclusive, as a partnership can show characteristics of more than one type of partnering. Questions for the institutional and partnering assessment were answered according to observations at the support organisations and using information gathered by interviewing current and former staff members. The questions used for the institutional assessment and scoring tables used for the partnering assessment are given in Appendix 8.1 and 8.2.

Costing analysis was done on the ESE and CSP level and aims at assessing the costs related to supporting and professionalising community management. The focus is on the following cost categories as defined by Fonseca et al. (2011) and Smits et al. (2011):

- capital expenditure on software (CapEx Software), which are costs for work with stakeholders before and during implementation, e.g. community mobilisation, capacity building and information materials;
- capital expenditure on hardware (CapEx Hardware), which are costs for physical project implementation, such as boreholes, concrete structures or pumps;
- operating expenditure for direct support (OpExDS), which are the direct costs for supporting the CSP and other local stakeholders in their day-to-day work, for example by monitoring, technical assistance or conflict management and training;
- operating expenditure on indirect support (OpExIDS), which relates to creating the enabling environment through macro-level planning and policies or regulation;
- the part of operating expenditure (OpEx) covered by the ESE, focussing on costs for professionalisation such as salaries for pump mechanics or office costs for the CSP.

Costing data was gathered from annual reports and accounts, complemented by information from key informant interviews. Historical costs were converted to 2014 costs using the Consumer Price Index calculated by the Reserve Bank of India for software costs (Reserve Bank of India, 2014a) and the Construction Price Index for construction costs (CIDC, 2014). Cost data was collected in INR and converted to USD using the exchange rate of INR 60 per USD 1 as of 30st June 2014 (Reserve Bank of India, 2014b). To aid international comparisons, costs in USD were adjusted by Purchasing Power Parity (PPP) (World Bank, 2015).

Research on the CSP level assessed the service delivery model, its performance and the degree of engagement with communities. Data was collected from secondary sources, key informant interviews with water committee members and focus group discussions in the community. As for the analysis on the ESE level, qualitative data was converted into ordinal scores using QIS and Likert-type scales. The degree of community participation was assessed using a ‘participation ladder’ based on Pretty (1994) and adapted from Arnstein (1969). On this ladder there are five

levels ranging from ‘passive participation’ to ‘self-mobilisation’. Like in the QIS, short descriptions are defined for each level and the one that best represents the situation observed in the field is selected. Furthermore, the status of infrastructure was assessed, as a snapshot indicator of sustainability. Scoring tables used for the CSP performance and participation assessments can be found in Appendix 8.3 and 8.4.

To validate the degree of success found in the cases, the service that users receive was assessed using the service level approach, as suggested by Moriarty et al. (2011). The service level of water supply was scored on five parameters: quantity, quality, accessibility, reliability and continuity. For each parameter, five levels from ‘no service’ to ‘high’ were defined, as shown in Table 1. The ‘basic’ service level corresponds to the Indian National Norms for Rural Drinking Water and can therefore be seen as the minimum acceptable service (Government of India, 2000). In every village, 30 household surveys were conducted, using a systematic sampling method. Based on the survey responses, every household was assigned a service level for each parameter. A more detailed explanation of how the service levels were calculated from survey data is given in Appendix 8.5.

The service levels on the individual parameters were then combined to an overall service level for each household as suggested by Amin et al. (2015). The five scores were averaged using a geometric mean, which has the benefit of providing partial non-compensability, meaning that low scores on one parameter are not compensated by high scores on another (Garriga and Foguet, 2010; Nardo et al., 2008; Swamee and Tyagi, 2000). Thresholds were added to reflect the normative nature of a ‘basic’ service; if any single parameter is scored below ‘basic’, therefore unacceptable, the overall service level cannot exceed it.

Table 1: Service levels (Smits et al., 2015)

Service level	Quantity (lpcd)	Accessibility (cumulative time spent per day by the family on fetching water)	Water quality: perception	Continuity (hours/day)	Reliability: piped supplies	Reliability: handpumps
High	> 80 lpcd	0-10 minutes per day	Good	> 3	Supply above the agreed schedule and duration, and response time does not exceed 24 hours.	Response time is less than 24 hours and handpumps are down for not more than 12 days per year.
Improved	60-80 lpcd	10-20 minutes per day		2-3	Supply above the agreed schedule and duration, and response time doesn’t exceed 48 hours.	Response time is less than 48 hours and handpumps are down for not more than 12 days per year.
Basic	40-60 lpcd	20-30 minutes per day	Acceptable	1-2	Supply according to an agreed schedule and duration and response time doesn’t exceed 48 hours.	Response time is less than 48 hours and handpumps are not broken down for more than 15 days per year.
Sub-standard	20-40 lpcd	30-60 minutes per day	Bad	< 1	Supply has scheduled times, duration and delivery but this is not always met, or response time exceeds 48 hours.	Response time is more than 48 hours or handpumps are broken down for more than 15 days per year.
No service	< 20 lpcd	> 60 minutes per day			Supply has scheduled times, duration and delivery but this is hardly ever met, or response time more than two weeks.	Response time it more than two weeks or handpumps are broken down for more than 30 days per years.

The results from all three cases were compared systematically on each of the four levels of analysis. Common themes were identified and similarities and differences explored. Service levels could be analysed statistically, using the Mann-Whitney *U*-test to compare medians between two groups, the Kruskal-Wallis Test to compare medians between multiple groups, and Kendall's *tau* (τ_b and τ_c) to measure the association between two variables. These nonparametric methods were used because the service levels to be compared are measured on an ordinal scale (Field, 2013; Sirkin, 2006).

4. Case study results

The three states included in this study are located in the east of India. Information on their socio-economics and demographics are given in Table 2. This is followed by a description of the main case study results for each state, which cover the support arrangements, the service providers and the household service levels.

Table 2: Socio-economic and demographic profiles of the states (Government of India, 2011; Ministry of Drinking Water & Sanitation, 2015; Ministry of Home Affairs, 2011; Reserve Bank of India, 2013; World Bank, 2014)

	Odisha	Chhattisgarh	Jharkhand	Indian average
Population (Million)	42	26	33	1,210 (total)
Scheduled Castes[3] (% of population)	17	13	12	17
Scheduled Tribes[3] (% of population)	23	31	26	9
Below poverty line (% of population)	33	40	37	22
HDI rank of Indian states	22	23	19	23 (total)
GDP per capita (USD PPP)	2,998	3,340	2,632	5,833
Literacy (% of population)	73	70	66	74
Access to piped water in rural areas (% of population)	8	9	4	31

4.1 Odisha

4.1.1 Context and history of the support organisation

In the studied villages in Odisha, support is provided by the NGO Gram Vikas, a name that is literally translated as ‘village development’. The organisation started working in Odisha in 1971, when a group of student volunteers from Chennai, called the Young Students Movement for Development (YSMD), came to Odisha after a cyclone left more than a million homeless in the state. Following the immediate disaster response, the volunteers started working with local tribal communities on issues such as livelihoods, rural indebtedness and health care. In 1979, the group found that they had little in common with YSMD back in Chennai and decided to form their own organisation, giving birth to Gram Vikas. The organisation continued to work with the poor and marginalised in the state and played a major role in a programme to promote biogas plants in Odisha in the 1980s, constructing about 80% of all biogas plants in Odisha from 1983 to 1993. In the early 1990s, Gram Vikas started working on water supply and sanitation, through its programme called Movement and Action Network for Transformation of Rural Areas (MANTRA). Water supply and sanitation serves as an entry point to work with communities, and is seen as a

[3] Scheduled Castes and Tribes are some of the most disadvantaged groups in India. They are recognised in the Constitution of India and qualify for quotas under affirmative action programmes.

way to empower marginalised groups in a village, by ensuring representation and coverage amongst these groups (Chowdhury and Santos, 2012; Whinney and Madiath, 2010). Gram Vikas has a particular way of working with communities, in that it requires every single household in the village to actively participate in the water supply and sanitation intervention. Every household has to construct a toilet and separate bathroom before any work on water supply starts, with users contributing around 50% of the costs for toilet construction. In Gram Vikas schemes, every house is provided with three water taps, one for the kitchen, one for the bathroom and one for the toilet. The aim is to provide water for 24 hours a day in all villages. Every household also has to initially contribute to a restricted use capital reserve fund, the interest of which pays for extensions to maintain full coverage with household connections.

Gram Vikas is a widely acclaimed organisation and has won numerous national and international awards, for example the Kyoto World Water Grand Prize and the Ashoka Changemakers Innovation Award (Gram Vikas, 2015).

In terms of water resource availability, annual groundwater withdrawals in Odisha are estimated at 28% of the net annual groundwater availability, which is considered a safe level (Central Ground Water Board, 2014; Rodell et al., 2009).

4.1.2 Enabling support environment

Gram Vikas provides intensive support and capacity building prior to scheme implementation and in the initial period of operation, which leads to service providers being mostly independent during regular operation. After the initial handholding period, support is mostly given on request, which was found to work effectively because of the good communication channels with, and quick response by, the support organisation. Staff working for Gram Vikas come from a range of educational and professional backgrounds such as engineering, social science, community development and management. This diversity and balance between ‘soft’ skills and engineering knowledge is valued highly in the organisation’s leadership. There are clear administrative procedures in place, but as one employee put it, “it is clear that the programme work is the core activity, and the support departments and administration cannot override its practical needs” (Choudhury, 2015, pers. comm., 15 June).

The institutional assessment for Gram Vikas is given in Figure 4 and shows that the organisation scores highly on all indicators. The interviews with employees indicated that staff satisfaction is high, as people are very committed and have a strong sense of working together on a common mission, which leads to the highest possible score on the organisational culture indicator. Employees take pride in their work, identify with the vision and goals of the organisation and are very conscious of the organisation’s history. Staff do not see water and sanitation as isolated

issues or projects, but are committed to community empowerment and development and have this overall goal in mind, which is shown in the high score for community orientation.

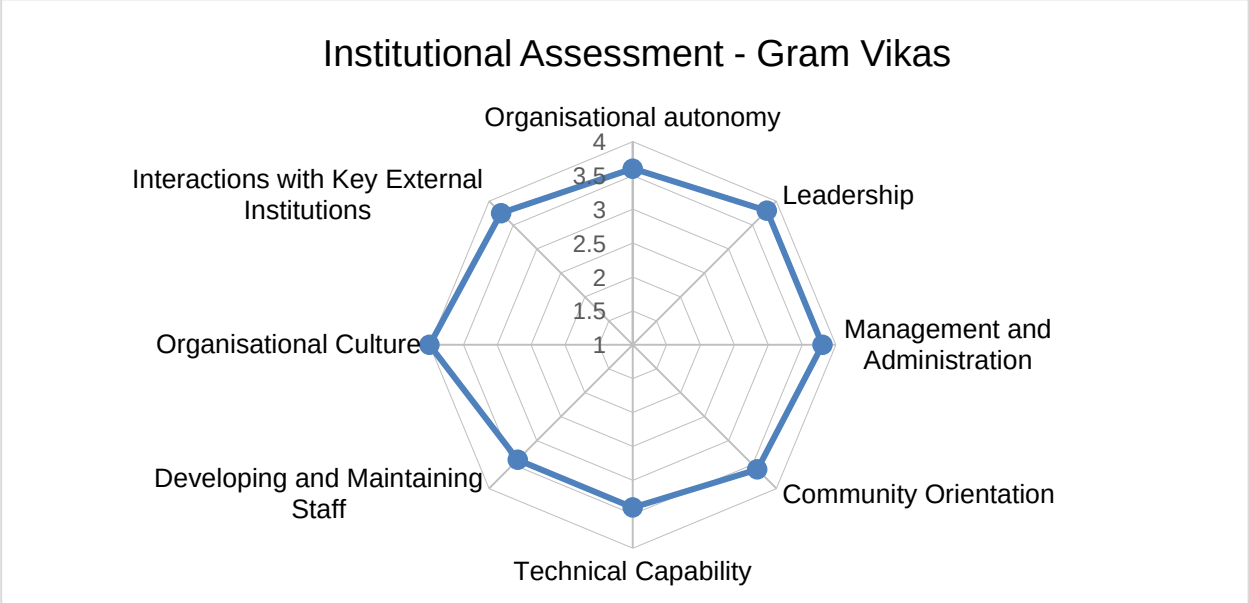

Figure 4: Institutional assessment for Gram Vikas

An assessment of the partnering between Gram Vikas and the community service providers in the studied villages is given in Figure 5. As discussed above, the programme is based on mobilising the entire community and on requiring every single household to participate before work on a water supply project starts. Therefore, a high level of partnering is found in the initial investment phase, with highest scores on the more interactive forms of partnering. Partnering scores for the service delivery phase seem relatively low, as communities usually do not need ongoing assistance or a subsidy for regular operation. However, if problems arise, Gram Vikas was found to give effective support when requested. The situation for system expansion is similar. As discussed above, before the scheme is constructed, a corpus (capital reserve) fund is established with financial contributions from every household. Interest from this fund is used to expand the system to newly constructed houses. Gram Vikas keeps track of these extensions and gives technical assistance if requested, but does not provide financial support. Similarly, Gram Vikas assists service providers in planning capital renewals and gives technical support, but does not cover the costs.

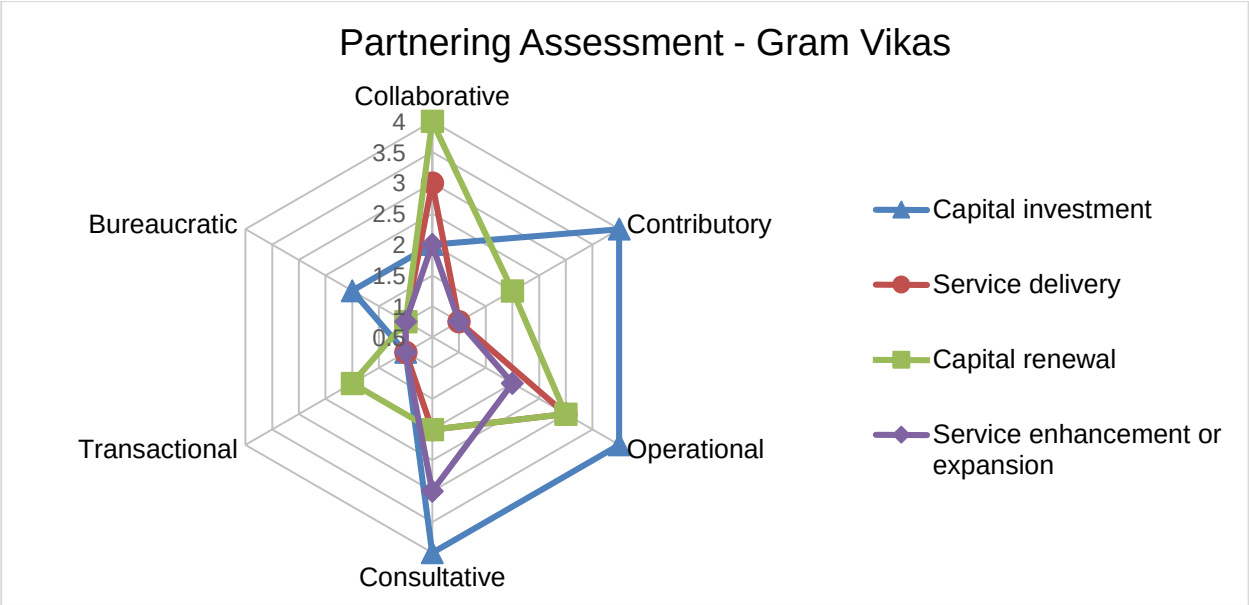

Figure 5: Partnering assessment for Gram Vikas

4.1.3 Community service providers

The four studied villages are located in different parts of Odisha and have populations of around 650 to 3,700. The water supply schemes are all groundwater-based, with water pumped to an overhead storage tank. Coverage with household connections was found to be practically 100% in the best practice villages, which were supported by Gram Vikas, and 29% in the control village, which did not receive support. Water is supplied for 24 hours a day in two best practice villages and five hours a day in the third best practice village, compared to 90 minutes a day in the control village. Two of the best practice villages have automatic chlorination devices using cooking salt and remote pump switching devices that can be operated using mobile phones. Whilst the study found functioning water committees in all four villages, the committees in the best practice villages were found to be more active and engaged with the communities. Table 3 shows results of a QIS assessment of the service providers' performance with scores ranging from 0 to 100.

In the best practice schemes, Gram Vikas assisted the community in forming water committees before the water supply scheme starts. The committee members are selected unanimously by the community, have to include 50% women and represent all castes and social strata, a requirement that was fulfilled in the studied villages. The committee members receive training on the technical operation of the scheme, book keeping and tariff collection. The committees in all villages have bank accounts in their names where the collected tariffs are deposited. Records of transactions were found to be kept by all committees, although they are more systematic in the best practice villages. In none of the villages, external auditing of these accounts takes place.

The committees in the best practice villages were supplied with operational manuals and maps of the pipeline layout. Gram Vikas has a policy of 'de-mystifying' these technical documents in

order to make them more understandable to rural communities by using very simple language and avoiding engineering terms. The hydraulics in the distribution network for example are not explained by using language such as total head and friction losses, but by showing that water flows from higher to lower places. The committees in best practice villages were found to keep systematic records of operation such as the supply duration, a register of users, or records of maintenance works. Measures aiming at water security by reducing water wastage could be observed in the all best practice villages, although mostly motivated by a reduction in electricity bills for pump operation. Water quality is tested in the first two or three years by Gram Vikas but not regularly after that by committee members, because water from deep borewells is seen as safe generally.

Table 3: CSP performance indicators – Odisha

Indicator	Kanamona	Lambrupali	Lakhanpur	*Tinkbir*[4]
Selection of the board of the service provider	50	50	50	50
Information sharing and accountability mechanisms	100	100	100	50
Cash reserves	75	75	75	75
Book keeping	75	75	75	50
Technical folder	75	75	75	25
Registry of operational information	100	100	100	75
Water metering	0*	0	0	0
Water security measures	50	50	50	0
Water quality management	25	25	25	25

***In Kanamona, water meters have been purchased and installation is planned**

There is a high degree of community participation throughout the service delivery cycle, as shown in Table 4. Participation during the initial implementation phase was assessed to be on the functional level. Gram Vikas schemes follow a rather standardised approach and have several non-negotiable rules, such as constructing toilets before work on water supply starts and providing three taps for every house. Therefore, communities are strongly involved during implementation but cannot fundamentally modify the design. In the service delivery phase, interaction participation was witnessed. Water committees consult with the community and they jointly take decisions on the operation of the scheme, such as deciding on the supply duration or the level of tariff. Likewise, decisions regarding asset renewal and service expansion are made in cooperation with the community, which is scored as interaction participation.

Participation in the control village was found to be significantly lower. During implementation, the community is consulted and asked to agree with the design, but cannot demand an alternative.

[4] The names of control villages are written in italics throughout this section.

During service delivery, the community can influence decisions regarding the management of the scheme, but only to a limited extent.

Table 4: Participation assessment – Odisha

Stage of delivery cycle	Kanamana	Lambrupali	Lakhanpur	*Tinkbir*
Capital Investment (implementation)	Functional participation	Functional participation	Functional participation	Participation by consultation
Service delivery	Interaction participation	Interaction participation	Interaction participation	Functional participation
Asset Renewal	Interaction participation	Interaction participation	Interaction participation	Passive participation
Service enhancement or expansion	Interaction participation	Interaction participation	Interaction participation	Passive participation

4.1.4 Household service levels

Service levels in the four studied villages are given in Table 5 and 6. Service levels in best practice villages are significantly higher, with more than 90% of consumers receiving an acceptable overall level of service, compared to 48% of consumers in the control village. Users are very satisfied with the water supply, which confirms the effectiveness of service provision and the higher levels of service achieved through support by Gram Vikas. One modification to the calculation of service levels was necessary to represent the reality of service in this case study. In one best practice village water is available for five hours a day and customers use water for domestic activities during that time. Therefore, users only need minimal storage, the volume of which is the basis for calculating the quantity service level for intermittent supply. Because of the long supply duration and the fact that every household has three taps, it can be assumed that users receive more than the 40 lpcd specified in the Indian Norms for Rural Drinking Water; therefore they were assigned 'basic' scores on the quantity parameter.

As coverage with household connections is virtually 100%, the schemes in best practice villages are equitable by design in regards to access to household connections. Looking at the quantity parameter, as it is the only one which is not uniformly high, no correlation between caste and lower service level could be found. In best practice villages, 61% of households belonging to Scheduled Castes or Tribes receive quantities classified as high, compared to 68% of households belonging to other castes. This difference in service levels was not found to be significant (Independent Sample Mann-Whitney *U*-test, p=0.446), which shows that quantity service levels are equitable in regards to caste.

Table 5: Service levels for best practice villages (n=91) – Odisha

	Best Practice					
	Quantity	**Accessibility**	**Quality**	**Continuity**	**Reliability**	**Overall**
High	65%	97%	100%	99%	96%	**62%**
Improved	0%	0%	0%	0%	3%	**31%**
Basic	30%	0%	0%	1%	0%	**1%**
Sub-standard	0%	1%	0%	0%	1%	**1%**
No service	5%	2%	0%	0%	0%	**5%**

Table 6: Service levels for control village (n=29) – Odisha

	Control					
	Quantity	**Accessibility**	**Quality**	**Continuity**	**Reliability**	**Overall**
High	65%	97%	100%	99%	96%	**3%**
Improved	0%	0%	0%	0%	3%	**45%**
Basic	30%	0%	0%	1%	0%	**0%**
Sub-standard	0%	1%	0%	0%	1%	**14%**
No service	5%	2%	0%	0%	0%	**38%**

4.2 Jharkhand

4.2.1 Context and history

Jharkhand is a state in East India that was carved out of Bihar in 2000, after decades of calls for a separate state for this mostly tribal area. Even though Jharkhand accounts for major parts of India's mineral deposits, for example 28% of its total coal and 26% of iron ore reserves (Indian Bureau of Mines, 2013), it is the 5th least developed state in India (Government of India, 2011). Since its formation, Jharkhand has been politically unstable, with 10 governments and three periods of President's rule[5]. The first Gram Panchayat elections in the new state were held in 2010. Community management was introduced at the same time and VWSCs formed in 2011 following the new Jharkhand Water Policy (Water Resources Department, 2011). Schemes were handed over to VWSCs gradually, but due to a lack of experience the government still needs to give a lot of assistance in O&M. The government entity responsible for rural water supply is the Drinking Water and Sanitation Department (DWSD). The department was formed following the creation of Jharkhand, first as the Public Health Engineering Department (PHED), which was later renamed to DWSD. In Jharkhand, total annual groundwater withdrawals amount to 32% of net annual availability, a level that is considered safe (Central Ground Water Board, 2014; Rodell et al., 2009).

4.2.2 Enabling support environment

Support to the service providers is given by DWSD. The department provides a number of support activities focussing mostly on technical aspects such as water quality testing and less on 'soft' topics such as scheme management or tariff collection. Some support activities such as conflict resolution are the responsibility of an NGO employed as what is called the Block Resource Centre. However, no evidence of these planned support activities could be found, which was explained by the missing mechanism for oversight. The department has a strong focus on engineering and technical solutions. Apart from the administrative and accounting section, all professionals working in the department have an engineering background, and there are no dedicated resources or employees for community interaction or mobilisation.

In the studied villages, DWSD often pays for spares and DWSD staff are directly involved in O&M, for example by sending the department plumber to repair broken pipes. Furthermore, the CSPs' electricity bills are paid by the department, which represents a major subsidy. However, according to DWSD guidelines, water committees should be responsible for all O&M, which shows the

[5]President's rule is a mechanism where a state is ruled directly from the central government when the state government fails (Government of India, 1949). In Jharkhand it was invoked because governments repeatedly lost their parliamentary majority.

somewhat unclear support arrangement. In the first year after handing over the scheme, the department provides a grant matching the amount of tariff collected after audited records are submitted, to incentivise providers to generate revenue.

Results from the institutional assessment for DWSD are shown in Figure 6. As could be expected from a department focused on engineering, it scores highly on the technical capability indicator. Staff are qualified and able to design appropriate infrastructure, although quality control of the final product was found to work less effectively. DWSD leadership operates with a high degree of autonomy and maintains good contacts with external institutions. The department scores relatively low on the remaining indicators. There are no systems for systematic staff development or hiring people with the right skills. Employees feel that promotions are not given by merit but based on seniority or personal connections. The organisational culture indicator was scored lowest, as very little team spirit or identification with the organisation's values could be observed in the interviews with department staff.

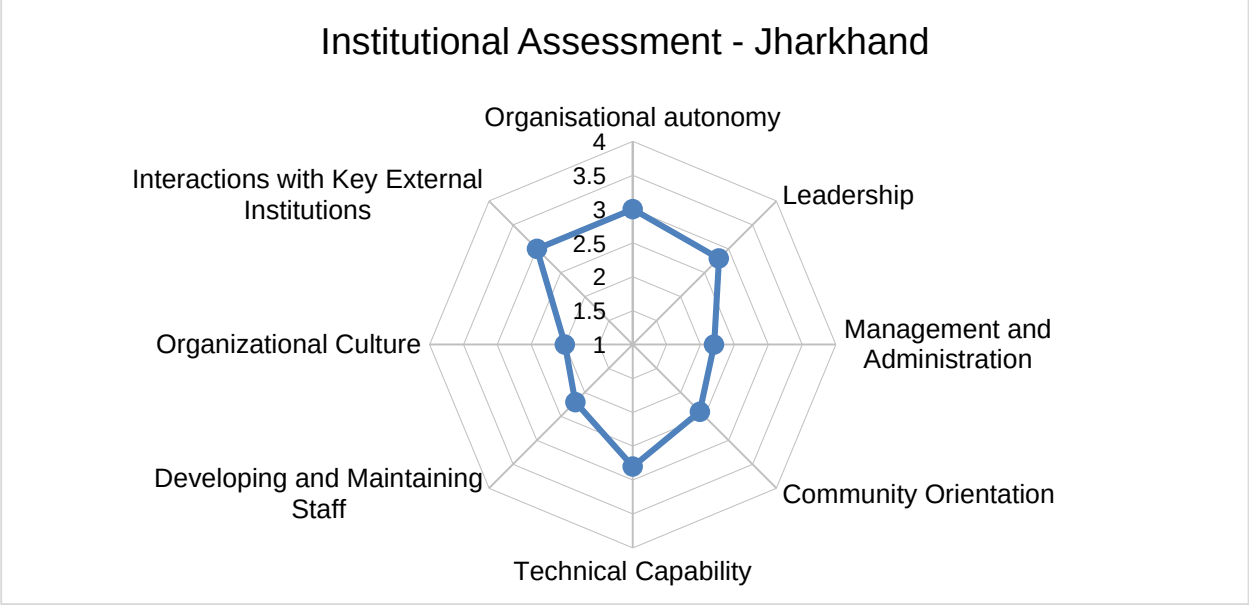

Figure 6: Institutional assessment for DWSD Jharkhand

As shown in Figure 7, the predominant form of partnering between DWSD and CSPs is the transactional type. New schemes, as well as asset renewal or major repairs follow a request by communities and negotiations with the department. In these negotiations and during the scheme design by DWSD engineers, the community is consulted, but there is no scope for the community to request major amendments in the design. In the service delivery phase there is evidence of contributory and operational partnering, defined by a pooling of resources and labour, respectively. The department pays the water committee's electricity bills and department engineers give assistance in the routine operation of the schemes. No specific evidence on service enhancement or expansion could be gathered as part of this study, this phase was therefore not assessed.

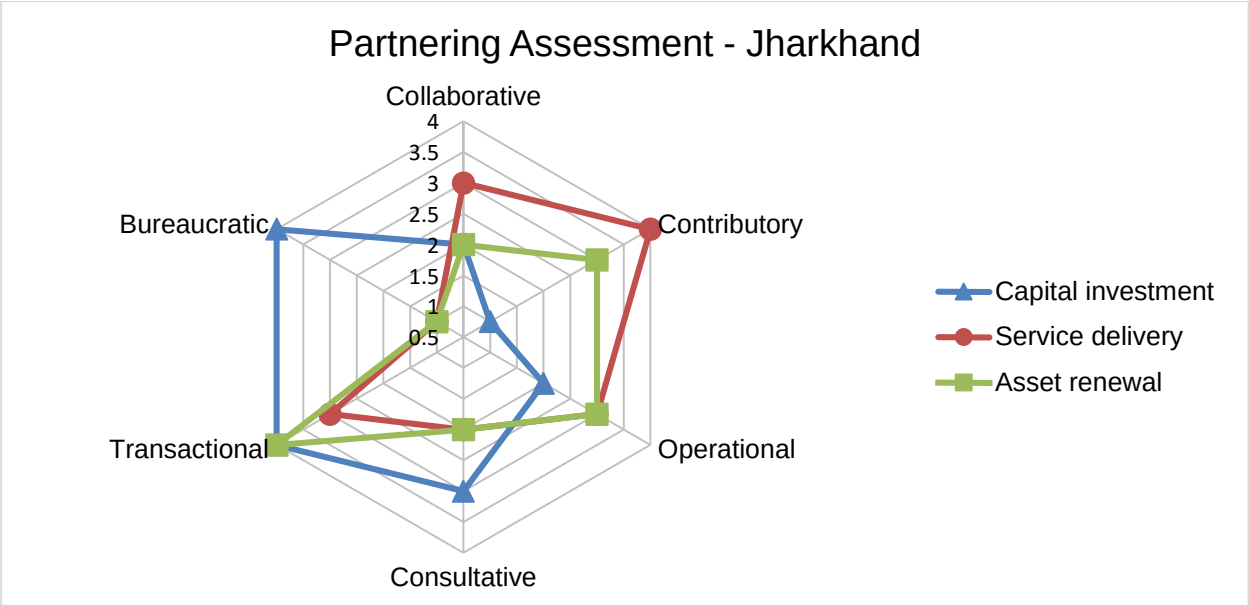

Figure 7: Partnering assessment for DWSD Jharkhand

4.2.3 Community service providers

The four studied villages are located in Ranchi district close to the state capital and have populations of around 4,000 to 7,000. Coverage with household connections was found to be between 15% and 42%. As state guidelines prohibit the construction of public standposts, households without private connections rely on handpumps or private wells and boreholes. Two out of the three best practice villages are supplied using surface water, by drawing water from a nearby river, whilst in the other two villages groundwater is pumped into an overhead storage tank and distributed from there.

The study found that water committees are managing the water supply in all villages, with each committee employing a 'Jal Sahiya' (translated as water volunteer) who acts as a treasurer and is responsible for water quality testing. These Jal Sahiyas are selected from the daughters-in-law of the village, as they do not leave the village after marriage and therefore ensure continuity of membership.

An assessment of the service providers' performance is given in Table 7. In all villages, VWSC members are selected in the general village meeting, but there is no formal document describing this process. At least 50% of the members, as well as 50% of the executive committee, i.e. president, vice president and Jal Sahiya, should be women, a requirement that is fulfilled in all studied villages. Information is shared with the community by bringing up issues regarding the water supply scheme in the general village meeting, which is held every month. Decisions on major issues such as tariff increases have to be discussed and agreed upon in these general village meetings. The committees have bank accounts in their name that are separate from the Gram Panchayat, to stop the Gram Panchayat from spending money from the water budget on

other activities. Although records of income and expenditure were kept in all studied villages, some discrepancies could be observed and the accounts were found not to be very systematic, which explains the relatively low scores for book keeping. The committees in best practice villages had a map of the scheme, operational guidelines and were found to keep track of operational information. Measures regarding water security or water resource management could not be found in any of the villages. Similarly, none of the studied committees were metering their consumers' water consumption. Water quality should be tested annually by the Jal Sahiya, which was found to be the case in two of the best practice villages.

Table 7: CSP performance indicators – Jharkhand

Indicator	Bero	Khijri	Rai Bazaar	*Brambe*
Selection of the board of the service provider	50	50	50	50
Information sharing and accountability mechanisms	50	50	50	50
Cash reserves	100	100	100	100
Book keeping	50	50	50	25
Technical folder	75	75	75	25
Registry of operational information	100	100	100	50
Water metering	0	0	0	0
Water security measures	0	0	0	0
Water quality management	100	50	100	25

Community participation, as shown in Table 8, varies between the villages. Participation in Bero, one of the best practice villages, was found to be on the 'interactive' level throughout the service delivery cycle, meaning that the community and service provider take decisions in cooperation. This high level of participation is mostly due to the efforts the committee takes in this village to involve the community in village meetings and through informal channels. The other best practice villages show mostly 'functional' partnering, meaning that arrangements and plans are discussed with the community, which has the chance to amend limited elements. In the control village, there is very limited participation. Communities are consulted during service delivery, but cannot get involved or demand major changes. In the other phases, the community in the control village does not participate, but is only informed of planned measures.

Table 8: Participation assessment – Jharkhand

Stage of delivery cycle	Bero	Khijri	Rai Bazaar	*Brambe*
Capital Investment (implementation)	Interaction participation	Functional participation	Functional participation	Passive participation
Service delivery	Interaction participation	Interaction participation	Interaction participation	Participation by consultation
Asset Renewal	Interaction participation	Functional participation	Participation by consultation	Passive participation
Service enhancement or expansion	Interaction participation	Functional participation	Functional participation	Passive participation

4.2.4 Household service levels

Household service levels in the studied villages are shown below in Table 9 and 10. In the three best practice villages, more than a third of users access quantities classified as unacceptable or receive water for less than one hour a day, showing that major challenges remain in this state. Still, the level of service provided can be seen as a relative success, as service is significantly better than in the control village, in which only 10% of consumers receive an acceptable overall service level.

The service level data suggests that the schemes are inequitable in regards to caste. In best practice villages, only 24% of households belonging to Scheduled Castes and Tribes, which represent marginalised groups, have household connections, compared to 65% of those belonging to other castes. Likewise, the percentage of users receiving inacceptable service on the quantity parameter is 45% for Scheduled Castes and Tribes, compared to 25% for other castes. This inequitable service is mostly caused by the settlement pattern. Marginalised groups tend to settle on the edge of studied villages and the piped water system often does not reach their parts of the village. Involving these groups more strongly in the planning phase and providing connections in their parts of the village could lead to more equitable schemes.

Table 9: Service levels for best practice villages (n=90) – Jharkhand

	Best Practice					
	Quantity	**Accessibility**	**Quality**	**Continuity**	**Reliability**	**Overall**
High	26%	87%	74%	2%	98%	**9%**
Improved	9%	2%	0%	9%	1%	**32%**
Basic	32%	1%	16%	51%	0%	**3%**
Sub-standard	20%	5%	10%	37%	1%	**40%**
No service	13%	5%	0%	0%	0%	**16%**

Table 10: Service levels for control village (n=30) – Jharkhand

	Control					
	Quantity	**Accessibility**	**Quality**	**Continuity**	**Reliability**	**Overall**
High	10%	67%	83%	0%	93%	**0%**
Improved	0%	3%	0%	0%	3%	**10%**
Basic	23%	3%	10%	20%	0%	**0%**
Sub-standard	30%	10%	7%	80%	3%	**40%**
No service	37%	17%	0%	0%	0%	**50%**

4.3 Chhattisgarh

4.3.1 Context and history

Like Jharkhand, Chhattisgarh was formed as a new state in 2000, by splitting away parts of Madhya Pradesh. Compared to Jharkhand, recent politics in the state have been stable, which has led to relatively strong Gram Panchayats. The Public Health Engineering Department (PHED) Chhattisgarh is responsible for implementing rural water supply schemes and supporting communities in their management. The department was formed when Chhattisgarh became a separate state. Before it became a separate organisation, the department was part of PHED Madhya Pradesh and had a similar way of operation.

Annual groundwater withdrawal in the state is estimated at 35% of the net annual groundwater availability, which is considered a safe level (Central Ground Water Board, 2014; Rodell et al., 2009).

4.3.2 Enabling support environment

Service providers in the studied villages received support from PHED. In the initial three to six months after a water supply scheme is constructed, PHED directly operates the scheme and involves local technicians and the community service provider. This was found to be crucial to the support arrangement as it ensures the functioning of the system and that communities have experience in running the schemes before they are handed over. After the schemes are transferred to the communities, there is a lack of systematic support to CSPs. An annual grant of INR 15,000 (USD 856 at PPP) is given to service providers, whilst other support is mostly confined to water quality and functionality testing. Although parts of the PHED recognise a need for more intensive support, there is no special funding or clear mandate for it. The department is dominated by engineers and there is no staff trained in community engagement or social sciences.

As shown in the institutional assessment given in Figure 8, qualified technical staff and effective administrative procedures lead to high scores on the technical capability as well as management and administration indicators. The focus on technical project implementation, combined with the attitude of viewing rural communities as backwards and unable to run schemes themselves witnessed in parts of the organisation, leads to the low score on community orientation. Interviewed staff did not display a sense of common mission or vision, leading to a low score on the leadership indicator. The comparatively high scores on the remaining indicators suggest that the department is nevertheless seen as an attractive place to work and is a stable, well-established organisation.

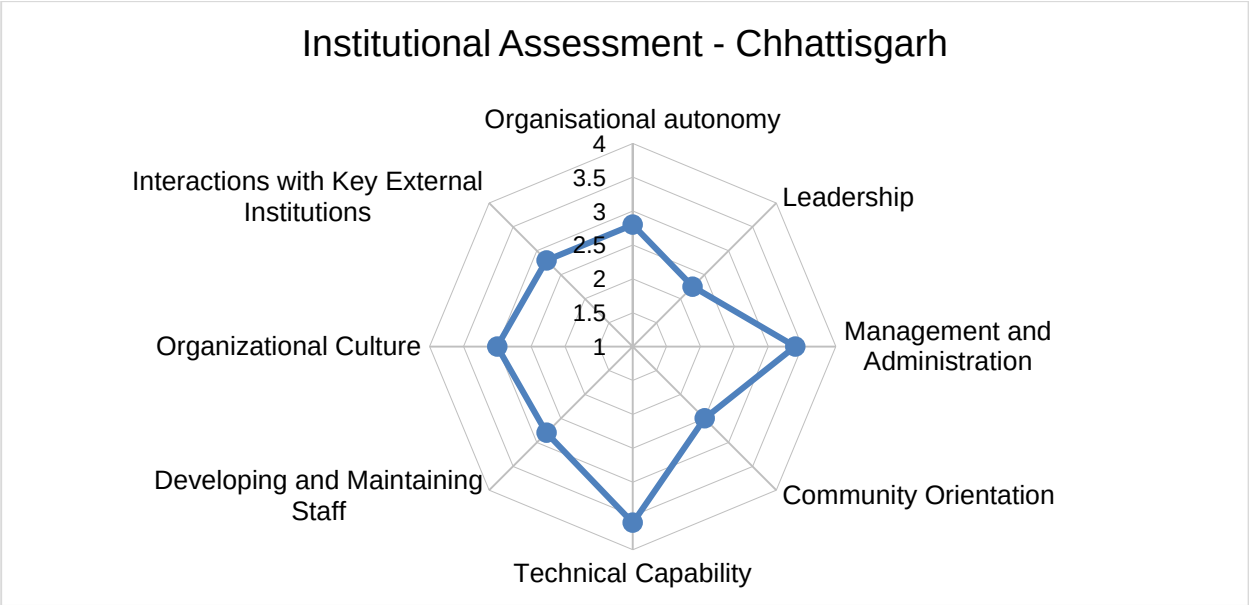

Figure 8: Institutional assessment for PHED Chhattisgarh

As shown in Figure 9, partnering between the support organisation and service providers is dominated by the bureaucratic type. Official guidelines define procedures, roles and responsibilities for both actors throughout the service delivery cycle. Transactional partnering is also scored highly, as communities file a request for new schemes, extensions or renewals and the PHED responds to it. The department informs communities about planned projects and measures and gives them a chance to amend limited elements, such as the location of overhead reservoirs, which leads to the high scores for consultative partnering. The low scores on the other forms of partnering show that there is limited direct cooperation between the PHED and service providers, apart from the annual grant given to water committees, which can be seen as a form of financial cooperation.

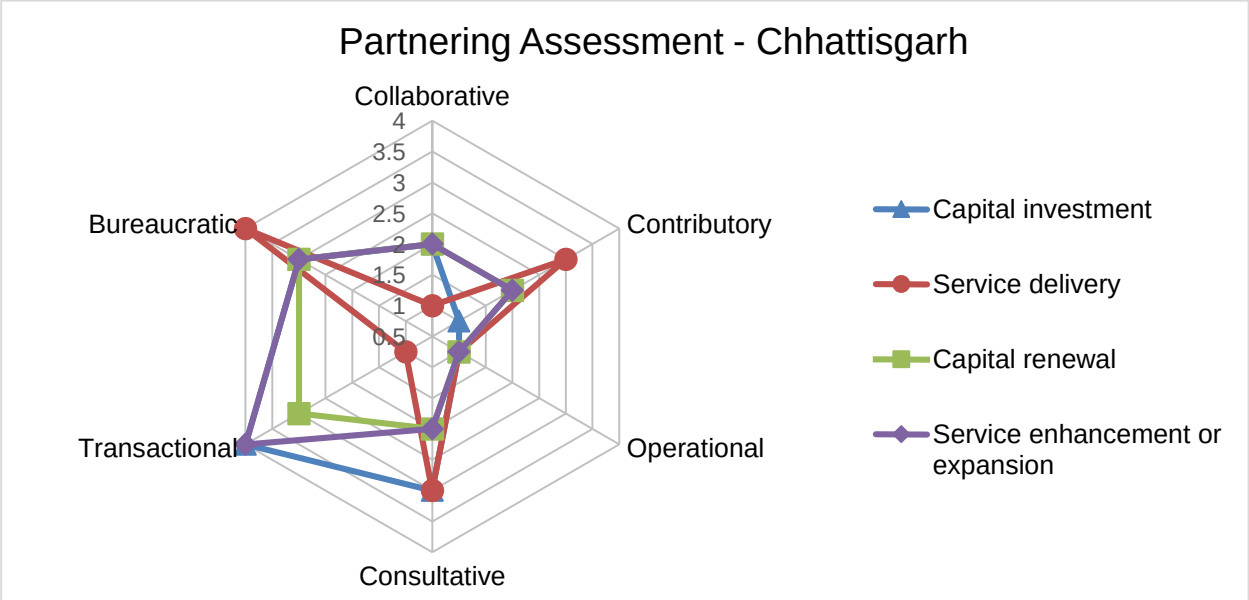

Figure 9: Partnering assessment for PHED Chhattisgarh

4.3.3 Community service providers

The studied villages are located in Rajnandgaon district and have populations of around 1,000 to 2,500. Coverage with household connections was found to be between 33% and 66%, with the remaining residents relying on public standposts, handpumps and private wells.

In the studied villages, the schemes are managed by communities through the Gram Panchayat. Although government guidelines mandate that rural water supply should be managed by water committees, an independent, functioning water committee could only be found in one village, Kutulbod Bhatagaon. In the other villages, a water committee only existed on paper or was not active, and therefore responsibility for water supply reverted to the Gram Panchayat. Although this could be viewed as a lower level of community involvement, it did for example enable one of the service providers to use its authority as local self-government to enforce tariff collection. This was done by withholding all Gram Panchayat benefits, such as pensions or ration cards, to users who do not pay their water bills.

An assessment of the service providers' performance is given in Table 11. In all villages, book keeping and management of funds is done by the Gram Panchayat secretary as part of the overall Gram Panchayat accounts. The Gram Panchayat accounts are audited externally every year, but this audit is not specifically focused on the accounts related to water supply. None of the studied villages had operational manuals or maps of the water supply systems. The committee in Kutulbod Bhatagaon was found to keep a registry of users and of breakdowns and maintenance, whilst the other three providers only had a list of users. Field kits for testing water quality had been supplied to the service providers, but no evidence of regular testing or a water quality management plan could be found.

Table 11: CSP performance indicators – Chhattisgarh

Indicator	Kutulbod Bhatagaon	Amatola	Belgaon	*Chilhati*
Selection of the board of the service provider	50	N/A	N/A	N/A
Information sharing and accountability mechanisms	50	50	50	25
Cash reserves	75*	75*	75*	75*
Book keeping	100*	100*	100*	25*
Technical folder	0	0	0	0
Registry of operational information	75	25	25	25
Water metering	0	0	0	0
Water security measures	0	0	0	0
Water quality management	0	0	0	0

***: Accounting and management of funds is done as part of the Gram Panchayat accounts**

Community participation in the best practice villages was assessed as mostly 'functional', as shown in Table 12. Users are consulted about major decisions through village meetings or informal channels. Communities receive information about planned activities and can request limited amendments. For example, the community is involved in deciding on the location of the overhead storage tank, and tariff increases have to be approved in the village meetings. The highest level of participation was found in the service enhancement phase in best practice villages, as decisions on system expansions follow intensive discussions with the community.

Table 12: Participation assessment – Chhattisgarh

Stage of delivery cycle	**Kutulbod Bhatagaon**	**Amatola**	**Belgaon**	***Chilhati***
Capital Investment (implementation)	Functional participation	Functional participation	Functional participation	Functional participation
Service delivery	Functional participation	Functional participation	Functional participation	Functional participation
Asset Renewal	No data	Functional participation	Functional participation	Participation by consultation
Service enhancement or expansion	Interaction participation	Interaction participation	Interaction participation	Participation by consultation

4.3.4 Household service levels

Service levels gathered through household surveys in the four villages are shown in Table 13 and 14. Although just over half of the respondents in best practice villages receive an acceptable overall service, the service levels there are still significantly higher than in the control village, where only 10% of users receive acceptable overall service levels. This shows the relative nature of success in this state. Quantity service levels are quite poor also in best practice villages, particularly amongst users of point sources such as handpumps or standposts. Almost 90% of handpumps users were found to access quantities classified as unacceptable, which is comparable to studies in Uganda, where a study showed that two thirds of users fetching water from point sources did not consume quantities that meet national standards (Bey et al., 2014; Magara, 2014).

Access to household connections is inequitable in the studied sample. In best practice villages, only 43% of households belonging to Scheduled Castes and Tribes have a private connection, compared to 65% of households belonging to other castes. Likewise, 52% of surveyed households belonging to Scheduled Castes and Tribes receive an unacceptable overall service, compared to 38% of those belonging to other castes. This inequity is probably linked to the settlement pattern. Marginalised groups tend to live on the edge of villages which are not reached by the distribution network. Involving these marginalised groups more strongly in the planning phase and in designing the pipeline layout could lead to more equitable schemes.

Table 13: Service levels for best practice villages (n=90) – Chhattisgarh

	Best Practice					
	Quantity	**Accessibility**	**Quality**	**Continuity**	**Reliability**	**Overall**
High	21%	58%	99%	44%	98%	**10%**
Improved	22%	1%	0%	20%	2%	**46%**
Basic	16%	8%	1%	36%	0%	**0%**
Sub-standard	29%	16%	0%	0%	0%	**19%**
No service	12%	18%	0%	0%	0%	**25%**

Table 14: Service levels for control village (n=30) – Chhattisgarh

	Control					
	Quantity	**Accessibility**	**Quality**	**Continuity**	**Reliability**	**Overall**
High	20%	57%	100%	0%	97%	**0%**
Improved	13%	3%	0%	0%	0%	**10%**
Basic	10%	3%	0%	16%	0%	**0%**
Sub-standard	23%	20%	0%	84%	0%	**50%**
No service	33%	17%	0%	0%	3%	**40%**

5. Synthesis and Discussion

This section compares the results of the three case studies and explores the factors contributing to success. It starts by focusing on the actual service users receive, as a high service at the household level validates the effectiveness of the support and service provision.

As shown in Figure 10, service levels in the best practice villages in Odisha are significantly better than in best practice villages in the other two states (Independent Samples Kruskal-Wallis Test, $p<0.001$). Odisha is the only state that has a significant percentage of users with high service levels, and has the smallest percentage of consumers receiving a service that fails the Indian Norms for Rural Drinking Water. There is no statistically significant difference between service levels in Jharkhand and Chhattisgarh (Independent Samples Mann-Whitney-*U* Test, $p=0.56$), showing that both systems deliver a lower, but similar level of service to users. The very high level of service achieved in the Gram Vikas schemes can be seen as a 'transformational' rather than incremental improvement in service from traditional water sources or handpumps. This transformation could explain the willingness to participate, pay tariffs and the generally high sense of ownership observed in Odisha. People are proud to live in a village with a Gram Vikas scheme, shown for example by anecdotal evidence of women from villages with Gram Vikas schemes refusing to marry into a village where Gram Vikas has not been active. By reaching this very high service level, the service providers in Odisha managed to escape from what has been called a 'low-level equilibrium trap' by several authors (Altaf et al., 1993; Savedoff and Spiller (eds.), 1999; Singh et al., 1993; Strand, 2012). In this low-level equilibrium, low tariffs and low willingness to pay lead to low service levels and utility performance, and vice versa. This vicious cycle is broken by the transformative change in the Gram Vikas schemes, which reach a high-level equilibrium in which satisfied users are willing to pay and the service is good. Contributing to this success might be the fact that in cohesive systems such as the schemes in Odisha all members of the community have a stake in the success, whilst the fragmented systems in the other states serve only parts of the population, limiting participation.

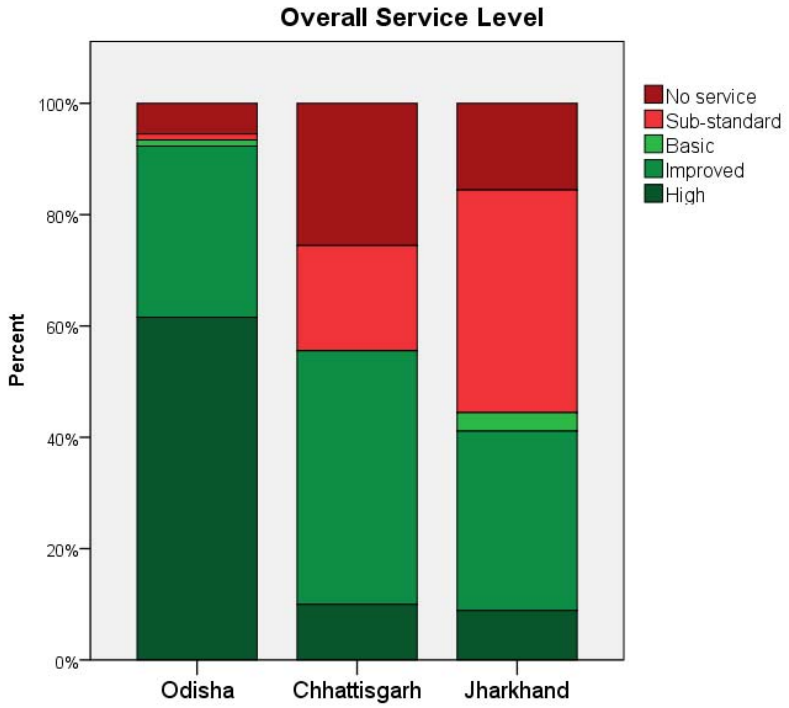

Figure 10: Comparison of overall service levels in best practice villages in the three states

Two of the highest-performing case studies completed in the Community Water *Plus* project so far are located in Gujarat, a state with a GDP per capita more than twice as high as Odisha (for the full case studies see Chary et al., 2015a, 2015b). There is no statistically significant difference between service levels in the Odisha and Gujarat case studies (Independent Sample Mann-Whitney-*U* Test, p=0.45), showing that support by Gram Vikas leads to services comparable to those in much wealthier states.

Gram Vikas schemes cover all residents, which guarantees equity in access to household connections. In both other states, marginalised groups, represented by Scheduled Castes and Tribes, have a significantly lower percentage of household connections (Chhattisgarh: τ_b=0.218, p=0.035; Jharkhand: τ_b=0.412, p<0.001). These groups usually live at the edge of the village in hamlets that are not covered by the distribution network. This suggests that schemes in these states face issues of equity and that there is a failure to address them appropriately.

The overview of costs given in Table 15 shows that CapEx Software, which includes community mobilisation, capacity building and initial training, is significantly higher in Odisha than in the other two states. As discussed above, Gram Vikas places a high importance on this phase and the mobilisation happens over a long period of time. This intensive mobilisation is necessary to ensure full coverage and collaboration of all households and is seen as one of the drivers of success for this model. In Chhattisgarh there is a lower investment in CapEx Software, but communities are involved and trained in the initial phase after construction when PHED is operating the scheme directly. CapEx Software in Jharkhand is almost non-existent and only consists of some staff days

during the planning and construction phase when DWSD engineers inform the community of the scheme design and explain the management arrangement. The service levels in Jharkhand and Chhattisgarh are not significantly different, which suggests a threshold effect in this initial support. The limited spending in Chhattisgarh did not make a difference in the service users receive, it is only with the significant support in Odisha that a difference in service levels becomes apparent.

Table 15: Overview of costs

Capital costs per person (USD PPP)	Odisha	Chhattisgarh	Jharkhand
CapEx Hardware (community contribution to CapEx in brackets)	135 (24)	125 (0)	252[6] (0)
CapEx Software	5.1	1.3	0.3
Total CapEx	164	126	252
Recurring cost per person and year (USD PPP)			
OpEx paid by community through tariffs	3.59	2.65	1.20
OpEx paid by Gram Panchayat	0	2.26	0
OpEx paid by ESE	0	0.40	3.02
Total OpEx excluding support costs	**3.59**	**5.31**	**4.22**
OpExDS	1.88	0.11	0.86
OpExIDS	0.46	0.17	0.06
Total costs to ESE	**2.34**	**0.68**	**3.94**
Total recurring costs	**5.93**	**5.59**	**5.14**

Recurring support costs also vary between the three cases. Whilst Gram Vikas spends significantly more on direct support than the departments in the other two states, it does not provide any subsidies for the day-to-day operation of schemes as the tariffs collected by VWSCs are sufficient to cover operation and maintenance. In Jharkhand, direct support costs are much lower, however the department covers a majority of the costs of running the scheme because VWSCs do not have the capacity to collect sufficient tariffs to cover operating expenses. In Chhattisgarh the direct subsidy from PHED is comparatively low and the collected tariffs do not meet the operating expenses, so the Gram Panchayats cover major parts of the recurring costs from their general funds. They pay an average of 46% of the recurring costs in the studied villages. An analysis of fund sources revealed that in these villages, state or central government grants represent 75% of Gram Panchayat income. Therefore, more than half of OpEx in Chhattisgarh is paid by either the PHED grant or through government grants to the Gram Panchayat directly, showing how dependent the service providers are on direct subsidies for ongoing operation. This comparison of support costs and direct subsidies suggests that the high spending on initial training and ongoing support in Odisha, as well as the complete coverage and high level of service reached, lead to successful schemes in which VWSCs achieve financial sustainability. The

[6] CapEx Hardware per capita in Jharkhand is higher because two of the studied villages are surface water-based.

service providers in Odisha cover their operating expenses from tariffs, which is not the case in the other two states. As a result, although total recurring costs are higher, ongoing costs to the support organisation are lower in Odisha than in Jharkhand, because Gram Vikas does not need to subsidise ongoing operation.

An analysis of direct support costs in different countries reached the conclusion that in order to ensure effective support, more than USD 1 per person and year should be spent (Smits et al., 2011). This level is reached in Odisha, whilst the department in Jharkhand spends a little less. The expenditure on direct support in Chhattisgarh is significantly lower, suggesting that the support is not effective, a view that is confirmed by observations in the field. Although PHED staff do water quality testing and check the functionality of schemes, results are not fed back to the community and this support does not have an impact on the performance of service providers.

The average community contribution to capital costs in Odisha amounts to 5% and 7% of the mean and median monthly income of respondents, respectively. As quoted earlier, Marks & Davis (2012) find that only a contribution of around one month's income leads to a high sense of ownership, suggesting that in our case study not the amount of contribution, but rather the type of intensive participation in the scheme design and implementation leads to the high levels of ownership observed. In the same study, the authors also find that both a household providing a labour contribution and having a private tap are significantly associated with a high sense of ownership. These two factors are present in Odisha, likely contributing to ownership.

An assessment of the supporting organisations' institutional performance is given in Figure 11. Gram Vikas scores highest on all indicators, showing that it is an organisation able to give comprehensive support to service providers. The difference between Gram Vikas and the other organisations is most pronounced for the community orientation and leadership indicators, highlighting the relative weakness of the studied government departments in interacting and engaging with communities. This was recognised by the department in Jharkhand, but issues of governance and accountability proved to be a challenge in addressing it. In this state, DWSD engages an NGO to act as what is called a 'Block Resource Centre' (BRC) to provide capacity building and ongoing software support to communities. Although funding is provided to BRC, no evidence of the planned support activities could be found. An official stated off-the-record that the BRCs do not provide the support they are paid for due to the lack of an oversight mechanism, and that the funding for the support is split between the owner of the NGO and corrupt officials. Building on the wider literature on development theory, this could be classified as isomorphic mimicry, where an organisation adopts the form and appearance of functioning effectively but does not deliver any of the actual outputs (Pritchett et al., 2013). This situation can often emerge in large public organisations in developing countries, especially if corruption is widespread. India

is ranked 85th of 175 countries on Transparency International's Corruption Perceptions Index (Transparency International, 2014), whilst Transparency International India classified the level of overall corruption in Jharkhand as 'high' (Centre for Media Studies, 2008). Gram Vikas does not face these issues because staff are highly committed to the organisation's values and there is a strong sense of mission, represented by its high scores on the leadership and organisational culture indicators in the institutional assessment.

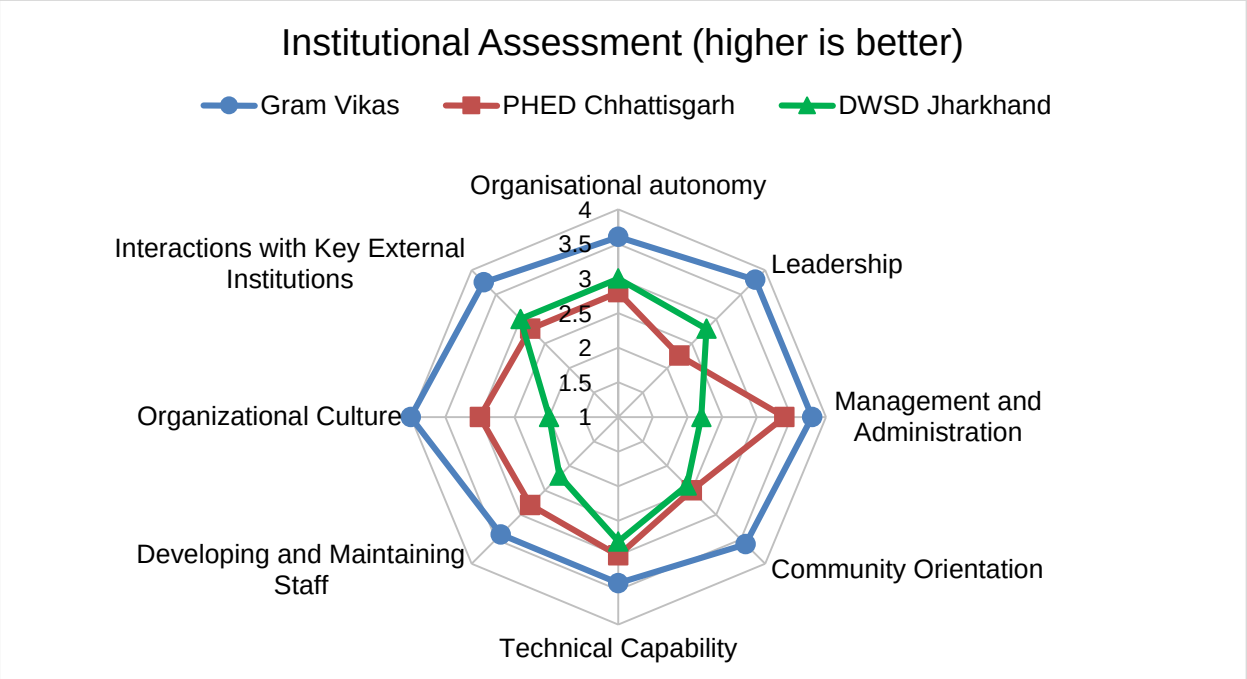

Figure 11: Comparison of institutional assessment scores

According to the typology by Burns & Stalker (1961), Gram Vikas can be classified as an organic organisation. There are no strict hierarchies, staff from different backgrounds collaborate and decisions are made at lower levels. This type of organisational structure can adapt to changing situations and challenges more easily and is more suited to engaging with communities. The government departments on the other hand are examples of the mechanistic organisational type. Hierarchies are strongly emphasised, operations and behaviour follow orders issued by superiors, operating procedures are standardised and people work in specialised areas without a lot of collaboration. This type of organisation can provide support to a larger population, but seems to be less suited to adapting to communities' needs and thereby only achieves limited success.

It could be shown how support by Gram Vikas leads to very high-performing, financially sustainable schemes. Since 1992, Gram Vikas has implemented its programme in more than 1000 villages and covered almost 350,000 people. Although this proves that the programme can be scaled up, the total number of beneficiaries is still only a fraction of Odisha's 35 million rural residents. One of the main challenges to rapid expansion is the commitment threshold mentioned above. The entire community has to agree to take part in the programme and construct toilets

before work on water supply starts. This is fundamental to the model, but leads to a long delay before the water supply scheme is constructed, often more than one year. If not everyone agrees to participate, or residents do not agree with constructing toilets before receiving water supply, Gram Vikas can decide the village is not ready for the intervention and return at a later point. A government department that has to reach a certain coverage target every year could not do this, especially in the context of Indian policies aiming at covering 90% of rural households with piped water in 2022 (Government of India, 2013). To increase Odisha's coverage from 8% as per the 2011 census to 90% in 2022, more than 2.5 million rural residents would need to be provided with access to piped water every year. Reaching this many people through Gram Vikas does not seem feasible, as a rough estimation shows that, using the CapEx figures obtained in this study, Gram Vikas would need more than 100 times its current funding for water supply and sanitation to provide water supplies to 2.5 million people a year. Scaling up to this size rapidly would likely affect the institutional performance, as procedures would invariably change and a large number of new employees would be needed that would not necessarily identify with the organisation and believe in its mission as much as the current staff (Billis and MacKeith, 1992; Hodson, 1992).

Therefore, the question is what government departments could do to move closer to Gram Vikas' level of success whilst retaining their ability to operate on a large scale. The results suggest that there are two key drivers for success: high-quality infrastructure and institutional performance. The service provided to users needs to be good enough to be seen as transformational so that a high-level equilibrium can be reached. Providing water for 30 minutes a day, like in one village in Chhattisgarh, will probably not lead to a high willingness to pay or to be involved in service provision. Additionally, a higher emphasis should be put on reaching a high, preferably complete, coverage with household connections when the scheme starts. Connecting only a fraction of residents to a piped water scheme leads not only to issues with equity, it also limits the tariff collected, therefore preventing financial sustainability.

In order to deliver these interventions effectively, the support organisation needs sufficiently high institutional performance. As discussed above, currently, the government departments can be classified as mechanistic organisations. Whilst keeping parts of the mechanistic typology is necessary to efficiently provide services on a large scale, in order to be more effective they would need to be complemented by a more organic department that can be flexible and innovative in engaging communities and giving 'software' support. This form of organisation has been described by Hage & Powers (1992) as mechanistic-organic, a typology applied to water utilities by Franceys (2001). An example of incorporating these more organic structures are special project departments within existing organisations, often with a less strict hierarchy and reporting directly to the higher levels to enable a more independent working style. An example of a large scale mechanistic-organic rural water support organisation in India is Gujarat mentioned above

(Chary et al., 2015a, 2015b). There, the Water and Sanitation Management Authority (WASMO) has the core competency of engaging with communities, training them and supporting service providers, which is done in a flexible and organic way. This is however supported by a strong infrastructure department dealing with physical implementation, which is organised mechanically to deliver technical solutions effectively and efficiently. This support organisation was created on a large scale with significant political buy-in, bypassing the existing public health engineering department, all of which likely helped in preventing isomorphic mimicry, as the organisation could not hide its ineffectiveness in relative obscurity.

6. Summary and Conclusions

This thesis investigated three case studies and analysed the performance of service providers, support arrangements and the costs associated with them. Support by Gram Vikas, an internationally acclaimed NGO, in Odisha was compared to support by two government departments in Chhattisgarh and Jharkhand. It could be shown that service levels in Odisha are significantly higher than in the other two states and comparable to those found in case studies in much wealthier states. The success of this model was found to be mostly due to the quality of infrastructure and the institutional performance of the support organisation. Every household is provided with a private connection and water is supplied for 24 hours in two studied villages. Gram Vikas has a long history of working in the area and staff are highly committed and believe in the organisation's values, leading to effective interventions. Costs for initial work with communities, as well as direct support costs were found to be significantly higher in Odisha. This however leads to schemes where the community pays all operational costs from tariff collection, which means that no direct subsidy for operation is required and schemes are more cost-efficient over the long term.

Ultimately, the results suggest a trade-off between depth and breadth. Gram Vikas shows how a very high level of service can be provided to fewer users through an organic organisational model harnessing genuine community management, whilst the government departments provide an acceptable level of service to a larger group of people in shorter timeframes, following a mechanistic model, which – irrespective of the label given to the approach – has limited community involvement. Better services for everyone could be delivered by incorporating parts of Gram Vikas' approach of community mobilisation and participation into the government schemes, whilst keeping the faster implementation speed and large scale. To achieve this, the government departments would need to include a more organic department focussing on community interaction or ensure better oversight if they were to partner with external organisations to provide this software support, with the acceptance that implementation will take longer. Further research is needed on how to conduct this organisational transformation, especially on aspects of political economy and the incentives needed for change, and on ways to achieve community mobilisation in a shorter timeframe.

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8. Appendix

The following Appendix contains the scoring tables and mini-scenarios used for the institutional assessment, partnering assessment and participation assessment. This is followed by a detailed explanation of the calculation of service levels from the household survey data.

8.1 Methodology for institutional assessment

Based on interviews with ESE staff and on observations in the field, the questions below are answered on a scale of 1 for ‘strongly disagree’ to 4 for ‘strongly agree’ and then averaged for each performance area.

Leadership

1. Provides clear sense of mission; articulates mission; involves people with the mission so they get a sense of ownership of mission; gets people excited about the mission, believing in it.
2. Identifies clear performance standards and is strict but fair; gives positive and negative feedback where due; disciplines where necessary based on performance.
3. Maintains sense of balance between future vision and everyday operational matters.
4. Demonstrates personal integrity (i.e., does not claim false overtime, take money, or cut corners for personal gain); instils sense of integrity in others.
5. Continuously guides technical staff on need to ensure that levels of technology used by the institution are those which are most suitable in terms of simplicity of operation and maintenance; monitors activities in this regard.

Management and Administration

1. Managers have a clear sense of their own and others' roles and responsibilities. They communicate roles and expectations clearly to others and involve them in the process of defining their roles and responsibilities.
2. People are held accountable for getting work done.
3. Administrative systems for the following functions have been developed and are regularly used. (Note: rate each system for effectiveness.)
    a. Accounting and Budgeting
    b. Personnel
    c. Management Information

Community Orientation

1. Staff at every level demonstrate that they are oriented toward serving the community / community service provider, and ensure engagement with different groups within community, including the most marginalized; when observed, their decisions and actions are clearly driven by what is best for the community.
2. There are identifiable mechanisms for communities/community service providers to interact with key areas of the institution over important matters (e.g., call-down for technical assistance, bill disputes, service problems), that are also accessible to the most marginalized groups within the community.
3. There is clear evidence that the institution responds to complaints, emergencies, and suggestions which community members / community service providers make.
4. There are identifiable, ongoing, and effective measures to educate communities / community service providers about institutional services and requirements.
5. The institution makes efforts to invite and evoke an effective level of community / community service providers participation (e.g., mechanisms for communities to bring concerns/complaints to the institutions).

Technical Capability

1. Consistently makes sound technical decisions and effectively serves management by conducting technical studies and planning as requested.
2. Ensures effective control of the quality of the end product and all other technical operations.
3. Uses or adapts technology which is suitable for the specific needs of the institution and avoids temptation to use more exciting-but not appropriate-technologies learned by staff who were trained in other settings.
4. Maintains levels of in-house technical skills adequate for routine technical responsibilities and sub-contracts to outside specialists those tasks which are either beyond the institution's own capabilities or necessary to meet peak needs.
5. Conducts practical research and experiments to improve existing uses of technology for local conditions and needs.

Developing and Maintaining Staff

1. A clear process for determining skill needs exists and is the basis for designing training programmes.
2. A system exists for developing competent managers and supervisors.
3. The institution provides adequate incentives to maintain staff (i.e. salary levels, employee benefits).
4. A clear system exists for hiring qualified personnel and firing or disciplining personnel when necessary.
5. A career path is open to social/community development staff and technical staff and management staff.

Organizational Culture

1. An observable team spirit exists among the staff.
2. People express a sense of ownership and pride about working that is communicated by such statements as "this is a good place to work."
3. Employees are able to articulate the history and legends of the organization in positive ways.
4. Continuity in the organizational culture is maintained (even with staff turnover at high or low organizational levels).
5. Staff place a value on maintaining the organisations physical infrastructure (offices, treatment plants, grounds) of the organization. Facilities look clean, well maintained, and attractive.

Interactions with Key External Institutions

1. Top management stays well informed about external policy, financial, and regulatory issues and actions.
2. Management maintains direct contact with the key individuals in all important external entities.
3. Specific strategies are formulated to influence policies, legislation, and other activities to obtain necessary approvals and resources.
4. Programmes are developed to influence the public in support of institutional goals.
5. To the extent to which it is not already responsible/involved in services, local government/Panchayati Raj is kept full informed and involved in the process of support and monitoring

8.2 Methodology for partnering assessment

Partnering between the ESE and CSP is assessed for each phase and partnering type by assigning a score from 1 for 'strongly disagree' to 4 for 'strongly agree' to each statement.

Phase in service delivery cycle / Type of partnering	Capital investment phase	Service delivery phase	Capital maintenance phase	Service enhancement or expansion phase
Collaborative	ESE and CSP share responsibility for decisions regarding hardware (e.g. infrastructure) and software (e.g. capacity building) development during implementation.	ESE and CSP share responsibility for decisions regarding administration, management and operation and maintenance.	ESE and CSP share responsibility for decision making regarding asset renewal.	ESE and CSP share responsibility for decisions regarding service enhancement or expansion.
Contributory	ESE and CSP pool financial resources to meet the costs of capital investment in hardware and software provision during implementation.	ESE and CSP pool financial resources to cover costs of administration, management, and operation and maintenance.	ESE and CSP save and pool financial resources to meet the costs of asset renewal.	ESE and CSP save and pool financial resources to meet the costs of service enhancement or expansion.
Operational	ESE and CSP work together contributing labour and/or resources to deliver hardware and software provision during implementation.	ESE and CSP work together contributing labour and/or resources to support administration, management, operation and maintenance.	ESE and service provider contribute labour and/or resources for asset renewal.	ESE and CSP contribute labour and/or resources for service enhancement or expansion.
Consultative	ESE and CSP communicate regularly during implementation with structured opportunities for feedback and dialogue.	The ESE and CSP have a systematic and transparent system for sharing information regarding administration, management, and operation and maintenance.	ESE and CSP systematically share information regarding service levels and technology status enabling proper planning for asset renewal.	Information regarding service levels, technology status and population is systematically shared, enabling proper planning for service enhancement or expansion.
Transactional	ESE and CSP initially negotiate an implementation plan that is then delivered by the ESE.	The ESE and CSP fulfil different elements of the administration, management, and operation and maintenance functions as per negotiated arrangements.	Asset renewal is dependent on negotiations between ESE and CSP following a request from the CSP.	Service enhancement or expansion is dependent on negotiations between ESE and CSP following a request from the CSP.
Bureaucratic	ESE provides CSP with a standardised model of hardware and software provision during implementation.	Bureaucratic standards dictate the system for administration, management, and operation and maintenance.	Asset renewal is dependent on generic programme timelines (i.e. every X years).	Planned asset replacement, expansion or renewal is dependent on generic programme timelines (e.g. every X years and/or with every X% of population increase.)

8.3 Methodology for the CSP performance assessment

As described in the methodology, the mini-scenario most closely describing the situation witnessed is selected and the corresponding score is obtained. The five types of records used in the 'registry of operational information' indicator are: 1) stock of material and tools; 2) water quality test results; 3) volumes of water supplied; 4) records of break-downs and major maintenance works; and 5) registry of users.

Indicator	Score				
	100	75	50	25	0
Election of the governing body of the CSP	The CSP has a formal document that describes how elections for its governing should take place. This was followed duly during the last elections.	The CSP has a formal document that describes how elections for its governing should take place. This was followed duly during the last elections.	There is no formal document describing how elections should take place, but users and CSP have a general understanding of how it would work. This informal procedure was followed during the last elections.	There is no formal document describing how elections should take place, but users and CSP have a general understanding of how it would work. This informal procedure was followed during the last elections with minor deviations.	No elections whatsoever are taking place for the governing body of the CSP
Information sharing and accountability mechanisms	The CSP has several mechanisms to inform and provide accountability to users. These are all used regularly.	The CSP has several mechanisms to inform and provide accountability to users, of which only one is used regularly	The CSP has at least one mechanism through which users are informed and accountability is provided. This is used regularly.	The CSP has at least one mechanism through which users are informed and accountability is provided. But this is not used regularly.	The CSP has no mechanisms through which users are informed about the service, nor is there a way for users to participate.
Cash reserves	The CSP actively manages a cash reserve both through petty tax box and bank account and regularly replenishes it from a dedicated part of its revenues.	The CSP actively manages a cash reserve both through petty tax box and bank account but replenishes it on an irregular basis.	The CSP actively has a cash reserve, either in the form of a petty tax box or bank account, which it regularly replenishes	The CSP actively has a cash reserve, either in the form of a petty tax box or bank account, which it replenishes on an irregular basis	The CSP doesn't manage any cash reserve whatsoever
Book keeping	The CSP tracks its income and expenditure systematically and produces an annual account. The annual accounts have been audited and approved.	The CSP tracks its income and expenditure systematically and produces an annual account. However, no auditing of these takes place.	The CSP regularly tracks its income and expenditure sheet and produces an annual account.	The CSP registers its income and expenditure in a haphazard and irregular way.	The CSP doesn't use any book keeping tool whatsoever.

Indicator	Score				
	100	75	50	25	0
Technical folder	The CSP has a folder with both the map or design of the system and the operational manual and guidelines and it consults these when it needs to.	The CSP has a complete folder with at least both the map or design of the system and the operational manual and guidelines	The CSP has a folder with at least the map or design of the system or the operational manual and guidelines	The CSP has no map, design or operational manual and guideline of the system but can access those from relevant government bodies, when it needs to	The CSP has no map, design or operational manual and guideline of the system nor is it able to access those from relevant government bodies
Registry of operational information	The CSP has more than two of the five types of records and all are up to date	The CSP has at least two of the five types of records mentioned above, and these seems all up to date	The CSP has at least two of the five types of records mentioned above, albeit that they may not all be up to date	The CSP has only one of the five types of records	The CSP doesn't keep any of the five types of records
Water metering	All users with household connections have water meters. These are read regularly and used for billing. In addition, the CSP compares the meter readers with the macro water reader to track non-revenue water.	All users with household connections have water meters. These are read regularly and used for billing.	Most users with household connections have water meters. But these are not regularly read nor used for billing.	Only a small percentage of users with household connections have water meters	No water meters at all have been installed at users with household connections.
Water security measures	A water security plan is in place and in execution	A water security plan is in place, but only partially executed	At least one water security measure is being taken, though not as part of a comprehensive water security plan	A water security plan exists, but no such measures are taken	No water security measures are taken, neither is any plan in place
Water quality management	A comprehensive water quality management plan is in place, that has been provided or approved by a competent ESE. This plan is being executed.	The CSP executes a comprehensive water quality management plan that it has developed itself. But it hasn't been reviewed by a competent ESE.	A water quality management plan has been developed and is followed most of the time but not always.	Even though a water quality management plan is in place, it is not followed.	There is no water quality management plan in place.

8.4 Methodology for participation assessment

For each phase the type of community involvement that most closely describes the situation witnessed is selected.

Phase in service delivery cycle / Type of community involvement	Capital investment phase	Service delivery phase	Capital maintenance phase	Service enhancement or expansion phase
Self-mobilisation	The community practices self-supply and seeks to improve this, or have developed an implementation plan and seek external support.	The community take responsibility for administration, management and operation and maintenance, either directly or by outsourcing these functions to external entities.	The community practices self-supply and invests in asset renewal, or identifies need and seeks external support for asset renewal.	The community practices self-supply and invests in service enhancement or expansion, or identifies need and seeks external support for service enhancement or expansion.
Interaction participation	The community in partnership with the service provider and/or support entities engage in a joint-analysis of implementation options before developing a plan.	The community in partnership with the service provider and/or support entities engage in joint-decision making regarding appropriate arrangements for administration, management and operation and maintenance.	The community in partnership with the service provider and/or support engage in joint-decision making regarding asset renewal.	The community in partnership with the service provider and/or support engage in joint-decision making regarding service enhancement or expansion.
Functional participation	The community is provided with a detailed implementation plan that they discuss and they have a chance to amend limited elements.	The community is provided with administration, management and operation and maintenance arrangements that they discuss and they have a chance to amend limited elements.	The community is provided with an asset renewal plan that they discuss and they have a chance to amend limited elements.	The community is provided with a service enhancement or expansion plan that they discuss and they have a chance to amend limited elements.
Participation by consultation	Community members are asked whether they want a predefined implementation scheme but have no formal decision making power to demand alternatives.	The community discusses administration, management and operation and maintenance functions but have no formal decision making power to demand alternatives.	Community members are asked about asset renewal but have no formal decision making power to demand alternatives.	Community members are asked about service enhancement or expansion but have no formal decision making power to demand alternatives.
Passive participation	Community members are informed that project implementation is going ahead as per an externally designed plan.	Community members are informed how administration, management and operation and maintenance will operate without opportunity for changes.	Community Service Provider informs community members about asset renewal as per an externally designed plan.	Community Service Provider informs community members about service enhancement or expansion as per an externally designed plan.

8.5 Calculation of service levels (from group project)

The section below is an excerpt from preliminary work done for the Community Water *Plus* project by the author as part of a group project at Cranfield University from February to May 2015 (for the full document, see Amin et al., 2015):

In line with the service level approach, and with reference to Indian National Guidelines for drinking water referenced above, the CW+ project uses the six service level parameters shown in Table 16. Of these, one is not obtained from household surveys (water quality: testing).

Table 16: Service levels for CW+ project (Smits et al., 2015)

Service level	Quantity (lpcd)	Accessibility (cumulative time spent per day by the family on fetching water)	Water quality: perception	Water quality: testing	Continuity (hours/day)[5]	Reliability: piped supplies	Reliability: handpumps
High	> 80 lpcd	0-10 minutes per day	Good	All tested samples are within permissible levels	> 3	Supply above the agreed schedule and duration, and response time doesn't exceed 24 hours.	Response time is less than 24 hours and handpumps are down for not more than 12 days per year
Improved	60-80 lpcd	10-20 minutes per day			2-3	Supply above the agreed schedule and duration, and response time doesn't exceed 48 hours.	Response time is less than 48 hours and handpumps are down for not more than 12 days per year
Basic	40-60 lpcd	20-30 minutes per day	Acceptable		1-2	Supply according to an agreed schedule and duration and response time doesn't exceed 48 hours	Response time is less than 48 hours and handpumps are not broken down for more than 15 days per year
Sub-standard	20-40 lpcd	30-60 minutes per day	Bad	Tested samples are tested positive for one parameter	< 1	Supply has scheduled times, duration and delivery but this is not always met, or response time exceeds 48 hours	Response time is more than 48 hours or handpumps are broken down for more than 15 days per year
No service	< 20 lpcd	> 60 minutes per day		Samples are tested positive and the contamination levels are very high		Supply has scheduled times, duration and delivery but this is hardly ever met, or response time more than 2 weeks	Response time it more than 2 weeks or handpumps are broken down for more than 30 days per years

Other than 'water quality: perception' and 'continuity', each of the parameters is calculated from multiple questions in the household survey. For instance, asking how many litres per capita per day of water a household uses is both a complex question and unlikely to provide accurate data. The calculation of each parameter is as follows:

Quantity

Quantity of water is calculated in two different ways for individual household connections and communal supply. In the case of households connected to piped water supply, quantity is determined from the size of household storage, the time it takes to fill this storage, and the total time that water is available per day. In the case of households with continuous 24-hour supply, household storage was deemed irrelevant and a high service level for quantity was assigned.

For households with communal supply, e.g. standposts or communal wells, the total quantity is the number of pots fetched per day multiplied with the size of the pot. The overall quantity is then divided by the total size of the household to obtain the quantity in litres per capita per day (lpcd).

Accessibility

The indicator for accessibility is based on the cumulative time spent per day by the family on fetching water, in minutes. Household connections are classified as having a high service level,

as the water is accessible at the house. For communal supplies, time spent per day is the product of the time taken per trip and the trips per day needed to fetch water.

Quality

In this study, the indicator for quality is based on the perceived water quality by the interviewee. The response ‘good’ corresponds to a high service level, ‘acceptable’ to a basic service level, while the response ‘bad’ gives a sub-standard service level.

Although perceived water quality is very important for the acceptance of water supply schemes (Rojas, 2013), no literature showing that it is a good proxy for chemical or microbiological water quality could be found. Water quality testing would be necessary to actually determine water quality and health risks arising from contamination.

Continuity

The indicator for continuity is only calculated for piped water supplies and is based on the amount of time in which water is available per day.

Reliability

For piped supplies, the indicator is based on the response time for repairs and the regularity of supply. For handpumps, the indicator relies on both repair response time for repairs and total downtime in the last year. Some respondents did not provide information on the response time for repairs, because the water source didn’t have any breakdowns in the previous 12 months. In these cases, a high service level for reliability was assigned.

9. Curriculum Vitae

Matthias Javorszky

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Date of Birth: 12 June 1987 Austrian Nationality

EDUCATION

10/2014 – 09/2015 **MSc Community Water and Sanitation: Cranfield University, UK – graduated top of class with a GPA of 80%**
Core modules: Managing and Financing World Water and Wastewater, Water Source Engineering, Sanitation and Wastewater Management, Communities and Development
Group project: Determining success in community managed rural water supplies using household surveys, in cooperation with IRC, The Netherlands

04/2013 – 01/2016 **MSc Environmental Engineering and Water Management: University of Natural Resources and Life Sciences, Vienna, Austria – current GPA of 1.19**
Selected specialisations: Water Supply and Sanitary Engineering, Hydrology and Water Resource Management, Sustainability and Risk Management

08/2010 – 09/2011 **ERASMUS International Studies: Istanbul Technical University, Turkey**
Classes taken: Building Construction, Hydraulics, Probability and Statistics, Waste Management, Photography, Turkish History & Language

10/2008 – 04/2013 **BSc Environmental Engineering and Water Management: University of Natural Resources and Life Sciences, Vienna, Austria – graduated with distinction with a GPA of 1.21**
Core modules: Hydrology, Water Resource Management, Water Supply and Sanitary Engineering, Statics, Natural Sciences, Building Construction, Transport Engineering
Thesis: Optimisation of a Method for Remote Sensing of CO_2-Emissions using OP-TDL

09/1997 – 06/2005 **Bundesrealgymnasium BRG 18, Vienna, Austria – Graduated summa cum laude**
Subjects in final examination: Mathematics, English, German, Latin, Geometry, all passed with the highest mark possible

PROFESSIONAL EXPERIENCE

09/2015 – 10/2015 **Consultant: WSUP (Water and Sanitation for the Urban Poor), London/Leeds**
Cooperated with Leeds University to finalise two case studies on the impact of connecting residents in informal areas to the water supply network. Responsible for analysing data on water demand and service levels using a modelling tool in Excel, as well as statistical analysis of household survey data in SPSS. Copyedited and drafted the final reports and other publications

07/2014 – 08/2014 **Internship: hydrophil GmbH, Vienna, Austria**
hydrophil is one of the leading private water and development consultancies in Austria. Assisted in the implementation and project management of donor-funded projects in the water sector in Nepal, Nigeria, Lebanon, Palestine and the Danube Region. Assisted in the bidding process for projects funded by the European Commission and European Investment Bank. Managed the pool of over 300 independent experts and assisted in personnel selection. Liaised with consultants worldwide, assisted in contract negotiations

02/2014 – 08/2014 **Consultant: Danube Water Program, IAWD/World Bank, Vienna, Austria**
Researched data on capacity building programs in the member water utilities and drafted a report with the findings. Compiled and analysed data on the financial and operational performance of utilities in participating countries as a basis for the State of the Sector Report

02/2014 **Internship: Vienna City Administration, Department for Environmental Protection, Austria**
Worked in the area of Sustainable Development. Main duties included research and data analysis, conducting interviews, drafting reports and translations

10/2013 – 02/2014	**Tutor: University of Natural Resources and Life Sciences, Vienna, Austria** Taught the practical part of a course in Hydrology and Water Resource Management, specialising in quantitative hydrological modelling
07/2013 – 08/2013	**IAESTE Internship: Kumasi Metropolitan Assembly, Ghana** Member of the Public Works Department. Participated in a World Bank funded project to improve water supply in communities around Kumasi. Main responsibilities included stakeholder participation, hydrogeology, borehole drilling and pumping tests
09/2012 – 06/2014	**Part-time staff member: Ingenieurbüro Heimo Zimmermann, Vienna, Austria** Engineering office specialising in environmental impact assessments of abandoned landfills. Involved in all aspects of project acquisition and implementation. Collected and analysed hydrological, chemical and topographical survey data. Created plans in AutoCAD and GeoDin, drafted reports, attended meetings, liaised with clients and the affected population
Spring term (Feb – Jun) 2010, 2012, 2013, 2014	**Tutor: University of Natural Resources and Applied Life Sciences Vienna, Austria** Taught the practical part of a course in Technical Geometry and Computer Aided Drawing. Overall responsibility for planning and conducting course units and providing feedback to students, as well as managing the e-learning environment
10/2005 – 09/2006	**Community Service: Jugendhaus der Caritas Wien, Vienna** Worked in a house for young homeless people. Managed a team of around 40 volunteers that prepared soup distributed to 200 homeless every night. Responsible for procuring ingredients, staffing schedule and supervision of the cooking teams

LANGUAGE SKILLS

German (native language), English (fluent), Turkish (intermediate), Hungarian (intermediate), Spanish (beginner)

COMPUTING SKILLS

Proficient User of MS Word, Excel, PowerPoint, Autodesk AutoCAD
Experience in SPSS (statistics), R (statistics), HEC-HMS (quantitative hydrologic runoff modelling), HEC-RAS (2-D hydraulic modelling), MODFLOW (quantitative groundwater modelling), GeoDin (borehole logging), ESRI ArcGIS (geographical information systems)

EXTRACURRICULAR ACTIVITIES

10/2014 – 09/2015	Elected Course Representative for the MSc Community Water and Sanitation. Represented student interests in meetings with staff and faculty. Regularly liaised with Course Director
10/2014 – 09/2015	Elected member of the Executive Committee for SAFAD, a student-run charity working in the field of water and development. As Membership & Alumni Officer responsible for liaising with current and former members, managing membership fees and attracting new members
10/2013 – 02/2014	With three other students organised the Future Lecture, an innovative event on sustainability and resource scarcity, held at the University of Natural Resources and Life Sciences, Vienna. Responsible for the concept, speakers, organisation of facilities, catering and marketing. Significantly exceeded expectations with around 200 people attending
11/2012 – 05/2013	Board member of IAESTE BOKU as the Project Manager for IAESTE FirmenShuttle 2013, a programme with field trips to companies hiring graduates. Responsibilities included the selection and acquisition of participating companies, management of the logistics and staffing
10/2009 – 09/2014	Received scholarships for extraordinary academic achievements at the University for Natural Resources and Life Sciences, Vienna in 2009, 2010, 2011, 2012 and 2014
07/2009	Participated in a summer school on Hungarian language and culture in Szombathely
02/2007 – 04/2008	Travelled in India, South-East Asia and Australia. Volunteered as English teacher in Indonesia and Cambodia and on organic farms in Australia

10. Affirmation

I certify that the master thesis was written by me, not using sources and tools other than quoted and without use of any other illegitimate support.

Parts of this thesis were written as part of a Double-Degree Programme between the University of Natural Resources and Life Sciences, Vienna and Cranfield University from May to August 2015. The thesis from Cranfield University has been extended and expanded at the University of Natural Resources and Life Sciences, Vienna from September to December 2015.

Vienna, 21.12.2015 *Matthias Javorszky*