

Hutchings, P. 2018. Community management or coproduction?
The role of state and citizens in rural water service delivery in India.
Water Alternatives 11(2): 357-374



Community Management or Coproduction? The Role of State and Citizens in Rural Water Service Delivery in India

Paul Hutchings

Cranfield University, Cranfield, Bedfordshire, UK; p.t.hutchings@cranfield.ac.uk

ABSTRACT: This paper makes the case for a realignment in the discourse and conceptualisation of community management of rural water supply. It draws on data from 20 case studies of reportedly successful community management programmes from India to argue that current discourse is remiss not to describe the substantial role of the state and other supporting agencies in financing and supporting service provision. In the context of such substantial levels of support, conceptually, it is argued that the tendency to treat the challenge of rural water supply as one of either a community participation or collective action problem that only the community can address further limits current thinking in this area. Recasting the primary challenge of rural water service delivery as improved cooperation and coordination between state and citizen, the paper proposes a more substantial focus on coproduction as a route to overcome sustainability problems in rural water supply. The paper ends by reflecting on the generalisability of this thinking noting the specific context of the Indian empirical data. It concludes by arguing that, although certain aspects of the study are specific to that empirical domain, the normative and conceptual reasons for shifting the discourse remain applicable in broader contexts.

KEYWORDS: Community management, coproduction, rural water supply, India

INTRODUCTION

This paper makes the case for a discursive and conceptual realignment in the study of the world's most common rural water supply management model – the community management approach. The backdrop is the long-standing concern with the lack of operational sustainability in rural water supply (Saunders and Warford, 1976; Paul, 1987; David et al., 2009; Schweitzer and Mihelcic, 2012) and, relatedly, the critiques of the community management model (Baumann, 2006; Harvey and Reed, 2006; Moriarty et al., 2013). In recent years, a simmering level of dissatisfaction with community management has seemingly boiled over into outright rejection of the model as a valid approach to managing rural water supply, at least in the academic literature (Broek and Brown, 2015; Chowns, 2015; Whaley and Cleaver, 2017). In an earlier paper, it was noted that, despite a critique, it is useful to reflect that community management has played a significant role as the world achieved the Millennium Development Goal for water supply and there remain many successful examples of it working in practice (Hutchings et al., 2015). This paper continues in that sympathetic regard. It is not a defence of community management as an approach but rather an attempt to highlight how we may traverse the contemporary malaise about the model through recasting how we conceptualise and discursively label the approach so as to deliver more productive rural water supply solutions going forward.

In a recent review, Whaley and Cleaver (2017) highlighted two major bodies of critique stemming from what they classified as practice-based and critical-academic perspectives. The practice-based literature focuses on the inadequacies of the model from a managerial perspective. For example, it argues the financial viability of the approach is one of the major barriers to operational sustainability (Lockwood and Smits, 2011; Moriarty et al., 2013). In an often quoted heuristic about the financing of

community management programmes, it is said that communities should cover the operational costs of supply as well as 10% of capital costs (Joshi, 2003), and whilst the specific amounts may vary, the notion that communities cover a significant proportional of costs is commonly associated with this approach (Moriarty et al., 2013). Yet the fundamental problem is that tariffs rarely cover the full costs of supply and so without further support the financing of the system becomes unviable (Franceys et al., 2016; Marks and Davis, 2012). The critical academic perspectives further reinforce such critiques by calling into question what they consider to be a naively apolitical approach to community management around the world (Whaley and Cleaver, 2017). Too often, programmes lack sensitivity to local customs and informal institutional functioning, completely ignoring the reality of power-relations on the ground leading to dismal outcomes such as a reinforcement of inequities within communities (Srivastava, 2012).

Both these critical-academic and practice-based literatures do coalesce on the view that thinking about community management should encapsulate and embed village-level institutions within a broader landscape (Whaley and Cleaver, 2017). This is seen through the calls for 'community management plus' a phrase coined by Baumann (2006) with the 'plus' signifying the ongoing support from government or other agencies that is required to ensure that community management is sustainable. This is in addition to the broader movement to understand and empower effective 'enabling support environments' as part of a broader service delivery approach to rural water supply, with the enabling support environment representing those organisations, whether public, private or not-for-profit, that "help communities in addressing issues they cannot reasonably solve on their own and gradually improve their performance in their service provider functions" (Lockwood and Smits, 2011: 22-23). It is also seen from the critical-academic perspective, in the need to "analyse governance dynamics beyond the domain of the village or community in order to understand a committee's capacity to function" (Whaley and Cleaver, 2017: 60). This work recognises the importance of understanding how power-relations beyond the village level shape the ability of a particular water committee to be effective. From either perspective there is an explicit realisation that what happens beyond the community matters.

Building on that theme, this paper argues for a discursive and conceptual realignment of community management that better takes into account these extra-community aspects. It does this by first highlighting the associated connection between community management and community participation, and the somewhat related conflation between the community-based management of natural resources (CBMNR) and the community management of rural water supply. Arguing that the collective action problems inherent in the CBMNR literature and empowerment challenges from participatory development are qualitatively different to the contemporary rural water supply challenge, the paper introduces thinking regarding the co-production of (public) services as a more useful conceptual frame for community management. It then presents an overview of findings from an empirical study in India that documents 20 cases of reportedly successful community management programmes. In that study, the level of support from the state and other enabling support agencies is so substantial that describing it as a form of community management is only a very partial description that is poorly captured by the label: 'community management'. The paper ends by reflecting on the generalisability of this thinking, noting the specific context of the Indian empirical data. It concludes by arguing that, although certain aspects of the study are specific to that empirical domain, the normative and conceptual reasons for shifting the discourse remain applicable in broader contexts.

PARTICIPATION, COLLECTIVE ACTION AND COPRODUCTION

This section discusses two of the major conceptual bodies of literature through which community management has been studied, including CBMNR and participatory development. It begins by emphasising a link that is often made between debates about community management of rural water

supply and the literature on CBMNR (Hope, 2015). There is a considerable body of work that can be described under CBMNR that uses different labels such as community-based resource management (Armitage, 2005; Blaikie, 2006; Leach et al., 1999) and common-pool resource management (Blaikie, 2006; Dynamics and Berkes, 2006). At the core of these works is the management of 'the commons' which can be described in the neoclassical terminology of economics as common-pool resources that are non-excludable and rivalrous (Agrawal and Gupta, 2005). However, more practically, much of this work focuses on the management of resources from which excluding potential appropriators is difficult, at least in the absence of state involvement or organised cooperation among users. In this sense, the basic problem that literature engages with can be characterised as different forms of the 'collective action problem' – for example, it investigates whether communities can avoid free-riding by individuals within their group (Olson, 2002; Ostrom, 1990, 2010). The most famous perspective to emerge from this literature is Ostrom's (1990) thesis on governing the commons. Through this and subsequent work, she has developed eight design principles that typified successful collective management systems (Ostrom, 1990; Cox and Arnold, 2010) which have since been further developed, tested and critiqued in a considerable number of works (Agrawal and Yadama, 1997; Dynamics and Berkes, 2006; Cox and Arnold, 2010; Cleaver, 2012).

This type of thinking has been linked with community management of rural water supply in other studies in part, it is contended, because it provides theoretical and methodological approaches for understanding the functioning of community institutions (e.g. Chowns, 2014; Jones, 2015). Yet the characterisation of rural water supply as non-excludable and therefore a common-pool resource is considered problematic. While developing this argument it is important to stress two points of clarification. The first is that this paper focuses on the management of domestic rural water supplies, rather than productive supplies for irrigation or the like, which are likely to remain usefully analysed as collective action problems. The second is that on a normative level the provision of water is a human right (United Nations, 2010) and, in this sense, is non-excludable, but in practice community management institutions are set up to manage specific water supply infrastructure assets which increasingly include piped networks to only some homes in a village, with other homes relying on private or alternative supplies. In this context, the services are excludable, and the specific challenges are not so much avoiding free-riding or the collective exhaustion of a common resource, but rather operating a quasi-professional organisation that brings together sufficient technical expertise and administrative capability to manage and renew the infrastructure so as to ensure water is delivered *ad infinitum*. In the words of Lockwood and Smits (2011) communities (or rather those involved in the water committees) must develop the "sense of being a service provider".

Another trend within the literature is to see community management as a subset of broader community participation processes. This may be because the emergence of community management from the 1990s onwards followed the broader trend to see community participation as the engine of development programmes and projects. In this sense, the concept of participation has been given as part of the justification for community management (Harvey and Reed, 2006), especially in the early literature (Paul, 1987; McCommon et al., 1990). Participation is itself a controversial subject with various definitions related to the idea of citizen empowerment (Brown and Ashman, 1996; Frances Cleaver, 1999; Mansuri and Rao, 2004; Cornwall and Brock, 2005; Hickey and Mohan, 2005). On a practical level, the efficacy of participatory development in terms of delivering lasting and equitable development outcomes is highly questionable (White et al., 2018). In the water sector, the prevailing levels of unsustainability in services in places such as sub-Saharan Africa where participation has been a policy focus have led to an increasing scepticism about the relationship between highly participatory rural water services and the long-term sustainability of services (Jones, 2011; Marks and Davis, 2012; Broek and Brown, 2015). In the context of this paper, the emphasis on participation as a frame for thinking through community management is considered limited. On the one hand, it emphasises the importance of local control and action, but with that comes the notion that it is the responsibility of the

communities to take meaningful action, without highlighting the roles and responsibilities of other actors. For this reason, it is considered to lead to a too narrow focus of concern with what happens within communities rather than a broader systemic perspective on communities as part of a wider support system.

Considering these, a more productive focus is thought to exist by focusing on the quality of the inter-organisational partnerships between a water committee (representing a limited number of organised citizens operating in a quasi-professional manner) and the broader supporting organisations, with the success of these arrangements determined by whether the needs of individual citizens across the community are being met in an equitable and satisfactory way. This conceptualisation would mean community management of domestic water supply is more usefully analysed in a similar way to other forms of service delivery, rather than as a subset of the broader common-pool management of water resources or community empowerment initiatives. In work focused on urban sanitation services, McGranahan (2015) and McGranahan and Mitlin (2016) have highlighted the distinction between collective-action problems and what they describe as a coproduction challenge. For them, the coproduction challenge is focused more prominently on building cooperation and coordination between the state and citizen, compared to the conventional starting point of citizen-citizen interaction in collective-action problems.

Similarly, in the particular context of domestic rural water supplies, it is argued that it is now more useful to frame community management as an arrangement between state (or other supporting agency) and citizens for delivering (public) services rather than conceptualise it using tools designed to study common-pool resource management or participatory development. In an analysis of how basic services are often managed in low- and middle-income countries, Joshi and Moore (2004: 144) emphasise the increasing importance of inter-organisational partnerships in service delivery and develop the concept of 'institutionalised coproduction', which they define as: "the provision of public services through regular, long-term relationships between state agencies and organised groups of citizens, where both make substantial resource contributions" (p. 40). This shares similarities with Ostrom's (1996) work on co-production in which she noted how individuals from different organisations often feed into the production of public goods and services as part of a poly-centric governance systems.

However, in the work of Joshi and Moore (2004), they focus more explicitly on the service delivery challenge, noting their notion of institutionalising co-production has four specific characteristics: 1) partnerships should not be temporary; 2) partnerships should not necessarily need to rely on formal contractual arrangements (although they can do); 3) partnerships often reflect a blurring of boundaries between public and private; and, 4) they "do not particularly associate institutionalised co-production with what Hood (1998) categorises as the egalitarian (participatory, communitarian) approach to dealing with public management issues" (Joshi and Moore, 2004: 40). This final point is thought to mean this conceptualisation has not been widely applied to the community management model, which has conventionally been associated with participatory development (Harvey and Reed, 2006). However, in the context of greater emphasis on the extra-community aspects of community management, the idea of co-production is considered to become more appropriate for describing the forms of service delivery that are being called for, such as community management plus. In practice, as will be argued in the following sections, they are already accurate in explaining the contemporary forms of service delivery found in supposedly community management programmes in India. And, finally, even beyond India, it will be further argued that such ideas hold normative resonance for application as they more clearly emphasise the responsibility of governments and other supporting agencies within service delivery processes.

INSTITUTIONAL AND FINANCIAL ARRANGEMENTS FOR COMMUNITY MANAGEMENT IN INDIA

The empirical material presented in this sections comes from a study into community management programmes from India conducted between 2013 and 2016, which has been presented in full alongside the methodology elsewhere (Hutchings et al., 2017). This section re-outlines the study design and approach, highlights the key aspects for the data presented in this paper, and then describes the results.

Study design and approach

The overall study involved a purposive selection of 20 community-management case studies of community-management programmes across states with different levels of wealth and geographical contexts. Cases were selected based on assessment of relative success within the operating context with pilot visits to confirm suitability of each case in terms of representing an operational programme (see Annex for an overview of cases). Five fieldwork teams delivered the case studies using a standardised methodology that involved key informant interviews, focus groups, household surveys and administrative records. The combined data set consisted of 2355 household surveys, 272 interviews and 130 focus groups that were gathered from 80 villages (four per case). The aim was to gather information on how the programmes operated, what service levels they delivered and the financing mechanisms found in the programmes. This section focuses primarily on the financial and institutional analyses from that larger study.

Key informant interviews, focus group discussions and administrative records were the key data sources for the financial analyses. Field researchers triangulated data from these sources into summary financial resource tables for each case study, covering: one-off Capital Expenditure (CapEx) and then the ongoing, annual Recurrent Expenditure made up of Operational Expenditure (OpEx) and Capital Maintenance Expenditure (CapManEx). Where necessary, costs were standardised to 2016 levels using a mixed inflation index – capital costs following the Construction Price Index and the operational costs following the Consumer Price Index, both of the Reserve Bank of India (Reserve Bank of India, 2015). Prices were converted into USD from INR using the Purchasing Power Parity conversion factors provided by the World Bank. A key aspect of the financial analysis was to assess the balance between the costs covered directly by communities through their tariff contributions and costs covered either directly or indirectly by supporting organisations across the case studies.

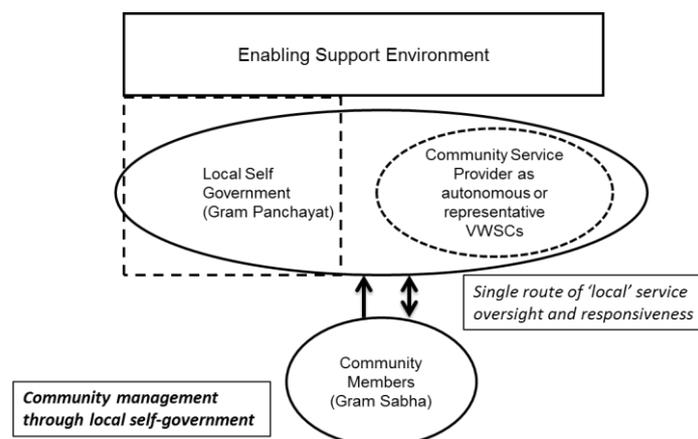
The institutional analysis followed a similar approach in focusing on the comparative analysis of roles and responsibilities between the community and higher-level supporting entities. Key informant interviews, focus group discussions and administrative records were again the main sources of data for the institutional analysis in each case study report. For those reports, the data were processed into a series of scoring frameworks that, for example, provided an assessment of the level of community participation during key stages of water supply management (e.g. the level of community participation during the implementation of a new project versus its ongoing management) as well as descriptions of the institutional arrangements found. Individual case study reports were then analysed together in comparative frameworks to support the synthesis process. This followed the principles advocated by Ritchie et al. (2013) in large-scale qualitative policy research in which the process of summarising case study features promotes learnings and research insights about key trends and patterns. A process of classification was also applied to the organisational arrangements found in each case study. This involved developing typologies that covered the organisational forms described in the reports and then allocating the case studies within these groups, with the main groups reported in the empirical results section below.

Summary of major findings

This section summarises findings from that larger study to illustrate the particular nature of community management found in India. The intention is not to provide a detailed analysis of factors that may determine different financial resource-sharing arrangements or to try to answer whether particular institutional forms are more effective than others, which are issues explored in the broader work. Rather, the data are presented here to demonstrate the validity of conceptualising the studied programmes as forms of co-production, as per the criteria outlined by Joshi and Moore (2004), described above. With the cases covering programmes from 17 of India’s 29 states, including both government and NGO initiatives, the approach is considered to allow a level of generalisation to be gathered from the findings in terms of reflecting contemporary trends in India during the study period. The focus is first on describing the type of institutional arrangements found across the cases which can be classified into two main organisational arrangements: 'community management through local self-government' and 'community management through societies'. A description of each is now presented before a discussion of their distribution across the cases.

To understand the local self-government model, it is helpful to explain the structure and ethos of public administration in rural India. It revolves around the Panchayat Raj Institutions (PRI) – a three-tier system of local self-government that has at its lowest level a Gram Panchayat which operates at (or close to) the village scale. Under this system, statutory responsibility is given to the Gram Panchayats for delivering most public services, however contemporary policy (in particular the National Rural Water Drinking Programme (Government of India, 2013)) dictates that for rural water supply it establishes a semi-independent Village Water and Sanitation Committee (VWSC) that comprises a mixture of Gram Panchayat employees and private citizens to take on this role. This organisational form is shaped by the principles of community management; however, the case studies from this study indicate that in practice the most critical roles of the VWSCs are fulfilled by the elected representatives or employees of the Gram Panchayat. For example, the Secretary of the Gram Panchayat acts as the treasurer of the VWSC, whilst the Gram Panchayat Sarpanch (President) is mandated to be the chair of the VWSC. This means the organisation is driven by the priorities of the local self-government system rather than reflecting some form of bottom-up collective organisation of community members (an organigram of the model is illustrated in Figure 1).

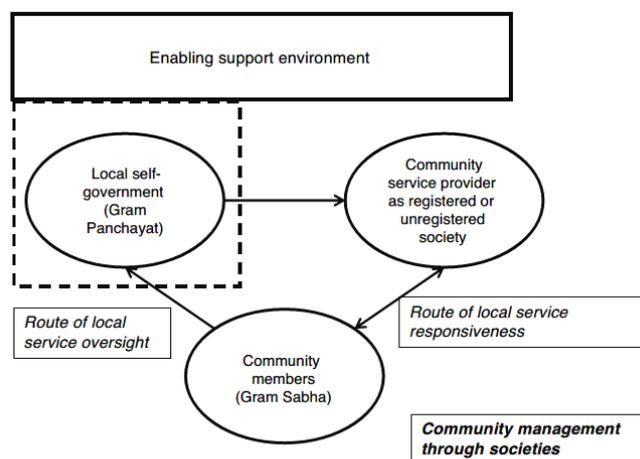
Figure 1. Organigram of community management through local self-government model.



The formal aspects of the societies-based model is best understood by explaining The Indian Societies Registration Act (Government of India, 1860), which dictates that all charitable bodies should be registered with government and have a specified management board and a set of agreed rules and

regulations. A Registered Society can open an independent bank account and have official (i.e. contractual) agreements with government entities to deliver services which are constitutionally the responsibility of the government. In this way, VWSCs can be established as Registered Societies in programmes and can take on the statutory responsibility for managing domestic water from the Gram Panchayat. In such cases, the VWSC have some level of independence from the government system but they can only operate with explicit permission of the Gram Panchayat. The case studies indicate that although this means the Registered Societies are distinct organisational bodies many of the substantive management functions that a VWSC must undertake remain dependent on the Gram Panchayat. For example, in a situation when some form of support is needed from government (e.g. for a major repair) this must be channelled through the Gram Panchayat system and the support that comes (often in the form of financial support) will be paid initially into the Gram Panchayat bank accounts. Ultimately, in practice, decision-making power remains embedded within the local self-government system (an organigram of the model is illustrated in Figure 2).

Figure 2. Organigram of community management through societies model.



As can be gathered from the overview in the annex, the societies’ model was found in each of the five NGO programmes covered in this study, with none of these programmes working through the LSG approach. However, across government programmes (15 case studies in total), there was a mixture between both models. In eight government programmes what was found was the local self-government model whereas in seven what was found was the registered societies’ model. This is considered to reflect the devolution of water to the state level which leads to different interpretations of guidelines to emerge between state agencies. The specific reasons why one or another model is adopted within government programmes across the states has been linked to the underlying political economy of devolution within each state (Hutchings et al., 2017). However, in both situations, the role of Gram Panchayats in taking many of the critical responsibilities for supply or, at least, being the avenue through which significant resources were channelled to VWSCs, meant that government was playing a significant role in the everyday management of water supply across all the community management programmes.

This sharing of responsibility becomes even more explicit when considering the sharing of financial costs between communities and the enabling support environment. Focusing on capital costs, the data from this study indicates that there is no standard model of community contribution for capital costs with significant variability in the proportion of costs covered across the cases (Figure 3). In four of the cases, mostly from the poorer states, the programmes have moved away from expecting any form of

community contribution to capital costs whilst in six cases, the contribution from the community is 5% or lower. Focusing on recurrent financing, Figure 4 illustrates the level of recurrent financial support underpinning many of the programmes. Again, there is no standard model across the cases but on average, under the local self-government model, financial support covers an average of 52% of the recurrent costs of supply with the rest is financed directly through community tariffs. Even for the community management through societies' approach financial support covers 42% with the remainder coming from community tariffs. Recognising that there is variability across the case studies, the consistent pattern remains of significant recurrent financing of rural water supply.

Figure 3. Contribution of enabling support entities to capital expenditure across the case studies.

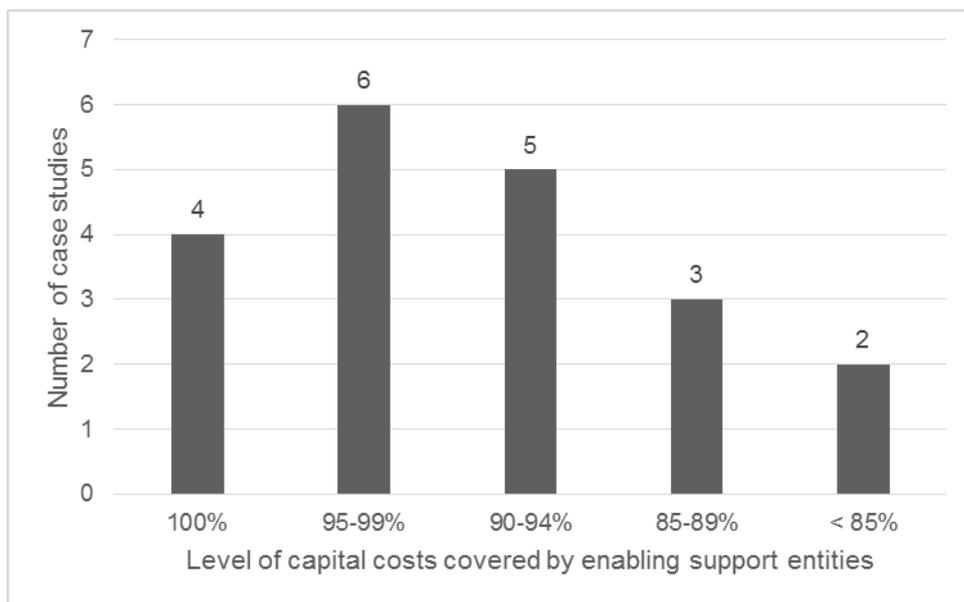
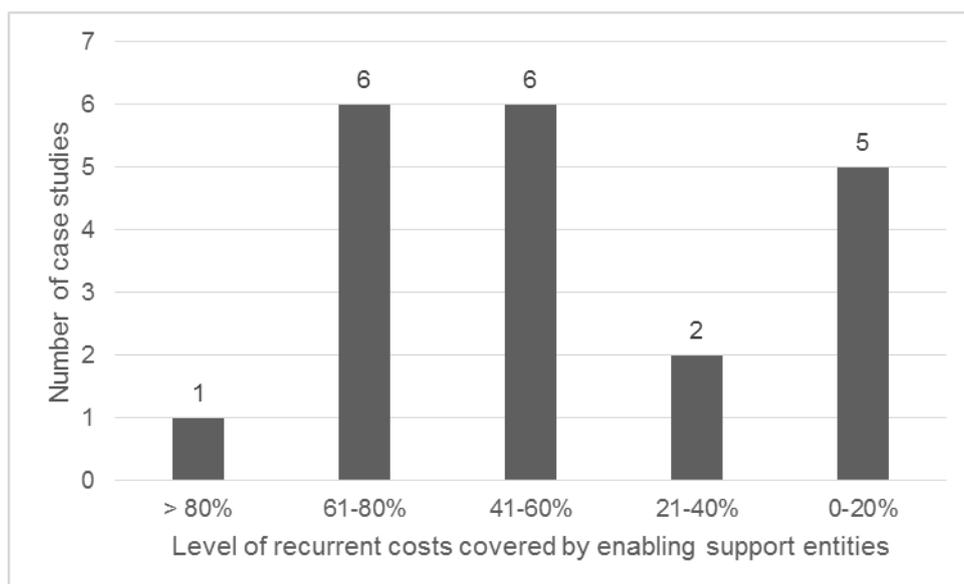


Figure 4. contribution of enabling support entities to recurrent financing across the case studies.



From the results it is clear that the modes of service delivery documented throughout that study exhibited institutional and financial costing arrangements that reflected a balance of recurrent inputs from the state (or other agencies) and communities. The institutional arrangements also reflect a significant overlap of community and public institutions. In explaining the arrangements, it is tempting to be still limited by a binary discourse with a continued emphasis on either describing it as a form of community management where the community takes the lead (e.g. the Societies model), or in cases where Gram Panchayats are more prominent, then a form of direct public provision (Rout, 2014). Yet the reality is a more nuanced situation with VWSCs working within, alongside and with approval from local self-government in all the programmes captured in this study. At a broad level, this reflects the point made by Ostrom (1996) in her work on co-production about not reifying the public and private divide within conceptual and practical thinking about natural resources management problems. Similarly, in these cases of rural water supply management, such binary categories become inadequate and hence the need for alternatives.

As explained earlier, Joshi and Moore (2004: 50) develop four particular characteristics they used to characterise their specific definition of 'institutionalised coproduction', which they argue is particularly common in developing countries. These include: 1) service delivery that involves substantial resource contribution from the state and private citizens; 2) service delivery based on long-term relationships between the involved parties; 3) service delivery that has the potential for informal arrangements governing those relationships; and, 4) service delivery that involves a blurring of distinctions between the traditional divide of public and private actors. Taking each point in turn: first, the evidence presented reflects the sharing of financial resource contribution; second, the programmes studied also had an average length of continuous operation of seven years (see annex) supporting the notion that the arrangements reflect long-term commitments; third, the informality criteria were not assessed in this research which focused more strongly on the formal institutional structures. However, informality is positioned as a tendency rather than a rule and this is, therefore, not considered to invalidate the applicability of the concept; and, fourth, the blurring of the private and public divide is considered a hallmark of both models described with significant overlap between individual's roles within the state system and the VWSCs. In summary, the main forms of service delivery studied could accurately be described as co-production as per the ideas of Joshi and Moore (2004).

UNDERSTANDING COPRODUCTION IN INDIA

In making the argument that these forms of service delivery are better described as co-production rather than community management, the author is cognisant about the risks of introducing a label that defies easy categorisation and boundary. Community management has emerged to become a sort of umbrella term to describe what can be extremely variable practices. In an earlier paper there was an attempt to introduce some more granulated terms to reflect difference in community roles, with the labels being: direct provision with community involvement, community management with direct support and professionalised community-based management (Hutchings et al., 2017). Equally, there are other forms of rural water service delivery models ranging from direct local government provision, public utility provision, private-sector provision and supported self-supply (World Bank, 2017), each with its own characteristics. In this regard, further work is needed to precisely clarify the characteristics and boundaries of co-production (and perhaps different forms of co-production) yet that is considered a distinct contribution to this paper. The major point here was to highlight the high-level utility of co-production as an umbrella term to describe what is often described as community management in India. As will be argued, this is not only on the ground of improved accuracy but also because of its normative value in using a concept that conveys the shared responsibility for service provision between citizens and the state (or other enabling support entities, such as NGOs).

Some further points of clarification are useful to stress here when interpreting these findings. First, it is acknowledged that co-production is more than co-financing but involves both parties actively involved in the production process of a service. In this sense, the financial data are one example of this but the involvement of both organised citizens and state employees involved in the running of the water systems, as per the institutional models described, is another element of this arrangement. Second, that community management and coproduction are not mutually exclusive, and community management can even happen within a co-production system if organised groups of citizens take on the management of part of a system. However, by describing it as community management it is only telling part of the story, and that community management should be embedded within a broader process of co-production. In this sense, community management can still happen within a broader process of co-production but it is the focus on that larger endeavour, discursively, conceptually and in a policy context, which is considered important and which I hope a new discourse may be able to help to move towards.

Building on that evidence, it is now argued for the need to reset the discourse of community management to one of 'co-production'. This is to not only promote a more accurate discourse but one that fairly attributes the reality of shared responsibility between state and citizen that is the hallmark of the programmes studied. This forms an attempt to bypass terms like community management or community management plus, which promote a sense of equivocation or, even, contradiction when used by governments, NGOs and donors to describe the programmes that *they* deliver. Yet in doing so it is important to note some limitations on these claims and, therefore, help provide greater clarity on how and why this situation has emerged in India and whether it is applicable in broader contexts. It is clear that the precise modes of co-production described in the case studies are shaped by the particular nature of Indian devolution. This makes direct comparisons to other national contexts limited in many regards. However, it does point to a more subtle implication of the study which is how community management has been adapted within an Indian context. In particular, the model has been integrated within and transformed by the political economy of rural administration, especially the Panchayat Raj system of devolution. This is considered an important point because a common mechanism of failure within the global development sector is the uncritical transfer of blueprint models from one context to another, without appropriate local adaptation (Scott, 1998; Pritchett et al., 2013). A recent critical paper on community management has even stated the model represents an international "blueprint for breakdown" that has become poorly implemented in many contexts (Broek and Brown, 2015).

This poses a related question – how and why has India avoided this blueprint adoption of community management failure and seemingly undertaken a process of appropriate adaptation towards co-production? First, it is worth noting that many of these changes have undoubtedly been enabled by the growing levels of wealth that have developed, albeit unevenly, across India. The country has become richer with per capita GDP (PPP) doubling in the past decade from around USD3000 (2006) to over USD6000 (2016) (World Bank, 2016) and this wealth will be enabling the state to more easily fund the subsidies going into the water sector. This situation is unfortunately not replicated in some of the lower income countries that also have widespread use of community management. Yet it is contended the Indian situation is also shaped by more ideological drivers that mean community management became framed not in opposition to the state but rather as an approach that is compatible with the local self-government system. This makes the narrative of community management in India qualitatively different to what could be described as the generic international narrative.

In the international arena, the justification for community management is that it is often an alternative to deficient public provision (Harvey and Reed, 2006; Broek and Brown, 2015) with the principle that NGOs could help facilitate community participation as some kind of replacement for public-sector involvement. Yet in India, the very notion of the local self-government system is that it reflects the political ideology of *Swajal* (Johnson et al., 2005; Banerjee, 2013). The *Swajal* ideology is

associated with self-determination and therefore has a dual association with both the Indian independence movement and also village self-sufficiency (Johnson et al., 2005; Banerjee, 2013). During the early 1990s, it was this political ideology of self-sufficiency that shaped the constitutional reforms that empowered the Panchayat Raj system of local self-government (Johnson et al., 2005) that is shaping the forms of co-produced rural water supply described above.

So, whilst the participatory underpinning of community management in the international literature implicitly adopted a rivalrous distinction between community participation and government (Harvey and Reed, 2006), within the Indian context, community participation is not implicitly considered as some form of alternative to public provision, but rather as the aim of public administration. Even if this ambition is not often achieved in practice it remains the dominant normative position on the relations between state and participation which is considered to have laid the foundations for these forms of co-production to emerge. In concluding this section on the Indian national context, the author believes that the forms of service delivery practised under the guise of community management in India can be more usefully described as co-production. There is considered to be normative and conceptual advantages of bringing in this concept within the Indian context, as it is considered more accurate and fairer in terms of describing the distribution of responsibility between citizens and supporting bodies. However, the specific nature of India does limit its easy transfer of these principles to broader contexts but withstanding these challenges, the next section still argues it still could be worthwhile.

DOES CO-PRODUCTION HAVE VALIDITY BEYOND INDIA?

This section now considers the validity of the arguments made in this paper beyond India. It, however, focuses predominantly on the sub-Saharan Africa context as this is where the most acute need remains in terms of basic access to rural water supply (WHO-UNICEF, 2017) and in terms of sustainability of rural water services (World Bank, 2017). In doing so, it is recognised that there are significant community management programmes operating in other contexts, some which exhibit strong co-production tendencies. Notable examples include the SISAR (Integrated Rural Water Supply and Sanitation System) programme in Brazil that involves pooling of risk between communities through the creation of a federation of community associations supported by the State Water Supply and Sanitation Company, and the circuit rider programmes in Nicaragua and Honduras which involve highly mobile technical experts employed by the State providing assistance to communities (for a recent review of experiences from around the world, see: World Bank, 2017). Although not considered in detail in this paper, these cases are considered to reinforce the view that it is important to think 'beyond the community' to consider rural water services as a joint enterprise between state and citizens.

Returning to earlier arguments about the distinction between collective action problems and co-production problems (McGranahan, 2015), it is possible to highlight a fundamental difference between the Indian case studies and the context of community management in the context of a sub-Saharan Africa. That is, the cases from India focus on piped water supply which are increasingly delivering household or yard connections, whilst the community management approach has largely been adopted in a sub-Saharan African context as an approach for managing communal handpumps or public stand posts (McCommon et al., 1990). In the latter context, it may still hold true that collective action problems remain a useful analytical way of explaining the challenge at the community level; yet its applicability becomes less relevant for household piped water supply that demands more professionalised management structures but also change the psychology of using the service. This poses the question about whether co-production should be seen as the next stage of community management which develops as technological sophistication increases and people begin to receive household services. This may be one fruitful way of thinking about co-production in India vis-à-vis lower-income contexts in other regions. In a separate piece it is argued that in some wealthier parts of India there is a move to 'utilitisation' of services in which urban-like utility services move into rural

areas, particularly in the context of multi-village schemes (Hutchings et al., *under consideration*), and in that light co-production may be a transitional step between the models. More broadly, the new Sustainable Development Goal targets have higher ambitions to deliver safely managed water supply located on the premises (WHO-UNICEF, 2017), which is likely to drive greater emphasis on delivering these forms of household supply around the world.

Yet sequenced theories of development have often proven inadequate in a predictive sense and so this thinking is not considered completely satisfactory. Rather, a discourse of co-production even in low-income contexts in which communal hand pumps or public stand posts are still used is considered valid on normative grounds. The challenges associated with management in these contexts is also likely to be best solved through providing highly decentralised support to community institutions and significant recurrent financing of supply (Stalker Prokopy and Thorsten, 2009; Lockwood and Smits, 2011), which then makes it a form of co-production. The label is important as it helps discursively recast water supply as a joint responsibility between communities and higher-level actors and not just the responsibility of communities. This is important not only in providing fairer expectations of rural communities but also in terms of advocating and holding to account governments (and other agencies) that too often leave communities without adequate support. As a discourse co-production is considered to hold normative promise in how it supports sharing of responsibility between state and citizen.

Thinking about these issues in a broader international context also opens up a route for further research. This study suggests that the ideals of community management have become co-opted and adapted into co-production through particular features of the Indian context. Further research understanding this process in India, as well as assessing whether and how this process plays out in other contexts, may provide insights into how internationally recognised practices can be better adapted into the national operating context by national and local actors. This is a particularly interesting question in countries with very different contexts, especially those with a smaller and less influential national public policy arena that may remain overly dominated by international actors. It is hoped that through the prism of co-production these efforts will more meaningfully focus on that critical relationships between community-level action and broader support systems, rather than the minutiae of particular intra-community interaction.

CONCLUSION

This paper makes the case for a realignment in the discourse and conceptualisation of community management of rural water supply. This is based on a twofold case. First, the discourse of community management is inaccurate in describing the balance of responsibility and resource contribution that is found in many programmes, at least as demonstrated via the case studies from India. In these cases, community institutions had become embedded or highly supported via the local self-government system. Financing of supply was also significantly subsidised by enabling support entities with communities covering approximately 5% of capital costs and half of recurrent costs. In practice, this form of service delivery is dependent on the enabling support entities and, put simply, the way we describe it should better reflect this. This leads to the second point. On a normative level, shifting the discourse is considered a fairer representation that appropriately indicates how the balance of responsibility should be across these scales. This point is important as it means that there is value in extending the notion of coproduction to other contexts to help shape and advocate for more equitable expectations and beliefs about the shared role of different actors in delivering rural water supply, even if these sorts of arrangements are not currently in practice.

On a conceptual level, the paper makes a related point about thinking through the central problem of rural water-supply service delivery as a co-production challenge rather than a collective action or participatory community empowerment challenge. Here, the point is that collective action and

participatory analyses tend towards a focus on intra-community dynamics and are poorly aligned to contemporary challenges in the management of domestic supply, especially when dealing with household piped water supply. In such cases, it is better to think through the challenge as one of co-produced service delivery involving both private citizens at the community level and broader supporting entities, particularly government bodies. As such, the challenge is about understanding how durable and productive relationships can be achieved at this level so as to produce the type of enduring social and technical structures that deliver effective and equitable services to populations. The India example has some insight here in that those types of relationships have been produced through its specific political economy (especially, devolution centred on the Panchayat Raj Institutions) as well as ideological frames (e.g. *Swajal*). On one level, this makes direct comparisons to other national contexts limited in scope, but it does indicate what is found in many other cases of successful service delivery programmes around the world. That is, that a process of national adaptation is likely to be an important step in developing workable and sustainable solutions.

ACKNOWLEDGEMENTS

This paper is an output from the Community Water Plus project, a three-year research investigation funded by the Department of Foreign Affairs and Trade (DFAT) of the Australian government as part of the Australian Development Research Awards Scheme (Grant: 66470). The research was undertaken by a consortium of partners including the Administrative Staff College of India (Hyderabad), the Centre of Excellence for Change (Chennai), Malaviya National Institute of Technology (Jaipur), Xavier Institute of Social Service (Ranchi), IRC from The Netherlands and Cranfield University, UK, who were also responsible for overall project coordination. The empirical data reported were first presented individually in the respective case study reports from the overall research project. Parts of the paper develop themes explored in the author's PhD thesis and associated book.

REFERENCES

- Agrawal, A. and Gupta, K. 2005. Decentralization and participation: The governance of common pool resources in Nepal's Terai. *World Development* 33(7): 1101-1114.
- Agrawal, A. and Yadama, G. 1997. How do Local Institutions Mediate Market and Population Pressures on resources? Forest Panchayats in Kumaon, India. *Development and Change* 28(3): 435-465.
- Armitage, D. 2005. Adaptive capacity and community-based natural resource management. *Environmental Management* 35(6): 703-15.
- Banerjee, R. 2013. What ails Panchayati Raj? *Economic and Political Weekly* 48(30): 172-176.
- Baumann, E. 2006. Do operation and maintenance pay? *Waterlines* 25(1): 10-12.
- Blaikie, P. 2006. "Is small really beautiful?" Community-Based Natural Resource Management in Malawi and Botswana. *World Development* 34(11): 1942-1957.
- Broek, M. van den and Brown, J. 2015. Geoforum blueprint for breakdown? Community based management of rural groundwater in Uganda. *Geoforum* 67: 51-63.
- Brown, L.D. and Ashman, D. 1996. Participation, social capital, and intersectoral problem solving: African and Asian cases. *World Development* 24(9): 1467-1479.
- Chary Vedala, S.; Jasthi, S. and Uddaraju, S. 2015. Users becoming managers of water supply; an initiative of Water and Sanitation Management Organization, Gandhinagar District, Gujarat. Hyderabad: Administrative Staff College of India.
- Chary Vedala, S.; Jasthi, S. and Uddaraju, S. 2016a. Community involvement in a multi-village scheme in Amravati district, Maharashtra. Hyderabad: Administrative Staff College of India.
- Chary Vedala, S.; Jasthi, S. and Uddaraju, S. 2016b. Decentralisation paving a way for efficient Service Delivery – A case of Kodur Gram Panchayat, Kerala. Hyderabad: Administrative Staff College of India.

- Chary Vedala, S.; Jasthi, S. and Uddaraju, S. 2016c. Professionally managed-community owned decentralized drinking water service delivery. Hyderabad: Administrative Staff College of India.
- Chowns, E. 2014. The political economy of community management: A study of factors influencing sustainability in Malawi's rural water supply sector. Birmingham: Birmingham University PhD thesis.
http://etheses.bham.ac.uk/5014/2/Decl_IS_Chowns.pdf
- Chowns, E. 2015. Is community management an efficient and effective model of public service delivery? Lessons from the rural water supply sector in Malawi. *Public Administration and Development* 35(4): 263-276.
- Cleaver, F. 1999. Paradoxes of participation: Questioning participatory approaches to development. *Journal of International Development* 11(4): 597-612.
- Cleaver, F. 2012. *Development through bricolage: Rethinking institutions for natural resource management*. Oxford: Routledge.
- Cornwall, A. and Brock, K. 2005. What do buzzwords do for development policy? A critical look at "participation", "empowerment" and "poverty reduction". *Third World Quarterly* 26(7): 1043-1060.
- Cox, M. and Arnold, G. 2010. A review of design principles for community-based natural resource. *Ecology and Society* 15(4): 38.
- Davis, J.; Lukacs, H.; Jeuland, M.; Alvestegui, A.; Soto, B.; Lizárraga, G. and Wakeman, W. 2009. Sustaining the benefits of rural water supply investments: Experience in Cochabamba and Chuquisaca, Bolivia. In Bakalian, A. and Wakeman, W. (Eds), *Post-construction support and sustainability in community-managed rural water supply : Case studies in Peru, Bolivia, and Ghana*, pp. 53-76. Washington, DC: World Bank-Netherlands Water Partnership.
- Dynamics, C. and Berkes, F. 2006. From community-based resource management to complex systems : The scale issue and marine commons. *Ecology and Society* 11(1): 45.
- Franceys, R.; Cavill, S. and Trevett, A. 2016. Who really pays? A critical overview of the practicalities of funding universal access. *Waterlines* 35(1): 78-93.
- Government of India. Societies Registration Act. 1860. Ministry of Corporate Affairs § 1860.
www.mca.gov.in/Ministry/actsbills/pdf/Societies_Registration_Act_1_860.pdf
- Government of India. 2013. National Rural Drinking Water Programme, Rajiv Gandhi Drinking Water Mission, Movement towards ensuring people's Drinking Water Security in Rural India, Framework for Implementation (updated 2013). New Delhi: Ministry of Drinking Water and Sanitation.
- Harris, B.; Brighu, U. and Poonia, R. 2016a. *24x7 water supply in Punjab: International funding for local action*. Jaipur: Malaviya National Institute of Technology.
- Harris, B.; Brighu, U. and Poonia, R. 2016b. *Community managed water supplies in rural Jaipur: The Swajaldhara scheme 15 years on*. Jaipur: Malaviya National Institute of Technology.
- Harvey, P.A. and Reed, R.A. 2006. Community-managed water supplies in Africa: Sustainable or dispensable? *Community Development Journal* 42(3): 365-378.
- Hickey, S. and Mohan, G. 2005. Relocating participation within a radical politics of development. *Development and Change* 36(2): 237-262.
- Hood, C. 1998. *The art of the state. Culture, rhetoric, and public management*. Oxford: Oxford University Press.
- Hope, R. 2015. Is community water management the community's choice? Implications for water and development policy in Africa. *Water Policy* 17(4): 664.
- Hutchings, P. 2015. *Supporting community management in Morappur, Tamil Nadu*. Cranfield: Cranfield University Press.
- Hutchings, P.; Chan, M.Y.; Cuadrado, L.; Ezbakhe, F.; Mesa, B.; Tamekawa, C. and Franceys, R. 2015. A systematic review of success factors in the community management of rural water supplies over the past 30 years. *Water Policy* 17(5): 963.
- Hutchings, P.; Franceys, R.; Mekala, S.; Smits, S. and James, A.J. 2017. Revisiting the history, concepts and typologies of community management for rural drinking water supply in India. *International Journal of Water Resources Development* 33(1): 152-169.

- Hutchings, P.; Franceys, R.; Smits, S. and Mekala, S. 2017. *Community management of rural water supply: Case studies of success from India*. London: Earthscan, Routledge.
- Javorszky, M.; Dash, P.C. and Panda, P.K. 2015. Understanding resource implications of the 'plus' in community management of rural water supply systems in India: The case of DWSD in Jharkhand. Ranchi: Xavier Institute for Social Service.
- Javorszky, M.; Dash, P.C. and Panda, P.K. 2016. Communal action for private connections: Gram Vikas' approach to supporting community management of rural water supplies in Odisha. Ranchi: Xavier Institute for Social Service.
- Johnson, C.P.D.; Deshingkar, P. and Start, D. 2005. Grounding the state: Devolution and development in India's Panchayats. *Journal of Development Studies* 41(6): 937-970.
- Jones, S. 2011. Participation as citizenship or payment? A case study of rural drinking water governance in Mali. *Water Alternatives* 4(1): 54-71.
- Jones, S.D. 2015, March 16. Bridging political economy analysis and critical institutionalism: An approach to help analyse institutional change for rural water services. *International Journal of the Commons*, www.thecommonsjournal.org/index.php/ijc/article/view/URN%3ANBN%3ANL%3AUI%3A10-1-116921/472
- Joshi, D. 2003. Secure water? Poverty, livelihoods and demand-responsive approaches. London. www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/1618.pdf
- Joshi, M. and Moore, J. 2004. Institutionalised co-production: Unorthodox public service delivery in challenging environments. *Journal of Development Studies* 40(4): 31-49.
- Leach, M.; Mearns, R. and Scoones, I. 1999. Environmental entitlements: Dynamics and institutions in community-based natural resource management. *World Development* 27(2): 225-247.
- Lockwood, H. and Smits, S. 2011. *Supporting rural water supply: Moving towards a service delivery approach*. Warwickshire, UK: Practical Action Publishing Ltd.
- Mansuri, G. and Rao, V. 2004. Community-based and -driven development: A critical review. *The World Bank Research Observer* 19(1): 1-39.
- Marks, S.J. and Davis, J. 2012. Does user participation lead to sense of ownership for rural water systems? Evidence from Kenya. *World Development* 40(8): 1569-1576.
- McCommon, C.; Warner, D. and Yohalem, D. 1990. *Community management of rural water supply and sanitation services*. WASH Technical Report 67. Washington, DC.: World Bank.
- McGranahan, G. 2015. Realizing the right to sanitation in deprived urban communities: Meeting the challenges of collective action, coproduction, affordability, and housing tenure. *World Development* 68: 242-253.
- McGranahan, G. and Mitlin, D. 2016. Learning from sustained success: How Community-driven initiatives to improve urban sanitation can meet the challenges. *World Development* 87: 307-317.
- Moriarty, P.; Butterworth, J.; Franceys, R.; Smits, S.; Butterworth, J. 2013. Trends in rural water supply: Towards a service delivery approach. *Water Alternatives* 6(3): 329-349.
- Olson, M. 2002. *The logic of collective action: Public goods and the theory of groups*. Oxford: Blackwell.
- Ostrom, E. 1990. *The evolution of institutions for collection action*. Cambridge: Cambridge University Press.
- Ostrom, E. 1996. Crossing the great divide: Coproduction, synergy, and development. *World Development* 24(6): 1073-1087.
- Ostrom, E. 2010. Analyzing collective action. *Agricultural Economics* 41(1): 155-166.
- Paul, S. 1987. Community participation in development projects: The World Bank experience. In *Readings in Community Participation*, pp. 1-52. Washington, DC: EDI.
- Pritchett, L.; Woolcock, M. and Andrews, M. 2013. Looking like a state: Techniques of persistent failure in state capability for implementation. *Journal of Development Studies* 49(1): 1-18.
- Ramamohan Roa, M.S. and Raviprakash, M.S. 2016a. *Empowered community – Secured safe water supply in parts of Dhar District, Madhya Pradesh*. Chennai: Centre for Excellence in Change.
- Ramamohan Roa, M.S. and Raviprakash, M.S. 2016b. *Jal Nirmal and beyond: Supporting the community management of rural water supply in Belagavi District, Karnataka*. Chennai: Centre for Excellence in Change.
- Reserve Bank of India. 2015. *Handbook of statistics on Indian economy*. New Delhi: Reserve Bank of India.

- Rout, S. 2014. Institutional variations in practice of demand responsive approach: Evidence from rural water supply in India. *Water Policy* 16(4): 650-668.
- Saraswathy, R. 2015. Kathirampatti Village Panchayat, Tamil Nadu Rural Water Supply. Chennai: Centre for Excellence in Change.
- Saraswathy, R. 2016a. Community managed gravity-fed piped water supply in Himalayan Sikkim. Chennai: Centre for Excellence in Change.
- Saraswathy, R. 2016b. Nenmeni Sudha Jala Vitharana Society (NSJVS) Kerala: Professionalised management of water supply by community. Chennai: Centre for Excellence in Change.
- Saunders, R.J. and Warford, J.J. 1976. *Village water supply: Economics and policy in the developing world*. Washington, DC: World Bank.
- Schweitzer, R.W. and Mihelcic, J.R. 2012. Assessing sustainability of community management of rural water systems in the developing world. *Journal of Water, Sanitation and Hygiene for Development* 2(1): 20.
- Scott, J.C. 1998. *Seeing like a state*. New Haven, Connecticut: Yale Agrarian Studies Series.
- Smits, S. and Mekala, S. 2015. *The effects and costs of support to community-managed handpumps in Patharpratima, West Bengal*. The Hague: IRC.
- Smits, S.; Shiva, R. and Kapur, D. 2016. *Support to community-managed rural water supplies in the Uttarakhand Himalayas – The Himmatthan Water Supply and Sanitation Initiative*. Community Water Plus Case Study Report No. 12. The Hague: IRC.
- Srivastava, S. 2012. Swajaldhara: 'Reversed' realities in rural water supply in India. *IDS Bulletin* 43(2): 37-43.
- Stalker Prokopy, L. and Thorsten, R. 2009. Post-construction support and sustainability in rural drinking water projects in Cuzco, Peru. In Bakalian, A. and Wakeman, W. (Eds), *Post-construction support and sustainability in community-managed rural water supply : Case studies in Peru, Bolivia, and Ghana*, pp. 17-51. Washington, DC: World Bank-Netherlands Water Partnership.
- United Nations. 2010. Resolution adopted by the General Assembly on 28 July 2010 (A/RES/64/292). New York: United Nations. www.un.org/es/comun/docs/?symbol=A/RES/64/292&lang=E
- Whaley, L. and Cleaver, F. 2017. Can 'functionality' save the community management model of rural water supply? *Water Resources and Rural Development* 9: 56-66.
- White, H.; Menon, R. and Waddington, H. 2018. *Community-driven development: Does it build social cohesion or infrastructure? A mixed-method evidence synthesis*. Working Paper 30. Delhi. www.3ieimpact.org/media/filer_public/2018/03/12/wp30-cdd.pdf
- WHO-UNICEF (World Health Organisation-United Nations Children's Fund. 2017. Progress on drinking water, sanitation and hygiene: 2017, update and SDG baseline. New York.
- World Bank. 2016. India-World Bank data. World Bank data. Washington, DC: World Bank.
- World Bank. 2017. *Sustainability assessment of rural water service delivery models: Findings of a multi-country review*. Washington, DC.

APPENDIX

Table 1. Overview of case studies.

State	Name of programme	Primary enabling support agency (agencies)	Community service provider model	Years since implementation	References
Jharkhand	National Rural Drinking Water Programme (NRDWP)	Drinking Water and Sanitation Department (State Government)	Sub-committee of the local self-government (LSG)	4	(Javorszky, Dash, and Panda, 2015)
Madhya Pradesh	Vasudha Vikas Sansthan	Vasudha Vikas Sansthan (NGO)	Registered society	2	(Ramamohan Roa and Raviprakash, 2016a)
Odisha	Gram Vikas	Gram Vikas (NGO)	Registered society	3	(Javorszky, Dash, and Panda, 2016)
Chhattisgarh	NRDWP	Public Health Engineering Department (PHED) (State Government)	Sub-committee of the LSG	14	(Javorszky et al., 2015)
Meghalaya	NRDWP	Dorbor (body of LSG system in tribal areas)	Sub-committee of the LSG	9	(Saraswathy, 2016b)
Rajasthan	Swajaldhara	PHED (State Government)	Sub-committee of the LSG	6	(Harris et al., 2016b)
West Bengal	Water for People	Water for People (NGO)	Registered society	6	(Smits and Mekala, 2015)
Telangana	Bala Vikas	Bala Vikas (NGO)	Registered society	5	(Chary Vedala et al., 2016c)
Karnataka	Jal Nirmal (World Bank supported programme)	Rural Drinking Water Supply and Sanitation Department (State Government)	Sub-committee of the LSG	6	(Ramamohan Roa and Raviprakash, 2016b)
Himachal Pradesh	NRDWP	Irrigation and Public Health Department (State Government)	Registered society	6	(Smits, Shiva, and Kapur, 2016)
Punjab	Punjab Rural Water Supply and Sanitation	Department of Water Supply and Sanitation (State	Registered society	3	(Harris, Brighu, and Poonia, 2016a)

	Project (World Bank-supported programme)	Government)				
Uttarakhand	Himmotthan Water Supply and Sanitation Initiative	Himmotthan (NGO)	Registered society	8		(Smits, Shiva, and Kapur, 2016)
Kerala I	Jalanidhi (World Bank- supported programme)	Kerala Rural Water Supply and Sanitation Agency	Registered society	9		(Saraswathy, 2016b)
Kerala II	NRDWP	Panchayat Raj Institutions	Registered society	9		(Chary Vedala et al., 2016b)
Gujarat I	Water and Sanitation Management Organisation (WASMO)	WASMO (State Government)	Registered society	11		(Chary Vedala et al., 2015)
Gujarat II	WASMO	WASMO (State Government)	Registered society	6		(Chary Vedala et al., 2015)
Tamil Nadu I	NRDWP	Tamil Nadu Water and Drainage Board (TWAD Board) (State Government)	Sub-committee of the LSG	10		(Saraswathy, 2015)
Tamil Nadu II	Hogenakkal Water Supply and Fluorosis Mitigation Project	TWAD Board (State Government)	Sub-committee of the LSG	3		(Paul. Hutchings, 2015)
Maharashtra	Shahnoor Dam Project	Maharashtra Jeevan Pradhikaran (MJP) and the	Sub-committee of the LSG	14		(Chary Vedala et al., 2016a)
Sikkim	NRDWP	Department of Rural Management and Development (State Government)	Sub-committee of the LSG	5		(Saraswathy, 2016a)

THIS ARTICLE IS DISTRIBUTED UNDER THE TERMS OF THE CREATIVE COMMONS *ATTRIBUTION-NONCOMMERCIAL-SHAREALIKE* LICENSE WHICH PERMITS ANY NON COMMERCIAL USE, DISTRIBUTION, AND REPRODUCTION IN ANY MEDIUM, PROVIDED THE ORIGINAL AUTHOR(S) AND SOURCE ARE CREDITED. SEE [HTTP://CREATIVECOMMONS.ORG/LICENSES/BY-NC-SA/3.0/LEGALCODE](http://creativecommons.org/licenses/by-nc-sa/3.0/legalcode)

