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Sociotechnical Alternatives and Controversies in Extending Water and Sanitation Networks in Lima, Peru

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ABSTRACT: Basic service utilities in developing countries have long been criticised for their inefficiencies. Lima's public utility firm, even so, has experimented with technical, social and institutional alternatives in order to adapt and extend water and sanitation networks to informal settlements. Though efficient, these innovative solutions have challenged conventional work practices and have not prompted a paradigm shift in the water and sanitation sector. The political economy of the utility's neoliberal reform and its limitations has already been extensively studied. Much less studied, however, are the everyday practices and discourses that underpin what can be considered to be innovation niches and which have actually permitted service extension to the poor. Focusing on these practices, this paper examines the cognitive, social and political controversies around adjusting the 'modern infrastructure ideal' to informal urbanisation patterns. It shows how urban policies in the Global South are both highly influenced by conventional international models and required to adapt to 'unconventional' conditions. It argues that the sociotechnical dimension of urban water supply has been neglected in conducting service delivery reforms, hindering sustainable implementation of innovations. Changing professional mindsets and practices therefore appears as a key driver in the support of pro-poor alternatives in urban water and sanitation provision.

KEYWORDS: Water and sanitation, innovation, sociotechnical regimes, informal urbanisation, Lima, Peru

INTRODUCTION: THE SOCIOTECHNICAL DIMENSION OF SERVICE DELIVERY

From a political economy to a sociotechnical perspective

Since the 1990s, neoliberal reforms have been implemented to increase the performance of utilities, infrastructure coverage and service quality for the urban poor. Pushed by some international donors under the Washington Consensus (World Bank, 2004) in many countries, these neoliberal reforms have led to public-private partnerships or privatisation of water utilities. The underlying logic was to create a favourable environment for market-based approaches in order to encourage efficiency and performance and thereby improve service delivery for all, and particularly for the urban poor.

Analyses of these reforms in terms of political economy and/or political ecology have been numerous. Their mixed results have been widely debated, resulting in the conclusion that local political economies and governance frameworks are critical – if not decisive – in influencing the actual impacts of such reforms (Batley, 1996; Estache et al., 2001). These analyses have also revealed the power and politics at stake in water reforms and the way in which they serve wider neoliberal agendas (Ioris, 2013). Complementary approaches have focused on the way water bureaucracies or hydrocracies – coalitions of elites, engineers and civil servants (Molle et al., 2009) – have favoured technocratic approaches. These hydrocracies, based on networks of individuals that are forged as early as during their university years (Oré and Rap, 2009), appear to be influential in centralised decision-making processes. The institutional dimension of water supply systems is also acknowledged (Leitmann and Baharoğlu, 1999; Bakker et al., 2008), highlighting that urban governance failures and miscoordination undermine the willingness and

ability to connect the urban poor. These analyses, however, focus on the political spheres at national levels and fall short of opening the 'black box' of the concerned utilities themselves.

On the one hand, the effect on performance and sustainability of cultural change within utilities (Mugabi et al., 2007), endogenous capacity-creation processes (Kayaga et al., 2013) and capability gaps (Worch et al., 2013) are rarely taken into account. Indeed, infrastructure networks are sociotechnical systems that combine material, cognitive and political elements (Graham, 2000; Hodson and Marvin, 2010). For a long time, service networks and utilities have abided by the 'modern infrastructure ideal': a monopolistic, integrated and standardised system for delivering universal, uniform and individualised services (Graham and Marvin, 2001), i.e. water treatment plants, pipes throughout the city and in-house connections. This technical model remains attractive and dominant in the minds of engineers and politicians (Gandy, 2008; McFarlane, 2008), and this cognitive model is reproduced and institutionalised in state apparatuses and hydrocracies that favour engineering solutions (Damonte, 2019). All these elements constitute a stable sociotechnical regime encompassing norms, financing mechanisms, supply chains, etc. which create path dependencies highly resistant to change (Coutard, 1999).

On the other hand, the materiality of service networks is still understudied, hampering understanding of the recurrent challenges in improving access to basic services in developing cities (Jaglin and Zérah, 2010). Sociotechnical systems of basic services are embedded in, and dependent on, urban contexts. In the Global South, utilities are confronted with the spatial, social and institutional irregularities of the settlements to be serviced (Criqui, 2013, 2015a);¹ these are field conditions which make the conventional deployment of infrastructure networks challenging. In fact, the inadequacy of the modern infrastructure ideal in the Global South makes its achievement incomplete (Coutard, 2008); policies and operations are therefore caught in a tension between this dominant sociotechnical regime and rapid and informal urbanisation that requires alternative solutions in order to service the urban poor (Jaglin, 2008). Such external factors have been characterised as 'landscape forces' that pressure the model to change or, on the contrary, to resist change (Geels and Schot, 2007). The literature highlights two sources of pressure on network extension in the Global South: an explicitly pro-poor urban governance framework (Connors, 2005; Bakker et al., 2008) and the critical role of utilities themselves in adopting changes (Hodson and Marvin, 2010; Worch et al., 2013; Criqui and Zérah, 2015).

The limits of the conventional model in the Global South have thus given birth to the call of "some for all rather than more for some" (Nicol et al., 2012), i.e. to abandon the old paradigm for pro-poor innovative techniques (Mara and Alabaster, 2008). Nonetheless, in a multilevel perspective the transition of a dominant sociotechnical system such as the modern infrastructure ideal emerges from the conjunction of favourable landscape forces with mature innovation niches (Geels and Schot, 2007). Such niches require highly committed stakeholders or champions, a favourable regulatory framework that allows for flexibility in the application of rules and norms, and an acceptance of risk, uncertainty and test-and-learn approaches. Innovations will break through, provided that 'interpretative work' is conducted among the stakeholders – in the water sector, the hydrocracy – which leads to with 'closure' around a new regime: vision, norms, techniques and financing mechanisms (Geels and Schot, 2007). All these conditions make the reconfiguration of the modern infrastructure ideal towards hybrid configurations of service delivery far from evident (Jaglin, 2008). Though technically feasible and economically appropriate to the extension of basic services to the urban poor, alternatives are a priori resisted and often relegated to being 'second-class' options (Paterson et al., 2007) since they call into question the historically, politically, sociologically and cognitively embedded model of the modern infrastructure ideal.

This paper applies this multilevel transition perspective of sociotechnical regimes to the extension of water and sanitation networks in the informal settlements of Lima. It takes stock of the neoliberal reforms

¹ The fact that urbanisation is not planned does not impact the economic equilibrium of service extension: not only does there exist a willingness and ability among the urban poor to pay for quality services (Estache et al., 2001), but emerging cities also have the financial capacity – if not the will – to invest in utilities (Lorrain, 2011).

that have been conducted over the last 20 years and of its criticisms, and adds a complementary sociotechnical perspective by scrutinising the landscape forces (urbanisation trends) and innovation niches (sociotechnical methods), in order to analyse how the regime of centralised and technocratic engineering approaches in the water sector has resisted sociotechnical change and maintained its dominance in Lima.

Approach: Actually existing water practices

Basic service utilities in the Global South have been criticised for being unable to keep pace with urbanisation; nevertheless, infrastructure networks are actually being steadily extended (Criqui, 2015a), albeit slowly and still unequally (Ioris, 2012a). There needs to be an examination of the discrepancy between critical political analyses and statistics on access (Criqui, 2015a) and the silence of the social science literature on infrastructure choices. A political economy interpretation grid of the decision-making process, financial equilibrium and the governance framework does not allow these contradictions to be grasped; it overlooks the endogenous capacity and managerial challenges the utility faces (Mugabi et al., 2007; Kayaga et al., 2013; Worch et al., 2013) as well as the operational challenges faced by field professionals in the implementation of projects, i.e. the building and managing of services.

Indeed, on a daily basis, utilities' engineers do install water pipes and electric poles in informal settlements; they 'muddle through' unplanned settlements, as observed in Istanbul (Leitmann and Baharoğlu, 1999), Bangalore (Connors, 2005), Delhi (Criqui and Zérah, 2015) and Lima (Criqui, 2013, 2015b). To do so, they must invent techniques that are adapted to the field, they must adjust norms, and they must negotiate with both officials and users. These efforts are rarely accounted for, but are decisive in the actual implementation of decisions that are made at the bureaucratic level.

To understand work practices, methods, discourses and mindsets, it is therefore necessary to open the black box of water utilities; one must go beyond state-level decision makers and acknowledge the daily practices of street-level professionals. Rather than adopting a political economy approach at high-level decision-making spheres and then routinely criticising the utilities' deficiencies (Connors, 2005), this research adopts a positive perspective in identifying sociotechnical alternatives that can be applied to improving access to basic services for the urban poor in developing cities.

From an epistemological point of view, this research relates to postcolonial studies (Legg and McFarlane, 2008) and Southern Urbanism (Schindler, 2017), which focus on the specific processes of urbanisation and planning in "ordinary cities" of the Global South (Amin and Graham, 1997; Robinson, 2006); it also adopts the premise of looking at "actually existing urbanisms" (Shatkin, 2011). In a non-normative postcolonial epistemology (McFarlane and Robinson, 2012) and considering that "what works matters" (Hoch, 1984), this research contrasts and compares operational field practices with official positions.

A review of the literature on Peru's water sector constitutes the background knowledge on the water regime at stake. A decisive turn has been taken since the 1990s towards neoliberalisation of the water sector; in parallel, three flagship programmes – on which this paper focuses – have been implemented to provide water in Lima's informal settlements. Official reports either from international donors or the Peruvian government have yielded factual information on the technical, financial and institutional arrangements implemented in the projects. This information has been contrasted with on-site investigations of realised water works, as well as with about seventy interviews with hydrocrats, with engineers from consulting firms and suppliers, with urban activists from local NGOs, and with end users in three informal settlements in northern Lima. Research was conducted in 2012-2013.

Field evidence and discourses have revealed fundamental controversies that tend to position state-level decision makers in opposition to street-level practitioners; research results also illustrate the interpretative flexibility surrounding sociotechnical alternatives. To account for these controversies, the paper adopts an historical perspective and explores the material, social and institutional dimensions that

are at stake; these combined approaches allow for a deconstruction of the dominant discourses and yield an underlying narrative around sociotechnical change.

The following section reviews the sociopolitical context of the extension of water services in informal settlements of Lima; it offers an understanding of the landscape forces at stake. It then goes through three main programmes – potential innovation niches – designed to extend water services to the urban poor. Since the modern infrastructure ideal still dominates Peruvian hydrocracy, the paper then discusses the ongoing controversies and debates in order to identify some of the pillars of the Peruvian sociotechnical regime in the water sector that may explain resistance to change. It concludes by identifying some triggers and critical conditions that can facilitate the transition to pro-poor innovation development within water utilities.

LIMA: THE SOCIOPOLITICAL CONTEXT OF NETWORK EXTENSION

In Peru, water and urban policies have evolved jointly (Corton, 2003). Until the 1990s, heterodox urban policies constituted influential landscape forces for including the urban poor in the city through service extension, a pressure that still exists.

Informal urbanisation and policies in Lima

More than half of the nine million residents of Lima live in settlements stemming from informal autonomous urbanisation; these are called *barriadas*, *pueblos jóvenes* or, more recently, the North, South and East Cones. This 'illegal city' appeared independent of official planning and it preceded any servicing of the area (Calderón, 2005). Facing strong social pressure (Matos Mar, 1984), the Peruvian state adopted pragmatic measures to deal with it, inspiring internationally influential trends (Fernández-Maldonado and Bredenoord, 2010) including self-help or progressive housing approaches (Turner, 1976; Bromley, 2003; Harris, 2003) and land formalisation and titling policies (de Soto, 1986, 2000; Fernandes, 2002).

In the 1950s and 1960s, facing 5% annual growth rates and unable to provide housing, the Peruvian state authorised, and at times supported, the invasion of available public land. In 1961, a law for informal settlements introduced the idea of integrated physico-legal sanitation of urban marginal areas² (Riofrío, 2003). The state relied on self-help housing by the people, while civil society organisations mounted pressure on the government to provide services; land and title regularisation was the final step in socio-spatial integration. This heterodox recognition of informal settlements as a solution to the pressures of urban growth has for decades permitted physical improvement and social inclusion of the urban poor in Peru (Matos Mar, 2012).

Political and economic instability and insecurity in the 1980s, however, limited public investment in infrastructure. Meanwhile, large organised *barriadas* had secured some access to services and had consolidated their environment, thus forming new urban centres (Matos Mar, 2012). Easily accessible land had become rare and new settlements appeared on adverse, remote and haphazard hillsides and on unstable sand dunes (Riofrío, 1978; Driant, 1991). By the end of the 1980s, the social and physical situation in informal settlements had deteriorated (Leonard, 2000) and urban services in Lima were in crisis; infrastructure coverage was low and the quality of service was poor (Figari Gold and Ricou, 1990).

Under Fujimori's government, 1990 was an important turning point in Peruvian politics and policies. A neoliberal shock therapy of structural adjustments was followed (Ioris, 2013). In 1996,³ in the urban sector, this shift led to the creation of the central *Comisión de Formalización de la Propiedad Informal* (Commission for the Formalisation of Informal Property) in charge of delivering property titles as a strategy for poverty reduction; results were contested (Calderón, 2004). The electricity and

² Ley 13517: Ley orgánica de barrios marginales, 14/02/1961 (Organic Law for Marginal Settlements).

³ Decreto-ley 803: Ley de promoción del acceso a la propiedad formal, 15/03/1996 (Decree-Law to promote Access to Formal Property).

telecommunications sectors were privatised, service delivery progressively improved (Fernández-Maldonado, 2008; Criqui, 2015b) and, more generally, living conditions improved in slum and informal settlements (Calderón et al., 2015).

Since then, the older informal settlements have become vibrant economic and social centres that are well connected to the city; they are referred to as emerging *nuevas Limas* (new Limas) (Smith, 2008; Arellano and Burgos, 2010; Matos Mar, 2012). The peripheries with the most recent neighbourhoods, however, are more vulnerable; they encroach on desert and on rocky and hilly land and are much less suited to the extension of infrastructure networks. It is here that most NGOs currently intervene. The idea of the inheritance of urban inclusion still permeates most political and urban discourses and constitutes an historical landscape force in favour of providing basic services. Alternative discourses related to the emergence of environmental concerns started to emerge, however, in the 2010s; these highlight an urban bias and the detrimental effects of urban expansion on sustainability (Hordijk et al., 2014; Hommes and Boelens, 2018)

The reform of the water and sanitation sector

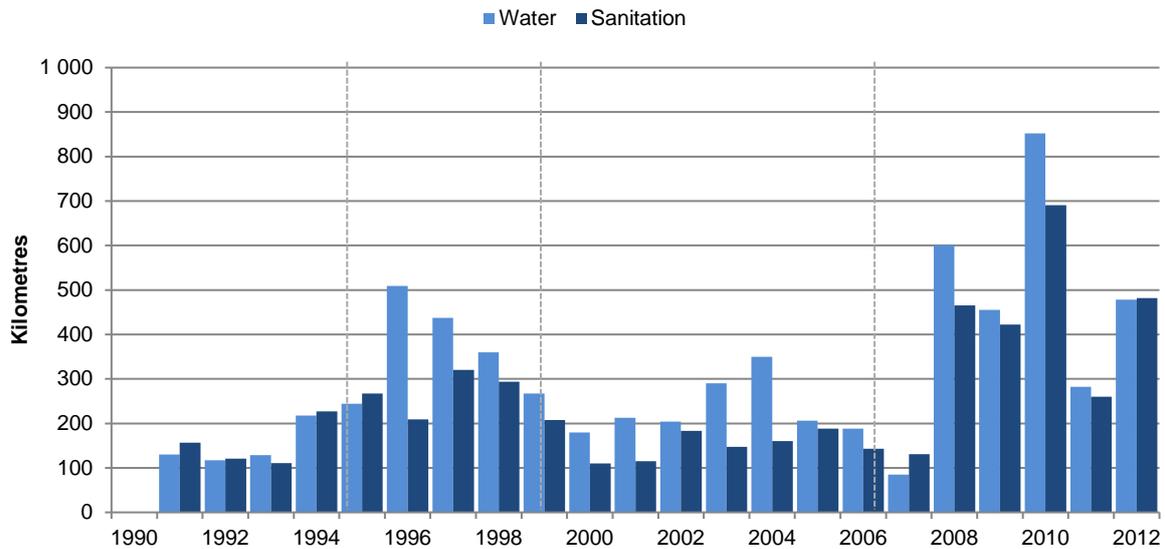
The reform of the water and sanitation sector in Peru follows the wider political agenda and has been profoundly reformed since the 1990s. It should be noted that Lima is the second-largest city situated in a desert; access to water sources is therefore critical; nevertheless, none of the interviewed stakeholder mentioned scarcity as being a constraint on providing water for the urban poor before 2009, when the new law on integrated water resource management was passed. Indeed, as many scholarly works suggest, there is a strong urban bias towards the provision of drinking water in Lima over surrounding rural areas (Hordijk et al., 2014; Damonte, 2019; Hommes, 2019).

As to water provision at the city level, the sector was opened to private capital⁴ in 1994 and the regulator *Superintendencia Nacional de Servicios de Saneamiento* (SUNASS) was created. The World Bank encouraged the privatisation of *Servicio de Agua Potable y Alcantarillado de Lima* (Sedapal), Lima's water utility, hence imposing criteria for utility efficiency and service quality to make it profitable for bidders (Alcázar et al., 2000). Within a few years, the Peruvian government was investing mainly in Sedapal, and entrepreneurial performance improved with wide-scale metering, increased service hours, reduced unaccounted-for water, etc. (Alcázar et al., 2000). Sociopolitical resistance, however, opposed the privatisation and the idea was abandoned in 1997; Sedapal remained a public utility under the control of the Ministry of Housing and Sanitation.

The neoliberal reform of the sector has continued even so; it is focused on technical improvements in infrastructure and the financial viability of the utility (Ioris, 2012b). It relies on public-private partnerships and build-operate-transfer (BOT) arrangements for large-scale water production infrastructure (ibid, 2012b). With the return to democracy and economic growth after 2000, this agenda was quietly pursued; in the 2006 presidential campaign, however, the issue of water and sanitation returned as a focus of public debate. Sedapal's history thus unfolds in phases (ibid, 2013) corresponding to different periods of network extension (Figure 1): emergency investments and reorganisation (1990-1996); rehabilitation, additional sources and leakage reduction (1996-2000); uncertainty (2000-2006); and distribution improvement (2007-2010).

⁴ Ley 26338: Ley general de servicios de saneamiento, 24/07/1994 (General Law for Water and Sanitation Services).

Figure 1. Kilometres added to Sedapal's network.



Source: Author's elaboration based on annual reports from Superintendencia Nacional de Servicios de Saneamiento (SUNASS) and Sedapal.

For the last 20 years, Sedapal has implemented a mainstream entrepreneurial reform agenda which was considered to be a condition for increased performance (Corton, 2003; Mugabi et al., 2007); this is a trend questioned by very few individuals belonging to the water sector in Lima. The political economy of the reform of Sedapal during the structural adjustment period has already been studied from an economic and institutional perspective (Ioris, 2012b, 2012c, 2013). These studies conclude that regulatory failures and socio-spatial inequalities persist (Fernandez-Baca, 1998; Alcázar et al., 2000; Corton, 2003; Ioris, 2012c, 2012b, 2012a, 2013, 2015); they reveal a strong shared neoliberal development discourse (Damonte, 2019). This can be considered the second landscape force influencing political choices in the water sector.

Pro-poor urban governance and utility modernisation have nevertheless supported the continuous extension of water and sanitation networks (Calderón et al., 2015). Access to water and sanitation has improved in Lima since the 1990s; according to the national statistical institute, connection rates have increased from approximately 75% of the population connected to water and less than 60% to sanitation in 1990 to 94.6% and 89.9% in 2012.

Considering that the neoliberal trend has been continuous and pervasive for the last 20 years, "privatization is not the main issue in the discussion to expand the networks for the poor" (Fernández-Maldonado, 2008). Indeed, interviews reveal that, in a manner similar to the processes of water resource management in Peru as a whole (Robert, 2018), there exists a dissociation between in-the-field daily practices and political orientations. There is still little known about the way that Sedapal's staff works on the ground, "muddl[ing] through" spatially and socially, in order to reach the urban poor in informal settlements. Interviewed stakeholders, however, report specific operational challenges in informal areas but also describe vivid political, social and expert debates as to the alternative means used to service informal urbanisation. These technical and social issues have both been largely stifled until now, though they appear to be much more controversial among Lima's water professionals than the (avoided) risk of privatisation.

This paper thus focuses on a basic and pragmatic question: how have Sedapal's professionals done in the field in terms to progressively catch up with informal urbanisation? The analysis of the network extension process through its operational mechanisms rather than its political orientations reveals

understudied but critical elements of service delivery. Tensions appear between the adaptation of conventional models and the adoption of alternative techniques for servicing the urban poor; this constitutes a strategic choice for utilities in unequally developing cities (Coutard, 2008).

EXPERIMENTAL SOCIOTECHNICAL ALTERNATIVES

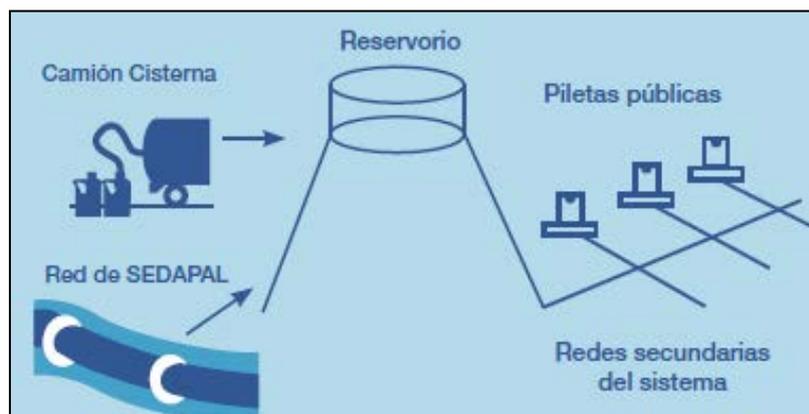
Since the 1990s, three main programmes have been explicitly targeted to extend Lima's water and sanitation networks to informal settlements (Figure 6). In their design and implementation, each of them relies on new technical options in order to adapt to irregular spatial layouts, participatory arrangements to facilitate social relations, and/or regulatory tools to overcome institutional informality. In an environment where few dedicated actors test novelties that depart from the conventional model, these programmes can be considered innovation niches (Geels and Schot, 2007).

Progressive autonomous systems

In 1991, a cholera outbreak prompted the Peruvian government to quickly improve water supply. The European Union proposed a system of autonomous networks that made it possible to bring good quality water to informal settlements that could not be connected to Sedapal's network in the medium term.

After a slow start as an emergency response, the programme *Agua Para los Pueblos Jóvenes* (APPJ) (Water for New Settlements) evolved into a progressive option for connecting informal settlements to the network (Bonfiglio, 2002). Sedapal provided communities with reservoirs and standpipes and installed the main pipes to connect them (Figure 2). These systems were supplied by private tankers and took advantage of natural gravity for distribution. In an improvement of this service, NGOs enhanced the system by installing individual rooftop water tanks on houses. When Sedapal would increase its provision capacity, these autonomous systems could be inexpensively connected to the main network, reservoirs and standpipes could be decommissioned, and household connections could be installed. The design aimed at offering an individualised service that approximated a stable and conventional one (ibid), hence as fully as possible meeting the expectations which were expressed to the project social managers during the beginning phase.

Figure 2. System of mini-network with reservoir.⁵



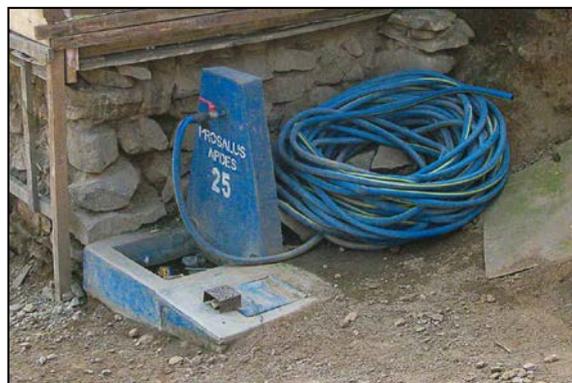
Source: Sedapal and World Bank (2006: 39).

⁵ Top left: water trucks; bottom left: Sedapal's network; Center: reservoir; top right: water standpipes; bottom right: secondary pipes of the system.

Extensive social commitment from the population was required for this programme to be successful; from an instrumental perspective in an emergency context, a public contribution not only reduces the construction costs (and thus augments the number of systems realised) but also guarantees their autonomous functioning. Each neighbourhood is in charge of building (with Sedapal's supervision) and operating its own system and maintaining and managing it technically and financially. Residents form NGO-supported *Comités Vecinales de Administración del Agua Potable* (COVAAPs) (Neighbourhood Committees for Drinking Water Management) which correspond to existing community-based organisations at the neighbourhood level. These committees secure water provision, charge for consumption, and ensure water quality; 'standpipe delegates' are nominated within the community to supervise distribution of water to individual tankers through protected hygienic pipes (Figure 3). Community management of the network created a sense of appropriation, which has been retrospectively evaluated as a key factor in the successful and sustained operation of these systems (ibid); this community-involvement model continues to be implemented by local NGOs in the most marginal areas.

In implementing the community-based model, NGOs for the first time became fully involved as executors of Sedapal's work; they brought both technical, social and institutional assistance to the beneficiaries and promoted civil mobilisation. NGOs which had been focused specifically on urban inclusion began to diversify their activities. Sociologists and social workers entered the Peruvian water and sanitation sector, took on roles as experts, and engaged in their new activities as recognised professionals; the importance of social intervention and capacity building in the delivery of water and sanitation services became a consensual component of water and sanitation projects in Lima.

Figure 3. Standpipe and reserved distribution pipe.



Source: Author, Lima, Comas, Collique, 29 August 2012.

Institutionally, the APPJ programme nevertheless remains conventionally framed in that settlements must have an officially registered association, and inhabitants an official property title. Multi-stakeholder arrangements were not impacted either: private tanker companies that supply water to the COVAAPs are the only customers recognised by Sedapal, and vending arrangements, timings and tariffs between water tankers and the population are not regulated by public authorities. The COVAAPs have asked in vain to be recognised as indirect customers, but the institutional and regulatory framework of the sector was not adjustable to the formal inclusion of these new actors in the distribution chain (Sedapal and World Bank, 2006).

The APPJ has therefore created intermediary positions in the water and sanitation system, physically between the main conventional network and informal petty arrangements, and socially between the utility Sedapal and the beneficiaries. The intended gradual connection of these extended distributional

networks to the main water network and the facilitating role of community-based committees in this process are considered by Lima's stakeholders to be pragmatic and strategic solutions. These systems, however, are also relegated to the non-formal sphere; they are ignored in the utility's database, contracts, tariff structure and maps. In the end, these extended networks are not really recognised as viable solutions to be institutionalised and integrated into the conventional system (Sedapal and World Bank, 2006).

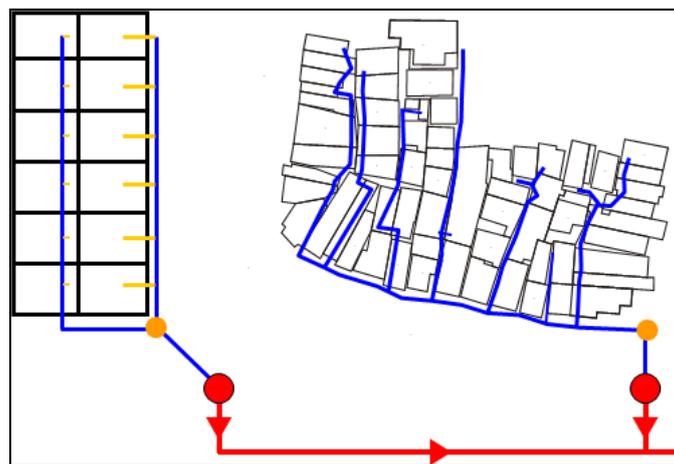
The APPJ programme has serviced 335,000 people. Some NGOs continue to install progressive autonomous networks in settlements where Sedapal cannot intervene (Figure 3). Having learned from their experience with APPJ, they build capacity within communities to pressure Sedapal to connect the community to the main network and receive individual connections. Interviews with both citizens and professionals reveal that this alternative distribution system is considered to be only a temporary solution which is intended to disappear as soon as possible.

Simplified condominial networks

In 2002, the World Bank built on the participatory lessons from APPJ and applied them to its *Programa de Ampliación de la Cobertura* (PAC) (Programme for Coverage Expansion), which relies on the condominial technique implemented in Brazil and Bolivia (cf. Melo, 2005).

The basics of condominial water and sanitation networks is to service a housing block with a single connection point and thereafter to connect each house individually with pipes that are smaller in diameter, depth and gradient; flexible networks are thus created which can go through sidewalks or backyards (Figure 4). This design is particularly well-suited to the haphazard morphology of irregular settlements (Paterson et al., 2007). Community participation, together with the simplified design, materials and construction of the condominial technology, generally allows for a 40% reduction in the cost of servicing (Watson, 1995). The World Bank estimates that between 2003 and 2008, 160,000 people in Lima have thus been connected (World Bank, 2009).

Figure 4. Condominial network and irregular urban layout.



Source: Communication from Sedapal.

Besides its alternative techniques, the PAC in Peru has been innovative by introducing a social component (Barrios Napuri, 2007). The project team, supported by World Bank experts and codirected by an engineer and a sociologist, describes its work as a "technico-social" intervention (Salcedo et al., 2003; Macedo and Conza, 2004). The World Bank and Sedapal required that executing agencies be composed of a

consortium between a construction company and a social team. In order to ensure community participation in construction and in network maintenance, social workers train environmental and hygiene promoters within communities; in the course of doing this work, the social team of the PAC unit produced a manual that specifically sets the parameters of social intervention in water and sanitation projects; this manual has remained the reference document for the sector. Social workers in the water and sanitation sector with APPJ have implemented the PAC and they have, in the process, consolidated their identity, role and work methods.

Except for Sedapal's technical norms, which were updated in 2003 to include the condominium option, the institutional and regulatory framework has remained stable. To be eligible, informal settlements must still present their official property titles, now delivered by the *Comisión de Formalización de la Propiedad Informal* (COFOPRI) (Commission for the Formalisation of Informal Property). This new, slow urban titling policy constrains the distribution of basic services by utilities (Ramirez Corzo and Riofrío, 2006; Calderón et al., 2015). Additionally, although the condominium system allows for collective provision and management of water, Sedapal maintains the individual contracts in order to keep control over its network and client base and thus avoid the introduction of intermediary actors. With the exception the community participation aspect, the framework of PAC intervention is similar to conventional water and sanitation projects.

Implemented mainly through World Bank funding, after 2006 and the end of the project condominium systems have quickly disappeared. Opinions about the reasons for its abandonment vary greatly, but the shift back to conventional systems has undeniably generated debates and tensions in Lima's water and sanitation sector (as discussed in a subsequent section).

Conventional 'water for all'

During the 2006 presidential election campaign, the then candidate A. García launched the slogan "*Sin agua no hay democracia*" (Without water, there is no democracy), thus putting water and sanitation issues back on the agenda. In the first week of the new government's term, a national programme called *Programa Agua Para Todos* (PAPT) (Water For All) was set up which was financed by a "shock of investments" from the Peruvian state.⁶

The PAPT systematically prefers the provision of conventional infrastructure. Increasing the political visibility and magnitude of its interventions through important public investments (Ioris, 2012b), Sedapal has engaged in a technocratic supply-driven approach and subcontracts work to private engineering companies (ibid, 2012b). Since then there has been a predominance of large-scale schemes (construction of dams and treatment plants) that favour public-private partnerships (ibid, 2016). Condominial networks were abandoned after 2006, in favour of "conventional water for all", i.e. conventional infrastructures and pipes.

The social intervention logic has also changed. A cell within Sedapal is in charge of community relations; its members acknowledge that its small size limits its action to information and communication, with no work being done on capacity building or social support of citizens. The beneficiaries are no longer involved in designing, building or operating the networks; local leaders' only role is to facilitate the construction firm's intervention by circulating information, gathering documentation, preparing the ground, clearing the roads and marking the plots. Professionals involved in APPJ and PAC programmes have left Sedapal because of their disagreement with this technocratic management of basic services. The partnership approach previously used has been replaced by a top-down, commercial relationship between a utility and its clients.

⁶ Ley 28870: Ley para optimizar la gestión de las empresas prestadoras de servicios de saneamiento, 11/08/2006 (Law to optimise the management of water and sanitation utilities).

Figure 5. Poster informing of the 'simple' requirement of *de facto* plot occupation in place of property title to benefit from Agua Para Todos.⁷



Source: Author, Lima, Las Lomas de Carabayllo, 9 September 2012.

More than social or technical innovations, it is the political and regulatory framework that has facilitated the implementation of the PAPT (Calderón et al., 2015). Declaring the water and sanitation sector to be in a state of emergency,⁸ the new government introduced flexibility for rapid public intervention. As the then Minister for Sanitation, Garrido-Lecca (2010: 25), explains:

Maybe the most important (but unknown until now) catalyst factor to explain the immediate results in mobilizing funds under the shock of investments for PAPT, has been the careful design of legal architecture and support of the program. In a way, the strategy used has been to carefully formulate a legal architecture, inclusive of the one implemented before that the elected president entered in power (Author's translation).

Indeed, a reform of the property formalisation policy has been introduced in 2000 which, only in 2006, resulted in the adoption by the outgoing government of a law to ease up access to urban land and services.⁹ It instituted a new tool, the certificate of possession, which replaced the property title as a prerequisite for applying for basic services (Figure 5). This certificate, delivered directly by the district municipality, unblocked access to basic services for the informal settlements that had not yet been formalised. Moreover, in 2006 the national investment system adopted in 2000 was also simplified; from three steps to the approval of public spending, the process for PAPT was reduced to a single "reinforced

⁷ "Water for all is now a reality ! We will soon start the physical works. To get a connection contract, you must actually live on your plot".

⁸ Decreto supremo 020-2006: Declaran en estado de emergencia la infraestructura para la prestación de servicios de saneamiento, 12/08/2006 (Supreme Decree declaring in a state of emergency the infrastructure providing water and sanitation services).

⁹ Ley 28687: Ley de desarrollo y complementaria de la formalización de la propiedad informal, acceso al suelo y dotación de servicios básicos, 17/03/2006 (Law for development, complementary for the formalisation of informal property, access to and delivery of basic services).

financial profile", and, in order to reduce delays in tenders, the same firm could both design, conceive and realise the project. Though it may serve the neoliberal agenda of a utility's performance or political interests (Ioris, 2013), this institutional and regulatory flexibility has facilitated the implementation of large-scale water and sanitation projects. Over the last decade, Peru has thus solved the usual "governance failures" in water supply systems (Bakker et al., 2008) by adapting technical norms, easing land title and tenure requirements, accelerating public investment processes, etc.

Figure 6. Main characteristics of the programmes.

	APPJ	PAC	PAPT
Funding	European Union, 1993-2001	World Bank, 2003-2008	Peru, 2006-2010
Beneficiaries	335,000 people	160,000 people	About 730,000 people
Contractors	NGOs for both technical and social operations	Consortium of constructing firms and NGOs	Subcontracting to construction companies
Technical options	Autonomous reservoirs, mains, standpipes, latrines	Condominial networks with individual connections	Conventional infrastructures
Social arrangements	Committee for building, operating and managing with NGO assistance	Community, with NGO training, participates in building and maintenance	Inhabitants are informed, they prepare the ground and priority hiring scheme
Institutional tools	Resident association, official layout plan and property title, no formal integration	Resident association, official layout plan and property title, individual contracting	Attestation of possession, community layout plan, simplified investment rules

Source: Elaborated from interviews; Sedapal and World Bank (2006); World Bank (2009).

In order to service unplanned urbanisation Sedapal has adapted its practices, resorting to technical, social and/or institutional alternatives (Figure 6). These reconfigurations have taken place in parallel with neoliberal performance-oriented reforms (Ioris, 2012c), but the utility has remained public. Since the reorganisation in the 1990s, there has been no drastic entrepreneurial change in the utility (Corton, 2003). Liberalisation reform is thus not the only driver to improving access to basic services (Bakker et al., 2008), and pro-poor strategies and innovative techniques are crucial factors (Connors, 2005; Fernández-Maldonado, 2008; Calderón et al., 2015). Nonetheless, if Sedapal follows a strict economic or technical perspective, evaluations suggest that the condominial option would be the most efficient (Watson, 1995; Mara and Alabaster, 2008; World Bank, 2009). In Lima, this has however been abandoned, which cannot be explained without opening the black box of Sedapal's functioning.

CROSS-CUTTING SOCIOPOLITICAL DEBATES

Literature (Watson, 1995; Paterson et al., 2007), project evaluations (Sedapal and World Bank, 2006; World Bank, 2009) as well as interviews suggest that conventional network alternatives are effective and efficient, but the evolution of sociotechnical options in Lima shows that there is no consensual acceptance of these. Expert and public debates have raged around several fault lines of argumentation, resorting to social, cultural or political rationales. The "interpretative flexibility" of these alternatives

prevents a form of "closure" (Geels and Schot, 2007) that would settle new practices as mainstream for service delivery. Interpreting such cases reveals key triggers that drive actors to accept or resist a paradigm shift.

Technical feasibility and "reform-mindedness"¹⁰

The condominal alternative particularly has mobilised the entire water and sanitation sector for years, from civil society, to donors, politicians, sociologists and engineers in Sedapal, to construction firms. Interviews reveal a wide diversity of positions that cross the lines of professional identities. On the one hand, its advocates are the previous members – engineers and social workers – of the PAC team, international experts from the World Bank, members of NGOs, and some Sedapal engineers; they argue that the technical and financial advantages of condominal networks are undeniable and that social intervention guarantees their good functioning.

On the other hand, this alternative is criticised by ex-officials from the PAPT (supporters of the 2006 government), by engineers from Sedapal and from contractors, as well as by some social workers. They argue that the idiosyncrasy of the population prevents the proper use of small sanitation pipes, that people are not willing or able to care for the networks, that social intervention is superficial and symbolic compared to hard engineering, and that it only serves to 'sweeten the pill' of service discrimination. An engineer working for a subcontracted firm during the time of the PAC presents a case, in a 12 July 2012 interview, that illustrates intertwined technical, social and institutional considerations:

It is absurd to call these condominal! I discussed that with Sedapal, I do not like what they did. I am definitely against it because what was needed was to make norms more flexible to authorize the installation of six-inch pipes through sidewalks; not only in irregular settlements but anywhere, in wealthy areas too I can go through backyards like in Brazil (...). Why couldn't I? It does not make any sense. Nothing else than adapting the norm was needed to design this kind of system. There, we made the mistake of going to irregular settlements and saying to the people that they will have a different system called "condominal". Thus, people think: "we are poor, and moreover, they give us a second-class network". That is the impression (...). Why create complications? This is the problem with social intervention (...), and that is why I do not agree with it either, because it was ill-conceived. We explained to the people that it was a special program; we should not have done it this way: we shall just have changed the system without saying anything. And if they want to give information training, let them do it with everybody, not only in irregular settlements. But the training, the sanitary fairs, nonsense! I am a practitioner, not a social worker, we wasted a lot of money (...)
(Author's translation).

These competing rationales and positions show that the issue of 'technical feasibility' is actually not so technical: in order to invalidate the alternative, its opponents resort to sociocultural arguments that do not question its efficiency. More than technical feasibility and financial appropriateness, which are undeniable (Paterson et al., 2007), opinions on the social fabric of informal urbanisation and on the ideal water and sanitation infrastructure network take over in the interviews. Debates between professionals as to the feasibility, acceptability, proper functioning and maintenance of condominal networks have not been settled.

Accounts of the rejection of the condominal option need also to be more nuanced. Indeed, as in other Latin American countries (Watson, 1995), resistance also comes from within the water and sanitation sector, where engineers are reluctant to accept what is considered to be a second-class alternative which alters the modern infrastructure ideal (Paterson et al., 2007). The former PAC technical director explains that convincing its other colleagues within Sedapal has been the most difficult task because of the corporate reluctance to change.

¹⁰ World Bank, 2004: 176.

Even after 2006, field engineers acknowledged in interviews that they kept using this technique because of its suitability to conditions on the ground. Faced with the challenge of servicing geographically complex areas, Sedapal turned back to the World Bank in the early 2010s, asking it to investigate options for 'small-scale', 'non-conventional' solutions, but avoiding any reference to the term 'condominial'. They also took care to present it as part of the conventional system rather than as an alternative; pipes, for example, are now grey instead of the orange colour they were under PAC. In this way the engineers have worked at reducing the visible differences and thus have absorbed the innovative dimensions of the condominial alternative into the conventional deployment of the network.

The challenges thus drift towards professional and organisational stakes: does the utility counter, compensate for, or support the positions and perceptions of these alternative solutions? In Sedapal, advocates for autonomous or condominial systems have found little support from the utility for defending sociotechnical innovations. The APPJ and PAC management units were isolated from Sedapal's operations; created for a specific purpose, their activity has remained independent from mainstream operations, hence hindering the possibility for capitalisation (World Bank, 2009). Social workers, hired on a contract basis, were dismissed when the programmes ended; as occurred in Bangalore (Connors, 2005), the few committed individuals struggled in convincing other stakeholders to adopt changes.

Sociotechnical change is stifled by institutional inertia and by the conventional routines encouraged by the modern infrastructure ideal (Watson, 1995). Generating institutional willingness to change depends on organisational change: institutional support and collective learning are required in order to lend legitimacy to innovations and thus make them credible alternatives to the dominant regime (Geels and Schot, 2007). A paradigm shift in water and sanitation issues therefore also relies on this underestimated importance of organisational transition within the utility (Mugabi et al., 2007; Kayaga et al., 2013), accompanied by professional capability and capacity building (Kayaga et al., 2013; Worch et al., 2013) and the dissemination of adequate knowledge and expertise (Nicol et al., 2012).

Social acceptability and openness to outsiders

There has been an evolution in the relations between Sedapal, the population, and third parties such as NGOs and construction firms. Urban NGOs in Lima have long experience in building citizens' capacity to put pressure on public authorities to deliver basic services (Matos Mar, 1984). In the 1990s, they entered the water and sanitation sector and have proved themselves to be efficient enough to operate Sedapal's projects.

NGOs nonetheless have been progressively pushed out of being core operators for APPJ and co-partners with consortiums in the PAC; they have been completely excluded from the PAPT (Ioris, 2012c). The relations between NGOs and communities on specific water and sanitation projects have been steadily weakened, and NGOs and Sedapal ignore each other's activities in informal settlements. More than the resentment and distrust of the utility by NGOs, the reorientation that has eroded their mobilisation on water and sanitation issues, side-lining them as outsiders. Sedapal is reluctant to open itself to civil society; managers in charge of the PAPT argue that they opted for conventional contracted relations with construction firms and clients because it was simpler than working with multiple partners. This choice is consistent with the previous refusal to recognise the COVAAPs, and hence confirms the idea that utilities consider individualised direct relationships to permit better control of their clients (Connors, 2005).

Losing that scope of activity and their funding source, the ability of Lima's NGOs to maintain their human resources has steadily deteriorated. Social workers have left the civil society sector but, interestingly, have then been hired by construction firms. Indeed, Sedapal's subcontractors – often with pressure or at least incentives from international donors – acknowledge that the success of their intervention in informal settlements depends on stabilised relations with their citizens; they thus have created in-house social responsibility cells that are staffed with the social workers previously involved in

APPJ and the PAC. This re-emergence of the profession within the corporate sector is another form of legitimisation of social intervention, despite Sedapal's attitude.

The counterpart of this institutionalisation seems, even so, to be a depoliticisation of social work; social intervention in the water and sanitation sector has become an expert activity that is structured by manuals and project activities. This rendering technical of social intervention has permitted its absorption into mainstream operations, though social workers, now part and parcel of the corporate sector, are compelled to abide by the firms' interests. No longer working in vibrant NGOs, they regret their lost political independence, their work to foment social mobilisation and contestation, and their capacity to pressure public authorities. Social intervention has moved from politicised popular education to apolitical efficient information and training provision. The creation of the social cell within Sedapal has likewise had the ambiguous effect of giving symbolic and organisational importance to social work while limiting its scope and impact; it appears to make partnerships with civil society redundant and thus unnecessary and potentially troublesome. A sociologist who worked for both APPJ and PAC, in a 21 June 2012 interview, presents the evolution of social work in Lima's water and sanitation sector:

To implement the PAC, Sedapal called for tenders from firms, which generated resentment within NGOs who thought they would be the executing agencies. They always expected it because of their experience, expertise and contribution (...). And then in the PAPT, there are no NGOs anymore at all, it is construction firms only which execute the works. Because Sedapal made it compulsory to have some kind of social action, some firms contract independent professionals on an ad hoc basis, with no experience; they do so because they have to but they are not interested in their real responsibility towards the people. Their objective is only to get the most from local labour, and not to the quality of work, the education of people to improve their lives. And for that, you need a real change in attitude towards the population. That is not what happens in PAPT, they do not want to commit themselves to really engaging with the people, they just want to avoid conflict. It is a completely different perspective, it is instrumental actually. (Author's translation)

The profession of social worker is now a legitimate and efficient line of action within water and sanitation projects, consensually endorsed by most of the actors; however, considering that inhabitants of informal settlements have been relegated from partners to clients, that community-based committees have never been recognised, that NGOs have been sidelined and social workers absorbed into the construction sector, it seems that the governance of the water and sanitation sector remains quite closed to outsiders. Third-party actors have struggled for legitimacy, but they remain quite marginal and their actions have lost their political strength.

The teams of social workers that were involved in the APPJ or the PAC have now started retiring, and the lack of engagement and support for social work from Sedapal in the last ten years has not spurred the emergence of a new generation of sociologists specialised in water and sanitation issues. International donors are again promoting open-mindedness; in reviewing Sedapal's master plan and drafting its projects, the World Bank thus has been pushing for the involvement of communities and NGOs in resource management in order to ensure the sustainability of water and sanitation systems (Kalra et al., 2015). In the absence of demand from Sedapal, however, the tightened job market for such profiles is jeopardising capitalisation and opportunities for generational renewal of such expertise in the long run.

Professional willingness and pragmatism

Far from being neutral choices based on rational cases, the technical feasibility and social acceptability of service delivery alternatives is thus political; it depends on cognitive ideals, conservative practices and professional positions that shape a 'willingness to supply'. Intermediate actors such as the professionals in Sedapal's social unit, caught between the utility's technical strategy and citizens' mobilisation, are aware of these underlying stakes:

Of course, we need technical alternatives in adverse environments and conditions. The problem is that with technology, there are always feelings of social classes, cultural practices, and then come political tensions because irregular urbanization is politically and socially a sensitive issue for public intervention and elections (Interview, 3 July 2012; author's translation).

The rise of social discontent and the abandonment of the condominial alternative was embedded in the politics of the 2006 presidential election campaign and in the new government's agenda and search for visibility (Fernández-Maldonado, 2008; Ioris, 2012b). PAPT directors argued that since the population had refused this 'second-class' system, it could not work and generated social conflict (Ioris, 2012b). Nevertheless, interviews conducted with beneficiaries and with professionals previously involved in the PAC mitigated this interpretation. Unpacking the history of social resistance, it appears that specific actors and biases were in operation. Indeed, there were three executing consortiums of building firms and NGOs for the North, East and South Cones of Lima; among them, two NGOs were engaged in long-term trust-based relations with the population and managed to gain people's adherence to condominial systems, which have been developed without problem. The third social team however has faced difficulties in working with the population as well as with Sedapal, the PAC directors and construction engineers. This team of independent sociologists – who both lacked experience in water and sanitation and did not know the area – was hired by the construction firm on an ad hoc basis. Its members themselves admitted that they were sceptical about the condominial alternative and of the actual added value of social intervention; it was, in fact, from this zone that popular resistance to the condominial technique appeared. While the programme had overall positive results (World Bank, 2009), the relationship among local actors in that zone was not sufficiently stable for projects to take place in 'social peace', and instead there arose political conflict.

Non-technical choices also prevail in the maintenance of autonomous progressive systems. Nowadays, when Sedapal enters settlements with autonomous networks, the latter is entirely replaced with conventional infrastructure. While the construction of the mini-networks has been supervised by Sedapal, they are still considered to be substandard and thus not acceptable compared to the brand new material and equipment. For the people, the engineers and the politicians, to extend water and sanitation services traditionally means to extend the modern conventional network; it is regarded as a symbol of progress and integration into the modern city and a sign of possessing full rights as citizens (Graham, 2000; Jaglin, 2008). In this context, providing sociotechnical alternatives that are perceived as second-class services can be politically risky.

It seems therefore that the real issues are neither technical feasibility nor social acceptability of alternatives by the population; rather, the issue appears to be the politicised management of network development (Graham, 2000). In Lima, cultural, social and political integration of informal settlements into the city through the extension of basic services has been a long struggle for civil society movements (Matos Mar, 2012; Calderón et al., 2015); alternatives that result in a different level of service provision thus seem sociopolitically hard to accept. Rather than being seen as innovative, diversification in Lima is understood to be discriminatory and this viewpoint is used to discredit it politically. The pragmatism of Peruvian governments in satisfying social demand and the pressure for equal and universal access to basic services thus become impediments to sociotechnical transition.

All these technical, social and political debates in the water and sanitation sector cross the classical professional constituencies; these are constituencies which have themselves largely evolved over the last 20 years along with the pilot programmes. As stated in an IEG Sustainable Development (2016) project report,

[t]he pilot effort to bring low-cost condominial networks to low-income peri-urban areas yielded limited results and was eventually discontinued due to insufficient social acceptance, the preference of beneficiaries for conventional networks, and the reluctance of Sedapal and contractors to depart from conventional

network norms and methods. In retrospect, the receptivity of both beneficiaries as well as Sedapal and the contractors was not adequately gauged.

Examining the instability and controversies around sociotechnical change thus reveals challenges in extending service networks which do not only come from the policy environment but are also entrenched within the water and sanitation sector and the utility itself. Even the allegations of corruption against the then President A. García in the awarding of public contracts have not disrupted this 'philosophy' of extending infrastructure rather than managing water uses. Though donors have promoted an approach with 'soft' actions towards demand-side management and efficiency (Kalra et al., 2015), Sedapal's master plans and interventions in precarious settlements still mainly focus on infrastructure improvements.

CONCLUSION AND OPERATIONAL IMPLICATIONS

Operational practices, discourses and arrangements thus disclose some crucial but often overlooked factors that affect the feasibility and acceptability of sociotechnical change that is caught between modernity and development. The examination of the controversies around network alternatives in Lima echoes the dynamics observed in the water and sanitation sector of Bangalore (Connors, 2005). Some wider lessons can be learned from this parallel: 1) progressive and simplified technical options exist; 2) social intervention is crucial both within the utility and with external partners; and 3) regulatory adjustments to overcome informality and to speed up public investments are possible. The breaking through of these innovations is nevertheless far from evident: pilot projects may permit experimentation in muddling through informal settlements, but innovation learning and scaling-up is slow and hesitant and is resisted. After pilot experiments and vivid controversies, utilities in both Lima and Bangalore have opted to step back and embrace less 'disturbing' conventional options.

In order to understand this movement, a sociotechnical unpacking of the utility helps reveal understudied but decisive factors in the challenging of conventional practices by alternative strategies. Beyond exogenous factors of liberalisation and regulation, it is critical that the utilities themselves be taken into account, as well as the position of their professional staff and the sociotechnical nature of water service networks (Mugabi et al., 2007; Kayaga et al., 2013; Worch et al., 2013). This conclusion must lead to specific policy and development action in order to help disseminate and institutionalise pro-poor water technologies.

Most of the scholarly work on Lima's water sector has focused on the political ecology of resource management; these studies unanimously conclude that a strong hydrocracy has favoured centralised, technocratic and conservative engineering approaches over social and environmental concerns (Oré and Rap, 2009; Hordijk et al., 2014; Damonte and Lynch, 2016; Hommes and Boelens, 2018; Damonte, 2019; Hommes, 2019), thus quietly feeding a neoliberal agenda.

Partial explanation for the inertia which, in spite of the introduction of important institutional innovations, continues to characterize the large operational structures in the sector supported, on the one hand, by a corps of agricultural engineers who have, historically speaking, promoted major irrigation projects and controlled policy and legislative orientations at the national level (Oré and Rap, 2009), and, on the other, by a large State company that holds the monopoly of the water service in Lima (Robert, 2018: 171).

This paper argues that a similar conclusion can be drawn for the sub-segment of water provision within the city of Lima itself.

In cities of the Global South, sociotechnical change is messy and the demand appears to be rather conservative; doubt is thus cast on the possibility of a paradigm shift that would improve access to water and sanitation for all. Like urban planning, policies and practices in the context of informal urbanisation, actually existing practices in service delivery are pragmatic, erratic bricolage (Shatkin, 2011; Criqui, 2015a). Water and sanitation network extension in informal urbanisation settings also challenges the professional practices of field engineers. The modern infrastructure ideal of the Global North, which is

adapted to slow-growing and planned cities, continues to permeate the knowledge, norms and mindsets of water and sanitation engineers; sociotechnical alternatives hence arise as contested knowledge (Nicol et al., 2012). The technocratic hydraulic paradigm that drives water and sanitation network extension is well entrenched, and its evolution is resisted by conservative professional interests. As pressing as the sociopolitical forces may be and as efficient as some technologies may also be, a reconfiguration of the modern infrastructure ideal requires specific change management among concerned professionals in the Global South. The same challenge can be observed more broadly in urban planning in general (Roy, 2005; Watson, 2009), and the same conclusions apply: professional identity and training must be adapted to the actual challenges faced by engineers in their daily work in developing cities, and the technical sphere must be opened to social and political concerns.

To bring this about, research on actual alternatives for water and sanitation in the Global South seems necessary, as well as on the drivers of change and the reasons for resistance to change. The international epistemic community and experts have a decisive influence on determining and legitimising what should be considered 'progress' (Nicol et al., 2012), and in promoting innovative model projects (World Bank, 2004). In Lima and elsewhere in Latin America, pilot condominium projects have been implemented thanks to donors' financial and technical assistance (Watson, 1995). World Bank officials have gained trust from the Peruvian government by deliberately pushing the prestigious 'star' experts from Brazil into the spotlight; however, as soon as the World Bank project ended, condominium systems were abandoned. In Bangalore, external donors provided a similar stimulus for change and then later lamented the shift back to a conventional approach (Connors, 2005). Looking for champions and disseminating best practices among developing countries thus constitutes a promising approach to opening the minds of water professionals as well as politicians.

Finally, the acceptance of external pressures – donors' influence, pro-poor urban policies and technological innovation niches – requires translation into meaningful operational and internal action, i.e. it needs to be adopted by field professionals themselves. From an organisational point of view, knowledge dissemination, management of skills and motivation, and appropriate competencies and capabilities within water utilities are critical (Worch et al., 2013). The role of frontline practitioners is widely underestimated, even though they are the active agents for change in the actual implementation of projects. In reforming utilities, the dimensions of change management, innovation valuation and promotion of collective learning and capacity building are often left out. The construction of new reference knowledge and know-how within water and sanitation utilities and in the sector itself thus could facilitate the emergence, acceptance and scaling-up of sociotechnical innovations. According to that perspective, the cognitive and operational dimensions of urban water supply systems should be scientifically and operationally considered, supported by a pro-poor political agenda, and put at the core of any change strategy in order to improve access to water services in cities of the Global South.

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REFERENCES

- Alcázar, L.; Xu, L.C. and Zuluaga, A.M. 2000. Institutions, politics, and contracts: the attempt to privatize the water and sanitation utility of Lima, Peru. Policy Research Working Papers 2478. World Bank.
- Amin, A. and Graham, S. 1997. The ordinary city. *Transactions of the Institute of British Geographers* 22: 411-429.
- Arellano, R. and Burgos, D. 2010. *Ciudad de los Reyes, de los Chávez, de los Quispe...* Lima: Planeta.

- Bakker, K.; Kooy, M.; Shofiani, N.E.E. and Martijn, E.-J. 2008. Governance failure: Rethinking the institutional dimensions of urban water supply to poor households. *World Development* 36(10): 1891-1915.
- Barrios Napuri, C. 2007. Desarrollo tecnologico y participacion comunitaria: Fortalezas ante la prevista crisis del agua. *DELOS: Desarrollo Local Sostenible* 1: 1-20.
- Batley, R. 1996. Public-private relationships and performance in service provision. *Urban Studies* 33(4-5): 723-751.
- Bonfiglio, G. 2002. Servicios de agua en zonas periurbanas de Lima Metropolitana. La experiencia del proyecto Alimentación de Agua para Pueblos Jóvenes (APPJ). Lima: Banco Mundial.
- Bromley, R. 2003. Peru 1957-1977: How time and place influenced John Turner's ideas on housing policy. *Habitat International* 27(2): 271-292.
- Calderón, J.C. 2004. The formalisation of property in Peru 2001-2002: The case of Lima. *Habitat International* 28(2): 289-300.
- Calderón, J.C. 2005. *La ciudad ilegal: Lima en el siglo XX*. Lima: Universidad Nacional Mayor de San Marcos.
- Calderón, J.C.; Romero, J.Q.; Lucci, P. and Lenhardt, A. 2015. On the path to progress: Improving living conditions in Peru's slum settlements. Development Progress case study. London: Overseas Development Institute.
- Connors, G. 2005. When utilities muddle through: Pro-poor governance in Bangalore's public water sector. *Environment & Urbanization* 17(1): 201-218.
- Corton, M.L. 2003. Benchmarking in the Latin American water sector: The case of Peru. *Utilities Policy* 11(3): 133-142.
- Coutard, O. (Ed). 1999. *The governance of large technical systems*. London: Routledge.
- Coutard, O. 2008. Placing splintering urbanism: Introduction. *Geoforum* 39(6): 1815-1820.
- Criqui, L. 2013. Pathways for progressive planning through extending water and electricity networks in the irregular settlements of Lima. In Garland, A.M. (Ed), *Innovation in urban development: Incremental housing, big data, and gender*, pp. 34-56. Washington, DC: Woodrow Wilson International Center for Scholars, www.wilsoncenter.org/sites/default/files/CUSP_130604_Innovation%20in%20Urban%20Poverty_rpt%201106_0.pdf
- Criqui, L. 2015a. Infrastructure urbanism: Roadmaps for servicing unplanned urbanisation in emerging cities. *Habitat International* 47: 93-102.
- Criqui, L. 2015b. L'électrification des quartiers irréguliers de Lima: Un rattrapage en pente raide. *Flux* 1(99): 5-18.
- Criqui, L. and Zérah, M.-H. 2015. Lost in transition? Comparing strategies of electricity companies in Delhi. *Energy Policy* 78: 179-188.
- Damonte, G. and Lynch, B. 2016. Cultura, política y ecología política del agua: Una presentación. *Anthropoligica* 36: 5-21.
- Damonte, G.H. 2019. The constitution of hydrosocial power: Agribusiness and water scarcity in Ica, Peru. *Ecology and Society* 24(2), <https://doi.org/10.5751/ES-10873-240221>
- Driant, J.-C. 1991. *Las barriadas de Lima: Historia e interpretación*. Lima: IFEA.
- Estache, A.; Gomez-Lobo, A. and Leipziger, D. 2001. Utilities privatization and the poor: Lessons and evidence from Latin America. *World Development* 29(7): 1179-1198.
- Fernandes, E. 2002. The influence of de Soto's The mystery of capital. *Land Lines* 14(1): 1.
- Fernandez-Baca, J. 1998. La experiencia regulatoria en Perú II: Los casos de la electricidad y del agua potable. *Apuntes* 43: 89-105.
- Fernández-Maldonado, A.M. 2008. Expanding networks for the urban poor: Water and telecommunications services in Lima, Peru. *Geoforum* 39(6): 1884-1896.
- Fernández-Maldonado, A.M. and Bredenoord, J. 2010. Progressive housing approaches in the current Peruvian policies. *Habitat International* 34(3): 342-350.
- Figari Gold, E. and Ricou, X. 1990. *Lima en crisis: Propuesta para la gestion de los servicios urbanos en Lima Metropolitana*. Lima: Universidad del Pacifico & IFEA.
- Gandy, M. 2008. Landscapes of disaster: Water, modernity, and urban fragmentation in Mumbai. *Environment and Planning A* 40(1): 108-130.

- Geels, F.W. and Schot, J. 2007. Typology of sociotechnical transition pathways. *Research Policy* 36: 399-417.
- Graham, S. 2000. Cities and infrastructure networks. *International Journal of Urban and Regional Research* 24(1): 114-119.
- Graham, S. and Marvin, S. 2001. *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. London: Routledge.
- Harris, R. 2003. A double irony: The originality and influence of John F.C. Turner. *Habitat International* 27: 245-269.
- Hoch, C.J. 1984. "Doing good and being right" The pragmatic connection in planning. *Journal of the American Planning Association* 50(3).
- Hodson, M. and Marvin, S. 2010. Can cities shape socio-technical transitions and how would we know if they were? *Research Policy* 39(4): 477-485.
- Hombres, L. 2019. Desarrollo hidroeléctrico y reconfiguraciones territoriales históricas en la cuenca del Rímac, en Lima, Perú. *Estudios Atacameños*, <https://doi.org/10.22199/issn.0718-1043-2019-0032>
- Hombres, L. and Boelens, R. 2018. From natural flow to 'working river': hydropower development, modernity and socio-territorial transformations in Lima's Rímac watershed. *Journal of Historical Geography* 62: 85-95.
- Hordijk, M.; Sara, L.M. and Sutherland, C. 2014. Resilience, transition or transformation? A comparative analysis of changing water governance systems in four southern cities. *Environment & Urbanization* 26(1): 130-146.
- IEG Sustainable Development. 2016. Project performance assessment report: Lima water rehabilitation and management project and National rural water supply and sanitation project. Project performance assessment report 106723. Washington, DC: World Bank.
- Ioris, A.A.R. 2012a. The persistent water problems of Lima, Peru: Neoliberalism, institutional failures and social inequalities. *Singapore Journal of Tropical Geography* 33(3): 335-350.
- Ioris, A.A.R. 2012b. The geography of multiple scarcities: Urban development and water problems in Lima, Peru. *Geoforum* 43(3): 612-622.
- Ioris, A.A.R. 2012c. The neoliberalization of water in Lima, Peru. *Political Geography* 31: 266-278.
- Ioris, A.A.R. 2013. The adaptive nature of the neoliberal State and the State-led neoliberalisation of nature: Unpacking the political economy of water in Lima, Peru. *New Political Economy* 18(6): 912-936.
- Ioris, A.A.R. 2015. Water services in Lima, Peru. Understanding the linkages between urban development, social inequality and water. In Aguilar-Barajas, I.; Mahlke, J.; Kaledin, J.; Kjellén, M. and Mejía-Betancourt, A. (Eds), *Water and cities in Latin America: Challenges for sustainable development*, pp. 89-101. London: Routledge.
- Ioris, A.A.R. 2016. Water scarcity and the exclusionary city: the struggle for water justice in Lima. *Water International* 41(1): 125-139.
- Jaglin, S. 2008. Differentiating networked services in Cape Town: Echoes of splintering urbanism? *Geoforum* 39(6): 1897-1906.
- Jaglin, S. and Zerah, M.-H. 2010. Eau des villes : Repenser des services en mutation. *Revue Tiers Monde* 3(203): 7-22.
- Kalra, N.; Groves, D.G.; Bonzanigo, L.; Molina Perez, E.; Ramos, C.; Brandon, C. and Rodriguez Cabanillas, I. 2015. Robust decision-making in the water sector. A strategy for implementing Lima's long-term water resources master plan. Policy Research Working Papers 7439. Washington, DC: World Bank.
- Kayaga, S.; Mugabi, J. and Kingdom, W. 2013. Evaluating the institutional sustainability of an urban water utility: A conceptual framework and research directions. *Utilities Policy* 27: 15-27.
- Legg, S. and McFarlane, C. 2008. Ordinary urban spaces: between postcolonialism and development. *Environment and Planning A* 40(1): 6-14.
- Leitmann, J. and Baharoğlu, D. 1999. Reaching Turkey's spontaneous settlements: The institutional dimension of infrastructure provision. *International Planning Studies* 4(2): 195-212.
- Leonard, J.B. 2000. City profile: Lima. *Cities* 17(6): 433-445.
- Lorrain, D. (Ed). 2011. *Métropoles XXL en pays émergents*. Paris: Presses de Sciences Po.
- Macedo, O. and Conza, A. 2004. El alcantarillado condominial en el cono norte de Lima: Una experiencia en Comas. *Boletín del comité sectorial de agua y saneamiento* 18.

- Mara, D. and Alabaster, G. 2008. A new paradigm for low-cost urban water supplies and sanitation in developing countries. *Water Policy* 10: 119-129.
- Matos Mar, J. 1984. *Desborde popular y crisis del Estado. El nuevo rostro del Perú en la década de 1980*. Lima: Instituto de Estudios Peruanos.
- Matos Mar, J. 2012. *Perú. Estado desbordado y sociedad nacional emergente*. Lima: Universidad Ricardo Palma.
- McFarlane, C. 2008. Sanitation in Mumbai's informal settlements: State, 'slum', and infrastructure. *Environment and Planning A* 40(1): 88-107.
- McFarlane, C. and Robinson, J. 2012. Introduction: Experiments in comparative urbanism. *Urban Geography* 33(6): 765-773.
- Melo, J.C. 2005. La experiencia de los sistemas de agua y alcantarillado condominiales en Brasil. Estudios de casos de Brasilia, Salvador y Parauapebas. Lima: World Bank.
- Molle, F.; Mollinga, P.P. and Wester, P. 2009. Hydraulic bureaucracies and the hydraulic mission: Flows of water, flows of power. *Water Alternatives* 2(3): 328-349.
- Mugabi, J.; Kayaga, S. and Njiru, C. 2007. Strategic planning for water utilities in developing countries. *Utilities Policy* 15(1): 1-8.
- Nicol, A.; Mehta, L. and Allouche, J. 2012. Introduction: 'some for all rather than more for some'? Contested pathways and politics since the 1990 New Delhi statement. *IDS Bulletin* 43(2): 1-9.
- Oré, M.T. and Rap, E. 2009. Políticas neoliberales de agua en el Perú. Antecedentes y entretelones de la ley de recursos hídricos. *Debates en Sociología* 34: 32-66.
- Paterson, C.; Mara, D. and Curtis, T. 2007. Pro-poor sanitation technologies. *Geoforum* 38(5): 901-907.
- Ramirez Corzo, D.N. and Riofrío, G. 2006. Formalización de la propiedad y mejoramiento de barrios: Bien legal, bien marginal. Estudios Urbanos. Lima: DESCO.
- Riofrío, G. 1978. *Se busca terreno para próxima barriada: Espacios disponibles en Lima, 1940-1978-1990*. Lima: DESCO.
- Riofrío, G. 2003. Lima, Peru. Urban Slums Reports. London: UN-Habitat.
- Robert, J. 2018. An ecological turn in urban water policies. The conflicts for the water council in Lima (Peru). In Robert, J.; Poupeau, F.; Razafimahefa, L.; Mercier, D. and Massardier, G. (Eds), *Water conflicts and hydrocracy in the Americas: Coalitions, networks, policies*, pp. 171-198. Sao Paulo: IEE-USP.
- Robinson, J. 2006. *Ordinary cities: Between modernity and development*. London: Routledge.
- Roy, A. 2005. Urban informality: Toward an epistemology of planning. *Journal of the American Planning Association* 71(2): 147-158.
- Salcedo, J.; Vasquez, R. and Acosta, J. 2003. Proyecto Ampliación de la Cobertura (PAC)-Sedapal: Estrategia para brindar servicios de agua y saneamiento a los mas pobres de Lima. *Boletín del comité sectorial de agua y saneamiento* 15: 1-3.
- Schindler, S. 2017. Towards a paradigm of Southern urbanism. *City* 21(1): 47-64.
- Sedapal and World Bank. 2006. *Agua para las zonas periurbanas de Lima Metropolitana. Lecciones aprendidas y recomendaciones*. Lima: World Bank.
- Shatkin, G. 2011. Coping with actually existing urbanisms: The real politics of planning in the global era. *Planning Theory* 10(1): 79-87.
- Smith, S. 2008. Discriminación, integración y el discurso del progreso en la Nueva Lima: Testimonios urbanos de cuatro jóvenes limeños. *Tinkuy* 9: 65-82.
- de Soto, H. 1986. *El otro sendero: La respuesta económica al terrorismo*. Lima: Instituto Libertad y Democracia.
- de Soto, H. 2000. *The mystery of capital. Why capitalism triumphs in the West and fails everywhere else*. New York: Basic Books.
- Turner, J.F.C. 1976. *Housing by people: Towards autonomy in building environments*. New York: Pantheon Books.
- Watson, G. 1995. *Good sewers cheap? Agency-customer interactions in low-cost urban sanitation in Brazil*. Washington, DC: World Bank.

- Watson, V. 2009. Seeing from the South: Refocusing urban planning on the globe's central urban issues. *Urban Studies* 46(11): 2259-2275.
- Worch, H.; Truffer, B.; Kabinga, M.; Eberhard, A. and Markard, J. 2013. A capability perspective on performance deficiencies in utility firms. *Utilities Policy* 25: 1-9.
- World Bank. 2004. *Making services work for poor people*. World Development Report. Washington, DC: World Bank.
- World Bank. 2009. Peru – Additional financing for the Lima Water Rehabilitation and Management Project. Implementation completion and results report 1241. World Bank.
<http://documents.worldbank.org/curated/en/2009/09/11215004/peru-additional-financing-lima-water-rehabilitation-management-project> (accessed 5 August 2014)

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