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Translocal Learning for Water Justice: Peri-Urban Pathways in India, Tanzania and Bolivia

Water Justice City Profile: Cochabamba

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Translocal Learning for Water Justice
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Abstract. *Translocal Learning for Water Justice.* (WatJust) is an action-learning alliance led by Prof. Adriana Allen at the Development Planning Unit (DPU, University College London). Launched in September 2014, WatJust explores the transformative potential of alternative water supply arrangements—small-scale, low-cost management practices, and new configurations of water governance—undertaken for and by the peri-urban poor in three urban regions: Kolkata (India), Dar es Salaam (Tanzania) and Cochabamba (Bolivia). The documentation and analysis of these practices aims to build the foundations of an innovative, grounded and in-depth exploration of the extent to which such arrangements can enhance water justice in a context where unmet needs are growing fastest, and where conventional centralised networks are unlikely to become the norm any time soon.

Foundational to the project is the establishment of a translocal learning alliance in collaboration with the three project partnerships. This report represents one of three profiles exploring the specific and localized manifestations of water injustices and alternative arrangements, mapping these approaches as a source of dialogue, comparison, and learning.

Content

City Profile

Cochabamba city and its residents have a deep and visible relationship with water service provision. From the Water War of 2000, to reforms implemented under the Morales government, the public control of water resources has played an integral role in both the public imaginary and practical service provision. The Bolivian Constitution (approved in 2009) recognizes water as a human right, and commits to the universal and equitable access to basic services, outlining the State's obligation to provide these services through public, communitarian, cooperative or mixed entities.

Despite important reforms to the water sector emergent out of these shifts, Cochabamba still faces significant challenges in the equitable distribution of water resources. Located 2500m above sea level, only 50% of the population of Cochabamba is served by the city's municipal water company, Semapa, concentrated primarily in the wealthier central areas of the city. Conditions are particularly serious in the southeastern peri-urban areas (such as Districts 7, 8, 9 and 14), where nearly 80% of households within the city's southern outskirts lack tapped drinking water inside their houses, spending up to 10% of the family income to purchase water of varying quality from outside sources. For this reason Cochabamba is sometimes described as a 'dual city', referring to the stratified service provision which concentrates the piped network in areas of wealth and power.

Strikingly however, and particularly in the outlying peri-urban areas, local inhabitants have found their own ways of collectively addressing their multiple water needs, relying on a mixture of community-driven systems. The Metropolitan Master Plan (2013) has identified nearly 200 of such small local systems in Districts 7, 8, 9 and 14. These operate under various management structures including Water Committees, Water Associations, Territorial Base Organizations, Cooperatives, private household developments, and the rurally-based *sindicatos*. In general, water committees, associations and cooperatives rely mostly on community resources and mutual aid, and are undertaken in collaboration with NGOs and religious organisations. In contrast, OTBs have developed community water services through collaboration with the State, accessing resources through formalized mechanisms provided by decentralization policies in the 1990s (i.e. Ley de Participacion Popular).

While highlighting these practices, it is also important to note that there are marked differences in water access and control *within* the city's under-served outskirts. The different management structures highlighted above are privileged to different levels of formalization and interaction with municipal authorities, influencing the financial and technical support available. Communities that have been established the longest typically have been more successful at extracting, managing, and developing infrastructure at the local level, and differences in household economic capabilities or land tenure status often dictate the ability for residents to claim for their water rights.

These dualities, inequalities and power differentials within the city's outskirts have generated a complex system for water distribution, control and access, and provide a rich ground for research. This report begins this process of investigation, outlining the multiple actors and trends which have shaped this terrain, highlighting in particular the foundations of co-produced practices in the Cochabamba context, and exploring the opportunities and potentials to work towards water justice in the city. (Allen et al., forthcoming)

1. Water Injustice in the City

1.1 Introduction

The city of Cochabamba is the capital of the department of Cochabamba[1], and is one of Bolivia's largest cities (after the cities of Santa Cruz, La Paz and El Alto). Around 90% of the urban population in the department of Cochabamba lives in the Metropolitan area (more than 1.5 million people), composed of 7 municipalities: Sacaba, Cochabamba, Tiquipaya, Colcapirhua, Quillacollo, Vinto and Sipe Sipe. The entire metropolitan area of Cochabamba is one of the three great urban conglomerates in Bolivia (Santa Cruz, La Paz and Cochabamba), who together account for 75% of the national urban population.

This report focuses on the city of Cochabamba, with a population of approximately 920,000 inhabitants (Map 1). This represents around 60% of the total metropolitan area population, and the consumption of around 70% of the metropolitan freshwater (Ledo, 2013). Despite its high levels of consumption, the city of Cochabamba has very few water sources of its own, with the main sources that supply the whole metropolitan area lying within the municipalities of Tiquipaya, Sacaba and Quillacollo (which have considerably less population and water consumption). As such, this report may briefly refer to dynamics occurring at the metropolitan level, even while the focus remains on the city of Cochabamba.

Several researchers and citizens have referred to Cochabamba as a "dual city", alluding to its noticeable characteristics of social exclusion and segregation in urban residential space (Ledo, 2013). This translates directly to spatial differences regarding the distribution of services such as water and basic sanitation, and the population's possibility to access these services. Critically, peri-urban areas of Cochabamba city (and particularly the southern outskirts: districts 7, 8, 9 and 14) are marked by the presence of several human settlements which are deemed illegal, a lack of municipal services (such as drinking water, sewage and garbage collection), environmental pollution, self-financing in the extension of electric services, and poorly-resourced health and education services (Achi & Kirchheimer, 2006). This is not the product of a "natural" delay in the development of newer urban and peri-urban areas, but a result of great inequity in the distribution of municipal budgets, which have historically prioritized urban cosmetic policies over social equity policies which aim to improve access to basic services, and provide other urban benefits (Achi and Kirchheimer, 2006).

A comprehensive diagnosis presented in the Metropolitan Master Plan for Drinking Water and Sanitation (PMMAPS, 2013: 3-5) identifies that the municipal provider of Cochabamba, Semapa, does not cover the water needs of the southern outskirts of Cochabamba, and identifies two main reasons: "partly because of insufficient financial and technical resources, and also because of insufficient amounts of water resource to supply the whole city, leaving the provision of this vital liquid of Districts 7, 8, 9 and 14 in the hands of local organizations." While these are legitimate challenges, it is also important to recognize that "social relations, economic constraints and power structures (…) shape the use of resources" (Neumann, 2005). Therefore, water scarcity is due not only to an increase in its demand or a decrease in the physical/technical availability of the resource, but also to formal and informal mechanisms of property, access and control over water (institutions for its management), which may harmonize or collide, and that greatly shape and transform water governance (Boelens and Zwarteveen, 2005). In fact, in Cochabamba many actors directly or indirectly involved in water use and management recognize that this resource is a synonym of power (Quiroz, 2014). And on many occasions in the city, water flows in the direction of power (Boelens, Cremers, & Zwarteveen, 2011), accumulating in the socio-economic sectors of privilege. The "dual" character of Cochabamba city is a good illustration of this, impacting the ability for residents to achieve water justice at scale.

1.2 Water injustice and emerging urban development trends

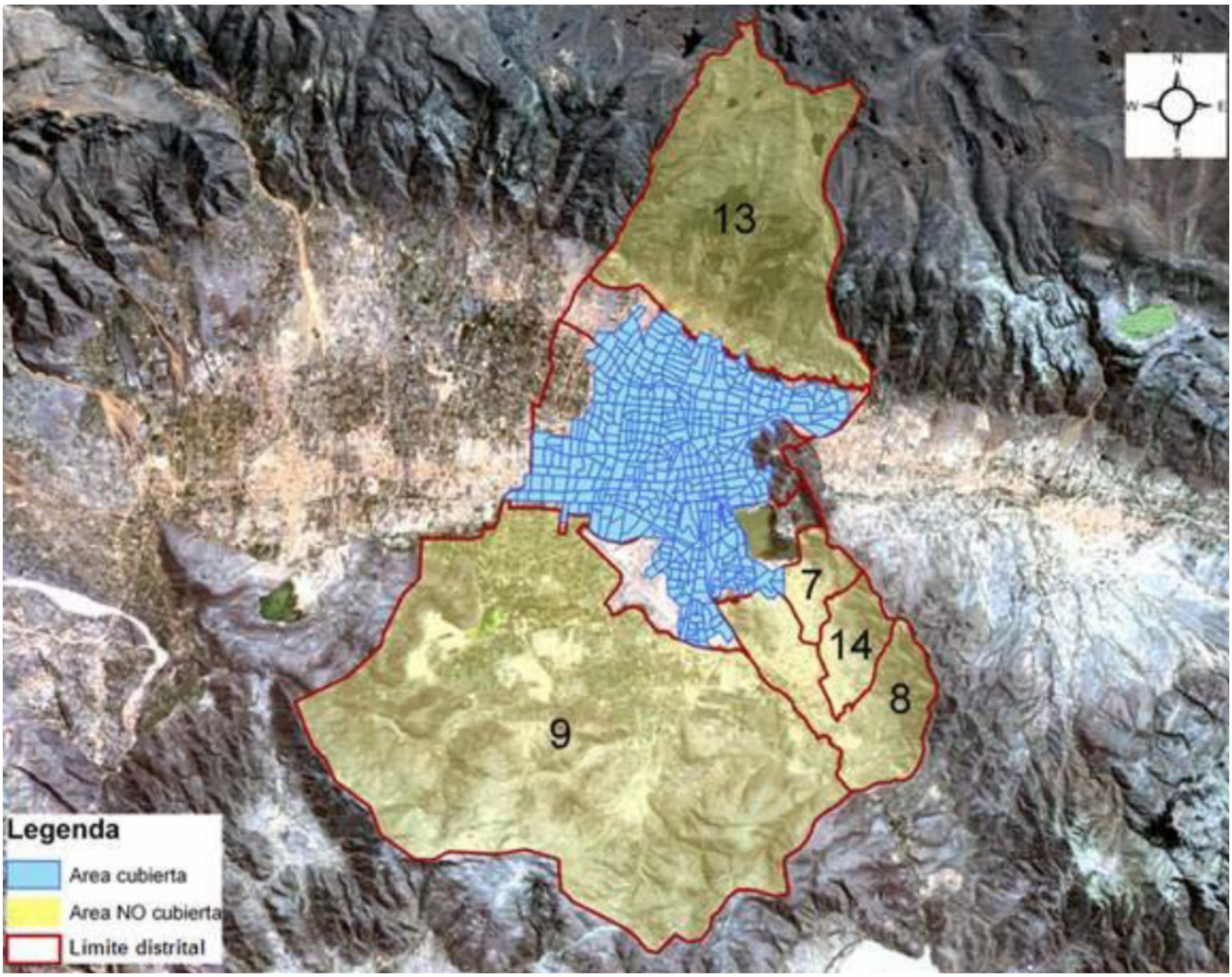
In the 1990s a number of reforms took place within the neoliberal framework adopted by the Bolivian government. This saw the decentralization of competences and resources to the municipal level, and the privatization of basic services such as drinking water and sanitation in urban areas (Perrault, 2005). Reforms were implemented to design an institutional framework and a set of policies that created an enabling environment for privatized companies.

A key example of this is the Potable Water and Sanitation Law No. 2029 *(Ley de Servicios de Agua Potable y Alcantarillado Sanitario)* in 1999, which precisely provides a framework for private sector participation in water provision. One of its main features was to introduce a sys-

tem of concessions and licenses for potable water. As Marston (2014) shows, concessions were to last for 40 years, whereas licenses could only be obtained for five. Around the same time, in Cochabamba, a transnational company called Aguas del Tunari obtained a concession to control all water sources in Cochabamba, which meant that existing local organizations such as cooperatives or neighbourhood associations would be forced to enter into contracts with the concessionaires (Assies, 2003, in Marston, 2014). In other words, this law authorized Aguas del Tunari the right to take control of all peri-urban water systems without compensating those people who had built them (Olivera and Lewis, 2004, in Marston 2014). This interrupted and threatened the autonomy of local water organizations, and worse, challenged the traditional relationship of the population with water.[2] Indeed, this set of reforms ended up being one of the detonators of the Water War in 2000 (interview with Luis Salazar, 2014).

As part of a massive social response to an accumulated discomfort with the results of neoliberalism, Evo Morales and the MAS (Movement towards Socialism) were elected in 2006, thus ending the neoliberal era in Bolivia and promising changes that would benefit the whole country, and especially the historically neglected populations: the working class, rural inhabitants and indigenous people (Komadina & Geffroy, 2007; Stefanoni & Do Alto, 2006). Under the Morales government a new Constitution was approved in 2009, which introduced the notion of a human right to water as an alternative to privatization. However, while other institutional changes were undertaken during this period, the water sector remains governed by law 2066, which was designed within the neoliberal

Map 1. The city of Cochabamba and Semapa's area of coverage. Source: Ledo, 2005.



Map 1 shows the limits of Cochabamba city, surrounded by the Metropolitan area (east and west), and highlights its outskirts (districts 7, 8, 9, 13 and 14), which are not covered by the public network (colored in blue).

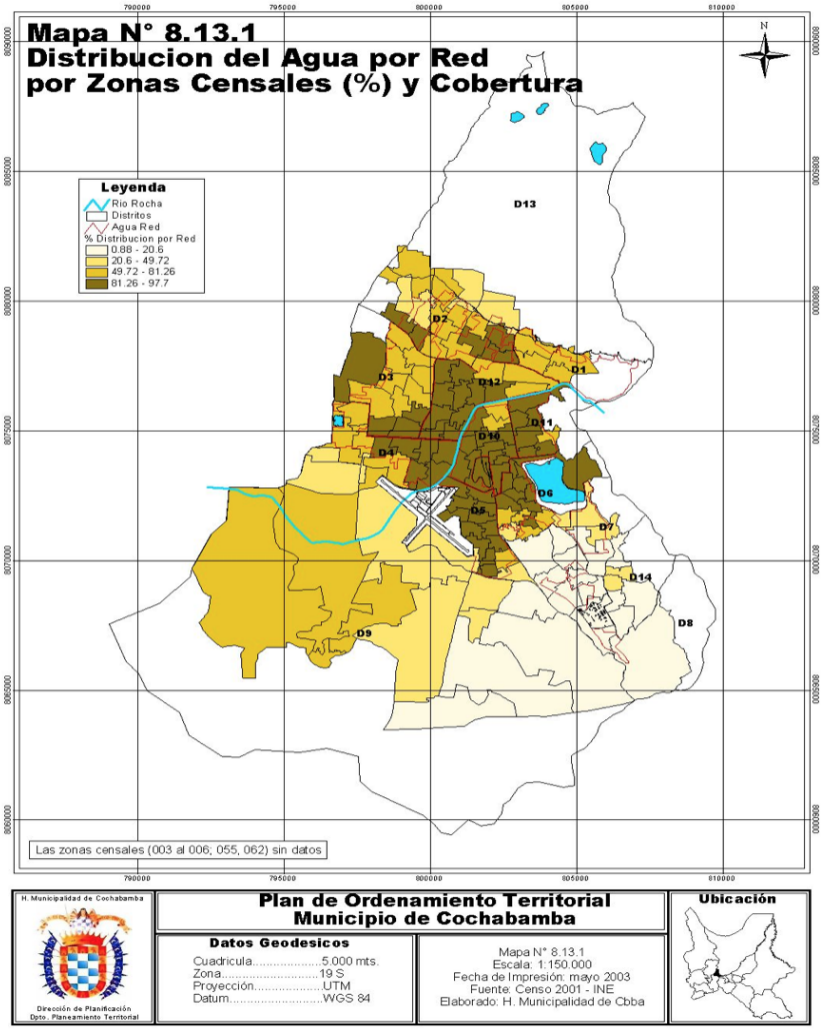
framework in 1999. While law 2066 represents an improvement from its predecessor (law 2029), it still remains far from fulfilling the promise of the Constitution.

Thus despite the upheaval of the Water War and subsequent changes, significant material improvements in water and sanitation provision have not occurred in the city of Cochabamba. Only half of Cochabamba is served by the city's water company Semapa (Municipal Service of Drinking Water and Sewage), and currently "the public water network ends where the poor neighborhoods begin" (Ledo, 2013: 9). Nearly 80% of households within the city's southern outskirts lack tapped drinking water inside their houses, spending up to 10% of the family income to purchase water of dubious quality from water tanker trucks (Ledo, 2013). Meanwhile, wealthier Cochabambinos who have access to Semapa's network spend only around 1% of the family income for a larger quantity and a higher quality of water. Map 2 below illustrates the differentiated access to water according to district. Although the information comes from the 2001 National Census, it helps to visualize the fragmentation within the city.

This situation is similar in regards to basic sanitation, as Semapa's sewage system only covers up to 53% of the territory (Map 3). Currently there is only one treatment plant for the entirety of the city (Albarrancho), and it is working at more than twice its capacity. As such, a significant amount of untreated wastewater is currently being discharged into the Rocha River, contaminating the river which is used for crop irrigation in different areas of the city.

A study carried out in 2009 by the NGO Agua Sustentable found that the city's underground waters are very vulnerable to contamination by wastewater due to the lack of sanitary sewage systems and the resultant proliferation of rudimentary septic tanks, cesspools and latrines. The presence of chemical waste from the municipal slaughterhouse and industries related to the production of plastic products, sodas, sausage factories and tanneries is also widespread. Leachate from trash decomposition (the city's dump is lo-

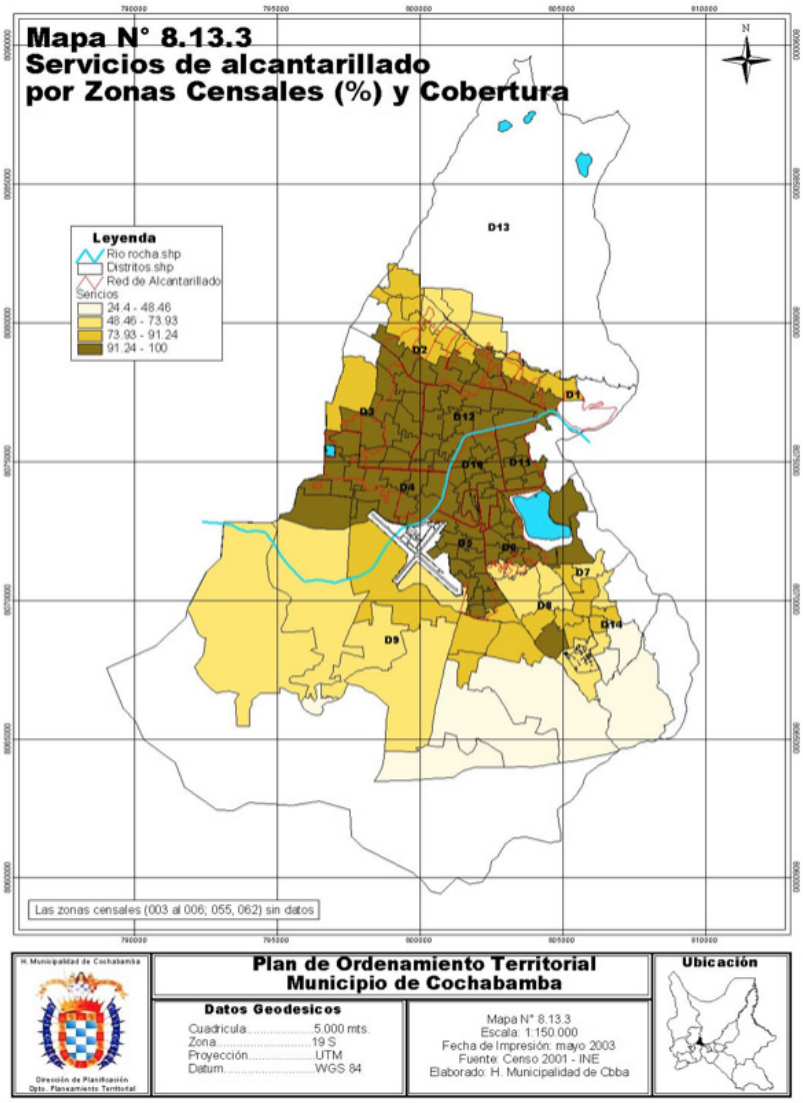
Map 2. Map of piped water coverage



cated in a district in the southern outskirts) and agricultural and livestock industries (fertilizers, pesticides, organic matter and fecal pathogens) are also significant contaminants of Cochabamba's underground water sources. Similarly, the Metropolitan Master Plan's diagnosis (2013) has detected that part of the underground waters suffer from the presence of ammonia nitrogen, nitrates, phosphates, gas (hydrogen sulfide), iron excess, and nickel from the municipal dump, and that *"according to comments from the operators in each system, the water extracted from wells in some cases have a bad smell (sulfur), in other occasions it has a brown-red color, there is water with salinity and even the presence of gas"* (PMMAPS, 2013: 3-51).

In highlighting these challenges, it is also important to note that there are marked differences in water access and control within the city's under-served outskirts (a nuanced understanding of different forms of fragmentation in Cochabamba city can be found in Rodriguez et al., 2009). This is related, for instance, to the economic capabilities of different residents to pay the sums required to connect to a system, or be part of a drinking water committee, cooperative, association or similar. Land tenure status has also proved to be either a constraining or facilitating factor to access water and sanitation services for different households. Similarly, differing levels of formality within these human settlements is also related to differing abilities to access water within Cochabamba's outskirts. Formally recognized settlements can access municipal resources through the local district council (for example, by using the Ley de Participacion Popular), and many use these resources to develop water services. Meanwhile, informal settlements have to manage with their own resources and/or depend on NGO support. The path towards formalization in some cases can be difficult, costly and slow. These dualities, inequalities and power differentials within the city's outskirts are factors that increase the complexity of the situation, and can be a rich ground for research.

Map 3. Map of municipal sewage service coverage



1.3 Institutional landscape for urban water and sanitation supply

Historically, the Bolivian state presence and involvement in the management of water sources has been very limited, especially regarding those used by local, indigenous and peasant communities. Different studies (Hoogendam and Gerbrandy, 1998; Bustamante, 2006; Scurrah, 2003; Perreault, 2006) have demonstrated that most issues related to the management and organization of water systems and conflict resolution are dealt with directly through customary institutions and norms. There has been a historical institutional deficit in regards to the water sector (regarding who does what, when, and how), and the interactions between residents and government authorities have often been limited to interventions such as dams or other large scale water projects, leaving decision-making on everyday water management to local organizations (Bustamante and Cossio, 2011).

However, neoliberal reforms in the 1990s introduced an institutional framework and a set of policies that encouraged the privatization of natural resources and basic services (in this case, water and sanitation provision). As is widely recognized, this shift towards privatization in Cochabamba lead to the famous "Water War" of 2000, which spread to La Paz and El Alto (2004 and 2005). Besides the expulsion of private water companies, these conflicts boosted and consolidated a new awareness about the need to give legal recognition to local, peasant and indigenous organizations in order to protect them from powerful transnational interests seeking to take over their water sources. This was to be achieved through formalization processes that would acknowledge and protect locals' water rights, management systems and organizations; simultaneously, organizations demanded inclusion into institutional bodies with decision-making power over water management (Bustamante and Cossio, 2009).

According to Bustamante and Cossio (2009), as a response to the negative effects of the neoliberal reforms of previous years and decades, the new institutional framework being developed in Bolivia is strongly "anti-neoliberal", and based on proposals drawn directly from social movements and organizations (at least in the official discourse). It is also argued that since the rise of the Evo Morales government in 2006, complex relationships between the state and social organizations and movements have shifted from antagonistic to "agreeable", which has also resulted in some cases of cooptation (ibid). However, Bustamante and Cossio (2009) also identify a strong "legal engineering" approach, which they posit has been responsible for the development of uncontrolled, fragmented, contradictory and sometimes incoherent new norms, institutions, competences and attributions at a formal level. Nevertheless, the Bolivian State has in fact created new institutional entities at the executive level in order to respond to water and sanitation issues and develop the process for the formalization of management systems, organizations and rights. The new Constitution— approved in 2009—not only recognizes water as a human right, but also establishes a universal and equitable access to basic services, outlining that it is the obligation of the state to provide these services through public, communitarian, cooperative or mixed entities.

Perhaps one of the most significant of these new institutional entities created under the Morales government is the Ministry of Environment and Water (in Spanish: Ministerio de Medio Ambiente y Agua, MMAyA), which is now the head of the entire water and environmental sector in Bolivia. This Ministry is responsible for developing and executing "public policies, norms, plans, programs and projects for conservation, adaptation and sustainable use of environmental resources, as well as for developing irrigation and basic sanitation with an integrated watershed approach, preserving the environment, giving priority to the use of water for life, respecting *usos y costumbres* (uses and customs) to achieve *vivir bien*" (the good life) (Law of Organization of the Executive-Power, Art. 11 SPO). The specific tasks to achieve these aims are carried out through its respective vice-ministries, directions and technical units (Figure 1).

The current legislation for the drinking water sector is Law 2066 (Law for drinking water and sanitation services). This law is a modification of the Drinking Water and Sanitation Law 2029, approved by the neoliberal government of Hugo Banzer in the year 1999. Law 2066 establishes the rules and norms for drinking water and sanitation provision and use, as well as the framework these norms are bounded to. It recognizes all forms of provision of water and sanitation services (different kinds of public, private and communitarian forms that providers may have), it establishes their rights and obligations as providers, and introduces the procedures through which all types of providers can acquire concessions, licenses and registrations. Although there is a project for a new water law called Water for Life (Agua para la Vida), it has remained in discussions for several years, and it seems that it may be some time before any advances are made in these discussions and negotiations.

In addition to Law 2066, the Constitution, the "Andres Ibañez" Law for Autonomy and Decentralization, the sectorial laws and the Constitutional Sentence Nº 2055, determine the State competences at national, departmental and municipal levels regarding water and sanitation. According to these stipulations, all levels of government are competent for developing, financing and executing drinking water and sanitation projects, in coordination with other levels of government and with autonomous indigenous/peasant local governments. Municipal and departmental levels should coordinate with the national level on all tasks requiring technical assistance and planning.

Once a project is concluded, it may then be handed over to a recognized operator. This legal framework also establishes that municipal governments are responsible for guaranteeing the provision of water and sanitation services through municipal services, cooperatives or communitarian entities. If the municipality is the direct provider, it is also responsible to determine tariffs for these services.

Law 2066 also establishes that all providers of drinking water and sanitation services in Bolivia are 'Water Service Provider Entities', whether they are public, communitarian, cooperatives, or associations (in Spanish: Entitades Prestadoras de Servicios de Agua Potable, EPSAs). In large and intermediate cities, the EPSAs in charge of providing drinking water and sanitation services are public companies, with the exception of Santa Cruz where the responsible entities are run as cooperatives. Meanwhile, in rural and peri-urban areas, the EPSAs are often communitarian, organized as civil associations, cooperatives and water committees. In Cochabamba city, the EPSA officially responsible for providing drinking water and sanitation services is Semapa. However, as it only supplies water for half of the city's population, the "other half" accesses services through independent systems managed through various other organizations recognized by law 2066 (also recognized as EPSAs). According to Perrault (2006, in Marston, 2014), one of the greatest improvements of Law 2066 from the perspective of independent water systems was that peasant and indigenous organisations would be able to obtain indefinite water licences, and that concessionaires would not have exclusive rights to water in their concession areas. *"This victory legitimised the water committees' presence and can be interpreted as a kind of quasi-formalisation. They now have the opportunity to be recognised by the state, though not all (or even most) of them have chosen to pursue this option"* (Marston, 2014: 77).

National water legislation, established mainly through law 2066, determines that all these small independent water providers must obtain a license from the Technical Committee of Licenses and Registrations (CTRL), which is part of the Authority for Monitoring and Social Control of Drinking Water and Basic Sanitation (AAPS in Spanish). These are decentralized and autonomous institutional entities, which work alongside SENASBA (Servicio Nacional para la Sostenibilidad de Servicios de Saneamiento Básic-National Services for the Sustainability of Sanitation Services) and EMAGUA (Entidad Ejecutorade Medio Ambiente y Agua-Executing Entitie for Water and Environment) (Figure 2). According to Bustamante and Cossio (2009), the formalization process has turned out to

Figure 1. Bolivia: Current official hierarchy of the (drinking) water and sanitation sector. Source: Compiled by the authors.

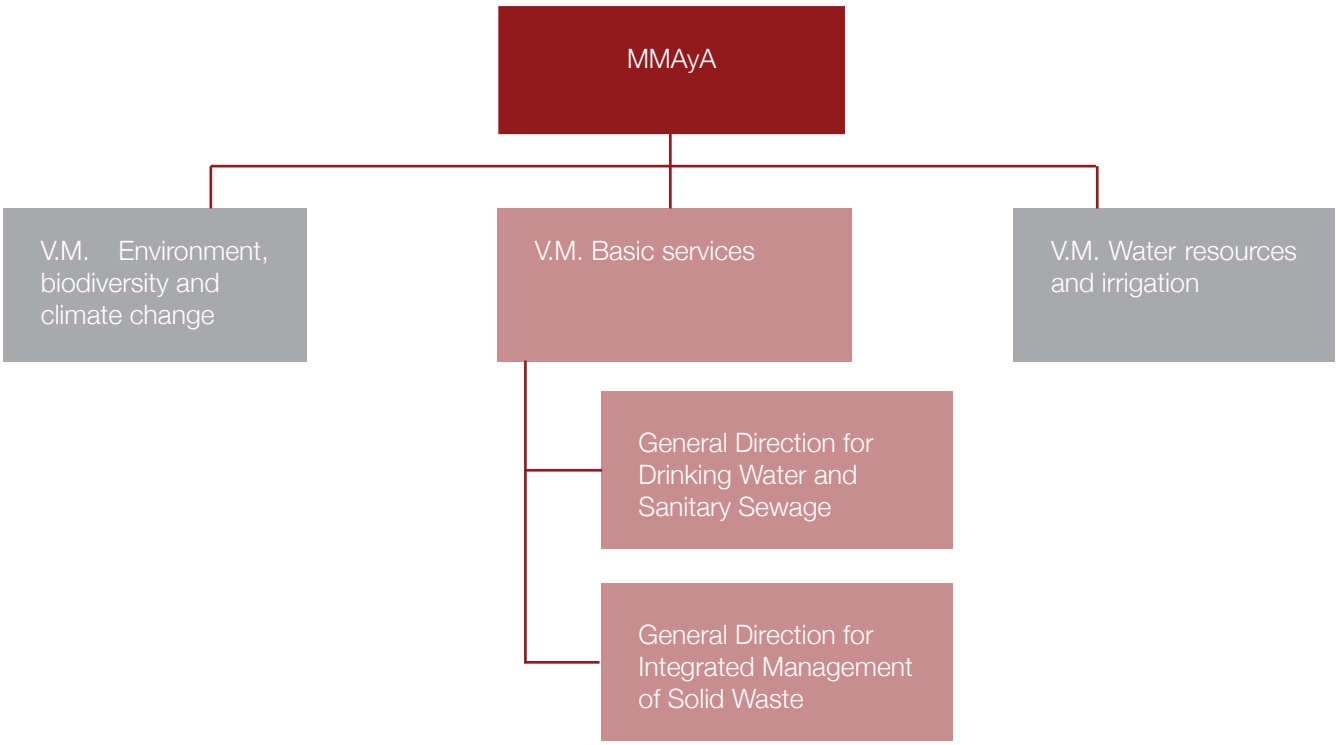
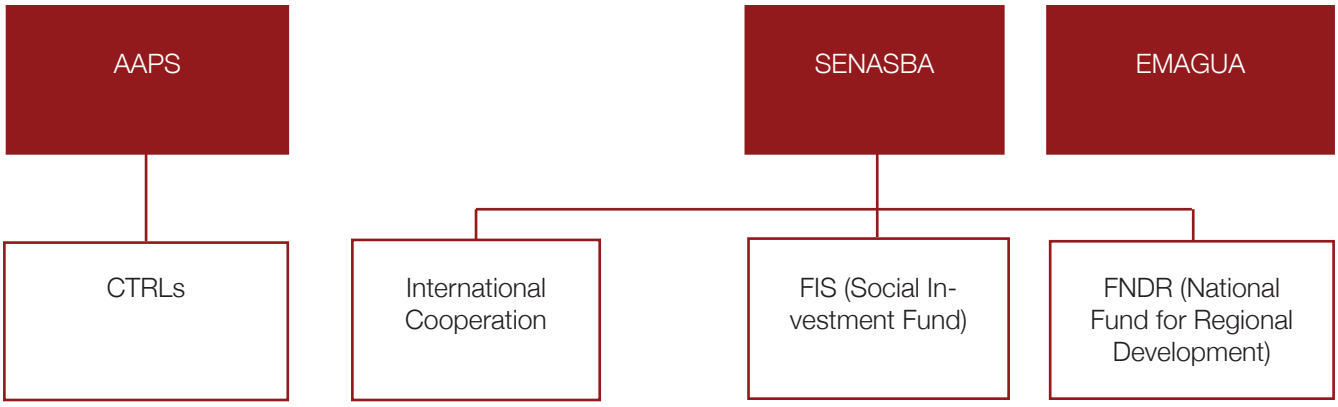


Figure 1 shows the current hierarchy of the official entities governing the drinking water sector, which in this case is the Vice-Ministry of basic services. The details of the other Vice-Ministries are omitted from the figure as they are not involved in the drinking water sector.

Figure 2. Licensing bodies. Source: Compiled by the authors



be conflictive in several places where local organizations were opposed to the process. However, *"in spite of all the problems, this task continues with the objective of having all systems (irrigation and drinking water) legalized and with legal certainty in a more or less fixed period"* (ibid: 4). However, according to the AAPS, until 2012 none of these small systems had a license, and have therefore been operating without any kind of control and regulation (PMMAPS, 2013). Similarly, other systems operate as a result of collective decision-making, and do not necessarily obtain legal recognition (ibid).

Marston (2014) argues that water committees and their advocates have in some cases engaged in *scalar strategies* in an effort to transform their water systems from informal to quasi-formal (generating more stability in the long run). The most recent of these scalar strategies is the elaboration of a multi-scalar co-management plan that aims to involve Semapa and the (currently under construction) Misicuni Dam as equal partners alongside water committees (Marston, 2014). This plan is part of a new way of organizing drinking water management in the whole metropolitan area of Cochabamba, which can be found in the Metropolitan Master Plan for Drinking Water and Sanitation (PMMAPS, 2013).

In addition to the well-known water deficit in the whole Cochabamba valley, this Plan has also identified an institutional deficit that has been insufficiently addressed by the MMAyA or by the municipalities. Accordingly, the departmental Government has recently taken the lead in the search for institutional alternatives for water management, outlining two key reasons why this should be undertaken at the Cochabamba metropolitan (rather than city) level. Firstly, the Misicuni Project (which purports to resolve the historical water shortage in Cochabamba) involves and benefits all 7 metropolitan municipalities (Sacaba, Cochabamba, Tiquipaya, Quillacollo, Colcapirhua, Sipe Sipe and Vinto). It consists of a massive water transfer from the Misicuni, Viscachas and Putucuni basins through huge tunnels, a mega-dam, hydroelectric generation, treatment plants and a main pipeline. This entire infrastructure requires a great investment involving all these municipalities and several other stakeholders, thus requiring coordination at a higher level.

Secondly, the Plan proposes the joint management of the main water sources at the metropolitan level in consideration of the fact that currently Cochabamba city's main water sources are in other metropolitan municipalities, even though the city serves more than 60% of the metropolitan population and accounts for approximately 70% of water consumption. Thus part of this new metropolitan management includes provisions for the modification of the existing water distribution—as it is expected that considerable amounts of water will be produced from Misicuni to supply the city of Cochabamba, this will 'free' the current water sources to be used in their respective municipalities. According to the Plan, this organization will also generate a significant savings in energy as it will require less pumps (relying upon gravity), and less routine work will be required as sources will serve nearby populations.

The PMMAPS also proposes the creation of a Metropolitan Water Company charged with operating the main Misicuni system and delivering blocks of water to each municipality (or their decentralized water companies) and other independent water systems. In the case of Cochabamba city, this would mean the new Metropolitan Company would sell an established amount of water to Semapa, as well as to the independent systems that are prepared to receive this water.

Although the idea of a Metropolitan Company may be viable, the proposal of a metropolitan management of all water sources is, in real and operational terms, much more complicated. This consolidation could well be understood by some actors as a similar initiative to the one

that prompted the Water War of the year 2000, which allowed Aguas del Tunari concessions over all water sources in Cochabamba. However, the most pressing challenge is that Misicuni is not yet a reality, and there is a persistent risk of further delays, conflicts and technical problems with the project. It is therefore unlikely for the citizens of Cochabamba city to "release" or "give back" the water sources they are actually using for a new source that—although proclaiming great promise—is still not a concrete reality.

Currently, the PMMAPS is being used by the departmental Government as a tool for sensitizing municipalities and other water actors on the urgent need to advance an intra-municipal organization of infrastructure and service provision that takes into account the heterogeneous realities of urban areas. It represents the most recent and comprehensive plan for the metropolitan area of Cochabamba in terms of the future water infrastructure and service provision. However, it does not address these issues at municipal levels, and the way each municipality will organize is still unexplored territory. In the city of Cochabamba, there has yet to be a serious debate on how to reorganize the public provision of drinking water and sanitation[3], and how the independent systems are to be included technically and institutionally in a way that citizens' water needs are met with better quantities and qualities. Nonetheless, the continued exploration of this proposal holds the potential to open a space in Cochabamba's society which may involve different actors in a discussion of the best ways to address the city's "dual" and marginalizing character, and therefore can constitute an opportunity for the peri-urban poor to influence the way the formal structure of service provision takes their realities into account in the future.

NOTES TO CHAPTER 1

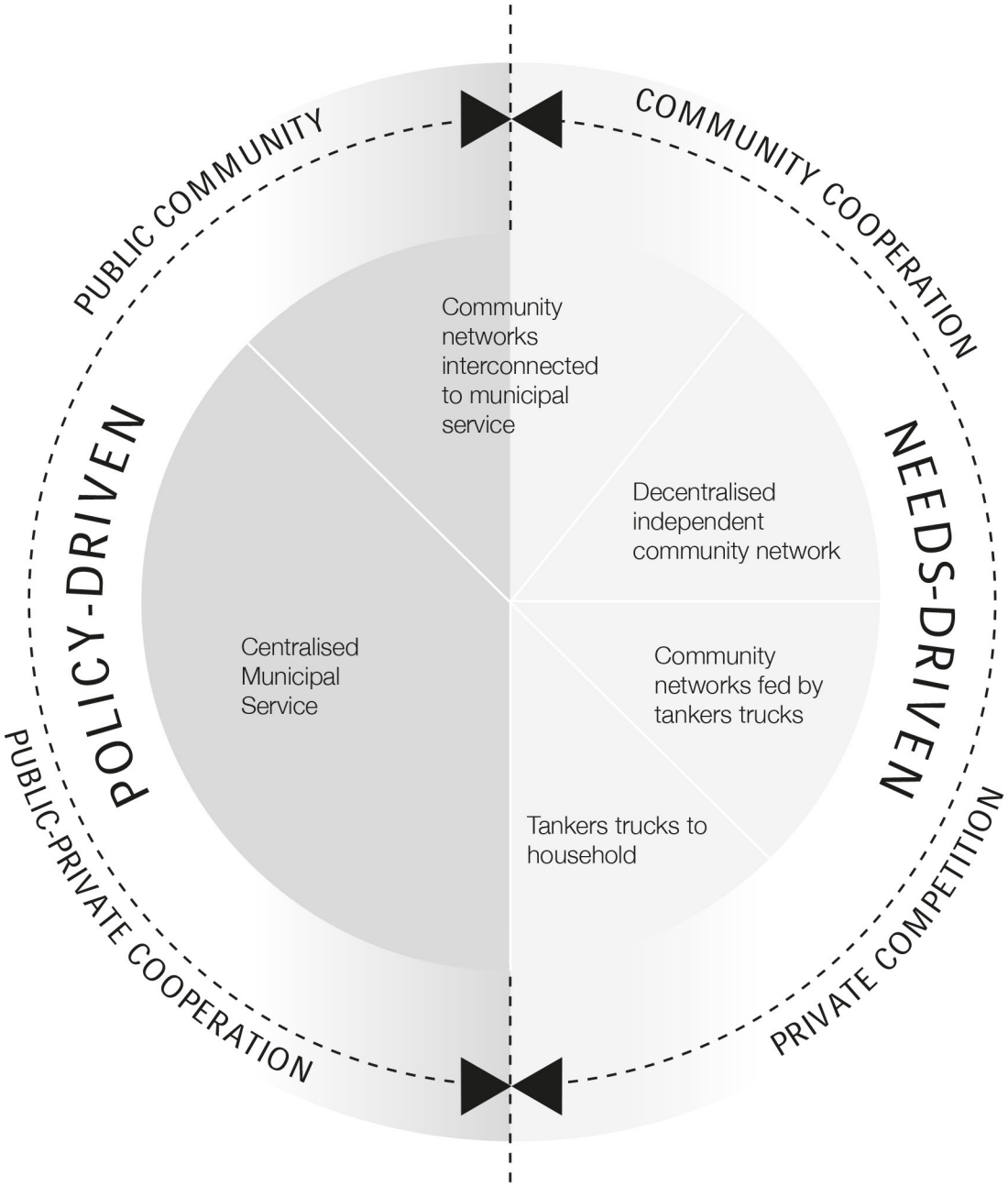
1. Bolivia is politically divided in 9 departments, which are in turn divided in provinces, and these are divided in municipalities. The capital of the Cochabamba department (Cochabamba city) is located in the Cercado province.

2. It is important to note that this relationship envisions people as rights holders and not simply water users (this sentiment is especially strong in peri-urban and rural areas), which is a key factor in institutional analysis frameworks regarding collective action and decision-making.

3. Deep changes in Semapa are currently needed, including perhaps a re-foundation or the creation of a new municipal company.

2. Water and Sanitation Wheel for Cochabamba

2.1 Policy-driven and needs-driven approaches in water supply



Source: Elaborated on the basis of Allen et al., 2006a; 2006b

The only policy-driven practice in the city of Cochabamba, in regards to both drinking water and basic sanitation, is the municipal service provided by Semapa, which has a coverage level of approximately 50% (this figure is slightly higher in the case of sanitation). This has in many cases proved inadequate in reaching more peripheral and peri-urban areas, generating a wider variety of needs-driven practices (Table 1).

Semapa's public network usually provides safer and cheaper water than those independent systems operating in the city's outskirts (cheaper than tanker-truck water, but more expensive that Cooperative/Water Committee water). Semapa has several wells operating, and its main sources are surface water (Escalerani, Wara Wara and Chungara dams, as well as a small but important flow from Plan Inmediato Misicuni), which all come from other municipalities within the metropolitan area of Cochabamba (Quillacollo, Sacaba, Tiquipaya). Water is then transported to different treatment plants, with different sizes and capacities, and undergoes different treatment methods, usually filtration and/or chlorination. However, some underground water is injected directly into the network in a "raw" state, without treatment. Semapa has many of the technical and financial advantages of being a public decentralized enterprise, including access to qualified personnel, equipment, advanced monitoring and accounting systems and economies of scale.

However, Semapa's service provision also has several weaknesses. Firstly, the utility is widely perceived to be party to excessive political interference and manipulation which has generated an increasing citizen distrust and criticism, with many believing that the 2000 Water War did alleviate Cochabamba's water problems. This has secondly been exacerbated by problems with the quality of the service itself. According to the Metropolitan Master Plan's diagnosis, Semapa is unable to provide a 24 hour service to all of its users (PMMAPS, 2013: 3-42), and Semapa's own 2011 report acknowledges that there is an average of only 15.15 hours of water delivery a day. Furthermore, this average hides that there are coverage areas which receive water with greater frequency, while others have to wait up to two days at a time, highlighting inequalities even within the public service. Finally, a third challenge for Semapa is the high percentage of water losses. Nearly 50% of the water it supplies to the city is lost either through network leakages, clandestine connections, or theft. Needless to say, leakages due to network obsolescence (the oldest pipelines were installed in the 1950s and 1960s) significantly increase the risk of contamination.

Those citizens who remain outside of the formal municipal system exert at least four needs-driven practices identified in this report (with residents sometimes engaging more than one practice simultaneously), which are taking place at the community level. These include different types of community-managed systems with and without their own water sources, as well as the provision of water through the domiciliary purchase of water from tanker trucks. A recent study from Ledo (2013) has georeferenced around 200 such independent systems in Districts 7, 8, 9 and 14 of Cochabamba city. The predominant form of managing these systems is through Water Committees (46%), followed by Water Associations (20%), Territorial Base Organizations (OTBs, 15%) and Cooperatives (11%). Meanwhile, the Metropolitan Master Plan (PMMAPS, 2013) has identified 189 small local systems managed either by OTBs (23 cases), self-management (122), small cooperatives (11), private household developments (26) and agrarian *sindicatos*[4] (7).

These community systems can be further divided into three types: those with their own water source (usually wells), those without (virtual networks), and those interconnected to the municipal system. Systems with their own water source are more independent, however the quality of the water may be low as a result of underground water contamination. Systems without a water source are called virtual networks: they buy water from private vendors such as tanker truckers, fill their storage tanks, and then distribute the water to households through their own piped network. Management is independent, but the sourcing of water depends on private vendors (with varying quality and price). Finally, there are those systems interconnected to the municipal system: instead of buying from tanker trucks water is purchased directly from Semapa, which is then similarly re-distributed through household connections. At present, in Cochabamba's southern outskirts it is most common to find the first three needs-driven practices: households buying directly from private water vendors, community systems with their own water source, and systems with virtual networks. Interconnections to Semapa are not yet widespread, although some virtual network systems are considering this option for the future, once the Misicuni project is a reality.

These systems all have different levels of legality and formal recognition. In general, Water Committees are mainly grassroots organizations. These water systems rely mostly on community resources and mutual aid, and are undertaken in collaboration with NGOs and religious organisations to support their construction and training on operation and maintenance. Water Committees thus often maintain their own governance systems but without a legal status. These can be distinguished from Water Associations, which are legally recognized. Similarly, OTBs have developed community water services through collaboration with the state, accessing resources through formalized mechanisms provided by decentralization policies in the 1990s (Ley de Participacion Popular). OTBs include neighborhood councils (juntas vecinales) and the sindicatos in the agrarian areas in the city (mostly in District 9). Finally, cooperatives are regulated by a specific law (Ley General de Cooperativas 356). In most cases

(60% of studied cases), these systems were built through the initiative of residents, who invested their own financial resources and used their own workforce for the construction process (Ledo, 2013: 100). Ledo (2013) estimates that the total investment made by residents in the southern outskirts of Cochabamba in these types of localised infrastructure (networks, wells, tanks) reaches around 16 million dollars.

The water sources for these independent systems are mostly underground wells, private water tanker trucks, and even a few natural springs.

In the case of tanker trucks, households buy water directly from these private water vendors, paying an average of up to 20 US dollars for the first 5 cubic meters, and store the water in barrels or home storage tanks. However, the water obtained in this way is of dubious quality, as many providers are informally established and/or do not check the quality of the water they sell. Meanwhile, underground sources such as wells and springs usually have low water flows, between 1.5 and 3 litres per second, and in some cases are found to have a very low supply of up to 33 litres per person per day (PMMAPS, 2013: 4-16).

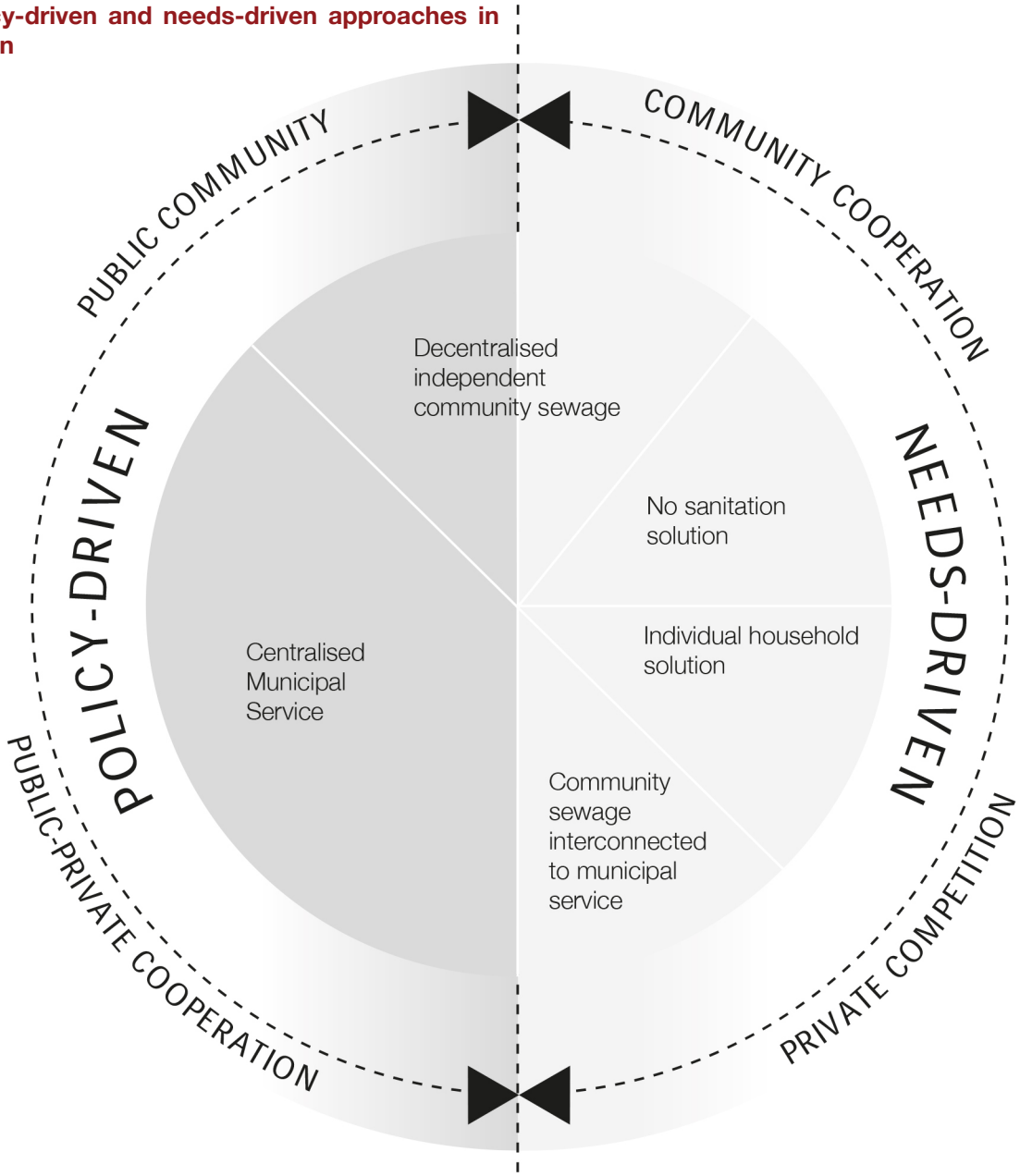
Further, according to the Metropolitan Master Plan, *"not only is the quantity of the vital fluid deficient, but also its quality: it has high contents of salts, excesses of iron and magnesium, and some contamination, producing water borne diseases. Water from tanker trucks does not reach standards either"* (PMMAPS, 2013: 3-45). A general problem for these small independent systems is that most do not have a routine water quality control plan, and lack the necessary infrastructure, equipment and personnel to carry out this work. Around 39% of the systems do carry out occasional water quality analysis at the University's Water and Environmental Sanitation Center (CASA-UMSS). However, even though water quality problems relating to color and turbidity have been reported, the Ministry of Health has not carried out tasks to monitor water quality (PMMAPS, 2013: 4-29). A 2009 study by CASA-UMSS and ordered by the National Service for the Sustainability of Basic Sanitation Services (SENASBA in Spanish), showed that in 73% of the water sampling points taken from the communitarian independent systems, two or more physicochemical parameters were in breach of the NB 512[5] norm. The study also showed that 35% of the sampled water was unfit for human consumption in microbiological terms, also breaching the standards established by the NB 512 norm.

In addition to these challenges of quantity and quality, these independent systems (committees, cooperatives) also face management difficulties. Most systems hire their personnel as casual workers—even the plumbers that operate the system are not permanent staff. In addition they are often faced with a shortage of personnel, and typically employ only 2 people working for an average of 250 connections (PMMAPS, 2013: 4-10-11). Another challenge is that only 40% of independent systems have water metres, making it impossible to measure the production and consumption of water, as well as water losses, thefts and overuse. According to the Metropolitan Master Plan, there have been many complaints about leaks and broken pipes, especially in the oldest systems (ibid). Around 7% of the systems lack accounting tools, making it difficult to manage financial information, while only 5% is deemed to have an adequate financial control. The remaining systems (88%) have only manual income-expenditure control and accountability mechanisms (Ledo, 2013: 101). All of these aspects are important not only for the internal operation, performance and sustainability of the systems, but also to determine if these small independent providers can be entitled to financial credit or supported through external cooperation.

Table 1. Drinking water policy-driven and needs-driven practices in peri-urban Cochabamba

Practice	Type	Approx. Cost (for first 5 m3 USD)	Characteristics	Further Observations	Examples
Water tanker trucks	Needs driven	20	People who work privately distributing water to neighbourhoods that lack water systems. Homes receive the water in metal barrels of 200 litres each, or in domiciliary tanks that can store between 1,000 and 12,000 litres. Tankers serve households individually.	Discontinuous and intermittent service. There is no control over the quality of the water. The service is unregulated.	Neighborhoods in Valle Hermoso
Communitarian systems with their own water source	Needs driven	1.5	Civil society organized through drinking water and sanitation committees (CAPYS) or through service cooperatives. In Cochabamba each system supplies between 500 and 5,000 users. There are more than 700 systems in the metropolitan area of Cochabamba.	Efficiency of the service and quality of the water is variable dependent on each organization. Ranges go from bad to very good.	Miraflores Sivingani María Auxiliadora
Communitarian systems without a water source (virtual networks)	Needs driven	12.5	Similar to the previous case in management, but lacking their own water sources. Water is supplied by a private provider (tanker truckers) who delivers the liquid in a storage tank. From there, the organization distributes the water, via pipelines, to each home.	Variable service depending on the system's management characteristics. Water may or may not be treated.	Central San Miguel Lomas del Pagador
Communitarian systems interconnected to municipal system	Needs driven	5	Similar to previous case, but instead of buying water from a tanker truck the system is supplied by a connection to the municipal system (Semapa sells an established amount to the system).	Variable service, depending on the systems' management characteristics.	Barrio Solterito Villa Urkupiña
Municipal system (Semapa)	Policy driven	6	The municipality is in charge of the production, distribution and delivery of water to homes through a pipeline network.	Service continuity: average of 8 hours per day. Quality of water is impaired by contamination due to leakages in the outdated network.	SEMAPA

2.2 Policy-driven and needs-driven approaches in sanitation



Source: Elaborated on the basis of Allen et al., 2006a; 2006b

Household access to basic sanitation in Cochabamba varies from policy-driven practices (provided through Semapa municipal services), community managed systems, individual household-level strategies, or having no sanitation system at all, resulting in open defecation. As previously stated, Semapas's sewage system only covers up to 53% of the city, and faces several challenges. There is currently only one treatment plant for the whole city (Albarrancho), and it is working at more than twice its capacity; therefore, there is a significant amount of wastewater currently being discharged untreated into the Rocha River.

In some cases, needs-driven practices have developed, including community sewage systems interconnected to the municipal sewage line. In this model, the sewage system is managed by the community (through a water committee or cooperative) that collects wastewater, which in turn is connected to the municipal system for treatment (community collection and municipal treatment). There are also independent (unconnected) community sewage systems, although most of these systems discharge the untreated waste water into a nearby rivers or gullies (only in a few cases is the wastewater treated). Many households opt for individual solutions which consist basically of the construction of latrines or hydraulic drag toilets connected to septic tanks or cesspools. (In the case of septic tanks, people typically hire a private service for periodic emptying. In the case of cesspools, the waste simply infiltrates in the soil). It is also common for homes to have no access to any

kind of sanitation system, resulting in open defecation, with all the associated disadvantages (lack of privacy, contamination, etc.). A summary of these sanitation practices can be found in table 2.

Table 2. Basic sanitation policy-driven and needs-driven practices in peri-urban Cochabamba

Practice	Type	Aprox. Cost (USD/ month)	Characteristics	Further Observations	Examples
Municipal sewage service	Policy driven	5-15	Municipality is in charge of collection (via sewers) and treatment of wastewater.	The only operational treatment plant is working at more than twice its capacity. There is a percentage of wastewater currently not being treated.	SEMAPA (Servicio Municipal de Agua Potable y Alcantarillado)
Communitarian sewage service interconnected to municipal sewage	Needs driven	4	Sewage systems managed by the community through cooperatives or water committees, but interconnected to the municipal sewage system for the treatment of the wastewater.	The cooperative is in charge of operating and maintaining the collection network, and the municipal service is in charge of the treatment of water. There may be maintenance problems depending on the cooperatives' capabilities.	
Independent communitarian sewage service	Needs driven	1-2	Sewage systems managed entirely by community members through a cooperative or a water committee.	These systems may or may not treat wastewater. In many cases there is only a collection network, with wastewater discharged into a nearby river.	Lomas del Pagador Sivingani
Individual household solutions	Needs driven	varies	Consists of the construction of latrines or hydraulic drag toilets, connected to septic tanks or cesspools (with infiltration). In the case of septic tanks, people hire a private service for periodic emptying.	There is no regulation or monitoring.	
No sanitation system	Needs driven	0	Housing without any sanitation infrastructure.	Typically results in open defecation.	

NOTES TO CHAPTER 2

4. Agrarian Sindicatos (peasant unions) are organizational structures created after the Agrarian Reform of 1953, and constitute the maximum authority at the rural community level. They are formally recognized as a legal organization and they usually legitimately represent the inhabitants in each community. Every person owning land in a community must affiliate to the Sindicato. Many local issues, which often includes local water management for irrigation and domestic purposes, are governed through the Sindicato (Cossío, et al, 2010: 6), and it is through these organizations that each community establishes contact with state and non-state organizations. Although Cochabamba city is primarily an urban space, there are still agricultural lands particularly in districts 8 and 9, where sindicatos exist as a communal organizational structure.

5. The Bolivian Norm NB 512 consists of a series of physical-chemical and bacteriological standards measured through certain parameters that allow a water to be considered fit for human consumption. For details regarding these parameters refer to the National Regulation for Quality Control of Water for Human Consumption, from the Ministry of Services and Public Works – Vice Ministry of Basic Services, and the National Regulation for Domiciliary Sanitary Facilities, from the Vice Ministry of Drinking water and Basic Sanitation (2011).

3. Selected Case Study Sites

At this early stage we have identified four possible case studies for further research, including the peri-urban communities and systems of: Central San Miguel, Miraflores Sivingani, Lomas del Pagador and Maria Auxiliadora.

3.1 Central San Miguel

The community of Central San Miguel (actually a *Junta Vecinal,* or neighbourhood council) is located in District 9, which is in the south/southeastern part of the city of Cochabamba. Its drinking water system serves 200 families and a total of 1,030 inhabitants, and is managed through a drinking water committee responsible for operations, maintenance and administration activities. The system lacks its own water source, and thus is a virtual network, with the committee purchasing water in bulk from private tanker truckers and then distributing it to each home.

The committee was formed by a Community Development (DESCOM) intervention carried out by the Fundacion AGUATUYA in cooperation with the Municipal Government and local residents. At this time the committee was trained by DESCOM in the basic functions of planning, financial and technical administration, operation, and maintenance, to support the system's economic and infrastructural sustainability, and a continuous 24 hour service. The Water Committee is an integral part of the Junta Vecinal as its operating arm for the drinking water system management.

Before the existence of the drinking water system the population used to buy their water from private vendors (tanker trucks), and so this system represents a significant improvement in the conditions and accessibility of water. The system has installed water metres to allow a good control over water consumption and payments. Water in this system is treated, and there are annual controls of the water quality. The president of the Water Committee has stated that as a system and as a community they prefer to maintain operations and remain independent from Semapa. In the future, this community has indicated that it would be interested in purchasing water directly from Misicuni if the price is suitable. However, in regards to sanitation there is no system as of yet. Around 80% of families use latrines or cesspools, and 10% have toilets leading to septic tanks, while the rest of residents are obliged to defecate in the open or in a nearby river.

3.2 Miraflores Sivingani

This community is managed as an OTB, located 5 km from the city centre, in District 9. The neighbourhood is seated on top of a hill, around 30 meters above the main road. Its drinking water system has its own source (well) and supplies two other neighbouring OTBs (San Juanillo and Villa Concepcion). It is managed by a Committee formed of representatives from the three communities. The OTB directory supports on and contributes to some of the Committee's tasks. People in this community (about 500 inhabitants) have opted for self-management as they felt that they could not rely upon the municipality for service.

One of the interesting features of Miraflores Sivingani is that the community also has a sewage service, managed entirely by the community through the OTB, and with regulations for its management. Furthermore, this sewage system has a small operational treatment plant. As such, treated water is made available for reuse in the surrounding park or for forestry irrigation. These characteristics in particular mark this community as an interesting case study, as it is one of the few communities in Cochabamba with an independent treatment plant.

3.3 Lomas del Pagador

This community is located in District 14 and has approximately 830 inhabitants. The drinking water system is managed by a Committee which is an integral part of the OTB, and consists of a virtual network, with water purchased from private vendors. As in the previous case, Lomas del Pagador also has an independent sewage system with their own small treatment plant.

This case may be of interest for further study as it has both community-managed water and sanitation systems, which are managed completely independently from municipal services and oversight. In particular, further research should be focused upon the evolution of both systems in terms of their performance and sustainability.

3.4 Maria Auxiliadora

"Comunidad María Auxiliadora" is located in the Sindicato Agrario Sivingani "El Rincón", in District 9 of Cochabamba city. It was initiated as a project for impoverished fami-

lies who agreed to live under a collective property regime, where house sales and rentals are forbidden. There are also several internal norms for general connivance and community work. This case is considered particularly interesting for further examination as it allows a deeper analysis of the different features of water and sanitation management in a community characterized by urban communitarian norms.

Maria Auxiliadora's drinking water system had been functioning since 2003, and was implemented with the support of an NGO called CIPROEC. This system has its own water source (well), and currently supplies 370 families. The initial cost for accessing the system was 65 dollars/family (or community counterpart), with the remaining 50% of the cost financed by a loan (22,743 dollars) from PAMS (Switzerland). In May 2014, the community of María Auxiliadora obtained its Registry certificate from the AAPS (Resolución AAPS Nº 128/2014), which authorizes the use of water resources and service provision.

In regards to sanitation, in September 2011, Aguatuya inaugurated a semi-decentralized Wastewater Treatment Plant in this area with an annual capacity of 360 metric tons of excreta. This plant benefits 720 inhabitants. Treated wastewater is used for irrigating the community's green areas and for its reforestation activities. The treatment plant's cost was approximately 26,700 dollars, and was financed by the "sustainable drinking water and sanitation services" project from the Swedish Embassy. Community inputs consisted of the labor force, land donations and some materials.

4. Conclusion

Cochabamba city and its residents have had a deep and visible relationship with water. From the Water Wars of 2000, to reforms implemented under the Morales government, the public control of water resources has played an integral role in the public imaginary and practical service provision. Particularly in the outlying peri-urban areas where the state provision of drinking water is lacking, local inhabitants have found their own ways of satisfying their multiple water needs. In this 50% of the territory where there is no public network, residents provide themselves with water using different mechanisms such as water tanker trucks, wells and small independent systems, built mostly through communal or neighborhood organizations.

These systems are governed under very different systems, with varying levels of legal or formal recognition by the municipal government, and with the ability to supply water to its beneficiaries with varying capacities and quality. Critically, these differences have meant that there are large disparities in levels of service provision even within these peri-urban regions, let alone between peri-urban and central areas.

While there are strong precedents for government support for these community-managed water and sanitation systems, there is still a gap in understanding the real differences and opportunities presented within these different structures. This report concludes with a call for a deep and nuanced examination of these various governance arrangements and the governmental policies and programmes within which they operate. In doing so, it is hoped that this will provide a deeper understanding of the real potential of these co-produced practices to operate at scale.

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