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## **Cultivating Innovation and Equity in Co-Production of Commercialized Spring Water in Peri-Urban Bandung, Indonesia**

### **Anindrya Nastiti**

Environmental Management Technology Research Group, The Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Bandung, West Java, Indonesia; [anindrya@tl.itb.ac.id](mailto:anindrya@tl.itb.ac.id)

### **S.V. Meijerink**

Institute for Management Research, Radboud University, Nijmegen; [s.meijerink@fm.ru.nl](mailto:s.meijerink@fm.ru.nl)

### **Mark Oelmann**

Hochschule Ruhr West, University of Applied Science, Mülheim an der Ruhr, Germany; [mark.oelmann@hs-ruhrwest.de](mailto:mark.oelmann@hs-ruhrwest.de)

### **A.J.M. Smits**

Institute for Science, Innovation, and Society, Radboud University, Nijmegen; and Delta Areas and Resources Applied Research Centre, Van Hall Larenstein University of Applied Science, Velp, the Netherlands; [a.smits@science.ru.nl](mailto:a.smits@science.ru.nl)

### **Barti Setiani Muntalif**

Environmental Management Technology Research Group, The Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Bandung, West Java, Indonesia; [barti\\_setiani@yahoo.com](mailto:barti_setiani@yahoo.com)

### **Arief Sudradjat**

Environmental Management Technology Research Group, The Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Bandung, West Java, Indonesia; [arief.sudradjat@yahoo.com](mailto:arief.sudradjat@yahoo.com)

### **Dwina Roosmini**

Environmental Management Technology Research Group, The Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Bandung, West Java, Indonesia; [dwinaroosmini@yahoo.com](mailto:dwinaroosmini@yahoo.com)

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**ABSTRACT:** This paper examines a co-production arrangement between private actors, households, and community actors occurring within the framework of scheme of commercialised spring water in peri-urban Bandung, Indonesia. We argue that the provision of spring water in Ujungberung District is a form of co-production, characterised by: (1) any one, or the elements, of the service production process being shared; (2) the presence of a fundamental shift in the balance of power between the primary producers and users/communities, and (3) the existence of mutual support and relationship networks, rather than a clearly defined delineation between providers and clients. Actor contributions defined as inputs along the value chain of spring water production were examined. We describe interactions between local private actors and community members in planning, service delivery, and conflict management with respect to disruption of water supplies, free-riding behaviour, and the geographical distribution of services. This paper identifies several institutional innovations that may yield a safer and more affordable water supply and nurture equity in the sense of: (1) improved access to

water for the previously unserved people by piped water and boreholes; (2) the opportunity to negotiate from below; and (3) transparency and accountability.

KEYWORDS: Co-production, equity, innovation, water commercialisation, Indonesia

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## INTRODUCTION

"(The previous owners of the springs) sell their land and their springs to the water entrepreneurs so these entrepreneurs can bring water to us... What's the use if spring water cannot flow to our houses? It will benefit no one if the water stays uphill". This statement, by a citizen of Ujungberung District, Bandung, Indonesia, illustrates how the locals see spring water commercialisation as a means of bringing clean water to people's homes. Transporting water to human settlements has been a challenge since the early history of urban development. In the postcolonial area of the South, population growth at the outskirts of cities is occurring faster than in the urban centres, yet infrastructure development is inconsistent (Firman, 2004; Norstrom, 2007). Development of centralised water infrastructure has focused mainly on urban centres and has not reached the sprawling areas at the fringes of cities. Peri-urban citizens remain underserved, if at all, since neither networked state utilities nor large-scale private water companies are able (or, often, willing) to serve these areas effectively (Allen et al., 2006).

The lack of a state-led service for water supply provides market opportunities for private actors to fill the gap of water provision. Local private actors, rather than state actors, serve as the main provider of basic services in many of the areas underserved by state-owned water companies (Venkatachalam, 2014). This paper examines the provision of commercialised spring water in Ujungberung District, Bandung. In the management practice of commercialised natural resources, commercial principles (such as efficiency and profit-maximisation) are introduced (Sangameswaran, 2009). What's more, in the wake of its inception in the early 2000s, the commercialisation of spring water in Ujungberung District has also been followed by interactions between local private actors, community actors, and households. These interactions are an example of co-production. Scholars traditionally define co-production as "the joint production of public service between citizens and the state, with any one or the elements of the production process being shared" (Allen et al., 2006: 340). The co-production concept is rarely applied during the characterisation of active engagements between non-state actors. Yet, the notion of co-production fundamentally reflects the relationship between service providers and service users in which users play an active role in improving the service they receive.

This paper presents a case study of a private and citizen co-production process occurring within the framework of a spring water commercialization scheme. We specifically address the following questions. Firstly, how is spring water service provision co-produced in Ujungberung District? We investigate the engagement of citizens, not merely as users, but also as (co)producers along the value chain of the production of drinking water, a range of processes in which they add value to raw water sources through abstraction, transportation, treatment, and distribution. The added value in these processes lies in the sense of the usability of spring water for the citizens in Ujungberung District; without these processes, people will not be able to enjoy the benefit of spring water daily. Secondly, does the co-production contribute to the improvement of service delivery? Who has the most convenient access to water, socially and geographically? These questions address whether innovations and equitable access along service provision are produced as results of the co-production processes.

The remainder of this paper is structured as follows. First, we briefly review the literature over private actors' involvement in the drinking water sector, along with definitions and experiences of co-production arrangements, before describing the method of our study and the case study area. Then we describe aspects of co-production within the commercialised spring water value chain and address the question whether such processes contribute to innovation and equity. Last, we discuss our results and

present conclusions. We demonstrate that commercialisation of spring water serves as a starting point for the establishment of a co-production arrangement between private actors, households, and community actors. Several institutional innovations that may yield a better service and nurture equity are highlighted.

### **PARTICIPATION OF THE PRIVATE SECTOR AND CO-PRODUCTION IN SERVICE DELIVERY OF THE WATER SUPPLY**

The involvement of private actors in water supply has been debated for a long time. Attempts to involve private actors in urban water supply network investments marked a departure in the late 1980s (Prasad, 2006).<sup>1</sup> International financial institutions and donor agencies expected private actors to provide a more efficient service and a better form of governance compared to 'low-level equilibrium' services provided by the state, in which low efficiency leads to low-quality service (Prasad, 2006). Even so, private actors' participation is often viewed to result in a violation of human right to water as these actors operate on the basis of full-cost recovery through user fees and, further, profit-making (Budds and McGranahan, 2003). For example, private-sector participation in water supply service of the capital city of Indonesia, Jakarta, may reduce water affordability as a consequence of tariff increase (Bakker et al., 2008). The poor, who cannot pay for water, are further excluded from basic water services. For these underserved poor, small-scale private providers (SSIPs) increasingly assume a role as the dominant providers. This type of water vending accounts for a large proportion of total water revenues and is no longer a fringe activity (Gulyani et al., 2005).

In many private-led water provision systems, both provided by large private corporations and SSIPs, citizens have traditionally been perceived as merely consumers at the receiving end of the water supply system. However, studies have documented that citizens occasionally contribute to the provision of water services through engagement in certain strategies that maintain the expected level of service (Allen et al., 2006; Mitlin, 2008). These strategies often occur jointly with the activities of private actors. For example, MacCarthy et al. (2013) reported the existence of 'self-supply' markets in which the local private sector provides drilling and pumping technologies to enable households to access shallow groundwater. The 'citizens as service providers' complement traditional water service providers. Citizens who play significant roles in service provision transform the traditional model of service production into one of co-production (Pestoff, 2006).

To guide the analysis, full understanding of co-production is necessary. The theoretical notion of co-production has been interpreted widely. In literature on new public management, the conceptions of co-production often lie within the scope of state and citizen collaborations (Brudney and England, 1983; Pestoff, 2006). The participation of citizens in these collaborations is voluntary in nature, rather than contracted (Brudney and England, 1983; Isham and Kähkönen, 1998). These voluntary acts are the distinct features of co-production that lead to the improvement of service quality and/or quantity. Ahlers et al. (2014) describe co-production as a process where hybrid service provision modalities produce new meaning. Ostrom (1996: 1073) defines co-production as "the process through which inputs used to provide a good or service are contributed by individuals who are not in the same organisation". Ostrom's definition is used to guide the analysis in this study, even though in her definition the primary producer is usually a governmental agency. Alford (2014) also advocates a

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<sup>1</sup> Attempts to involve the private sector were formalised in the Act of Water Resources of the Republic of Indonesia of 2004. The Act of Water Resource Number 7 regulates the rights of water utilisation and the rights of water commercialisation (the rights to obtain, use, or commercialise water for specific uses, e.g. water use in production/manufacturing processes). One year after its enforcement, a judicial review of the legislation was brought to court. The act was perceived to: (1) open the door to privatisation that reduces the state's ability to support human rights in relation to water; (2) fundamentally reform the ownership of water, and (3) undermine the socioeconomic, cultural, and religious values of water (Constitutional Court, 2013). The judicial review of the act led to its retraction, effective in 2015.

deeper analysis beyond the simple attribution of co-producers, to include what they do for, and gain from the co-production process. This definition allows further analysis of the capacity and motivations of each actor.

Early definitions of co-production restricted the definition of co-producers to consumers, and thus disseminated the notion of 'consumer producer' (Joshi and Moore, 2004). Consumers (partly) provide their own services, contributing to the service they receive (Pestoff et al., 2006). The involvement of a diverse range of organisations undertaking social activities aimed at raising the quality of public services has also been recorded; thus co-producers may also be volunteers and community members (Bovaird, 2007). Pestoff and Brandsen (2010) refer to these actors as the 'third sector' in public service delivery, which includes the voluntary sector, the (private) non-profit sector, and civil society. Parks et al. (1981: 1002) suggest that collaborations "may occur directly through coordinated efforts in the same production process, or indirectly through independent, yet related efforts". Our study emphasises the coordinated efforts of private actors and the third sector in the co-production of services, and includes the separate contributions of households to service quality improvement.

Pestoff and Brandsen (2010) have discussed the advantages of co-production of service delivery compared to their traditional counterparts in which citizens merely function as users. This article focuses on the potential contributions of co-production towards innovation and equity. Pestoff and Brandsen (2010: 228) define innovation as "the ability to renew the collective structure of service provision, whether it be in terms of skills, activities or even the underlying paradigm", or concerning "the quality of the service itself".

In the water supply sector, equity of access to water is entered in the framework of Sustainable Development Goals (SDGs) (UN – Water et al., 2015). The United Nations (2007) also emphasises that poor households should not be burdened by higher water expenditure than the rich. SDGs also require to "allow the poorest and most vulnerable to negotiate from below" and demand more transparency and accountability in its conceptions of equity (UN-Water et al., 2015: 5). McMillan et al. (2014) examine technical water committees in Venezuela with respect to co-production of water service delivery. Reduction of asymmetry in the availability of information and improved accountability are the main advantages of this arrangement. Jakobsen and Andersen (2013) further argue that the main constraint suffered by disadvantaged citizens during co-production is their lack of knowledge (and materials). Thus, evidence that the Venezuelan water committees reduce knowledge barriers suggests that co-production also contributes to reduced inequity. Two studies in South America, McMillan et al. (2014) and Llano-Arias (2015), discuss cases of state and citizen co-production. However, evidence elucidating the contributions of private/citizen co-production towards equity remains scarce. We analysed the case of a commercialised spring water source supplied by local, small-scale private actors, and investigated any potential resulting institutional innovations and whether these arrangements come at a cost to equity.

## **THE CASE STUDY OF UJUNGBERUNG DISTRICT, BANDUNG, INDONESIA**

### **Data collection**

To understand how water is co-produced, we conducted semi-structured interviews with local private actors, community actors, and households (see Table 1). We recruited participants mainly based on information provided by a key informant and recommendations made by the interviewees. There is limited documentation on the occurrence of non-state-led water provision in Ujungberung District. Thus, we first distinguished different types of water sources used among households in Ujungberung District, and identified relevant individuals/groups (and their related activities) within the chain of water service production: from usage, distribution, treatment, transportation, and source extraction.

Table 1. Interviewees and interview questions.

Interviewees	Interview topics
<p>Three spring owners and/or operators;            Two water tanker truck owners who buy water from spring owners and sell it to commercial clients, e.g. refill water kiosks.            Five refill water kiosks that own and operate small bottled water facilities. They sell pre-treated water in refillable 19 litre bottles.            Two pushcart vendors that sell water door to door to households.            Three senior community members and local chiefs<sup>2</sup> who have gained experience with both state and co-production regimes of water provision since the 1980s.</p>	<p>Business establishment, raw water sources, operation and maintenance (O&amp;M) practices, costs, volume of water sales, water pricing, labour arrangements, quality assurance, business strategy, free-riding behaviours, and relationships with other actors.</p>
<p>Two volunteer water stewards, who contribute to the operation, maintenance, monitoring, and allocation of water delivered by spring-water entrepreneurs to a communal tank.            A water watcher who is responsible for the monitoring of the spring water distribution network.            Two households that have individual connections to spring water sources.</p>	<p>Experiences before and after both commercialisation of spring water and co-production took place, (before and after receiving?) information on the water allocation agreement between entrepreneurs and the community.            O&amp;M of distribution network of spring water.</p>
<p>A supervisor from the municipal piped water company (MWC).</p>	<p>Household economy, the maintenance of service levels, free-riding behaviour, and attitude towards commercialising of spring water.            O&amp;M of the treatment plant and distribution network.</p>

To further facilitate understanding of user's experiences with different modes of provision, additional semi-structured interviews were conducted with 70 household participants in Ujungberung District. We collected data on types of access, household strategies, the perception towards dimensions of access (physical access, quality, continuity, quantity, and affordability of water), and expenditure for water. All interviews in this study were recorded on a digital voice recorder and transcribed in the original language: a mix between Bahasa and Sundanese.

### Data analysis

We conducted a content analysis of all interview transcripts, codified key terms, and extracted emerging themes (Elo and Kyngäs, 2008; Otero et al., 2011). To understand how water is produced, we followed Ostrom's (1996) concept of co-production, i.e. the process by which individuals from different organisations contribute inputs to the water supply service provision. We examined the input contributions of water actors along the value chains of water production. We operationalised input as

<sup>2</sup> A local chief is a neighbourhood head appointed by the community members. A local chief is responsible in assisting public service activities and bridging the communication gap between the government and the community.

production factors that are used to deliver water supply to consumers: human labour, technology, land, and financial capitals.

Next, we scrutinised how we could properly evaluate the contribution of co-production to innovation. As discussed in Nganyanyuka et al. (2014), water supply has dimensions of access that relate not only to the physical access, but also to water quality, water quantity, water continuity, and affordability. Following Pestoff and Brandsen (2010), we conceived of innovation as a renewed structure in the provision of water service delivery that leads to an improvement in one or more dimensions of access in water service delivery. Assessing the contributions of a renewed provision structure was done by: (1) comparing different modes of provision, and (2) revisiting the characteristics of past water services and contrasting those with present circumstances. We identified both actors and their activities which have contributed significantly to changes in physical access, quality and affordability of water provision.

Next, we examine the change in access to water and operationalised the concept of equity of Jakobsen and Andersen (2013) to understand how co-production may affect equity of water supply provision. We also sought to reveal the effect of co-production on accountability, examined available evidence of negotiations at the grass-roots level and determined the presence of any knowledge barrier that could impact access to water services. We obtained insights from community members and household users. Additionally, we investigated geographical differences in access to spring water services.

### **Water provision in Ujungberung District, Bandung, Indonesia**

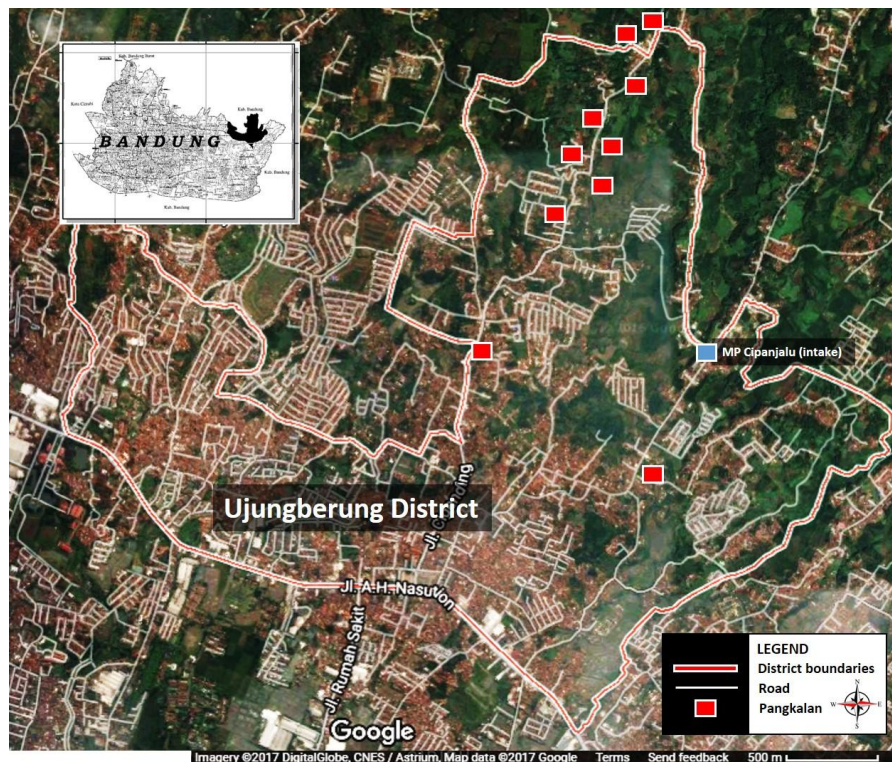
Bandung, the capital city of West Java Province, Indonesia, consists of 32 districts and is inhabited by a population of 2.5 million. Roughly a third of the water supplied in Bandung City is provided by the Municipal Water Company (MWC) (Yamani, 2002). We selected one of the eastern districts, Ujungberung District, as the central research area of this analysis owing to the presence of commercialising of spring water (see Figure 1). This district is a rural-urban fringe region and consists of 18,467 households (Statistical Office of Bandung City, 2015). The elevated part of this district sits adjacent to the neighbouring Bandung Regency, which is mostly unserved by the MWC water service.<sup>3</sup>

The MWC of Bandung City currently serves only 6.7% of the district's population through household connections (Government of Bandung City, 2014). The water is supplied from a water treatment and distribution facility, Mini Plant (MP) Cijanalu, which was built in 2004. Meanwhile, most of the district's population are served by self-service (i.e. groundwater and surface water sources, including spring water) or through commercial means (i.e. sale of both bottled water and spring water by local entrepreneurs). More than 77% of households in Ujungberung District rely heavily on groundwater extracted through boreholes or dug wells (Bandung City Health Office, 2013). Spring water had also previously been utilised, but not to the degree that it is being extracted at present. Formerly, spring water users obtained their water on the basis of neighbourly relations: spring water was gifted and collected in containers. At present, spring water, well-known as 'mountain water', is sold extensively within and outside the district.

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<sup>3</sup> The administrative hierarchy of Indonesia extends from the level of national government, to provincial government, city/regency government, district, and finally village. City has the same administrative level as regency, only a city has urban characteristics, whilst a regency has more rural characteristics. A city or regency consists of districts, and a district consists of villages.

Figure 1. Map of Ujungberung District (from Google Earth© 2017).

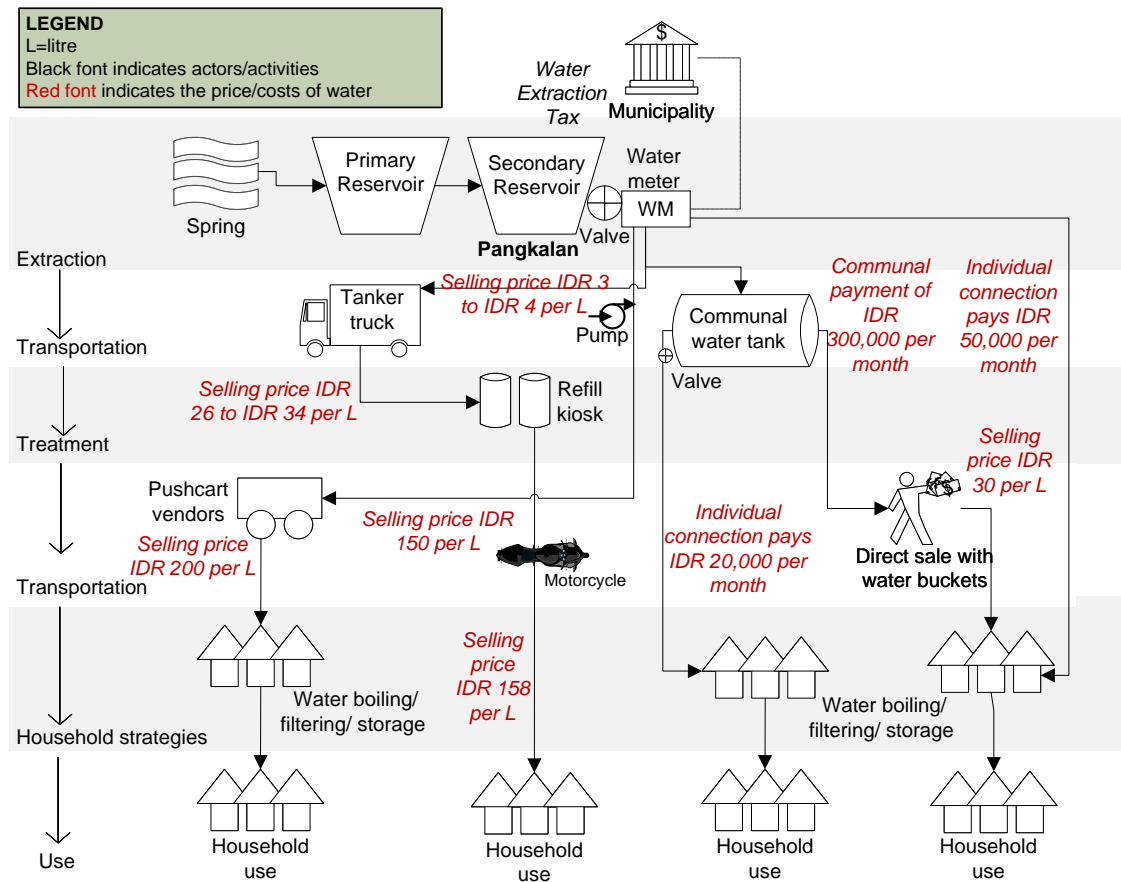


Note: The district is well-known for commercialising of spring water. Spring water sales take place mainly in *pangkalan* shown by red rectangles.

### THE VALUE-CHAIN OF COMMERCIALISED SPRING WATER

Commercialised spring water first entered the market in the early 2000s when some landlords sold parcels of land which included springs to local water entrepreneurs. We examine the value chain of commercialised spring water from source to consumer and identified three types of actors and their roles in the value chain of spring water: local private actors, community actors and committees, and household users (see Figure 2). Water extracted at the springs is transported to refill kiosks by tanker trucks. The water is then treated, packed, and distributed by refill kiosks to household users as readily available drinking water. Water from springs is also distributed to houses through pushcarts, hoses or buckets from communal water tanks. Prior to use, households may also adopt several strategies to improve quality or ensure availability of spring water from vendors or communal water tank (i.e. through boiling and filtering water followed by storage). Co-production processes particularly occur in the distribution of water until it reaches household users.

Figure 2. Value chains of commercialised spring water in Ujungberung District.



**Water extraction**

To acquire the freshwater in springs, local entrepreneurs bought land parcels from former landlords. An entrepreneur invested roughly IDR 100,000,000 (USD8475)<sup>4</sup> to install one typical extraction facility for spring water, i.e. spring protection structures, primary reservoirs, gravity-led piping systems, secondary concrete reservoirs, and electrical pumps. As shown in Figure 1 above, the natural spring is protected by concrete structures which also facilitate water flow to a primary reservoir. Water is delivered from the primary reservoir through piping systems, partly underground and partly on the surface, to a station in which a secondary reservoir is located. Stations in which water sales activities take place are locally known as *pangkalan*. We identified ten *pangkalan* in our study area, including those located in the administrative territory of the neighbouring regency (Figure 1).

**'Raw' water transportation from springs/pangkalan to refill kiosks**

Spring owners, or *pangkalan* owners, sell water to their primary customers, tanker trucks owned and operated by individuals who serve as the primary transporters of spring water to commercial clients (i.e. refill kiosks) and industrial clients (e.g. manufacturing or beverage industries that require bulk water supply for their production processes). Electrical pumps are used to draw water from secondary reservoirs into tanker trucks that have a capacity of 3000 to 5000 litres. Additionally, *pangkalan* owners

<sup>4</sup> The IDR to USD exchange rate in August 2014 was IDR 11,800 per USD1.00.



commonly provide their own tanker trucks. The selling price of water from tanker truck owners to refill kiosk owners depends on the distances over which the water is transported. Prices range between IDR 130,000 (USD11.00) and IDR 170,000 (USD14.5) per 5000 litres (or IDR 26 to 34 per litre). The price is based on fuel costs, and the salary of truck drivers and their assistants. Some kiosk owners provide their own tanker trucks to buy raw water supply from pangkalan.

### **Water treatment by refill kiosks**

Refill kiosks apply industrial processes that treat raw water to produce potable water, which they subsequently sell directly to consumers in refillable bottles (Ministry of Industrial and Trade, 2004). Tanker trucks deliver raw water three times a week to the refill kiosks. Water is stored until it is treated to provide drinking water. Refill kiosk owners buy a set of water treatment units that typically apply filtration, and ozone purification processes. The cost of a single unit ranges from IDR 21,000,000 (USD 1780) to IDR 35,000,000 (USD 2966). Filtered and disinfected water is then bottled using 19-litre plastic containers. Kiosk owners sold water to consumers for a price of IDR 3000 (USD 0.25) per container (or IDR 158 per litre).

### **Water distribution to household users**

Spring water reached users via several different pathways: pushcart vendors, refill kiosks, directly from pangkalan through individual networks, or indirectly via communal tanks. Pushcart vendors buy water from pangkalan at a price of IDR 1500 (USD 0.13) per 10 litres (or IDR 150 per litre) using pickup trucks, each with a capacity of 1000 litres. These vendors mainly sell water to regular household clients at a price of IDR 2000 (USD 0.17) per 10 litres (or IDR 200 per litre). Water vendors own multiple units of pushcarts and hire other individuals to sell water door to door. However, water delivered by these vendors is not potable water. Refill water kiosks deliver to households water that can be supposedly consumed directly without treatment, mainly by motorcycles.

Spring water is also distributed through individual and communal networks. We focused on pangkalan that allow local communities to tap from the reservoir, either directly to premises using rubber hoses or indirectly via communal water tanks. It is in these situations where co-production, characterised by the voluntary efforts of community actors and users to enhance the service quality of water provision, occurs. Households situated near pangkalan have negotiated a monthly price of IDR 50,000 (USD 4.3) for individual connections that provide two or three hours of water supply daily. A pangkalan owner explained the arrangement, "that house only receives water in the evening, we cut off the supply in the morning. That's the deal we talked about, no written agreements". Under this arrangement, individual households are responsible for the setting up and maintenance of their own supply network and storage tanks.

If a communal supply is arranged, pangkalan owners and community actors initially come to an informal agreement. This agreement allows the pangkalan owners to sell water outside Ujungberung District only if they also provide water to local communities. Pangkalan owners initiate supply to local communities after supply trucks stop operating for the day. Further, local communities are responsible for the distribution of water from pangkalan to the point of use. Different neighbourhood communities acquire spring water from pangkalan in turn for three hours per day. Personnel volunteered as water stewards are responsible for: (1) setting up the distribution and storage system, (2) negotiating the schedule for distribution within neighbourhoods, (3) operating and maintaining the water delivery system, (4) collecting payments, and (5) recording complaints. Spring water from pangkalan is distributed through rubber hoses to iron water tanks with a capacity of 3000 litres. Water is further distributed from communal tanks to dwellings through individual connections. Additionally, water is sold directly from communal tanks for IDR 500 or USD 0.04 per 3.3 litre bucket. When the water supply is maintained according to the agreed schedule of three hours per day, households with individual

connections pay IDR 20,000 every 10th day of the month (USD 1.7). However, these households can pay less (IDR 15,000 or USD 1.3) if the supply of water is interrupted. The continuity-based price was considered to be a strong advantage of this arrangement in comparison with the piped water service provided by the MWC. Fees are collected by water stewards and IDR 300,000 (USD 25.4) of the collected fees is paid to pangkalan owners as a standard monthly payment. Any remaining fees are used to maintain the tanks and distribution network.

Figure 4. (a) A truck is filling its tank with spring water in a pangkalan; (b) household water storage; (c) and (d) two examples of communal water tank.



### Household strategies and water usage

Households use water that is delivered either by pushcart vendors or through a communal or individual network for drinking, bathing, washing, and cleaning. To improve the quality of water, households boil spring water obtained from communal tanks, individual networks, and pushcart vendors prior to drinking. Households adopt water storage practices to mitigate for the unreliable water supply. These strategies are individual household's contribution to the co-production process for the provision of water supply.

### THE CONTRIBUTIONS OF CO-PRODUCTION TO INNOVATION AND EQUITY IN WATER SERVICE PROVISION

In this section, we discuss how collaborations between private, community, and household actors have contributed towards innovations in service provision and equitable access to water in Ujungberung District. Users' experiences of water delivered were analysed to determine any change in the dimensions of access resulting from the co-production process. We interviewed 70 householders with

an average income of IDR 3,000,000 (the Minimum Regional Salary of Bandung City 2014<sup>5</sup> is IDR 2,000,000); 34% of householders interviewed used spring water and only 11% enjoyed a piped water service daily. The others rely on groundwater extracted from boreholes with pumps or dug wells. However, the use of multiple water sources is a common practice: 67% of households combine different water sources to be used daily. Some households whose main water supply consisted of shared or individual access to spring water previously relied on an unimproved source which is unreliable during the dry season, i.e. water vendors or dug wells. In general, the joint activities of spring entrepreneurs and community actors have led to an increase in diversity of water sources in the district; 56 out of the 70 households which we have interviewed are unserved by 'improved' water sources (i.e. piped water and boreholes); now these households can enjoy spring water daily. This has improved household's physical access to water.

Our interviewees expressed a strong preference towards spring water. Spring water is generally perceived to offer superior quality compared with other water sources (i.e. the MWC's piped water service, shallow groundwater, and surface water). As shown in Table 1, spring water delivered through individual connections and from communal tanks has a lower coliform faecal count compared to piped and well water (Iqbal et al., 2015). As a householder put it, "now, we can use (spring) water for drinking. We cannot do that with water from our well". More than 70% of interviewees drank spring water, while piped water and water from shallow dug wells was mainly used for non-drinking purposes.

Our findings also suggest that the presence of a network of spring water allows households to access safer water at a cheaper cost compared to previously available sources. Individual or shared spring water connections had the lowest initial charges compared with piped water or the construction costs associated with boreholes or dug wells (see Table 1).

Water extracted from an individual borehole of at least 60 meters depth was perceived as an ideal, yet expensive and often unaffordable, solution.<sup>6</sup> Well operations also lead to energy costs that result from the use of extraction pumps and other costs are incurred due to the construction of storage facilities. Spring water users were charged the lowest monthly payment compared to piped water users and users of water provided by private vendors. Hence, affordability of access to water has been improved by the provision of spring water. On the other hand, the water cost gap still persists between those with access to the spring water network and those who rely on spring water sold by vendors. "It (the spring water connection) is cheap, actually. Imagine if we had to buy water in jerrycans. It costs IDR 1500 for a small one, ten jerrycans cost IDR 15,000 and that is not even enough for bathing".

Following the improvement of physical access to better quality and more affordable water supply, we then discuss which actors contribute to these improvements (see Figure 3). In the early establishment of the spring water businesses, community actors came to an agreement with spring owners who expect them to distribute some water for the local communities if they continue to sell water to areas outside Ujungberung District. Since citizens hold more power to bargain, the power relationship that exists between citizens and local private actors is different from that existing between citizens and large private companies, like in Jakarta, or state-owned companies. A formal permit is issued by local administrators when entrepreneurs intend to establish business activities. Refusal to save water for local people may jeopardize the sustainability of water entrepreneur's business. A local chief suggested:

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<sup>5</sup> The Regional Minimum Salary is a minimum standard for industries to provide monthly salary to the unmarried labourers. It is proposed by a regional-level committee consisting of representatives of bureaucrats, academics, labourers, and industries; it may be revised each year and is stipulated through a provincial-level regulation.

<sup>6</sup> The soil layer in Ujungberung area is highly rocky which makes drilling difficult. Approximately IDR 6,000,000 (US\$ 508.5) is required to drill to a depth of up to 40 meters, almost three times the minimum monthly regional salary of Bandung City in 2014. An interviewee revealed the application of a staged drilling strategy applied over several years to maintain affordability.

Table 1. Cost estimates and potability of different water sources.

Water source	Initial cost in IDR 1000	Cost per litre, in IDR 1000	Monthly cost, in IDR 1000	Average faecal coliform concentration in water samples, in MPN
Metered piped water from the MWC	739-750	0.01	50-120	190.1
Boreholes	2500-11,500	N/A	N/A	9.4
Dug wells	500-2500	-	-	420.0
Individual spring water connection	200	-	15-50	5.8
Shared spring water via communal tank	200-237	N/A	20-50	
Spring water bought with buckets from communal tank	-	0.15	N/A	
Branded bottled water	40	6	70-170	9.4
Refilled bottled water	35	1	26-50	145.2
Pushcart vendor	-	1	50-200	7.5

## Notes:

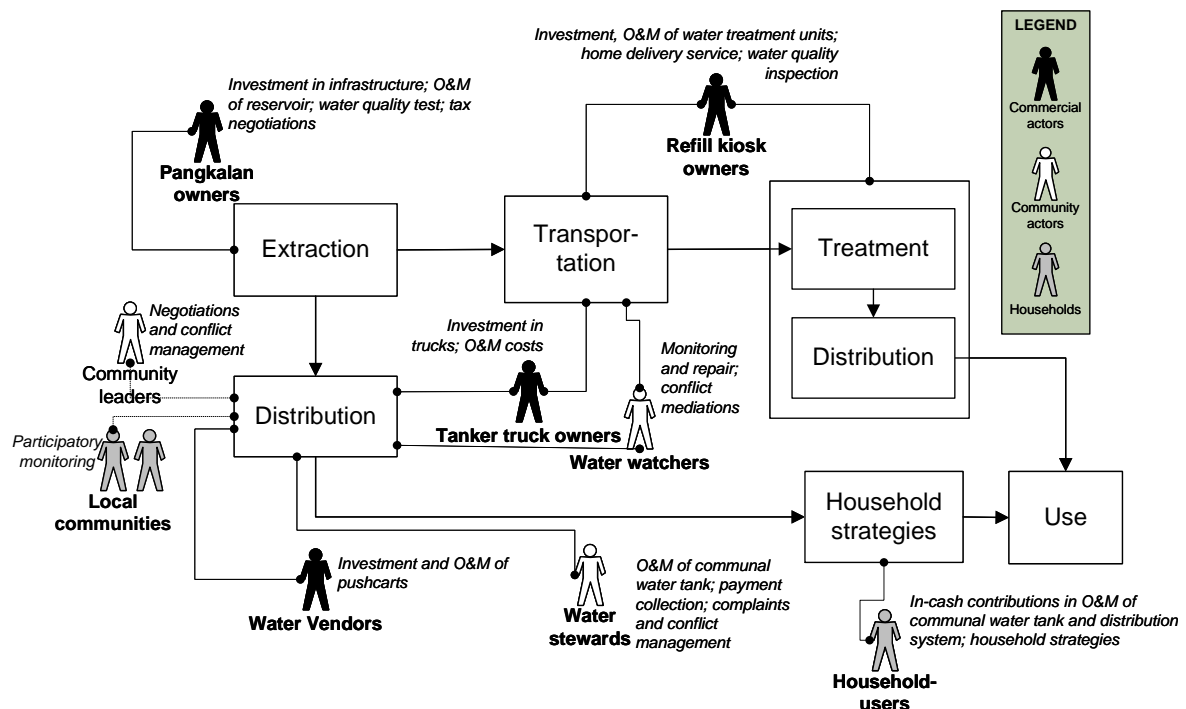
- Costs were estimated based on the information obtained from the interviews with households and local contractors in Ujungberung District.
- The average monthly household income of participants is IDR 3,000,000.
- N/A=Data not available
- Participants could not provide an estimate of the monthly cost of a borehole, but we suggest it may be significant if the energy cost of water pumping is considered.
- Data on coliform concentration are taken from Iqbal et al. (2015). MPN=Most Probable Number. The water quality record does not differentiate between the type of spring water connection. For drinking water, faecal coliform concentration must be 0 (Ministry of Health, 2010).

If they want to build a business, they need our permission. Our regulations forbid anyone to commercialise water, but it is happening. The entrepreneurs have invested so much in the creation of reservoirs, a network system, and in tankers. They need to sell water. If we act there will be no water for sale. So we keep quiet, we need water, too. What's important is that there is no clash between the entrepreneurs and the people. We could've played rough, but we understand each other.

Multiple actors jointly contribute their inputs particularly in the distribution chain.

A spring owner also confided, "It's hard to build a business in the middle of a place like this, let's just say that we are vulnerable. If we don't provide water, although we lack it sometimes, it won't be good for us. At least we have each other's back". Even so, we found other pangkalan who do not allow community to tap from their springs, and still, the threat of business termination has never materialised.

Figure 3. The actor and input diagram in the value chain of commercialised spring water in Ujungberung District.



On the other hand, the community's supply of water depends on the sustainability of water entrepreneurs. If the commercialisation of spring water did not take place, the community may not be able to enjoy the spring water. The local community does not have any financial means to bring water from the springs to people's premises. A senior member of the community put it as follows: "it takes a lot of money to build a network to deliver water from the springs to the second reservoirs. Trucks are also needed to bring water from the reservoirs. Trucks also cannot run by themselves, fuel and drivers are needed, hence, money". The senior community member later emphasised that "it is a business, but otherwise, people in Ujungberung District would not have clean water".

Private actor's investments and operations are mainly driven by the profit motive and the need to sustain business activities. Spring owners/operators strived to attract new customers but kept loyal customers by applying many strategies. These range from setting up a negotiable and competitive selling price, ensuring good water quality through a well-maintained distribution network, to promoting the results of water quality testing. The refill kiosk owners interviewed avoid using groundwater or piped water as raw water sources, and instead opt for spring water that has a good reputation for quality. Additionally, refill kiosks gain customer's loyalty by maintaining their treatment efficacy, and in some cases using water-quality testing certificates to promote their products. To some extent, these business strategies result in indirect effects (externalities) that lead to improvements in physical access to the network of spring water and an accompanying safer and/or more affordable supply compared to other water sources.

Apart from the contributions of co-production to the improvement of physical access, quality, and affordability, we observed that cooperation between local entrepreneurs and community members extends to conflict management. This was articulated by a local chief when discussing water as a source of conflict, "water is hot, even if it is actually cold". Potential sources of conflict relating to equity are water disruption, free-riding behaviour, and inequalities in the geographical distribution of services.

*Water Disruption Problems.* Households connected to individual spring water supplies are serviced continually, although households sometimes suffered from low water pressure. However, households that rely on communal tanks experienced frequent water disruption, particularly during dry periods. Although households using spring water and piped water supplied by the MWC experienced similar problems of poor daily and seasonal continuity, households preferred the spring water source. During the dry season, or when demand is high, the spring owner is often unable to provide sufficient water to supply both businesses and households at the same time. Ujungberung District is famous for its mountain water. Therefore, commercial and industrial clients of spring water entrepreneurs are spread throughout the city and over neighbouring regencies. Water must be delivered by tanker trucks beyond the district limits to these commercial and industrial clients. These types of clients benefit local entrepreneurs rather than household or communal users primarily because they buy water in large quantity per trip and pay in higher prices.

Minor unrest and distrust are sparked when entrepreneurs are accused of prioritising commercial and industrial clients, while local entrepreneurs claim that they never actively reduce the supply to the local community. Such conflicts are managed by local chiefs and water stewards. Their presence, and the social relationships between actors, help bypass the traditional complaints procedure. Households convey their complaints to local chiefs, who are responsible for immediately conveying complaints to operators of spring water. If the problem lies in the distribution system between the spring water reservoir and the communal tank, for example due to damaged pipes, households, together with local water stewards and local chiefs take collective responsibility for repairing the network or paying for repairs. In this way problems have a greater chance of being resolved rapidly.<sup>7</sup>

*Free-riding behaviour and participatory monitoring.* In the late 1980s, a state-led piped water service supplied clean water to communities in the Ujungberung District. At that time, raw water sources were bought from natural spring sources owned by members of the local community. The piped water service was stopped to some areas, three years after the MWC began their operations. A senior community member suggested that the short life of the MWC service in certain areas was mainly driven by the occurrence of massive and illegal water tapping. As a senior community member recounted, "the officers monitored the reservoir... but they did not monitor the network rigorously. People began stealing water. There was no water. It took so long for the water to flow. The water was taken all the way along. People drilled the pipes, like woodpeckers". At present, spring owners face similar, yet less significant, problems. Some illegal actions occurred during times of water shortage. People siphoned water by perforating plastic pipes and diverting water to their dwellings without permission, often using mechanical pumps. Identifying evidence for water theft was straightforward, particularly during the rainy season because (1) water flow rate suddenly decreased; or (2) the water turns murky because contaminants were sucked into the system through punctures.

These problems are mitigated by some forms of participatory monitoring. Spring owners are negatively affected by deteriorations in water quality and reduced water flows that result from illegal tapping. Therefore, spring owners work hard to alleviate illegal tapping at the point of extraction and transportation. Households become aware of occasional water theft when there is a sudden decrease of water pressure. Households contribute to monitoring at the point of distribution by reporting leakage occurrences to water stewards or network watchers, who then investigate the distribution hoses. Network watchers voluntarily monitor the distribution system and local people report

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<sup>7</sup> Compared to the MWC, the complaints procedure for the connection of spring water is much less complex. In the case of disruptions to piped water supply and problems relating to water meters or water bills, consumers are required to attend the central office in the northern part of Bandung City and formally file their complaints by filling out forms. Following this, consumers wait for up to one month for their complaint to be addressed.

occurrences of damage within the spring water distribution network. A water committee member confided:

Now our watchers monitor. People also monitor the water, should such things (illegal tapping) happen, they get annoyed. We know exactly which hose goes to which neighbourhood. If parts of the network pass along a motor taxi terminal, the drivers will tell us. If parts of the network run through a small shop, they will tell us.

In the past, some conflicts arose around the use of the communal spring water tank. Water is scheduled to be delivered to a certain neighbourhood for three hours a day, for example from 7 a.m. to 10 a.m. After 10 a.m.; the valve supplying that neighbourhood is closed, and water is diverted to another neighbourhood. Incidences of flow being diverted to neighbourhoods which were not scheduled to receive water at that time outside the allocated period have occurred. Again, the watchers are tasked with preventing such occurrences.

*Geographic distribution of service.* Individual and shared access to the network of spring water are confined to locations where gravity allows water flow. Networks of spring water use rubber or plastic hoses, which are more vulnerable than the PCV, asbestos or iron pipes used by the MWC. Even so, hoses are preferable to other type of pipes due to the flexibility of hoses. The network of spring water is often sighted at unprotected locations, such as the roadside. The durability of these hoses is hence reduced when greater lengths are used, in term of the susceptibility to frequent damage by traffic. We found communities located in this 'technical outreach' of the network of spring water are not served by such a system. Our interview revealed that there was a shared consciousness that "not all can get water from the communal tank" and that "the water won't be enough". To further reduce the conflicts between those who receive spring water service and those who do not, the water stewards determined the monthly fees of IDR 300,000. This fee is collected from the households using spring water service and paid to the pangkalan owners. However, pangkalan owners do not press people to pay this fee. Water stewards and senior community members insisted on setting this fee. This monthly fee was not the price of water nor the price of water distribution. It was rather 'the price of peace'. A high fee would lead to protests from local people who feel they were entitled to a water supply, while supplying the water for free would trigger protests based on social envy from those who are unable to access spring water.

## DISCUSSION AND CONCLUSION

### Private actors and co-production

This study highlights co-production occurring within the value-chain of commercialised spring water. Commercialising of spring water started to occur when local entrepreneurs identified a gap in the market for drinking water supply left by the state that provided an inadequate service for all citizens in Ujungberung District. An example of commercialising of water in South Africa suggests that disengagement of citizens is worsened and access to water services by poorer people is reduced (McDonald and Ruiters, 2005). Our findings demonstrate that private control over natural water sources stimulates institutionalised co-production arrangements and institutional innovations, which further leads to an improved access to a safer and more affordable water supply, and nurture equity. Cooperation between private and community actors demonstrates its effectiveness at reducing tension between market-based provision and added value for the public (Bovaird, 2006).

This study analyses the cooperation and experiences of private actors, households, and community actors, that Pestoff and Brandsen (2010) refer to as the 'third sector', in co-producing spring water supply services. The term co-production is commonly used to describe the arrangements in which services are jointly produced by state agencies, citizens, and communities only (Brandsen and Honingh,

2015). However, the involvement of private parties in co-production activities is referred to in public-private partnership arrangements (Klijn and Teisman, 2005). The concept of co-production, or co-creation, is also found in the relationships between private service providers and their clients in service-based industries (Auh et al., 2007; Ordanini and Pasini, 2008; Voorberg et al., 2014).

We argue that the case of spring water distribution in Ujungberung District is a form of co-production since this arrangement displays the characteristics of co-production described by Boyle and Harris (2009) who identify primary producers and users/communities as *both* co-planners and co-deliverers of services. Aside from any one or the elements of the service production process being shared, co-production is further defined by: (1) the presence of a fundamental shift in the balance of power between the primary producers and users/communities, and (2) the existence of mutual support and relationships networks rather than a clearly defined delineation between providers and clients (Boyle and Harris, 2009).

In the planning phase of water distribution system, private actors and the third sector negotiate the extent and means by which spring water can reach the community. In the service delivery phase, private actors (spring owners) provide the water while the community actors including water stewards, water watchers, and local chiefs maintain the sustainability of spring water delivery via the distribution network. Lastly, households individually contribute to improvements in the quality and continuity dimensions for water services they receive. Inconsistent supply and water quality problems are mitigated through home strategies such as water treatment and storage and by giving feedback regarding service quality addressed by community and private actors.

We have observed a fundamental shift in the balance of power among actors. When spring water was given based on neighbourly relationships, users relied on the generosity of spring owners who provided free water. With respect to the state-led piped water service, there is a sense that the MWC exerts authority over their clients, reflected in a lack of action in response to customer's demands for service improvements (Nastiti et al., 2017). This example of co-production extends beyond "volunteers ministering to ever more passive needy individuals on the fringes of public services, whilst the professionals continue with business as usual" (Boyle and Harris, 2009: 17). Users positioned at the receiving ends of the water service are motivated to assist in the provisioning of spring water by establishing water committees which regulate water allocation at distribution points or, at the very least, report service quality problems and leakages within distribution networks. This is similar to what Alford (2014) described when referring to the role of building occupants in providing early notification to the fire department when fire occurs.

As previously described, the size of the water entrepreneurships, the requirements for local permits, and the social relationship between private and community actors shift the balance of power of primary producers away from private actors to the community. The practices of the MWC are defined strictly by typical state provider and client relationships, in which the installation of new connections, the submission of complaints, monitoring of meters, and all other regular activities of water provision are conducted through formal means and procedures. Our interviewees suggested that the MWC retains all control over their provision of water. In contrast, the relationships of local private actors with the local community are based on informal agreements and social relations, thus giving room for grassroots negotiations and reducing communication barriers. Contrary to a typical provider and client relationship, the co-production arrangement in the Ujungberung District promotes partnerships between the private sector and the community.

Ostrom (1996: 1074) argued that the major examples of infrastructure such as water and sanitation works are "not where one would first look to find important, replicable examples of effective co-production". Our case study of the Ujungberung District indicates that the provision of spring water characterised by co-production makes up a third of water used by households we interviewed. The contributions of different actors stimulate improvements in the overall quality of water supply service.



Our findings show that there are improvements in the physical access, quality and affordability dimensions of water service because of institutional innovations. These innovations manifest themselves mainly in the distribution chain because of cooperation between local private actors and community actors, i.e. through negotiation, participatory monitoring, and conflict management.

Pestoff and Brandsen (2010) argued, however, that innovation alone is not sufficient as it must also be accessible to a broad range of users. This emphasises the equity issue in service improvement. Although in general the co-production processes in the Ujungberung District have improved access to water for the previously unserved by piped water and boreholes, had given the opportunity to negotiate from below, and yield in a more transparent and accountable provision, we showed that the impact of co-production is in line with the particularistic nature of the third sector, where the benefits of improved quality of the water service are restricted to a group of users (Pestoff and Brandsen, 2010). In our example, groups with geographical advantages in relation to the spring water service, those with the financial means to provide their own spring water connections, and neighbourhoods able to effectively negotiate with local entrepreneurs benefited over others. Despite the remaining inconsistent service coverage, co-production has led to the introduction of viable options for increased access to clean spring water for previously unserved households.

To further understand and better manage co-production arrangements, Alford (2014) suggests a classification for co-producers that focuses on service outcomes rather than just service outputs. In the case of Ujungberung District, the co-production process is not limited to the output of consistently supplying good quality water to consumers. It also includes the outcomes of safeguarding public health and general well-being, and reducing conflicts among neighbourhoods which may occur in association with commercialised spring water. The motivations of local private actors in co-production activities are characterised mainly by profit and business sustainability, while the motivations of community actors gravitate towards maintaining peace and reducing tensions and conflicts in the district, while household users expect to receive access to a clean, adequate, and affordable water supply that promotes health and productivity. For the co-production process to thrive, positive relationships between actors with different motivations are essential. Therefore, the act of negotiation, and the cultivation of transparency and accountability are required. We suggest that the acknowledgement of each co-producer's motivations, and an understanding of how these motivations regulate the co-production arrangement are vital to optimise the co-production process.

### **The policy implications of co-production within commercialised spring water**

While we found that co-production processes within commercialised spring water might indeed improve access to water, concerns over the presence of capitalistic entities in basic infrastructure service remain. These concerns gravitate not only in a worry that the prime economic motives of these entities may someday trump the social aspect of water, but also on the potential problem of excessive extractions which may lead to the degradation of spring water resources. We then place the discussion within the broader spectrum of water governance by focusing on the role of the state and the current legislative framework in mitigating these disasters.

By law, raw water abstraction for commercial purposes is permitted based on commercial water rights, an instrument to limit the volume of water that can be extracted by permit holders. If enforced properly, such an instrument was expected to prevent ecological problems caused by excessive extractions. The newly enacted Drinking Water Bill 122/2015 further implies that any business with water as commodity intended to be produced not for the sake of self-sufficiency, violate this Bill. At the city level, the licensing instrument is still in place: every person or entity that performs groundwater and surface water extraction, including pangkalan, requires a Water Extraction Permit (WEP) from the

Mayor<sup>8</sup> (Government of Bandung City, 2002). WEP holders are also required to pay a levy based on the volume of water they extract. Failure to fulfil these obligations leads to a forced suspension of business activities, but we found partial enforcement of this legal obligation in which not all pangkalan operate legally with a WEP. We estimate that the amount of tax is 1.25 times higher than the maximum gross monthly revenues of a pangkalan. The high cost of formalisation discourages pangkalan to legally register their activities with the city, making it difficult for the government to control the volume of water extracted by these entities.

The new 122/2015 Drinking Water Bill also mentions that state organisations shall be given priority to manage and provide water supply services. The current mayor of Bandung City, Ridwan Kamil, had requested to acquire privately owned springs for public company's raw water supply. Out of 400 springs located in Bandung City, only 70 are in operation for public use. This brings us to the discussion of re-municipalisation as a form of government intervention that sheds light on the debate of public-private ownership in water provision service. The recent debate in the international and national communities are whether to formalise the informal water provision or heighten the role of the public sector through, perhaps, a re-municipalisation (Valdovinos, 2012). We suggest that the success of re-municipalisation and its effect on water market depends on the acceptance or willingness for the community to embrace water provided by the public sector, which is known to be unreliable. A separate study in our case study area demonstrates that a loss aversion behaviour of a perceived poor service quality may demotivate households to connect even when households have the sole authority to decide and are given options to connect (Nastiti et al., 2017).

## CONCLUSION AND RECOMMENDATIONS

We conclude that rather than making a distinction between state or market provision, water supply management incorporates a broad spectrum of provision structures. Private sector involvement does not necessarily lead to less equity in terms of: (1) improved access to water; (2) the opportunity to negotiate from below; and (3) transparency and accountability. However, this will depend on the presence of effective local community actors. Institutional innovations established in the co-production process in the Ujungberung District, Bandung have yielded a safe and affordable water supply service for citizens who previously had no access to piped water or boreholes in the district. Multiple case comparisons are required to confirm the generalisability of our results to all private/citizen co-productions, and will further increase understanding of this particular institutional arrangement. Findings in Greater Jakarta provide an example of a similar supply system where spring water is delivered by trucks. Similar communal provisions were also found in other peripheral areas of Bandung.<sup>9</sup> Further research is needed to fully understand how this type of co-production arrangement may contribute to larger-scale urban water planning. Additional research should be conducted to analyse how changes in the local institutional framework of urban water management can further improve such co-production arrangements.

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<sup>8</sup> An exception to this are households that use private wells with an extraction volume of less than 100,000 litres per month and a depth of 40 to 60 metres.

<sup>9</sup> Field findings by Indrawan Prabaharyaka provide an example of a similar supply system in the Greater Jakarta area where spring water is delivered by trucks. Similar communal provisions were also found in other peripheral areas of Bandung.

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