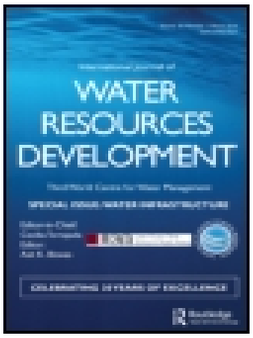

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Institutional inertia: challenges in urban water management on the path towards a water-sensitive Surabaya, Indonesia

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ABSTRACT
Traditional approaches to urban water management are increasingly questioned. To understand whether the alternative water-sensitive city (WSC) paradigm is applicable in Surabaya, Indonesia, its water governance system was analyzed using semi-structured interviews with relevant stakeholders, questionnaires, and a literature review. Three main institutional obstacles to a transition towards a WSC were identified: national and local political interference; lack of institutional coordination; and the commercialization of Surabaya's water utility. A discord between water practitioners' individual beliefs and water management practices also makes changes towards a WSC difficult. Yet, opportunities are found where existing political goals align with elements of the WSC.

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Water governance; water-sensitive city; urban water management; institutional challenges; modern infrastructural ideal; Surabaya

Introduction

With urbanization predicted to continue increasing over the next 30 years (United Nations, 2015), two-thirds of the global population will reside in urban areas by 2050. The greatest growth is expected in developing countries of Africa and Asia (United Nations, 2015). This rapid and often unplanned urban growth poses great challenges for cities' infrastructure and basic services (United Nations, 2015). Despite major investments in water infrastructure, one in nine people still lack access to clean and safe water. This amounts to 783 million people worldwide (The Water Project, 2016). Providing water supply in cities has long been based on the modern infrastructural ideal (MII) paradigm. Recently, a different paradigm has emerged, the water-sensitive city (WSC). Each water management paradigm embodies a set of assumptions about how water provision should be managed. The paradigms manifest themselves in the technical infrastructure, planning approaches, regulations and engineering practices of a city or region (Pahl-Wostl, Jeffrey, Isendahl, & Brugnach, 2011).

Modern infrastructural ideal

The MII has been a dominant narrative in urban planning since its emergence in the late nineteenth century. It incorporates a strong belief that through advancements in

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Supplemental data for this article can be accessed here.

science, positive transformations in urban infrastructure can be achieved following the vision of the 'progressive force of modernity' (Graham & Marvin, 2001). According to this paradigm, standardized infrastructural networks and services have to be made universally accessible across cities as they form the basis for modern production, distribution and consumption. Universal access to potable water is to be provided through a single centralized pipe system (Graham & Marvin, 2001). This centralized provision should be taken on by 'social institutions based on private or public monopoly control', while fragmented or informal supply of infrastructural networks is viewed as chaotic and undesirable (Graham & Marvin, 2001).

Many governments and municipalities in developing countries, including Indonesia, adopted the urban planning ideals and strategies of developed countries and tried to design their cities according to this model (Damayanti, 2006). In Indonesia, many planning regulations and laws were adopted from Dutch legislation during colonial times, but also afterwards. However, this effort of imitation often ignored differences between countries in administrative capacity, political philosophy and bureaucracy (Damayanti, 2006). As a result, in Indonesia, a plurality of water supply modes is still found in cities, including wells, bottled and refill-bottled drinking water (Hadipuro, 2012; Kooy, 2014; Kooy, Walter, & Prabaharyaka, 2018; Susnik et al., 2017). This plurality of water supply modes led the government of Indonesia to launch various projects geared towards extending water service coverage, such as the Water Supply and Sanitation for Low-Income Communities Project (Penyediaan Air Minum dan Sanitasi Berbasis Masyarakat, PAMSIMAS) (World Bank, 2015a, 2015b).

Water-sensitive city

Conventional urban water strategies applied in the cities of developing countries have often proven unable to address current water needs and future challenges stemming from climate variability, population growth and climate change (Wong & Brown, 2009) due to a focus on inflexible engineering and technocratic solutions with little consideration for ecological and social values (Buurman & Padawangi, 2018). The WSC, which roughly falls under the umbrella concept of sustainable and/or integrated urban water management (also referred to as urban water security by Hoekstra, Buurman, & van Ginkel, 2018), represents an alternative paradigm to the MII (Bichai & Cabrera Flamini, 2018). The WSC concept rests on three key pillars. The first is the development of a variety of water sources to reduce dependency on a single water source and distribution form (Wong & Brown, 2009). City resilience can be strengthened through the harvesting of alternative water sources, like stormwater, rainwater and recycled wastewater, which are present within the city boundaries. Obtaining as much water as possible within the city not only reduces the costs and environmental impacts of a city's water use, but also develops a closed urban water cycle that minimizes water loss (Wong & Brown, 2009).

The second pillar emphasizes the provision of ecosystem services within the city. The city should introduce regulations, technologies and urban design that drive a holistic approach to use green infrastructure. This makes water provision resilient to the impacts of climate change and other future uncertainties. It requires a departure from the conventional approach of urban communities, which sustain themselves by depleting ecosystems and natural environments (Wong & Brown, 2009).

The third pillar stresses the need for strong institutional capacities within a city to enable a transition towards a WSC. The conceptual approach of the WSC and the new technologies it entails have to be socially embedded to guarantee successful implementation (Buurman & Padawangi, 2018). Institutional reforms, broad political support and community awareness and engagement are essential (Buurman & Padawangi, 2018; Wong & Brown, 2009). This transition is especially challenging as it requires establishing a new culture across multiple organizations, professions and tiers of government. New technologies often demand a fundamental change in organizational capacity at various levels, including new knowledge and skills, organizational systems and relationships, policy frameworks, and regulatory rewards and penalties (Brown & Clarke, 2007).

From the modern infrastructural ideal to the water-sensitive city?

While the WSC paradigm largely emerged in developed countries, there is growing tendency to advocate the approach for cities in the Global South (Bichai & Cabrera Flamini, 2018). In recent years, a growing literature has focused on potential pathways of institutional transition towards sustainable water management (Bettini, Brown, de Haan, & Farrelly, 2015; Jensen, Fratini, & Cashmore, 2016; Werbeloff & Brown, 2016; Werbeloff, Brown, & Loorbach, 2016). Buurman and Padawangi (2018) reviewed obstacles reported in the literature to transitioning towards a WSC, and proposed a framework to analyze and support decision making on the integration of sociological aspects into water-sensitive programmes, applied to Singapore. However, the established frameworks are mainly based on the analysis of management regimes in industrialized countries. These are mostly characterized by uniform service provision and a principal governing authority (Van Welie, Cherunya, Truffer, & Murphy, 2018), while developing cities often have fragmented services and governance systems (Reymond, Renggli, & Lüthi, 2016).

Many cities of the Global South, for example in Indonesia, have very low water security (where water security is understood to encompass water sustainability or water-sensitivity) due to a combination of high hazard exposure and high vulnerability, the latter often being related to infrastructural deficiencies and institutional challenges (Hoekstra et al., 2018). Documenting how to transition towards higher water security (or towards a WSC) was recognized as a critical research need in a recent review of urban water security (Hoekstra et al., 2018). As the government is required to play an 'increasingly comprehensive role' (Buurman & Padawangi, 2018) in such a transition, a thorough understanding of governing structures and mechanisms is highly needed to integrate social and ecological factors into safe and reliable water provision goals. To date, only limited research has shed light on institutional bottlenecks of water management systems in the Global South that hamper the adoption of sustainable innovation (Nilsson, 2016; Ramos-Mejía, Franco-Garcia, & Jauregui-Becker, 2018; Reymond et al., 2016; Van Welie et al., 2018). This article aims to contribute to bridging this research gap by examining the governance system for water provision in Surabaya, Indonesia, to understand the role that institutional conditions play in allowing the city's transition towards the WSC. This is done by focusing on an analysis of institutional arrangements and of the beliefs and opinions of influential stakeholders with respect to the concepts of the WSC and the MII.

As a starting point, this article describes the current physical condition and problems of Surabaya's water provision. This information is necessary to understand the mechanisms of the city's water governance system and the conditions under which the various stakeholders work. Second, challenges within the governance system of Surabaya's water provision are identified through analyzing key actors and their competencies, interests, influence and mutual relations, as well as their belief systems. Building on this, the potential of Surabaya for a transition towards a WSC is discussed, along with potential windows of opportunity to introduce sustainable innovation. This analysis brings practical observations from a southern context into the urban transition literature, contributing by exemplifying some of the limitations of globalizing water management paradigms. We also highlight windows of opportunity for improvement in water services when interpreting the WSC paradigm in combination with the perspectives and priorities of relevant stakeholders.

Methods

Case study selection

Indonesia provides an interesting study context, as water provision in many of its metropoles is highly insufficient, and existing infrastructure is under increasing pressure due to rapid population growth and urbanization. Moreover, many areas of the country face water scarcity, even though Indonesia is one of the richest countries in terms of water resources: they account for around 6% of global water reserves and 21% of the Asia-Pacific region's (Ardhianie, 2015). As reforms in the water sector are urgently needed, the WSC framework might provide sustainable solutions.

Surabaya was chosen as a study site, as its water provision has been inadequate and unreliable for many decades due to polluted water sources, outdated distribution infrastructure and insufficient water quantity (Anityasari, Sholihah, & Maftuhah, 2017; Lucas & Djati, 2007; Ostojic, Bose, Krambeck, Lim, & Zhang, 2013; Razif, Soemarno, Yanuwiadi, Rachmansyah, & Belgiawan, 2014; Susnik et al., 2017). Even though the city flourishes economically as one of the biggest trading hubs in the country and South-East Asia (Ostojic et al., 2013), water infrastructure lags behind (Asian Century Institute, 2016). To address these challenges, several urban development projects financed by international donors like the United Nations, the World Bank and others have focused mainly on expanding the pipe network within the city or on increasing the access to water of low-income populations (PAMSIMAS, 2016; Sugimoto, 2007; World Bank, 2007, 2009, 2015a, 2015b). Moreover, the local government has initiated several community-driven projects, like the Green and Clean Competition and the Free from Waste Competition, which encourage the local population to engage in clean water management (Sholihah, Anityasari, & Maftuhah, 2017). While these initiatives are steps in the right direction, Surabaya's main water-related challenges, low water quality and quantity, remain.

Data collection and analysis

The core data were collected through semi-structured interviews with relevant stakeholders in July and August 2016. Semi-structured interviews, consisting of open-ended questions covering the main themes of interest, allowed interviewees to express individual opinions

and introduce new information and topics. This was essential to avoid excluding important unforeseen arguments. Actors were considered relevant if they had official or informal influence on water sources, water treatment, distribution infrastructure or public policy making in the water sector of Surabaya. Semi-structured interviews were conducted with representatives of the regional government (5), the local water utility Perusahaan Daerah Air Minum Surya Sembada Kota Surabaya (PDAM Surabaya) (2), the regional public enterprise for water service Perusahaan Umum Jasa Tirta I (PJT1) (2), the environmental agency of the city of Surabaya (4), a local non-governmental organization (1) and an international supportive project (1). As most interviewees did not speak sufficient English, a graduate student from the Institute of Technology Sepuluh Nopember (ITS) translated during the interviews. In addition to these stakeholders, interviews were held with key informants on the physical realities of Surabaya's water provision and to hear an outside opinion on the water governance system. Secondary data from interviews and a focus group conducted by Dr Maria Anityasari (ITS) were also used for our analysis. An overview of the interviews is presented in the online supplemental material (Tables A1 and A2). The data from the interviews were manually coded (Bogdan & Biklen, 1982) using ATLAS.ti. The codes were not defined prior to the interviews, but emerged from the text (inductive coding). The results from the interviews were triangulated with information on responsibilities and duties of stakeholders from official websites, regulatory documents, academic literature and unpublished documents.

To further evaluate the belief system of stakeholders, a questionnaire was developed comprising 25 practical statements representing either the MII (13 statements) or the WSC paradigm (12 statements). The statements reflect the three WSC pillars of urban water management. The respondents were able to express their agreement or disagreement with each of the statements on a five-point Likert scale, from 'strongly agree' to 'strongly disagree'. Statements were presented in a mixed order in the questionnaire, across dimensions and paradigms. In total, 12 questionnaires were collected from five different organizations: Dinas PU Cipta Karya dan Tata Ruang Provinisi Jawa Timur (Cipta Karya East Java), the provincial unit of the Ministry of Public Works and Public Housing (2 respondents), ITS, a local university (2 respondents), Badan Lingkungan Hidup Pemerintah Kota Surabaya (BLH Kota Surabaya), the environmental agency of Surabaya (4 respondents), PDAM Surabaya, the local water utility of Surabaya (2 respondents) and PJT1, the regional public enterprise for water service (2 respondents). The results of this survey are presented in the online supplemental material (Table A3). Due to time restrictions and difficulty obtaining access to several organizations, the questionnaire could not be distributed to all relevant stakeholders in the field.

Overview of socio-environmental and technical challenges in Surabaya

Surabaya is on the north-east coast of Java and is inhabited by around 2.7 million people (Badan Pusat Statistik Kota Surabaya, 2010). The climate of Surabaya is tropical, with around 1500 mm of annual rainfall (Ostojic et al., 2013). The rainy season runs from November through May, and the dry season, from June to October. While the city flourishes economically as one of the biggest trading hubs in Indonesia and Southeast Asia (Ostojic et al., 2013), its water provision faces enormous challenges, as it suffers from insufficient water quality and quantity.

Unlike many other Indonesian cities, Surabaya cannot rely on groundwater: the local groundwater is brackish because of saltwater intrusion (interview 7). Groundwater availability is also too low to permit commercial extraction (RISPAM Kota Surabaya, 2014). Furthermore, the city's soil is dominated by clay, which makes groundwater extraction difficult and expensive (interview 8). As a result, the Surabaya River, which flows through the city, serves as Surabaya's main water source (RISPAM Kota Surabaya, 2014). The Surabaya River is a branch of the Brantas River, the largest river in East Java (Figure 1). Both rivers are polluted by untreated industrial and domestic wastewater. The daily pollution load due to non-industrial waste discharged into the Surabaya River was estimated to be over 65,000 kg of biological oxygen demand and 170,000 kg of chemical oxygen demand, with the increasing number of malls discharging insufficiently treated wastewater being reported as a contributing factor (Razif et al., 2014). The industrial contamination stems mainly from the many factories along the river, which discharge untreated wastewater into the stream (interview 8; Lucas & Djati, 2007; Ostojic et al., 2013; Razif et al., 2014; RISPAM Kota Surabaya, 2014). The Brantas River also shows a high degree of domestic pollution due to untreated discharges from cities and settlements along the waterway (Razif et al., 2014; Sholihah et al., 2017). Also, Surabaya's citizens discharge a great quantity of untreated domestic wastewater into the Surabaya River because the city does not have an extensive and uniform wastewater infrastructure. Several private companies treat

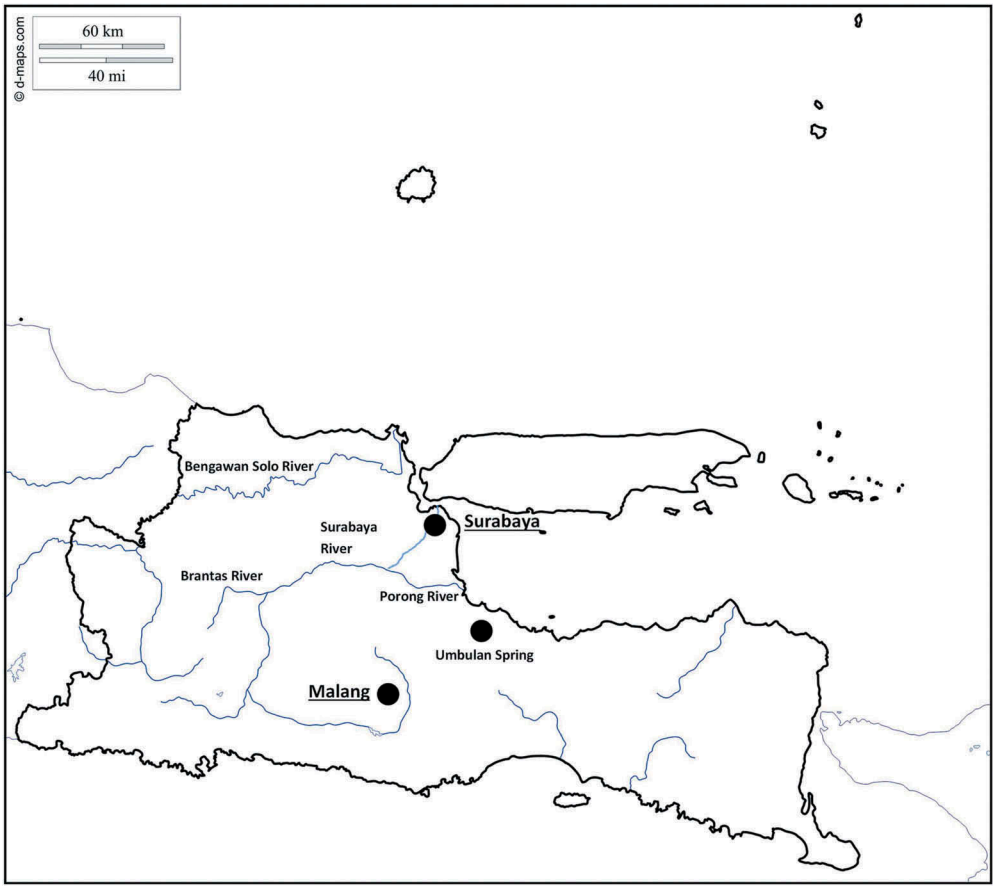

Figure 1. Map of East Java (based on d-maps, 'Map of East Java', 2018, retrieved from http://d-maps.com/carte.php?num_car=136373&lang=en).

wastewater for large buildings or campuses, but only a small percentage of households are connected to a wastewater treatment system (Ostojic et al., 2013). Experts estimate that 80% of Surabaya's population uses septic tanks for domestic blackwater (interview 8) and only 5–25% of households are connected to a greywater treatment system (interviews 7, 8, 9, MA 2). PDAM Surabaya reported in 2014 that only 60% of Surabaya's households use latrines with septic tanks (RISPAM Kota Surabaya, 2014). The rest of the city, including small businesses like restaurants, laundry services and carwash shops, discharges its wastewater into an open sewer system, which empties directly into the Surabaya River. Moreover, many people dispose their solid waste into the open sewer channels, either because their area is not covered by the city's waste management service or to avoid paying garbage pick-up service fees (interview MA 5). The great quantity of solid and liquid waste discharged into the river impairs water quality and makes extensive treatment necessary before water can be distributed to Surabaya's inhabitants (interview 4). Although the water is considered fit for human consumption on leaving the water treatment plant, contamination during distribution (a consequence of the outdated and highly perforated pipes) results in the water no longer being potable when reaching households (interviews 2, 3, 4). While the water quality is not compromised in every part of the city, most people feel uncertain about the water quality and thus rely on bottled or refill-bottled drinking water (Hadipuro, 2010; Susnik et al., 2017). Only those households that cannot afford bottled water boil and consume tap water (interview 8). PDAM Surabaya reported that by the end of 2014, 2,537,785 people, or around 79% of Surabaya's population, used their piped water service as the main water source, while 2% used piped water from private providers and 19% relied on wells or water tanks (RISPAM Kota Surabaya, 2014). But these statistics only include those households that are formally registered in the municipality and exclude illegal settlements. Considering all settlements, currently 93% have access to water. The poor condition of the distribution network also generates physical losses of up to 27% and thus significant financial losses for the water utility (interview 3).

Decreasing water supply and increasing demand is another major concern (RISPAM Kota Surabaya, 2014). The population of Surabaya is growing steadily, and the average water demand of its citizens is estimated at 200 L per capita per day (interview 9), with a range between 183 (Susnik et al., 2017) and 290 L per capita per day (Ostojic et al., 2013) found in the literature and local sources. Moreover, the water flow from the Brantas River system is steadily decreasing due to deforestation and the slow sedimentation of the riverbed by the high amount of waste entering the stream (interviews 8, MA 6, RISPAM Kota Surabaya, 2014). To meet rising water demands, new sources are being developed. In 2019, additional water from the Umbulan Spring, 70 km south-east of Surabaya (Figure 1), is expected to become available for Surabaya (interview 3). While currently Surabaya only has 110 L/s of supply, the Umbulan Spring project would raise water availability from that source to 1000 L/s (interview 1). However, how long this additional water source will be able to meet the increasing demand of the growing city is a question that is fiercely debated. Some experts and academics predict that within the next five years, Surabaya will face a major water crisis (interviews 2, 9, informal conversation 1), while others see Umbulan Spring as a long-term solution (interview 1).

Challenges of Surabaya's water governance system

Three main challenges characterize the water provision governance system in Surabaya. First, water policy is highly influenced by the political interests of both national and local

stakeholders, which hinders the effective tackling of water provision problems. Second, effective coordination among stakeholders is hampered by the fragmentation of their responsibilities as well as overlapping, unclear and, at times, lacking competencies. Third, the commercialization of Surabaya's water utility leads to a trade-off between cost-efficiency and modernization.

Influence of politics

The policy-making process in Surabaya's water sector is strongly influenced by political leaders at different administrative levels. At the beginning of every Indonesian president's term, nationwide targets are set to guide the development of provincial and local water provision. These plans are often strongly influenced by international initiatives such as the Sustainable Development Goals (UNESCO Office Jakarta, 2014), and presented in a national medium-term (five-year) development plan (Asian Development Bank, 2012). In addition, national long-term development plans set goals for 20 years, influencing the terms of four consecutive presidents (interview 9). These national priorities have to be included in mid- and long-term provincial and local development plans.

The strong political influence means that Surabaya's development projects and investments may not be aimed at local necessities but instead follow political goals. This politicization of decision making regarding water management is visible in the prioritization of certain development goals, the emphasis on short-term planning and the selective enforcement of laws. These issues are discussed in more detail below.

The current National Medium Term Development Plan (2015–2019) contains the ambitious target to ensure safe access to drinking water for 100% of Indonesia's population by 2019 (Tampubolon, 2016). The mayor of Surabaya has made this objective her first priority and focuses most development projects on achieving this goal (interviews 3, 4). She ordered the water utility (PDAM Surabaya) to connect as many households as possible to the piped network (interview 3). However, the achievement of this goal is highly unlikely, as Surabaya's service coverage of 93% is one of the highest in the country. The remaining 7% are mainly informal settlers, which often cannot be connected to the formal network, as many of them live on land where settling is prohibited (interview 3, MA 4).

Moreover, several actors state that this strict prioritization impedes the solving of more urgent water problems (interview 3). For example, PDAM Surabaya argues that rehabilitation of the existing water distribution system is urgently needed to reduce water losses and prevent microbial contamination of tapwater. Furthermore, the company has argued that without an increase of water tariffs, it will soon no longer be able to cover its operating costs (interview 4). However, the mayor has prohibited a raise of tariffs, as she wishes to ensure affordable water supply for the city's poor inhabitants, which is a precondition for 100% coverage (interview 4).

Political influence is also reflected in the rather short planning horizon in Surabaya's water sector. According to PDAM Surabaya, no concrete plans exist for the development of Surabaya's water provision beyond the next five years (interview 3). While there are 20-year development plans, they only set general directions, not detailed targets for Surabaya's water sector (interview 9). Although new water sources need to be developed to meet the city's demand, no initiatives have been undertaken to secure these new resources (interviews 1, 5, 7, 9). Some insist that the additional water from the

Umbulan Spring project (to be operational in 2019) will meet the city's demand for the next decade (interviews 1, 3). But others argue that the water demand of Surabaya's growing population will exceed the supply within four or five years (informal conversation 1). This would make immediate exploration, planning and development of new sources essential to prevent a water crisis in the near future. But, so far, no such actions have been taken. It appears that political leaders are reluctant to make large investments in water infrastructure, as such investments give them no advantage for the next elections (interviews 5, 9).

Political considerations also influence local law enforcement. Strict national regulations on pollution prevention clearly determine standards for effluent discharged into rivers. But the municipality of Surabaya hesitates to take action against factories that violate these standards, lest the companies relocate to other regions. Politicians expect greater chances for re-election if they economic development (interview 5). Rather than imposing sanctions on polluting companies, the local environmental agency (BHL Kota Surabaya) opts to 'educate' them about wastewater discharge standards (interview 7).

Coordination among stakeholders: water resources and river pollution

Challenges in the coordination among key stakeholders are a result of both the fragmentation of organizational responsibilities and unclear or overlapping competencies. Moreover, coordination between neighbouring cities using common water sources and infrastructure is limited as each city has great autonomy in managing its water provision. The challenges of coordination become especially apparent when looking at the current governance of the city's water resources, which includes water supply capacity management and river pollution management. The consequences of these challenges are discussed below.

Water resources management

The management of the Brantas River is divided between two organizations: PJT1 and Balai Besar Wilayah Sungai Brantas (BBWS Brantas). PJT1 is a state-owned enterprise which manages the raw water supply of the Brantas River to secure its availability for domestic use, industry, agriculture, power plants and other water requirements of the region (Perusahaan Umum Jasa Tirta I, 2014). Every commercial user of the river's water has to pay a monthly service fee to PJT1 according to the amount of water it wants to receive. To ensure that enough water is available, and that every user receives enough, PJT1 calculates and plans the water allocation for all users once a year, in October, before the beginning of the rainy season in November. For this purpose, PJT1 relies on historical and meteorological data and monitors the river's water level. Moreover, PTJ1 is responsible for conserving the river's water resources and prevneting the springs that feed the stream from drying up. Therefore, the company has started to plant thousands of trees in the upstream regions. Despite these efforts, PJT1 acknowledges that the river's water level is dropping and is convinced that new water sources must be developed in the near future (interview 6).

PJT1's revenue stems mainly from the monthly fees paid by water users, which have to cover the costs of water resources management. PDAM Surabaya is one of PJT1's biggest customers. Still, the relationship between the two companies stays purely contractual,

'business to business' (interview 6), and PJT1 has no direct influence over Surabaya's water supply planning process. To further increase the company's income, PJT1 also provides other services, like the testing of water samples in their water-quality laboratory, leasing large-scale construction equipment and tourist activities along the river (interview 6).

Like PJT1, BBWS Brantas works under the authority of the Ministry of Public Works and Public Housing and is responsible for managing the water resources of the Brantas River. But in contrast to PJT1, BBWS Brantas receives its funding from the national government. While PJT1 is only responsible for ensuring sufficient water resources for its customers, BBWS Brantas has the right to decide who those customers are, by issuing or denying water permits (interview MA 3). Moreover, BBWS Brantas is responsible for river basin planning and development (Isnugroho, 2010). This includes primarily the development of infrastructure projects on the river, such as the construction and maintenance of dams (interview MA 1).

The overlap of their operational tasks leads to conflicts between the two organizations. While PJT1 is responsible for securing sufficient water for all consumers along the river, they cannot issue water permits. BBWS Brantas issues these permits, often without consulting PJT1, which then has no choice but to allocate the water to new users. This puts PJT1 in a difficult situation, as they are already struggling to serve current needs, due to the decreasing water level of the Brantas River. Another challenge is the development of new water sources. While many stakeholders highlighted the importance of developing new water sources, none of them considered themselves responsible or competent to promote such development (interviews 1, 3, 4, 6, 7, 8). PJT1 sees its task only in the management of the water resources of the Brantas River and locates the responsibility for the development of new water sources in the municipalities and the local water utilities along the Brantas River (interview 6). However, a shared effort by these municipalities to develop new water sources is unlikely, as cooperation between municipalities is difficult (interviews 6, 9). Each city enjoys autonomy in the design of its water provision and thus sets goals and priorities according to their own interests. Many cities are unwilling to subordinate their own goals to a common effort (interviews 6, 9). Illustrative of this problem is the inability to realize the Umbulan Spring project for over four decades. One of the main reasons for the project's deferral were intense disputes over the distribution of the spring's water between Surabaya and its bordering districts. No municipality wanted to accept cuts in their share, and therefore these water resources remained unused for many years (Lucas & Djati, 2007).

Management of industrial and domestic pollution

When looking at the management of the water quality of the Brantas River, it is useful to differentiate between domestic and industrial river pollution, as responsibilities are allocated differently. Official responsibility for regulating industrial pollution is often attributed to PJT1, as the company is responsible for ensuring access for their customers to water resources of a certain quality (interviews 1, 4, 9). However, PJT1's actual ability to prevent pollution is limited. To detect industrial pollution, the company regularly tests water samples and participates in monthly patrols along the Surabaya River, together with the provincial and local environmental agency, Badan Lingkungan Hidup (BLH) East Java and BLH Kota Surabaya, the police and several non-governmental organizations (interview 6). (Note that after the data collection for this research was completed, BLH Kota Surabaya was renamed Dinas

Lingkungan Hidup Kota Surabaya. But throughout this article the abbreviation BLH is used, as the analysis is based on the governance system at a specific point in time.) PJT1 then reports contamination to BLH East Java and BLH Kota Surabaya, as the environmental agencies have the authority to issue warnings and penalties against polluters. But both agencies hesitate to sanction polluting factories due to political pressure (as discussed above). The only action PJT1 can then take is to dilute the river's pollution through the additional flow of water from reservoirs. Therefore, PJT1 identifies the environmental agencies as the accountable actor (interview 6). BLH in turn denies being responsible, referring to their limited resources, especially their staff shortage, to effectively monitor and punish polluters. The regulations of the mayor of Surabaya, number 58 of 2016 and number 74 of 2016, extended the duties and functions of BLH Kota Surabaya in the area of wastewater monitoring, and it is now directly responsible to the mayor. (Again, note that these changes have not been integrated into this article, as our analysis is based on a snapshot of Surabaya's organizations at the time of the field study, i.e., July and August 2016). The environmental agency attributes the final responsibility to PJT1, as it is the company managing the raw water (interview 7). Also, PDAM Surabaya sees itself as customer of PJT1, which is contractually responsible for delivering clean raw water (interview 4). Per the contract, PJT1 is obliged to deliver raw water to PDAM Surabaya that complies with certain quality standards. If these standards cannot be met, PDAM Surabaya has no other option but to increase their use of chemicals to treat the water, which increases their operating costs. Consequently, poor water quality leads to frequent conflicts between PDAM Surabaya and PJT1 (interview 4).

In the case of domestic pollution, every municipality along the Brantas River is responsible for ensuring that its wastewater meets official national standards before it is discharged into the river. However, Surabaya and most other cities along the river do not comply with these regulations. In fact, in most cities no organization has been mandated to monitor domestic wastewater treatment. Even though many local organizations are aware of the severity of the problem, they hesitate to take action, and claim that it is outside their area of competence (informal conversation 2). At the same time, provincial agencies, like PJT1 and BLH East Java, argue that they have no authority to intervene in the management of municipal wastewater (interviews 6, 7). PJT1 even claims that they do not even perform water quality tests for domestic contamination, as currently no effective methods exist to stop this pollution, so testing seems useless (interview 6). Moreover, a significant reduction of domestic river pollution would require the commitment of many municipalities. But joint efforts seem unachievable, as no city is willing to make financial investments to improve their infrastructure for the common benefit, while others can free-ride and continue discharging untreated wastewater (interview 9).

Commercialization of water utilities

PDAM Surabaya is responsible for the treatment of raw water and the distribution of potable water to the city's inhabitants (interview 3). The company is tightly controlled by the local government – which is in charge of all decisions on the company's investment and budget and also sets the company's water tariffs (Smets, 2015) – in addition to being regulated by

Ministry of Home Affairs Decree No. 23/2006 (Adi & Achwan, 2018; Hadipuro, 2010). The progress of PDAM Surabaya is monitored through an annual report on the company's finances and key performance indicators, which are determined by the mayor (interview 4). Moreover, every five years, PDAM Surabaya has to present a corporate strategy that includes the current status of Surabaya's water supply and a detailed plan for how the mayor's goals will be implemented. This strategy requires the approval of the mayor. This plan is followed up by annual action plans, which also need the approval of the local government. Both plans have to be in accordance with the Master Plan of the Drinking Water Supply System (Revisi Rencana Induk Sistem Penyediaan Air Minum) and Cipta Karya East Java's spatial plan (Rencana Tata Ruang Wilayah) (interview 3). Cipta Karya East Java is a provincial unit formed by the Ministry of Public Works and Public Housing, which is responsible for aligning local and provincial interests and plans. Thus, PDAM Surabaya mainly executes the plans and goals of the local government and has little influence in establishing its own targets (interview 3).

PDAM Surabaya was established as a business corporation, so it has to recover its operational costs. The company generates revenues by supplying their customers with potable water. In addition to recovering operational costs, 55% of the remaining profits are to be paid to the local government (interview 4). Although some PDAMs in the region which do not meet an 80% service coverage are freed from obligations to contribute to government income, according to Surat Edaran Menteri Dalam Negeri Nomor 690/477/SJ (Ministry of Home Affairs, 2009), the water utility model remains based on cost recovery, and PDAM Surabaya's obligations to the government are enforced since its coverage is higher than 80%. The need to focus on cost recovery means the utility's investments are mainly focused on profitable areas in which they expect to generate substantial revenues. This potentially blocks innovative developments, which may be less profitable. Indonesia is one of the richest countries in terms of available rainwater, but so far, this resource has not been harvested in Surabaya. Several proposals have been made to make rainwater accessible for Surabaya's citizens. PDAM Surabaya dismisses ideas of decentralized rainwater harvesting as this would reduce the water demand of the company's customers and thus cut into revenues (interview 3). Instead, the water supply company supports the idea of large-scale rainwater catchment systems that could supplement the raw water source for their business (interview 3).

Discussion: institutional inertia and the water-sensitive city

Institutional obstacles to Surabaya's transition

The potential for a transition of Surabaya towards a WSC varies among the paradigm's three pillars. The first pillar of the WSC demands diversified water sources and distribution infrastructure. Most stakeholders welcome the idea of alternative water sources, with 70% supporting this idea (stakeholder belief survey, see Table A3). Despite their favourable attitude, the current institutional arrangements inhibit the development of new water sources. The short-term planning horizon prevalent across organizations favours development projects with immediate impact and with no consideration for future water demand. Also, the low regional cooperation and cities' prioritization of their own individual interests hampers joint efforts of municipalities to develop more sources jointly. Another limitation concerns the profit orientation of PDAM Surabaya, which

leads them to reject solutions that would damage their business, like decentralized rainwater tanks. Moreover, currently no organization involved in Surabaya's water provision is officially responsible for initiating the development of new sources.

In contrast, most of the interviewees rejected the diversification of water distribution (stakeholder belief survey, see Table A3). Influential actors not only are convinced that it will be possible in the future to reach all inhabitants through a centralized water system, but also perceive it as the only desirable and acceptable solution. The firmly established ideal of the MII in this area and the perception of uniform service provision as a symbol of modernity and progress inhibit innovation and context-sensitive development. Similar observations have been made in other developing cities. David Nilsson (2016) describes that the government in Nairobi did not dare to aim for 'lower' infrastructural standards, as they felt political pressure to fulfil their promise of progress and development, which in their eyes is synonymous with Western ideals. He describes that, due to a permanent emulation of Western city standards, state actors are unable to recognize that their envisioned solutions will never be able to address the context-specific infrastructural problems of their city. This can be also seen in Surabaya, where most of the city's stakeholders seem to ignore the fact that the single distribution system they desire will never be able to give informal settlers access to water (interviews 2, 3).

From a system design standpoint, the existing separation of greywater from blackwater at the household level could open up opportunities for decentralized reuse. Yet, synthesizing the findings above, a transition towards a diversified system of water sources and distribution infrastructure seems improbable at present. At best, partial implementations of new sources supplied through centralized infrastructure might occur.

All interviewed stakeholders acknowledge that environmental protection and social concerns should play an important role in Surabaya's water sector, in accordance with the WSC's second pillar (stakeholder belief survey, see Table A3). This awareness is said to have only developed within the last few decades. However, despite awareness of the harmful effects of the severe pollution of the Brantas River, current institutional settings prevent an effective response to it. Organizational fragmentation and unclear allocation of responsibilities within Surabaya's water governance system prevent efficient coordination of control measures among stakeholders. Political priorities also prevent the punishment of polluting factories to foster the economic growth of the city. Moreover, most stakeholders think that water distribution should remain a profit-oriented business, and economic considerations should retain priority in the development of Surabaya's water provision.

In relation to the third pillar of the WSC, most stakeholders do not perceive institutional settings and the design of the water management system as decisive factors for the effectiveness and efficiency of the city's water provision. Therefore, current management arrangements are neither questioned nor open to debate. The high fragmentation and unclear attribution of competencies among actors are perceived as unchangeable settings in which one has to operate as effectively as possible. Equally, the strong influence of political interests or the potentially conflicting effects of the commercialization of the city's water utility are not discussed among stakeholders. Rather, persisting problems are attributed to insufficient technological knowledge or resources.

Windows of opportunity for change

The current water governance system impedes Surabaya's transition towards a water-sensitive city and reforms that are paramount for solving Surabaya's water provision problems. Understanding these institutional blockages (summarized in Figure 2) is vital for assessing possible access points for development actors to promote change. Aiming for an immediate system-wide transition, however, is unlikely to be successful (Bettini et al., 2015) as regime transformations might take up to 50 years (Werbeloff & Brown, 2016). It might even be undesirable for Surabaya to apply every idea of the WSC, as not all its concepts might fit the local context. In fact, no WSC exists today (Bichai & Cabrera Flamini, 2018; Hoekstra et al., 2018). Molle (2008) describes similar paradigms (like Integrated Water Resources Management) as 'nirvana concepts': portraits of how urban water management should ideally work. These concepts present an idealized contrast to existing conditions and problems. It is highly unlikely that the 'utopian' state portrayed in these concepts is ever achieved (Molle, 2008). The uncritical application of paradigms has been described as potentially precluding the emergence of locally preferable approaches and causing negative unintended effects (Giordano & Shah, 2014; Mguni, Herslund, & Jensen, 2016).

Instead, 'windows of opportunity' must be identified that allow a stepwise evolution of sustainability (Bettini et al., 2015). In Surabaya, such a potential starting point might be the development of alternative water sources. Most state actors view them as desirable (stakeholder belief survey, see Table A3), as conventional sources will not be able to meet the city's increasing water demand. Initiatives in this field might also receive political support, as the city major's goal to reach 100% coverage might be jeopardized by water shortage.

Bettini et al. (2015) suggest that cooperation on low-risk experimental projects could build trust among organizations. The experience of collaboration on small scale, where common goals already exist and no large investments are needed, will facilitate the building of new positive inter-organizational relations. These projects also offer a platform to share information and develop shared understandings and visions of Surabaya's future water provision. In Surabaya, the Green and Clean Competition and the Free from Waste Competition, established in 2005, might provide such an opportunity to experiment with the introduction of alternative water sources. Through yearly awards, the local government sets incentives for local communities to improve waste management within their neighbourhoods. Such initiatives strengthen community awareness and engagement, a key element in the WSC paradigm (Buurman & Padawangi, 2018; Wong & Brown, 2009). In recent years, the objectives of the competition have been expanded to include initiatives for wastewater treatment and reuse. Until now, Surabaya's government has presented the yearly competitions and related campaigns as great success stories (interview MA 7). However, the achievements in this area are still small (Mintorogo, Arifin, Canadarma, & Juniwati, 2015; Sholihah et al., 2017; UCLG, 2010).

Moreover, it is essential that these new forms of cooperation and introduction of new water provision approaches be integrated into regulatory frameworks. Otherwise, the newfound collaborative network and sustainability achievements might be easily lost by changes in the political landscape or the loss of key personalities (Werbeloff et al., 2016). Worse, abandoned or poorly maintained infrastructure as well as unanticipated uses can

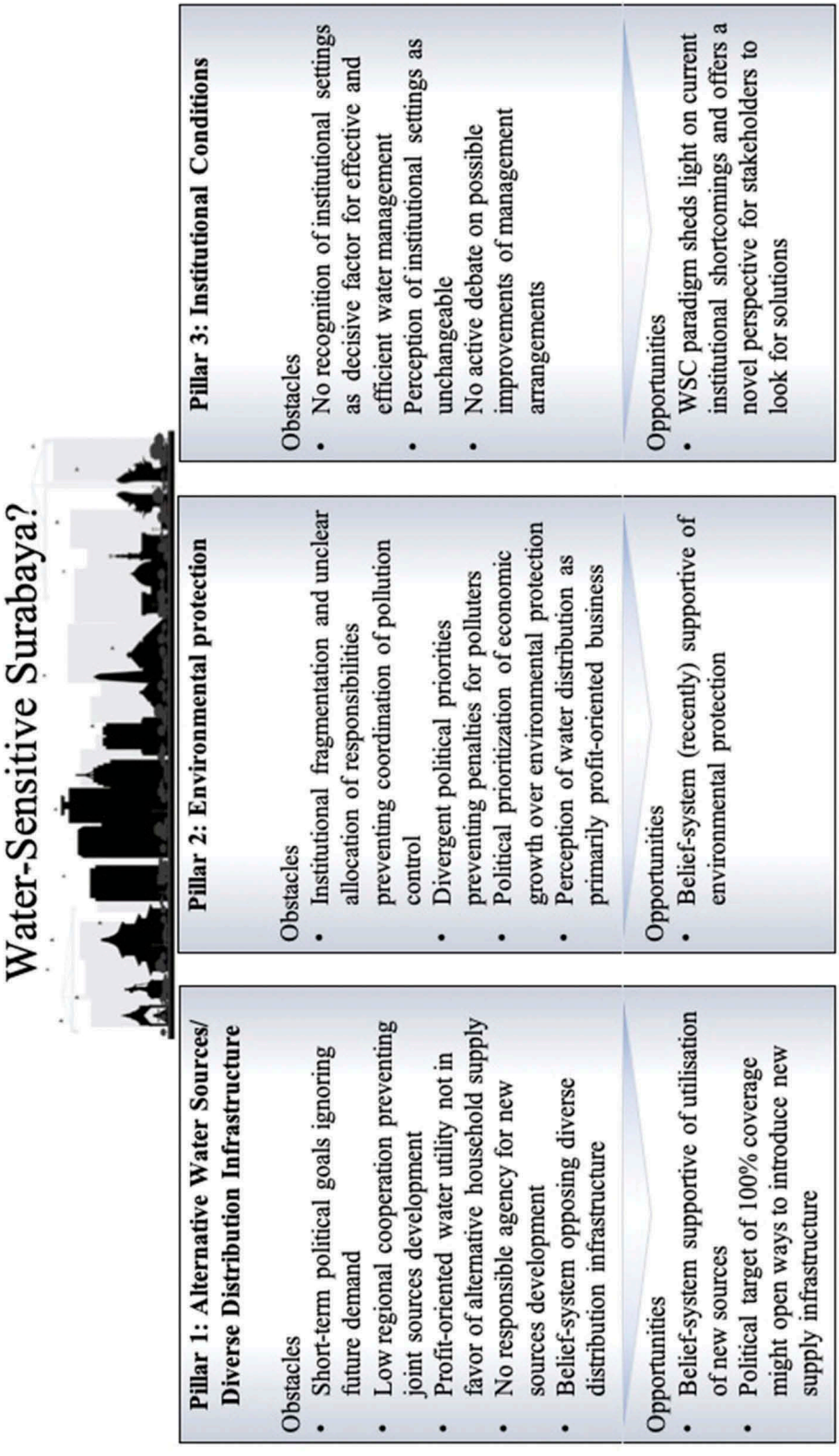

Figure 2. Summary of institutional obstacles to a water-sensitive Surabaya and windows of opportunity.

have severe negative impacts, like the creation of health threats or the rise of criminal activities (Mguni et al., 2016). So far, the community improvements in Surabaya have not found their way into official regulations. Therefore, the improvements remain isolated cases and may be easily lost if the community's commitment fades.

To achieve lasting transformation, the institutional settings in Surabaya need to be substantially reformed. Therefore, it is necessary that stakeholders first become aware of the problems that the current government structures are creating, and that these can be changed and shaped actively. An example of possible efficient institutional change can be found in the city of Malang, also located in the province of East Java. For many years in Malang, like in Surabaya, no organization was officially responsible for wastewater effluent monitoring. This changed when the city's political leaders officially assigned the task to the local water utility, PDAM Malang. Thus, responsibilities but also competencies became clearer, facilitating efficient action against domestic river pollution from all relevant actors.

Conclusion: Surabaya as a water-sensitive city?

The foregoing analysis of Surabaya's water governance system at a point in time contributes to documenting potential limitations and opportunities that arise from the globalized movement towards WSC-like paradigms in urban water management, especially when their application in the Global South is targeted. The WSC vision seems out of reach for Surabaya in its current situation. Traditional approaches of urban water management inherited from the MII still prevail. Even in areas where stakeholders' belief systems align with the WSC, the transition is impeded by current institutional settings. Against this backdrop, the application of the WSC water management paradigm in a location like Surabaya can be questioned. Although it is clear that, in Surabaya, the existing model of water management is problematic, it is unclear to what extent exporting such models can be helpful or harmful to the development of local solutions to water management problems. While a complete realization of the WSC paradigm seems questionable, the approach sheds light on current shortcomings in Surabaya's water provision system and offers a novel perspective for stakeholders to look for solutions.

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