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Analysing piped water service provider performance based on consumer perceptions

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ABSTRACT

A consumer perception survey was conducted across 13 WSPs in Cikarang, Indonesia, to evaluate WSP performance around water continuity, supply pressure, water quality, and tariff affordability. The results showed that: (1) most respondents place water continuity as the most important indicator and expect uninterrupted supply; (2) significant differences exist between respondent expectations and perceptions, where most respondents perceive WSP performance as lower than what they expect; (3) consumer perceptions of performance were better for privately owned WSPs than government WSP. In the absence of performance monitoring and water surveillance, consumer perception can provide accurate initial assessments on performance, especially in identifying WSPs that perform poorly.

1. Introduction

The former Millennium Development Goals (MDGs) drinking water target, as part of the United Nations' program to improve sustainable access to safe drinking water has previously been criticised (Clasen, 2012; Hutton and Chase, 2016; Satterthwaite, 2016). The target measures the number of households with improved water (WHO and UNICEF undated), but this has been criticised as it did not account for quality, quantity, and accessibility to water (Clasen, 2012; Hutton and Chase, 2016; Satterthwaite, 2016; Thomson and Koehler, 2016). It can also be argued that the target did not account for settlement characteristics, which would distinguish indicators between urban and rural settlements. Furthermore, Satterthwaite (2016) suggested that instead of improved water sources, water piped to premises should be the primary indicator to meet drinking water targets in urban areas.

The requirement for drinking water targets in the Sustainable Development Goals (SDGs), as a continuation of the MDGs, is an improvement, as it delineates water source into several levels or ladders: no service, unimproved, limited, basic and safely managed service levels (WHO and UNICEF, 2017b). The current ladder places water piped to premises on the highest rung (safely managed service level), as long as it satisfies the requirement that it is "available when needed and is free of faecal and priority chemical contaminations" (WHO and UNICEF, 2017b). However, this is a substantial challenge in urban water supply, especially in developing countries, where piped water supply is often poorly delivered (Bakker, 2010; Danilenko et al., 2014; Lee and Schwab, 2005). Therefore, to ensure that water is delivered at a safely managed service level, rigorous assessments on piped water service providers (WSPs) should be conducted.

Assessment of water service's performance indicators (PIs) is conducted on WSPs to evaluate their performance, and optimize the efficiency and effectiveness of their systems (Alegre and Association, 2006; Fekete and Stakhiv, 2014; Vilanova et al., 2015). From the government's point of view, surveillance on PIs is needed to ensure that WSPs deliver an adequate service level. Consequently, the PIs consist of certain categories and variables that significantly influence WSP performance and are frequently measured through performance monitoring. When PIs are able to meet the benchmark, it is assumed that a company is able to supply water at an adequate level to the community.

Performance monitoring is an important procedure conducted to understand the condition of water supply distribution systems and is a tool used for water surveillance. It provides data on the condition of water samples at the time of sampling and can be used to indicate the condition of the entire supply system (NHMRC, 2011; WHO, 2011). Consequently, it is important to prepare a proper sampling protocol that includes determining the required number of samples to be taken, sampling locations, sampling frequency and sampling time, and may result in a complicated procedure. The technical challenges associated with sampling requirements for water quality monitoring and poor enforcement (Steynberg, 2002) are possible reasons why performance monitoring is not conducted frequently, even in developed countries (Hunter et al., 2010).

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In contrast to performance monitoring, some institutions (NHMRC, 2011; WHO, 2011) and studies (de França Doria, 2010; Turgeon et al., 2004) support the need to gather information about PIs from the consumers' point of view as a validation of WSP performance (NHMRC, 2011). An added benefit of this approach is that incidents adversely affecting water supply can take place in locations that are not included in performance monitoring or occur outside of sampling times. Given that consumers are usually the first to notice and respond when affected by problems in a water supply distribution system, and especially in places where performance monitoring is conducted infrequently, consumer perception would be a suitable tool to obtain qualitative information on WSP performance.

The consumer-perception approach, which is known as Gap-5 of the service quality (SERVQUAL) model (Parasuraman et al., 1985; Zeithaml et al., 1988) is commonly used to measure service quality by comparing consumer expectation and perception (Zeithaml et al., 1988 in Sum Chau and Kao, 2009). In performance monitoring, it is common practice that PIs adopt a benchmark when comparing current with previous performance (Alegre and Association, 2006). For consumer-perception approach, the consumers' expectation is used as a benchmark, as it is influenced by "word of mouth communication, personal needs, and past experience" of service performance (Parasuraman et al., 1985; Zeithaml et al., 1988). In Gap-5, service quality is determined by considering five indicators: tangibles, reliability, responsiveness, assurance, and empathy (Parasuraman et al., 1985; Sum Chau and Kao, 2009; Zeithaml et al., 1988). In this research, we do not aim to evaluate a WSP as an entity providing a service to the consumer, but rather, to determine if its product, that is, piped water supply, meets consumers' expectations focusing on health and safety considerations. We propose to measure consumer satisfaction using the consumer-perception approach, albeit based on water supply related indicators.

Previous research related to consumer perception of water supply focussed largely on water quality (de França Doria, 2010; Turgeon et al., 2004). However, it is also important to gather consumer perceptions of other indicators of WSP performance, especially with regards to principles consistent with water availability as a human right and public health. In Indonesia, this is also consistent with the government's role in achieving the SDG drinking water target of "achieving universal and equitable access to safe and affordable drinking water for all by 2030" (United Nations, 2015). The objective of this research therefore, was to develop a measure of consumers' perception of WSP performance based on the SDG drinking water target. While the SDGs recognize other drinking water sources as improved water sources that could fulfil the target (WHO and UNICEF, 2017b), the discussion here will be limited to investigating the performance of piped water, as the highest rung of household drinking water source (WHO and UNICEF, 2017b), and the water source should be that devoted to urban settlements (Satterthwaite, 2016). The study area is Cikarang, an urban area in Kabupaten Bekasi, West Java, Indonesia. This area is served by several WSPs and performance monitoring on WSP PIs is limited (WHO and UN Water, 2015).

2. Performance indicators for sustainable development

The drinking water target of the SDGs is measured by quantifying the proportion of households with access to safely managed drinking water services (WHO and UNICEF, 2017a). Water is expected to be located at the premises, available when needed, and free of faecal and chemical contamination. This means that a safely managed drinking water source should satisfy accessibility, availability and quality criteria (WHO and UNICEF, 2017b). Here, water accessibility refers to the collection of water, which is not applicable for piped water service, the focus of this study. For this reason, the accessibility criterion is not considered. The term water availability requires water to be available in sufficient amounts above a minimum level, and without interruption (WHO and UNICEF, 2017b). The standards for availability vary. For example, Gleick (1996) states the need for 50 lpcpd[1] as a fundamental human right, The World Health Organization (WHO) refers to 20 lpcpd for basic access (Howard and Bartram, 2003), and the Indonesian government (The Ministry of Home Affair Regulation, *Permendagri 23/2006*[2]) states 60 lpcpd or 10 m^3 per household per month is required for drinking purposes. For WSPs, the challenge to fulfil the availability requirement is mostly based on water continuity and supply pressure. The SDG drinking water target also requires water to be affordable for communities across socio-economic status and levels, thus resulting in an additional criterion of affordability, replacing accessibility. Consequently, there are four indicators to monitor WSP performance based on SDG drinking water targets: water continuity, supply pressure, water quality, and tariff affordability. These indicators were used in our study as benchmarks to evaluate the performance of WSPs in our study.

2.1. Water continuity

The SDG target calls for drinking water to be available when needed. Ideally, this means that water flows from the tap whenever required. In reality, piped water in many developing countries flow intermittently and for less than 24 h per day (Bakker, 2010; Danilenko et al., 2014; Lee and Schwab, 2005) and there will be times when households do not have access to water. When the service is delayed for longer periods of time, minimum household water requirements may not be met. Intermittent water service can also cause contamination in the distribution system (Kumpel and Nelson, 2013; Lee and Schwab, 2005; WHO, 2011), increase the risk of households reducing water consumption to less than minimum requirements, and increase the risk of households adopting less hygienic practices (Fan et al., 2014). For these reasons, it is important to provide water consistently over 24 h per day, in the interest of public health.

2.2. Supply pressure

Supply pressure plays an important role in water supply. If supply pressure is very low, households will require more time to receive the water they need. Unfortunately, low supply pressure is a common problem in developing countries, at the extreme being available only in drips (Lee and Schwab, 2005). Research has shown that low supply pressure can also cause flow reversals and contribute to water contamination (Lee and Schwab, 2005; WHO, 2011). This can, in turn, cause users to turn to alternative water sources which may be less safe (Bakker, 2007). For these reasons, supply pressure is also suggested as a performance indicator in WHO guidelines (WHO, 2011).

2.3. Water quality

This indicator might be the most important aspect of public health and is a key aspect for MDG and SDG water and sanitation goals. The most significant concern is that unsafe water, together with poor sanitation, can lead to diarrhoea, which is a major cause of child mortality and other diseases (Wolf et al., 2014). Therefore, the SDG safe water target aims for every household to have access to drinking water in "good" condition, free from faecal and chemical contamination (WHO and UNICEF, 2017a). The WHO (2011) provides guidelines that are used as a benchmark for water quality standards internationally.

2.4. Tariff affordability

This indicator is needed to ensure the achievement of "affordable drinking water for all" (WHO and UNICEF, 2017a). As for the case of

[1] lpcpd = litre per capita per day.

[2] The regulation was renewed by *Permendagri No. 71/2016*, but the contents discussed here were unchanged.