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Practical Paper

Revenue augmentation through improved water supply services: a case study of the SMART-WASA team of Faisalabad, Pakistan

R. Ogata[a,*], S. Segawa[b], S. Rashid[c] and H. Nakayama[a]

[a] JICA, Niban-cho, Chiyoda-ku, Tokyo, Japan
[b] Yokohama Waterworks Bureau, Yokohama City, Japan
[c] Water and Sanitation Agency Faisalabad, Faisalabad, Pakistan
*Corresponding author. E-mail: ogata.ryuji2@jica.go.jp

RO, 0000-0003-1440-7963

ABSTRACT

The Water and Sanitation Agency of Faisalabad has tried to increase its revenue by increasing both its water demands and total number of customers. To this end, a pilot activity was implemented. Two selected pilot areas were hydraulically separated to increase water pressures within the areas. The results showed that the durations of water supply increased from 3.5 to 12 hours and from 6 to 18 hours per day in the pilot areas. The water pressure in each pilot area increased from 2 to 10 m and from 3 to 18 m, respectively. Wastewater contamination was also eliminated after increasing the water pressure. Customers were informed of these achievements through workshops, flyers, and banners on streets, which encouraged them to shift from a flat rate system to a metering system. Consequently, the total billed amounts for two pilot areas in March 2019 increased by 65.0% and 97.0%, compared with those from November 2016. The bill collection ratios also increased from 48.2% to 56.9% and from 48.1% to 60.6% during pilot activities. Improving services of water supply utilities through the formation of a water distribution area with an increase in water pressure is recommended as an effective method for revenue augmentation.

Key words: hydraulic separation, Pakistan, revenue augmentation, service improvement, willingness to pay

HIGHLIGHTS

- Water supply services were improved in an attempt to augment revenue.
- The pilot areas were hydraulically separated as distribution management areas to increase their water pressures.
- Water pressure and duration of water supply both significantly increased following service improvements, and wastewater contamination was eliminated.
- The total revenues of the two pilot areas increased by 65.0 and 97.0%.

INTRODUCTION

The ability to access potable water in a sustainable manner is essential to achieve the United Nations (UN) sustainable development goal (SDG) 6.1 (United Nations General Assembly 2015). Access to drinking water in terms of urban water supply can be improved through better water supply services such as improvement of water pressure, water quality and duration of water supply time. Faisalabad city is located in the Punjab Province of Pakistan for which the national ratio of water access was 91% in 2017 (JMP 2019). It is the nation's third largest city, with a population of 3.3 million people (WASA Faisalabad 2021).

Although the Water and Sanitation Agency Faisalabad (WASA-F) has the infrastructure to supply approximately 500,000 m^3 of water per day, only half of that amount is actually supplied, owing to the high operation costs of transmission and distribution pumping (JICA *et al.* 2019). In addition, WASA-F had adopted a flat rate system, in which tariffs were based on the sizes of customers' properties and not the amounts of water that they use (Ahmad *et al.* 2017). Therefore, increasing the water supply to customers might not increase WASA-F's revenue. Owing to its high operation costs and this flat rate system, WASA-F currently only supplies water for at best 6 hours per day.

The existing distribution network of WASA-F was expanded as the supplying area was widened without the necessary proper planning, which resulted in many water pipes in the city being internally connected without clear boundaries. Therefore, it is difficult to establish an efficient water distribution network, and the water pressure generated at water treatment plants or overhead reservoirs quickly disappears in the vast distribution network. As a result, customers currently receive only 2–3 m of water pressure at their taps.

In the aforementioned situation, the Government of Punjab, with support from the Japan International Cooperation Agency (JICA), began to formulate a long-term master plan for the development of water supply, sewerage, and drainage, together with improving the management of WASA-F (JICA *et al.* 2019). In this master plan project from July 2016 to June 2019, a pilot activity was conducted with the aim of providing better water supply services through the establishment of a hydraulically separated distribution system that has its own ground storage tank (GST), overhead reservoir (OHR) and isolated distribution network. The concept of the pilot activity came from the idea that urban residences in Pakistan would be willing to pay more for better water services (Akram *et al.* 2011; Asim & Lohano 2015), and that customers' satisfaction would change from a vicious to a virtuous spiral regarding water supply services (Figure 1).

METHODS

During the master plan project, a taskforce team named 'SMART WASA (Supply Management and Revenue Team)' was formed within WASA-F to conduct the pilot activity from November 2016 to March 2019. This team was designed to be cross-organizational; its members consisted of WASA-F staff in the related sections of geographical information systems, water distribution, and revenue recovery. Two areas (Sarfraz Colony, which had 844 households and 487 water connections, and Madina Town, which had 1040 households and 322 water connections) were selected as pilot areas (Figure 2) because they had a sufficient water source and enough capacity of GSTs and OHRs to achieve the targets of the pilot activity.

The targets of the pilot activity were as follows:

- Establish a new water distribution system through hydraulic separation
- Detect and formalize unregistered and illegal connections
- Achieve a continuous water supply at least for 12 hours per day
- Ensure appropriate water pressure (12 m or more) at water taps
- Increase water connection ratios and customer satisfaction
- Shift to a metering system and using the change to improve WASA-F's revenue.

In the pilot areas, new water distribution pipelines were laid around the outer circumferences of the areas covered by the GSTs and OHRs, and all distribution pipes coming from outside of these areas were disconnected to make the water distribution areas isolated (Figure 3). The only exceptions were the main lines for which water flows were controlled with valves.

In addition to physically improving the water distribution system, a standard operation procedure (SOP) was developed to shift to a metering system. Moreover, a check sheet was prepared so that staff in the field could install water meters properly and record the amount of water usage correctly. Combined with on-the-job training, these actions successfully established meter reading systems in the pilot areas. Furthermore, to promote an understanding of metering systems, public relations (PR) activities toward residents in the pilot areas were also implemented through workshops, PR activities in mosques,

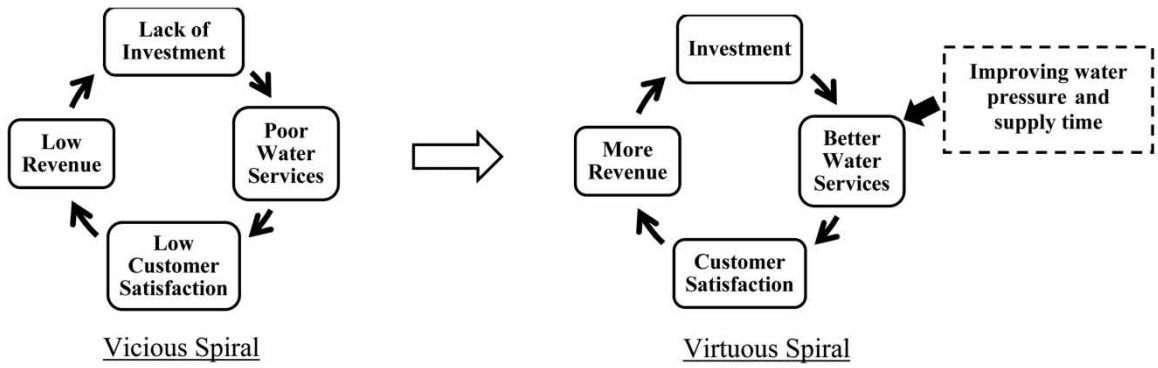

Figure 1 | Conversion from a vicious spiral to a virtuous spiral.

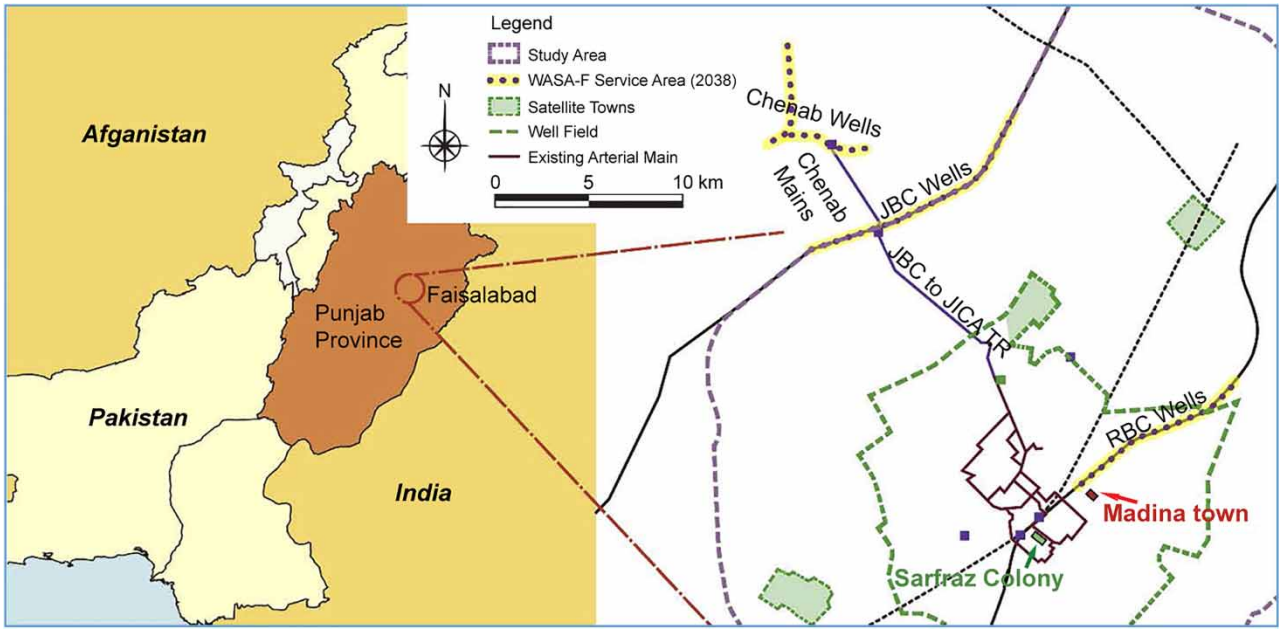

Figure 2 | Location of Sarfraz Colony and Madina Town (JICA *et al.* 2019).

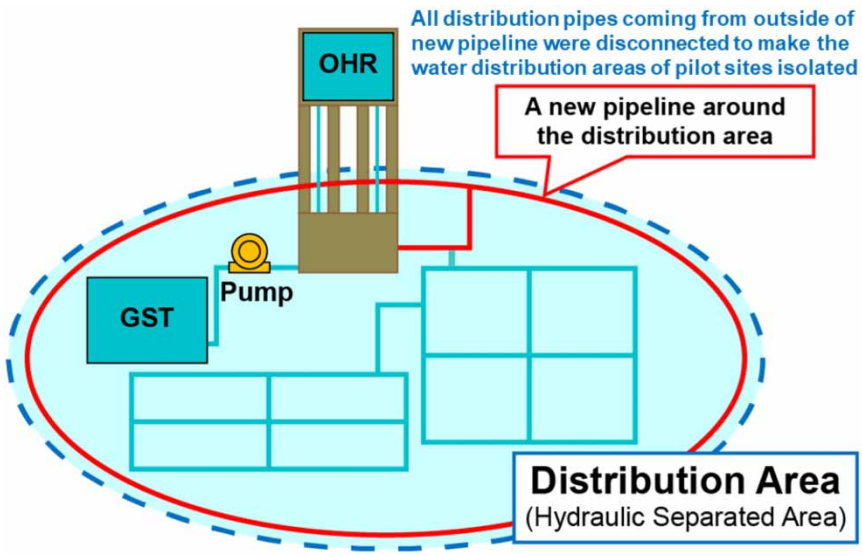

Figure 3 | Illustration of hydraulic separation (GST: ground storage tank, OHR: overhead reservoir) (JICA *et al.* 2019).

flyer distribution, and banner display on streets. SMART-WASA members also implemented door-to-door visits to confirm the water supply status in each house, announce the start of improved water services, and ask customers to pay their water bills.

RESULTS AND DISCUSSION

By disconnecting most of the pipelines connected to the outsides of the pilot areas, the amounts of outflows from the OHRs to the outside areas were significantly reduced. As a result, water pressure in Sarfraz Colony was increased from 2–3 m to 7–10 m, and its water supply time also increased from 3.5 to 12 hours per day; moreover, claims of odors from wastewater contamination were not heard. In Madina Town, water leakages were frequently discovered at the joints of distribution pipes and service branches due to poor construction and poor-quality materials. After the leakages were repaired, complete

hydraulic separation was achieved with more than 18 m of water pressure, and a water supply of 18 hours per day was secured. There was no significant negative impact to the outside of the pilot areas because the main water pipes were not affected and water supply was supplemented from other pipelines.

In addition to improving the water supply services, PR activities helped customers to realize that the new situation differed from WASA-F's past water supply services. The site survey during the pilot activity showed that as customer satisfaction increased and more customers connected to WASA-F's services and expressed willingness to pay their bills. This increase in the number of paying customers led to an increase in revenue for WASA-F.

Water meters were installed to change the billing system for all customers in the pilot areas with the agreements of the users. WASA-F installed 577 water meters in Sarfraz Colony and 350 water meters in Madina Town. However, before the start of a new metering system, WASA-F needed a preparatory period to set appropriate tariffs, establish accounting procedures, and provide training to meter-readers by following the SOP created by the project. In December 2018, 2 years after the project started in November 2016, the first metering system was launched in Sarfraz Colony, followed soon by the second launch in Madina Town.

Following the pilot activity in Sarfraz Colony, the bill collection ratio increased from 48.2% to 56.9% and the number of customers increased from 487 to 592 connections (+21.6%). In Madina Town, the bill collection ratio also increased from 48.1% to 60.6%, and the number of customers increased from 332 to 350 connections (+9%). During the period of pilot activity from November 2016 to March 2019, the billed amount that reflects instant credit for WASA-F also increased by 65% in Sarfraz Colony and by 97% in Madina Town (Table 1).

CONCLUSIONS

Water supply utilities generally apply to increase their revenues using the traditional method of reducing non-revenue water (NRW) that consists of leakage reduction, meter repair, and commercial activities, which is a traditional method that is

Table 1 | Key figures before and after the pilot activities in the pilot areas (Source: JICA *et al.* 2019)

	As of Nov. 2016	As of Mar. 2019	Remarks
Sarfraz Colony			
Water tariff system	Flat rate	Metered rate	
Billed amount	Average: 1.90USD Total: 928.03USD	Average: 2.58USD Total: 1,530.97USD	+ 35.5% per connection +65.0%
Water supply time	3.5 hours	12 hours	
Water pressure	2–3 m	7–10 m	Water can reach 2nd floor
Water quality	Contamination was observed	No complaints of contamination were expressed by the customers	
Bill collection	48.2%	56.9%	
No. of conns.	487	592	+ 21.6%, +105
Madina Town			
Water tariff system	Flat rate	Metered rate	
Billed amount	Average: 1.37USD Total: 444.43USD	Average: 2.51USD Total: 875.42USD	+ 82.6% per connection +97.0%
Water supply time	6 hours	18 hours	
Water pressure	2–3 m	18 m	Water can reach 3rd floor
Water quality	Odors from water noted	Odors from water not noted	Odors generated by wastewater contamination
Bill collection	48.1%	60.6%	
No. of conns.	322	350	+ 9%, +28

(1USD = 104.85PKR, as of December 2017).

widely used by water supply providers worldwide (Dimaano 2015; Mukherjee *et al.* 2015; Karimlou *et al.* 2020). However, this study presents the first trial by WASA-F to increase revenue by not only reducing NRW in the traditional way but also by improving its water supply services of water pressure and supply time. To achieve this objective, hydraulically separated distribution systems were introduced in both Sarfraz Colony and Madina Town, resulting in an increased duration of water supply time in both areas. The water pressure also increased significantly in both of these pilot areas. More importantly, wastewater contamination was not observed at any house in the pilot areas upon completion of the pilot activity. These improvements in water supply services demonstrated by the pilot activity raised customer satisfaction, which increased their willingness to pay, thus increasing WASA-F's revenue. These findings prove that the pilot activity triggered a conversion from a vicious spiral to a virtuous one. To realize this conversion, a hydraulic separation area carefully designed to minimize its negative impact outside the area is required and water supply utilities must have a willingness to change themselves based on this opportunity. WASA-F plans to expand this successful change beyond the pilot areas.

DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

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