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Empowering Traditional Education Institution through the Implementation of Potable Water Provision System

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ABSTRACT

The activity reported in this journal was aimed to empower the traditional education institutions commonly found and not formally financed by government of Indonesia. Empowering was carried out through the implementation of an action plan to ensure the potable water provision. Clean as well as potable water is indispensable for daily life and activities of students and teachers, especially those who were living and boarding in the school complex. The action was also potential to improve the financial independence of organization and to develop the entrepreneurship skills of students. The obtained tangible results of the action were in the form of production facility with ready-to-drink water quality of less than 10 ppm (parts per million) of total dissolved solids.

Keywords empowering; financial independence; potable water; total dissolved solids; traditional education institutions
Paper type Research paper

INTRODUCTION

All human beings need water to survive. Sixty percent of human body weight is made up of water. Water can be found in many parts of the cells, organs, and tissues, to help regulate body temperature and maintain other bodily functions. Human bodies lose water through breathing, sweating, and digestion, so it is crucial to rehydrate and replace water by drinking fluids and eating foods that contain water. Consequently, the guarantee of drinking water availability in every household is non-negotiable. The United Nation (UN) even declared that access to safe drinking water as a fundamental human right, and an essential step towards improving living standards [1,2]. It was one of the main goal of Milenium Development Goals (UN-MDGs) and it is also one of the main goal of the Sustainable Development Goals (SDGs).

Tarbiyatul Iman Islamic Boarding School is an educational institution located in Malang city of Indonesia. The potable water availability in this school has been a challenging problem to solve. The building location is abundant with well water sources but the quality of water is not sufficiently healthy to drink. So far, the drinking water needs have been fulfilled by buying water in gallons, which requires a considerable amount of spending considering the large number of water needs.

Tarbiyatul Iman Islamic Boarding School is basically one form of the long established traditional Islamic education institutions in Indonesia. Two most common examples of traditional Islamic education schools in Indonesia are 'madrasah' and 'pesantren'. In these types of educational institutions, only religious studies courses were mainly taught. Students normally live together on-site or around the location of schools and study under the guidance of teachers, being known as 'kiai'.

Education in traditional Islamic institution cannot be exempted from the influence of globalization. Efforts to modernize the traditional education must always be pursued to keep up with the social and technological developments. These educational institutions are required to be able to produce graduates who in turn have the ability to adapt to any changes, and have the ability and willingness to learn throughout their life. Modernization of traditional Islamic education institutions is in general pioneered by scholars and graduates who have been experiencing and much exposed to modern education systems and facilities.

The modernization in terms of education curriculum has been implemented not only by covering merely religious studies course but also by implementing the national curricula. It has been proven to produce quality graduates with intellectual intelligence, emotional and spiritual well-balanced [3-6]. These modernized types of Islamic education are now becoming the ideal forms and more and more attractive to many upper-middle class of moslem communities. Although in general it costs higher than common schools, the society does not mind paying more considering the benefits they expect to gain.

The provision of a good drinking water installation is one of the efforts to improve the facilities to support the modernization of the Tarbiyatul Iman Islamic Boarding School. It is a very important daily life support for the students living in general in the dormitories; consequently, it is urgently needed to strengthen the institution's role in the education system in Indonesia.

This paper explores the modernization of the Tarbiyatul Iman Islamic Boarding School through the implementation of a drinking water facility improvement project. The related possibility to create and grow entrepreneurship which is potential to empower the school and students is also to be investigated. It is expected that the success of this project can be transmitted to various other traditional Islamic boarding schools, furthermore strengthening the efforts to produce quality Indonesian people.

METHOD

Purpose of the Project

The purpose of the project is to create a water treatment system to provide potable/drinking water for the residing students and teachers of the Tarbiyatul Iman Islamic Boarding School in Malang city of Indonesia (Fig. 1). The object of technology implementation in this project is the treatment process of well water using reverse osmosis (RO) method. The water purification process technology is used to provide ready-to-drink water for the school residents.

The partner of this project is the Tarbiyatul Iman Islamic Boarding School in Malang city of Indonesia. This boarding school is one of the educational institutions under the Putera Zaman Education Institute, which forms a *pesantren*-based educational program. It was established as an actual response in the form of the need for a generation of moslems who have the concern and ability for community development.

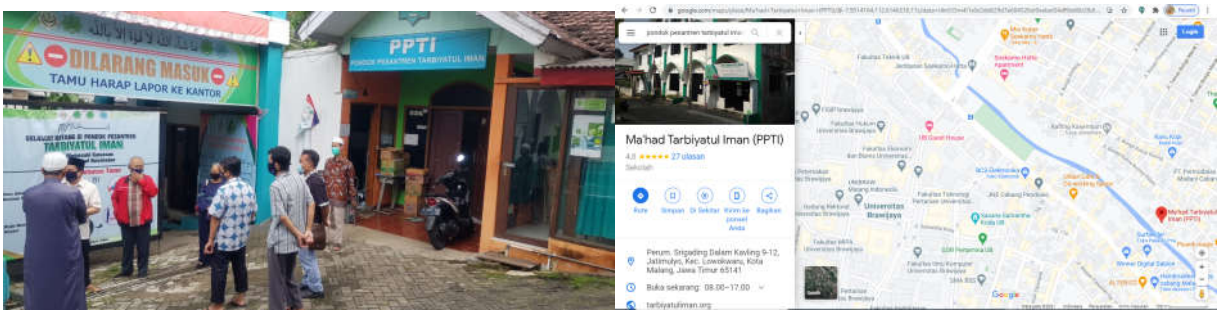


Fig. 1. Tarbiyatul Iman Islamic Boarding School in Malang city of Indonesia.

Problem of Existing Water Provision System

The problem of the availability of clean, ready-to-drink water in Tarbiyatul Iman Islamic Boarding School has been a challenge because in terms of location, it is blessed with abundant well water sources but the quality is not sufficient to become ready-to-drink water. So far, the fulfillment of drinking water needs in the school has been carried out by buying gallons of water or using tap water supply. Both require a considerable expense for the drinking consumption, considering the large number of water needs for students, teachers and administrators of the school. The total number of students as well as teachers in this school are 144 people, consisting of 73 students on the primary level, 33 students on the secondary level, and a total of 38 teachers and some school managers.

On the other hand, there is abundant bored ground-water on site with a water discharge of around 176.67 liters/minute or 2.94 liters/second. However, based on measurement data, the Total Dissolve Solid (TDS) of the water is around 215 ppm (being shown in Fig. 2), which is still too high being compared to the TDS standard value for drinking water. The drinking water treatment process is carried out to obtain a total content of dissolved solid (TDS) smaller than the maximum standard value, which is 10 ppm.

The second problem is the need to empower the *pesantren* community by benefitting the abundant water resources in their area to create economic opportunities. Considering the potential and willingness of the students, teachers, and managers of the school, the implementation of the proposed solution and technology will become the capital asset in economic perspective.

Proposed Solution Method

In the frame of empowering the boarding school in terms of facility improvement, the main concern of the project is to transfer appropriate technology to overcome the previously mentioned problem. The potable water provision challenge is to be solved by applying technology diffusion in the form of processing well water into ready-to-drink water being equipped with the related monitoring system of the water quality. Ready-to-drink water treatment using the reverse-osmosis technique is a practical solution for partners in overcoming the problem of providing potable water, because it is

processed directly from the water potential on-site of the school location area and is also managed by the school community.

Fig. 2. Total Dissolve Solid (TDS) content of the water from the existing ground source.

The solutions are transferred in the form of hands-on training for the school community concerning the applied technology understanding as well as the facility management and the water quality monitoring techniques. The monitoring is indispensable to maintain the water quality in terms of low content of total dissolved solids. The reverse osmosis method is applied and disseminated to the school residents so that the fulfillment of drinking water needs can be done independently by their own.

As a capital asset, the applied technology is to be improved to create and increase the potential economic productivity of the *pesantren* community. The water excess of the treatment result may be furthermore bottled, packaged and commercialized as ready-to-drink bottled water for the surrounding community and consumers in general. It will reduce the operation cost as well as become the new source of funding for the school. It is also expected that they gain knowledge and skills in ready-to-drink water treatment while increasing the entrepreneurship potential and the economy independence of the school community. Entrepreneurship skills can be grown to support the water selling system and to improve the welfare of the school residents.

RESULTS AND DISCUSSION

The implementation results of the potable water provision system technology to empower the Tarbiyatul Iman Islamic Boarding School include: a) the design and construction of the water purification system and the related water quality monitoring system, b) technology and management knowledge transfer. They are described as follows.

Water Purification Process and its Monitoring System

The reverse osmosis technology has been applied for the drinking water treatment in this project. The process has been carried out by applying high pressure to water which is flowing through a semi-permeable membrane. The ion separation occurring in the membrane will make the water molecules form a barrier to block the passage of almost all contaminants while allowing the water molecules to pass through. The rejection may happen due to size exclusion, charge exclusion and physical–chemical interactions between solute, solvent and membrane [7-8]. The rejection rate can be in the range of 85-95% depending on operational parameters and on membrane and feed water properties like initial quality of the treated water.

It is known that many technologies and methods are effective for removing a number of contaminants, but no single technology known can remove all contaminants. Specific technologies or a combination of several technologies are usually used to address certain condition of raw water quality problems that will be processed into drinking water [9-10]. Applying the combination of technologies, the purification process will be carried out in several stages (multi-staging). Each stage serves to remove certain contaminants. The technology used at each stage, as well as the number of stages used will determine the quality of the water produced. The reverse osmosis technology can be applied to various scales of use needed such as for urban, industrial, and household scales.

Some equipment and tools being used in the water purification process in this project are given in Fig. 3.

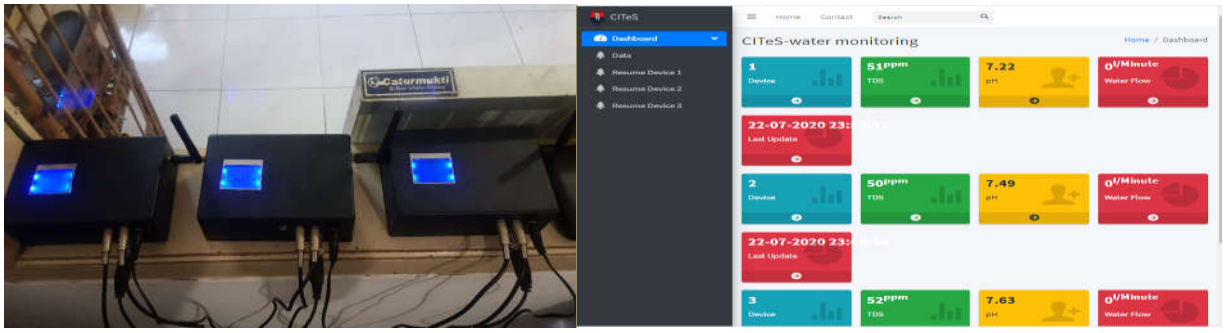
Fig. 3. The equipment for water purification process.

The design of a digital drinking water quality monitoring tool is made based on the measurement of the TDS and pH parameters of the water. In addition, water flow is used to determine the condition of the membrane. If the water flow decreases from normal conditions, it is necessary to check the reverse osmosis membrane, because there may be a blockage. The calibration process of equipment for water quality monitoring system is presented in Fig. 4. As seen, there are flow sensor, TDS sensor, and pH sensor.

(a) (b) (c)

Fig. 4. The calibration of equipment for water quality monitoring system: a) flow sensor, b) TDS sensor, c) pH sensor.

The integration of the three sensors is then combined with the processor and communication module for the three devices. The three sets of monitoring tools that have been integrated and equipped with a communication module using Wi-Fi can then be used to send results to the website, as shown in Fig. 5.



(a) (b)

Fig. 5. The system integration (a), and the web-base monitoring system (b).

The results of the TDS measurement using a digital TDS meter that has been installed before and after tuning the membrane and filter are shown in Fig. 6. The tuning succeeded in suppressing the TDS value from 17.22 ppm to 2.96 ppm. This is a very good result as it can be adapted to the needs.

(a) (b)

Fig. 6. The installed reverse-osmosis machine (a) and the resulted TDS content after the tuning of membrane and filter (b).

Technology and Management Knowledge Transfer

Knowledge is the most important resource within an organization [11], including in Tarbiyatul Iman Islamic Boarding School. Management knowledge serves to further improve the benefit gained from the implementation of water treatment technology. The technology transferred needs to be managed and improved for more advantage to gain. Management

knowledge has been transferred to create and strengthen the entrepreneurial spirit and skills among the school community member, involving the students, teachers, as well as the school management board.

The creation of special team in the community was aimed to handle the operation and maintenance of the installed water purification system. The team should always be prepared for any trouble encountered during the operation of the system. Another special team is responsible for the creation of drinking water product for commercialization of the excess of water treatment result. The economic productivity will furthermore support the financing independence of their other needs beyond the potable water need.

CONCLUSION

The project for the installation and management of a drinking water treatment system is intended so that residents of Islamic boarding schools, especially students, can have access to proper and healthy drinking water. It is very important to maintain the health of students, as they become the future generation of the nation. In addition, technology transfer and marketing management of the excess products from water purification installations are also aimed at supporting the economic independence program of the *pesantren* community. The choice of the technology has been based on the availability of abundant well water and the potential ease of operating and maintaining the installation being built. The results of the activities provide the schools in fulfilling the high needs of drinking water for their students and producing economic independence by creating entrepreneurial activities from the results of the application of diffused technology, as well as reducing the operational costs of the boarding schools for the drinking water expense.

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