

# Information technology as a less resources consumption system to support river water

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**Submission date:** 31-Aug-2023 11:36AM (UTC+0700)

**Submission ID:** 2154776015

**File name:** s\_a\_less\_resources\_consumption\_system\_to\_support\_river\_water.pdf (691.57K)

**Word count:** 2493

**Character count:** 14312

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To cite this article: Y M Yustiani *et al* 2021 *IOP Conf. Ser.: Mater. Sci. Eng.* **1098** 052021

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## Information technology as a less resources consumption system to support river water quality monitoring activity in Indonesia

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**Abstract.** The current river's condition in Indonesia has decreased in water quality, especially in big cities. The rivers have been polluted by domestic and non-domestic waste. Therefore, the Government has to monitor rivers water quality periodically to see its condition of the rivers water quality. Utilization of the information technology in river quality monitoring is one of the less resources consumption. This study aims to investigate the development of information technology in big cities in order to support to monitoring river water quality. This study is carried out with literature and references reviews as well as expert interviews. The results showed that the information technology has not yet been applied to monitor rivers in Indonesia. Several efforts have been started, but the systems are still incomplete. Although smart water program has been adopted in Indonesia, it shows problem in its sustainability due to financial difficulty, devices durability, and connection instability. To overcome these obstacles, it is recommended that government should have strong inter-collaboration between divisions and partnership with other institutions.

### 1. Introduction

In developing countries, rivers passing through urban areas are continuously being polluted due to discharge of large amounts of raw or inadequately treated municipal wastewater [1]. Wastewaters discharged into rivers containing oxygen consuming elements and organisms usually deplete the oxygen concentration of the river water posing threat to the aquatic lives.

Many urban rivers in Indonesia suffer from heavy pollution. Their capabilities to perform self-purification appear relatively low and resulting in the deterioration of the water quality, physically, chemically and biologically [2]. The function of rivers as self-purification water body become very due to high pollutant content. Citarum River, for example, has a low pollution load capacity, especially during dry seasons [3]. Degradation of organic pollutants is primarily affected by the river water characteristic. Contaminants generated from industries can threat river capability of self-purification. Several indicators can be used to explain how the natural remediation of the river cannot be carried out [2].

To support pollution control activities in Indonesia, alternative information technology is needed, one of which is online monitoring of water quality in accordance with river conditions in Indonesia [4]. Utilization of the information technology in river quality monitoring is one of the less resources consumption. Even though the existence of information technology that supports monitoring river water



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quality in Indonesia can help various river water quality problems, especially for the government [5]. The use of information technology in efforts to manage river water quality should be encouraged so that it can have a positive impact on society and the environment.

This study aims to investigate the development of information technology (IT) in big cities in Indonesia. The research is focusing on the attempt of stakeholders and users of the IT in order to support the monitoring river water quality activities. The scope of this research is to look at several journals on information technology that support river water quality monitoring activities in Indonesia and abroad.

## 2. Methods

This study was conducted with a literature review related to information technology in monitoring river water quality efforts in major cities in developing countries, where the characteristics of the river are high in pollutants. In addition, literature review was also carried out from several developed countries as a comparison in the information technology system of river water quality monitoring.

This research was also conducted by means of in-depth interviews with experts in their fields, both government and private. The data analysis method used looks from the results of research conducted, by looking at information technology resources used in improving river quality monitoring in Indonesia.

## 3. Results and discussion

### 3.1. Information technology of environmental

The Ministry of Environment issues the Indonesian Environmental Status and Environmental Quality Index as an assessment of the Indonesian Environmental Environment. In addition to data sources on the environment, it also conveys information about human activities on the environment and social that are expected to be input for policy making in the application of sustainable development.

At this time, advances in information technology cannot be completed from various fields, because with this computer application can improve information systems, for example data that is processed to be more complete, accurate, easy and timely, so that the information generated will be able to support increased results related to management from planning to evaluating the Environmental pollution control program. In addition to seeing information on the status of the environment based on the territory it is very necessary to facilitate the implementation of interventions in each region [6].

When compared to China which is a region of high pollution the rebound effect of information technology on environmental pollution has played a major role, suggesting China's policy of using information technology to improve environmental quality is: unclear [7].

### 3.2. Utilization of IT for monitoring river quality in major cities in Indonesia

Monitoring pollution and river quality in Indonesia has not utilized information technology so that the results are less effective, less efficient, less informative, and less well documented [6]. Whereas with the advancement of information technology can assist the government in carrying out monitoring of river water quality and according to Koesnowo [8] with the availability of river water quality monitoring systems can also be utilized for law enforcement.

To overcome the above problems, the central and regional governments have implemented a number of efforts to conserve water resources, water pollution control programs, river restoration programs and several other programs whose results are expected to reduce the impact of pollution on the quality of the aquatic environment for the people of Indonesia. One of them is by utilizing the Online Monitoring Technology (ONLIMO) developed by BPPT since 2007 until now which has been widely applied in Indonesia specially to monitor river water quality in 19 Priority Watersheds [4]. Fig. 1 shows the ONLIMO display by the developer.



Figure 1. Web display ONLIMO [9].

So far the use of ONLIMO has had a positive impact on surface water quality, especially for KLHK (Ministry of Environment and Forestry of Republic of Indonesia) to monitor river water quality in some 19 priority watersheds. In addition to the PDAM (Water Supply Company) and several industries also has a positive impact by providing an overview of surface water quality online and in real time in several locations in Indonesia. Nevertheless, the use of ONLIMO has not been carried out evenly in all major cities in Indonesia. Fig. 2 shows the ONLIMO utilization by the KLHK.

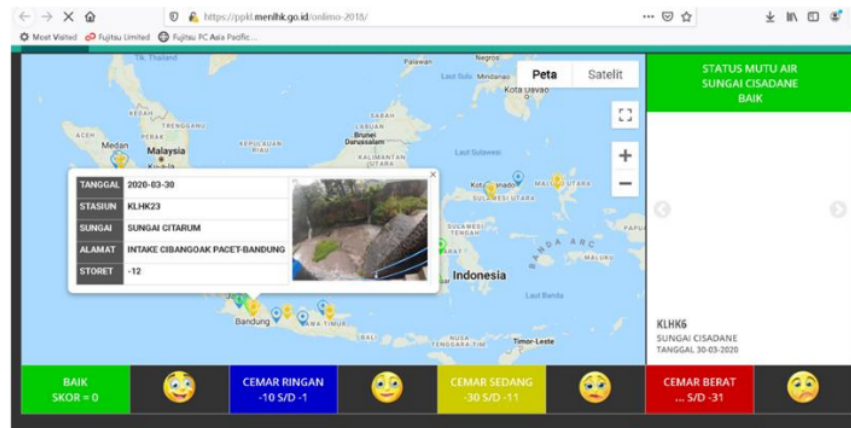


Figure 2. ONLIMO usage [10].

In addition, solutions that can be taken to overcome these problems are the technology of river water quality monitoring systems based on Wireless Sensor Network (WSN) and the Internet of Things (IoT) [11] as well as utilizing Geographic Information System (GIS) technology. Web-based for river water quality monitoring activities [6].

### 3.3. Smart water program

Digital technology can improve data collection and analytics to support proactive decisions and increase the efficiency of water utilities. Smart water management systems can provide a more resilient and efficient water supply system, reducing costs and improving sustainability [12].

The Government of Indonesia and the Government of Korea, established cooperation related to the implementation of the Smart Water Management System and the City of Denpasar became a pilot project for the implementation of this Information and Communication (ICT) based system [13]. According to the Head of Denpasar City DLHK, I Ketut Wisada said that his party was still waiting for the policy of the Ministry of Public Works and Public Housing of the Republic of Indonesia, to be able to carry out this pilot project, which was planned to be implemented in 2020-2022. But until now, the implementation of smart water management has not been carried out.

Countries that have tested smart water technology, such as the Republic of Korea, provide a model for the development of smart systems in the water sector, which includes turnkey solutions in equipment installation, training in technology/software use, and maintenance. A workshop in Seoul shared Korean expertise in smart technology and innovative policies for waste and wastewater management. Smart systems can provide accurate and up-to-date information that enable informed and systematic, rather than ad hoc, decision-making by water managers. These can automate tasks and reduce staffing requirements. For example, by employing smart technology, the Seoul Metropolitan Government in the Republic of Korea needs only 80 people to manage the city's water supply systems [12].

#### 3.4. *IT application constraints*

The current constraints are lack of coordination between sectors and stakeholders, and uneven ability to control environmental management reliably. Efforts have also begun, but the system is still incomplete. Although the smart water program has been adopted in Indonesia, as well as other information technology based on WSN, IoT, and GIS, this program shows problems in its sustainability due to financial difficulties, device durability, and connection instability.

The sustainability of the information system used is also relatively low, especially if the system is implemented in partial services. This is caused by unstable human resources and lack of supporting technology. In addition, unsustainable financial support is also a threat to the continuation of IT utilization for river management.

Another obstacle encountered in the use of information technology in displaying the results of river water quality monitoring is the concern of misuse of information for improper purposes [2]. The collected data must be filtered and selected before being an open access publication.

#### 3.5. *Recommendation*

The Indonesian government through ministries and departments related to environmental management has in fact carried out several activities that use information technology facilities. However, its usefulness is not widely known by potential users, such as academics, researchers, regional decision makers, etc. This resulted in the insignificant positive impact of the system that had been built.

The government must cooperate with other stakeholders such as experts, the private sector and the public in the use of this information technology. So that there is a synergic and strengthening relationship in the implementation of information technology, especially in monitoring river water quality.

Considering the financial constraints, the government should be able to reduce the cost of sampling activities in the field and then focus on the use of this information system. In addition to cost savings, IT will also reduce the consumption of other resources such as human resources, equipment, energy and time.

#### 4. **Conclusion**

This study is an initial attempt to investigate the development of information technology in major cities in Indonesia in order to support monitoring of river water quality. The results of research in general the use of information technology in Indonesia in monitoring the quality of the river water environment has been carried out, but many are still independent and not maximized as best as possible. Nevertheless, the Government has also sought information technology, one of which is utilizing the Online Monitoring Technology (ONLIMO) developed by BPPT in monitoring the quality of the river water environment. In addition, the government also adopted a smart water management system.

In an effort to monitor river water quality the government must synergize and cooperate with relevant stakeholders, experts and the private sector. In order to create actual information technology, so the results will be effective, efficient, informative, and well documented.

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