

# River Water Quality Modeling as A supporting tool

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## River water quality modeling as a supporting tool of river management in Indonesia

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**Abstract.** Many urban river water qualities in Indonesia have decrease due to both domestic and non-domestic wastewater discharges. One effort in restoring the river quality is by modeling of the river to determine the most appropriate actions to take. At present many river modeling have been carried out in order to restore river water quality. However, implication of modeling utilization is still insignificant. This study aims to investigate the application of water quality modeling in Indonesian urban rivers. Methods used in this study including expert interviews, previous research review, and data analysis. The research result gives condition that modeling is merely applied in limited function. Stakeholders sometimes doubt the modeling results. It is caused by several aspects of uncertainty, such as river discharge fluctuation, unstable pollution concentration, etc. In addition, the model used is often obtained from sub-tropical area, so there is a disparity of conditions with the environment in Indonesia. Nevertheless, water quality modeling plays an important role in environmental impact assessment as a prediction tool in Indonesia.

### 1. Introduction

The river is one of the natural resources that supports life. The function of rivers can be clean water for household and other activities and the river can also be a place for domestic and non-domestic wastewater discharge [1]. The importance of maintaining river water quality remains good so that the river can continue to be used as a source of clean water. However, seeing the development of population and industry many river water qualities in Indonesia has decreased both due to domestic and non-domestic discharge [2].

There have been several efforts to restore river water quality such as naturalization, normalization and others. River modeling is an effort to restore river quality. With the application of modeling in the river, the problems contained in the river can be identified more easily. River modeling can help in determining the most appropriate action to take [3].

At present many types of modeling have been carried out to restore the quality of water in rivers in Indonesia. In general, the purpose of modeling is to find out the amount of pollutant load from domestic and non-domestic waste. Then use a software that can present the desired model and then intervene from the model. The results of the modeling are used as consideration for the determination of an environmental policy [4].

The implication of the use of the model is still not significant considering the number of rivers in Indonesia that are still polluted. Though the model can help various problems, especially for the



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government. Several studies on river water quality modeling have been carried out, but there has been no in-depth analysis of the overall use of the modeling. This study aims to investigate the application of water quality modeling in Indonesian urban rivers. This research looked at several journals about modeling urban rivers in Indonesia and abroad then compared them.

## 2. Methodology

This research uses the literature study method through research and papers on modeling of urban river water quality that has been carried out in Indonesia. The research data used were 5 journals from river water quality modeling in Indonesia and to be used as a comparison from abroad also used 5 journals modeling river water quality abroad. The analysis carried out looks at the results of research conducted and the effect on the river based on actions taken by stakeholders or related parties.

## 3. Results and discussion

### 3.1. River water quality modeling

In Indonesia, river quality modeling has been carried out in many rivers. Most of the modeling is done just to see how the quality of river water using BOD and DO parameters because it is the most important parameter in determining the level of water pollution, considering that all life in nature requires oxygen [5]. It's a pity if the modeling is only used to see the quality of river water. In addition to knowing the quality of river water, modeling can be used to determine patterns of distribution of pollutants in river water [6] and create model scenarios aimed at getting the right policy picture in controlling pollution and maintaining river quality [4].

The results obtained are based on a journal analysis of river water quality modeling in Indonesia

- Research conducted by Budiman on the Ciliwung River makes 3 scenarios from the results of monitoring the water quality of the Ciliwung River. From each scenario given, it is always related to the government but there is still no action from the research [4].
- Research conducted by Susilowati et al and in collaboration with LIPI on the Mahakam River makes modeling and scenario analysis of the Mahakam River. The scenario results show how the river pollution and how things can be done but no further information from stakeholder action [5].
- Research conducted by Triane, D and Haryanto on the Ciliwung River by using and analyzing the BOD and DO parameters obtained succeeded in making a design of the management pattern for the Ciliwung River but there was no action either from stakeholders or the government [6].
- Research conducted by Hendrianti and Kamaningroem on the Brantas River only to see the quality of the Brantas River [7].
- Research conducted by Yustiani et al on the Cikapundung river and funded by the Ministry of Research, Technology and Higher Education of the Republic of Indonesia to determine the deoxygenation condition of the Cikapundung river with BOD and DO parameters. There is no information on the implications of the government for the modeling [8].

From a number of research journals, no research has been used in legal purposes to prove that a factory is polluting the river.

### 3.2. Comparison of river water quality modeling in Indonesia and other countries

The research conducted by Hermant on the Godawari river, India is a model carried out not only to find out the river's water quality but also to evaluate the effectiveness of existing pollution control measures and to assess the nature and level of requirements of additional pollution control measures and assess water quality improvement as a result of implementation [9]. Another study conducted in India was a study conducted by Sarkar and Pandey on the Yamuna River which was carried out only to determine the quality of river water [10].

In Brazil research conducted by Menezes et al on the Ribeirão Vermelho river using BOD and DO parameters. Research results prove the quality of river water has deteriorated due to industrial, agricultural and municipal waste. But there is no info on the implications for enforcing the law of the waste [11]. In Turkey research carried out by Yuceer on the Beylerderesi River produced a study that could help predict the effects of planned industrial investment on water quality and assistance in the preparation Environmental Impact Assessments [12]. In Malaysia, a study was conducted by Osmi et al on the Malacca river with the results of making 5 scenario models and from that scenario can be used for other rivers in Malaysia but there is no information for the implications [13].

Both Indonesia and other countries have not seen the results of modeling that can make the industry exposed to the law due to the waste it discharges. Modeling in Indonesia is still of limited use. Stakeholders sometimes doubt the modeling results. It is caused by several aspects of uncertainty, such as river discharge fluctuation, unstable pollution concentration, etc. The stakeholders are interested mostly in the domestic source related pollutants [14]. In addition, the model used is often obtained from sub-tropical area. Indonesia is a country in the tropic, so there is a disparity of conditions with the environment in Indonesia. To improve stakeholder trust, coordinate incentives and routinely to discuss important matters.

### 3.3. Recommendation

The results from modeling need to be applied so that river quality can improve. This can be achieved if there is mutual trust between stakeholders and researchers. If the results of the modeling are not as expected, an evaluation needs to be done.

## 4. Conclusion

Most modeling in Indonesia only uses DO and BOD parameters. Because DO and BOD are important parameters in determining the level of water pollution. There are already enough rivers in Indonesia that have been modeled. However, there has been no results from modeling that is used as a legal route to prove factory violations both in Indonesia and abroad.

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