Strengthening Water Irrigation Management to Increase Water Usage Efficiency

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Abstract. The land-use change from agricultural to the industrial city took place in Karawang. Besides land conversion, transfer in water usage also increased for industrial needs. This is caused by poor water management in terms of distribution and control of water usage, mainly in the industrial and agricultural sectors. The area of irrigated land was reduced from 97,037 ha (2009) to 90,062 ha (2017), while the amount of dry land increased from 22,063 ha (2009) to 46,299 ha (2017). It showed that the lack of irrigation water management has an impact on the reduction of fertile paddy fields. Therefore, this research aims to formulate an action plan of water irrigation management. The study was conducted in West Telukjambe District, Karawang Regency. The method used stakeholder analysis. Data obtained from observation and interview data, irrigated land area, and the amount of irrigation water availability. The results showed the overlapping and missing roles of several stakeholders in charge of irrigation water management in West Telukjambe. Model simulations showed the increasing of irrigation serving area for additional management performance of each stakeholder. Therefore, the integrated management of irrigation systems needed to control the distribution and water irrigation efficient.

1. Introduction

One of the vital factor in wetland agriculture, especially rice paddy fields, is sufficient irrigation. Extensive irrigated land in Indonesia in 2016 reached 4,781,494.65 ha or 58.41% of total paddy fields in Indonesia 8,186,469.65 ha [1]. West Java has the irrigation field 913,975.70 ha or 80.34% of the total area of irrigated land, while the Karawang Regency has 95,876 ha of irrigated land in 2016 or 94.38% of the total area of paddy fields [1]. The high percentage of irrigated land area in Indonesia, especially in Karawang showed that rice fields in Indonesia productivity are highly dependent on the availability of irrigation water sourced from surface water.

However, the problems faced is the lack of management of water resources in irrigation management, especially in Karawang Regency have an impact on drought wetland for years and impactful on land-management practices by farmers. This was indicated by a decrease in irrigated land area in Karawang. In the period from 2009 to 2017, irrigated land area decreased by 3.515 ha, while the area of non-irrigated paddy fields / rainfed grows 2,201 ha in the same period of the year [6,7]. The data shown should be a concern that the decline in rice fields not only influenced by the conversion of paddy fields into the built-up area but also be affected by the lack of water supply as a significant factor of production in paddy
fields. Based on the results from observations and interviews on some farmers in Karawang regency, especially in West Telukjambe District, droughts land almost in all districts. This is because the supply of water from the main source / primary channel is not enough even dried. Such cases occur within a year at some point. This is an indication that the manager of the authorities still does not resolve the drought problem technically. Therefore, it is necessary to study the current state of irrigation water management in Karawang to know the problems that led to the slow handling of irrigation problems faced by farmers in Karawang.

2. Method

This research was conducted in the West Telukjambe District, Karawang Regency, West Java Province (figure 1). The study was conducted from August to September 2019. The District of West Telukjambe was selected as research area because 90% topography is dominated by plains with an average height of 20-57 meters, so this the area chosen for the development of agricultural land [2]. In addition, 79.8% of paddy fields in the district of West Telukjambe is paddy fields with technical irrigation [3].

![Figure 1. Study area](image)

The method used in this study is stakeholder analysis. A stakeholder analysis was chosen as the method of this study because of its function to parse and identify a person or institution has a part as the decision-maker and can identify opportunities respective stakeholders [4]. In addition, Stakeholders analysis is used to evaluate and understand the stakeholders and determine their relevance to policy [5].

The data used in this study are primary data obtained from the results of observation and interview several managers as an informer of the services related to water management in Karawang Regency (District of West Telukjambe). Stages stakeholder analysis consists of three phases [8], namely:

1. Identify all stakeholders and relevant information with a policy or a project.
2. Analysis of the effects or potential effects of each of the stakeholders to devise a strategy.
3. Assessment of the reactions and responses of each stakeholder in a variety of situations in order to develop strategies in order to increase their influence on a policy or project.

In this research, stakeholder analysis models used are interest / influence grid to classify stakeholders into four categories: key players are stakeholders with high interest and high influence; Context setters that have high influence but little interest; subjects which stakeholders with high interest but little influence; and the crowd that is, of little interest and little effect [9].
3. Results and discussion

Based on the results of the stakeholder analysis by the method of interest/influence grid stakeholder grouping results obtained as in figure 2. In figure 2 identified that stakeholders who act as first key players are BBWS Citarum. BBWS Citarum becomes stakeholders who act as critical players for the authority in charge of implementing water resources management in the region, including the District Telukjambe river as part of the Karawang regency. Portions were getting irrigation flow of the Citarum River in the District of West Telukjambe is downstream or upstream Cibeet River. In terms of duties and functions, BBWS Citarum also ensures the availability of irrigation water in order to develop wetlands irrigated agriculture. However, observation results showed irrigated land area in West Telukjambe with water from the River Cibeet is experiencing prolonged drought, causing drought wetland. This makes the farmers are forced not to cultivate the land and resulted in the reduction of the income of farmers. Water balance data is supplied from BBWS to Karawang regency currently not available because it has not done research related to monitoring and controlling the distribution of water and water availability.

Second key players are Perum Jasa Tirta II (PJT II). Perum Jasa Tirta II has a high authority so that power/influence on a policy related to water management are also strong. A high authority associated with his duties as manager of water resources in the Citarum River Basin includes the provision of water irrigation and one for Region Karawang. Karawang region, especially the District Telukjambe get irrigation water supply from West Tarum Channel or Channel Kalimalang (Curug). In performing its duties, PJT II is also committed to the accuracy of the operation and monitoring of the water. The results of the observation showed that the monitoring or control of the water made by PJT II reached the stage of recording of water in the upstream supply at West Tarum Channel. In the annual report 2018, PJT II noted the plan and the realization of irrigation water that comes in the West Tarum Channel. Comparison between plan and realization are presented in figure 3.
Figure 3 illustrates that the discharge plan met from January to September 2018. However, the absence of monitoring of water to downstream or in the primary irrigation canal before getting into the fields that may cause high runoff / high inefficiency so that the reality on the ground there was a drought in paddy fields. This proves the need for control of upstream to downstream irrigation channels.

The third vital players in the department of agriculture. The agriculture department has influence and high interest in the affairs of agriculture and water in irrigation supported by the department of land and water. Despite their part, the agriculture department to focus more on lands such as production, productivity, and land. However, to achieve production, the fields need water. However, the calculation of the amount of water required for wetland registered in the Department of Agriculture has not to be considered to be one of the variables that must be investigated and reported. Also, the Department of Agriculture to facilitate each sub-district with the Agricultural Extension Officers as container media aspirations and agricultural issues, including the issue of land drought.

Next is a stakeholder that acts as a context setter, namely the Department of Public Works and Spatial Planning. Department of Public Works and Spatial Planning is responsible for secondary and tertiary canals and portion control water resources. Nevertheless, the results of observation found that the Department of Public Works and Spatial Planning does not have actual data of the discharge of irrigation that flowing on secondary and tertiary canals, and the channel conditions are also not routinely reported.

The next stakeholder who acted as subjects, namely farmers. Farmers who cultivate land directly definitively determine the condition and needs of their land through experience in preparing the land to create interest and knowledge of farmers to grow rice field. Their interest was high, not matched by a low level of influence. This is in line with the results of interviews at the farmers say that the drought in the region is often reported to the farm, but the report was not acted upon. Besides, the interest of farmers to pull out his ideas as a solution to the problem of drought hindered by a difficult position to gain material support.

Last stakeholders have included crowds, namely non-farmers society and industries. Although it seems stakeholder interests and influences were a little on irrigation management, but still need to be involved in irrigation management. Community non-farmers and industries contribute to polluting the irrigation channel indicated by the high percentage of household waste 60%, chemical industry waste liquid 30% in the Citarum River Basin [10]. These stakeholders should be involved in the management of irrigation water to reduce the negative impacts that lead to decreased efficiency of irrigation water use.
The stakeholder analysis method is able to help break the stakeholders who took the role in accordance with the interests and power in a situation to assist in the process of drafting a policy or project. This is in line with the results of other studies [11] which also uses stakeholder analysis in terms of management of irrigation that the findings reveal that there is an overlap of authority between the stakeholders. There is a role contradictory between the stakeholders, namely the department of agriculture, PSDA province, the Jeneberang River Region Hall, the Farmers Group and the P3A. The results of the stakeholder analysis can also identify the complexity of actors and sectors involved in the management of natural resources. In the irrigation infrastructure planning by the method of stakeholder analysis [12] indicates the dominance of local actors such as engineers in irrigation infrastructure planning. Results of another study [13] showed that the use of methods of stakeholder analysis provides deep insight in understanding the power/influence and interest of stakeholders to obtain overlapping and conflict between stakeholder interests and opinion.

4. Conclusion
Stakeholders involved in irrigation management in West Telukjambe, Karawang has missing role and inefficiency authority. The absence of those who run the actual control of the discharge into the paddy field or the channels of the secondary and tertiary be one of the causes of land drought is prolonged. Networking among stakeholders needed a more structured so that the problem of drought in irrigation source can be identified and solved more accurately and quickly.

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