REVIEW OF THE WATER ALLOCATION IN IRRIGATION MANAGEMENT

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ABSTRACT

When the water demand issmall compared with the water availability the water is felt very abundant. Along with the increasing of water demand in various sectors such as public water supply and industrial water, the water available for agriculture irrigation systems will be reduced. A fair efficient and sustainable water allocation in irrigation system management is required to ensure the sustainability of irrigation system. It is concluded that optimal utilization of water in irrigation management through fair, efficient and sustainable water allocation can be achieved the by technical and non-technical measures.

Keywords: efficiency, water allocation, irrigation management

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INTRODUCTION

Background

When the water is still considered as abundant and not exploited, it is not necessary to control the irrigation water. But now, the water availability is felt more and more limited, while the water demand for various purposes such as drinking water, industry, and agriculture is increased. The problems of limited water in Indonesia, especially due to the following matters (Notodihardjo,1989): 1) Population, which is geographically unbalance water distribution and uneven distribution of density population, will also lead to uneven water supply and demand imbalance; 2) Food security, irrigation for rice as the main staple food in Indonesia requires a lot of water, it takes almost 85 percent of the total water demand; 3) Increasing of employment opportunities, to improve living standards and achieve a fair and equitable prosperity for all people, growing industry resulted in increasing of water demand.

Therefore a fair, efficient and sustainable water allocation management to allocate the available water for all water users is needed. Water Law no. 7/2004 mandates that the water supply for basic needs of people and irrigation for agriculture in the existing irrigation system is the highest priority among all other water demands.

Formulation

Along with the growing needs of water, it is more realized that water is a vital resource that availability is limited. Therefore a water allocation management is needed, as part of water management. To make overall efficient water use, one should make efficient use in all sectors of water demand such as public water supply, irrigation, and industry. It means that water is used as optimal as possible, and minimize wasted water. Since irrigation is one of the main priorities in the provision of water resources, this paper is focusing on the efficiency of water for irrigation

Scope

The scope of this review is limited to discuss the efficiency of water allocation in irrigation management in order to save the irrigation water.

Goals and Targets

The purpose of this review is to discuss the efficient water allocation for irrigation, from the tertiary unit to the river intake structures. The goal is to identify efficient ways of water allocation in irrigation management, supporting the movement of water saving in irrigation.

Methodology

The methodology in this review is a literature review and secondary data on the efficiency of water allocation in irrigation management.

LITERATURE REVIEW

Irrigation is the effort to provide, regulate, and drain the water to support the agriculture. There are surface water irrigation, swamp irrigation, groundwater irrigation, pump irrigation, and fishpond irrigation. Management of irrigation water consist of activities on distributing, providing, and using irrigation water. Water use right for irrigation is the right to acquire and use the water from water source for irrigation purposes.

Irrigation in Indonesia

Angoedi (1984) and Pasandaran (1991) describe irrigation history in Indonesia. Development of irrigation in Indonesia towards to advanced irrigation systems and resilient cannot be separated from the traditional irrigation. Data of the oldest inscriptions in Indonesia stated that the development of water channels created in the village's oldest monument at Cilincing, North Jakarta on the fifth century AD, according to the translation of Purbatjaraka, King Purnawarman ordered to dig Candrabhaga River flowed into the sea. Geomorphologic of old Candrabhaga River is Cakung River at present.

The old organization of traditional irrigation management in Indonesia is known as Subak Sekaha in Bali, that is a forerunner to the current irrigation management organization that known as the P3A or Association of Water User Farmer. Subak is a collection of rice fields owned by many people and they all get irrigation water from an irrigation system which is always closely connected with the law of land and water usage. Subak organization is specified in the implementing regulations in the democratic management of irrigation, which requires the liability and give the same rights for every member.

Modern irrigation system is estimated to begin in the nineteenth century with the development of Indonesia's first dam that was built in 1832 at the Sampean River. Nowadays a lot of dams were built for irrigation purposes. Since the early twentieth century, there are large dams for irrigation, such as the Nglangon Dam in Central Java (1910 - 1916), Jatiluhur Dam (West Java), Karangkates Dam (East Java), Kedung Ombo Dam (Central Java), Bili-Bili Dam (South Sulawesi), etc. The dam generally consists of rock or earth filler type dam, which are flexible and suitable for earthquake areas; and other types of dams, for example concrete dams that require a strong foundation and abutment, requiring a specific eligible location for construction.

Principles of Water Allocation

Before introduction of integrated water resources management approach, irrigation development usually is a single purpose, only to provide irrigation water, without considering the possibility of development for the other purposes or at another location in the same river (Pasandaran, 1991). With the implementation of river basin development approach, the connections of one with other development need to be considered carefully in integrated and comprehensive ways, resulting optimal water use plan for various purposes.

Optimizing the utilization of water is carried out by setting an optimum water allocation. For example, if there are two kinds of different water consumption with a limited amount of available water, then it is needed making the best alternative of water allocation. The general principle is to find the maximum of overall benefits to our needs and the availability of existing water.

Water Use Efficiency Movement

Movement of water use efficiency including water saving and efficiency in irrigation water was declared by the President of the Republic Indonesia in commemoration of World Food Day on October 16, 1994, to anticipate water shortages caused by unfavourable water utilization in Indonesia (Kurnia, 1997). Water use efficiency can be defined simply as efforts to reach a new situation more effectively and efficiently with a certain amount of available water resources (at all levels of utilization), that can provide more benefits than previously or to achieve an expected certain benefits that require fewer quantity of water than before.

Efficient use of water movement is through four stages as follows: The first step is to bring the same understanding of the water saving movement in the all sectors, such as industrial, agriculture, and housing; The second stage is to strive for efficient water movement into people's behaviour; The third stage is to encourage communities to take a large role in the movement of water saving; and the fourth stage is the stabilization phase of the development of public attitudes in a broad sense includes farmers, domestic water users, industry, even the managers, experts/professionals and manufacturing takes a central position in achieving water saving.

Economic policy and financial instruments for growing a water-saving behaviour is by creating a mechanism that can increase the value of water from just functioning as social goods to a combination of economic-social goods, that can be implemented by: 1) Determine the structure of water pricing and tariff services; 2) Define the structure of incentives and researchers; 3) Cross subsidy from water user groups; 4) Allocation of conservation costs on beneficiaries; and 5) Privatization of water distribution.

Under the existing Indonesian statutory, approach to water saving behaviour can be achieved by: 1) Prohibition of using of water for certain purposes during the dry conditions; 2) Policies that control the growth of water demand (growth transferring from one sector to another sector); and 3) System of water use rights and water use licensing that are conducive to water saving.

DISCUSSION

Long time ago, when the population of Indonesia is not yet as many people as at present, the availability of water is felt totally abundant, but in line with population growth in Indonesia, which has more than 206 million inhabitants in 2000 (Badan Pusat Statistik, 2000), the need for water is getting higher. The same also apply to irrigation water requirements, along with increasing of water demand in other sectors such as drinking water and industry, water supply for agriculture through irrigation systems will be reduced. To ensure the sustainability of irrigation systems, an efficient water allocation of irrigation and or water-saving irrigation is required.

One example of technical efficiency improvement of water allocation in irrigation management is to implement water sharing in tertiary as described in Kurnia (1997) as follows:

1. Tertiary rotation divided into four blocks, namely Block A, B, C, and D (each block area is having almost the same size of areas).

Water sharing in tertiary performed with four different ways, they are:

a. Simultaneously, carried out if Q> 80% Q_{Max}

b. Rotation I (one block are not irrigated but three other blocks are irrigated), performed if Q = 60-80% $Q_{max.}$

The trick was by the using of blocks rotation, A, B, C and D is divided into four periods during the 14 days or 336 hours.

Period I: A, B, and C are irrigated, while D is not irrigated.

The duration of water = $\frac{A+B+C}{A+B+C+D} X \frac{336}{3}$ hour

Period II: B, C, and D are irrigated, whereas A is not irrigated.

The duration of water = $\frac{B+C+D}{A+B+C+D} X \frac{336}{3}$ hour

Period III: A, C, and D are irrigated, while B is not irrigated.

The duration of water = $\frac{A+C+D}{A+B+C+D} X \frac{336}{3}$ hour

Period IV: A, B, and D are irrigated, while C is not irrigated.

The duration of water = $\frac{A+B+D}{A+B+C+D} X \frac{336}{3}$ hour

c. Rotation II (two blocks are not irrigated, but two other blocks are irrigated), performed if Q = 40-60% $Q_{max.}$

The trick was by dividing water into two periods during the 7 days or 168 hours. Combining of that produces nearly the same total area, such as combine the smallest size the smallest block with the greatest breadth.

Period I: A and C are watered, while B and D are not irrigated.

The duration of water = $\frac{A+C}{A+B+C+D} X 168$ hour

Period II: B and D are irrigated, while A and C are not irrigated.

The duration of water = $\frac{B+D}{A+B+C+D} X 168$ hour

d. Rotation III (three blocks are not irrigated but one block is irrigated), performed if Q = 40% $Q_{max.}$

The trick was by dividing water into four periods during the 7 days or 168 hours.

Period I: A is watered, while B, C and D are not irrigated.

The duration of water = $\frac{A}{A+B+C+D} X168$ hour

Period II: B is irrigated, while A, C and D are not irrigated.

The duration of water = $\frac{B}{A+B+C+D} X168$ hour

Period III: C is irrigated, while A, B and D are not irrigated.

The duration of water = $\frac{C}{A+B+C+D} X168$ hour

Period IV: D is irrigated, while A, B and C are not irrigated.

The duration of water = $\frac{D}{A+B+C+D} X168$ hour

2. Tertiary rotation is divided into three blocks, namely Block A, B, and C (each block is having almost the same size of area).

   Distribution of water is divided into three types, they are:

   a. Distribution of water is continuously carried out if Q> 80% $Q_{max.}$

   b. Rotation I (one block is not irrigated but two other blocks are) happens when Q = 50-80% $Q_{max.}$

      Period I: C is not irrigated, while A and B are irrigated.

      The duration of water = $\frac{A+B}{A+B+C} X168$ hour

      Period II: B is not irrigated, while A and C are watered.

      The duration of water = $\frac{A+C}{A+B+C} X168$ hour

      Period III: A is not irrigated, while B and C are watered.

      The duration of water = $\frac{B+C}{A+B+C} X168$ hour

   c. Rotation II (two blocks are not irrigated, while another block is) happens when Q = 50-80% $Q_{max.}$ The supply of water is divided into three periods during the 7 days or 168 hours.

      Period I: A is watered, while B and C are not irrigated.

      The duration of water = $\frac{A}{A+B+C} X168$ hour

Period II: B is irrigated, while A and C are not irrigated.

The duration of water = $\frac{B}{A+B+C} X 168$ hour

Period III: C is irrigated, while B and C are not irrigated.

The duration of water = $\frac{C}{A+B+C} X 168$ hour

One of example of improving technical efficiency of water allocation in irrigation management is rice field engineering for irrigation water savings described by Sufyandi in Kurnia (1997). According to Sufyandi, engineered rice field is carried out by minimizing the loss of water due to percolation. By designing a minimum area of 0.2 ha plot of a rice field, the loss caused by percolation can be minimized into between 2-15 mm/day. The ideal dimension for a rice field is a rectangular, length of field map should be parallel to the contour lines but the width should be intersection with the contour lines. With this layout system of rice fields, allowing better water management; a discontinuous or intermittent water supply can be implemented so that water can be utilized as efficient as possible in accordance with the needs of plant growth.

In addition to the technical aspects, a social and cultural approaches to improve the efficiency of water allocation in irrigation management is also needed. This is due to the fact that technical approach cannot be implemented easily. Engineering fields with a minimum of 0.2 ha of rice field is difficult, because the farmers in Indonesia are so poor and generally do not have an area of more than 0.2 ha of rice fields.

According to Soelaiman in Kurnia (1997), participation of farmers gives significant contribution to improve the efficiency of water allocation in irrigation, especially on several matters as follows: 1) Water for agriculture. In this context, water can be an area of participation, especially in a series of efforts to obtain water from its source; water allocation is managed by the user settings, and distribution of water from its source to a particular place in the amount and time period. 2) Structures that is necessary to control the discharge and water flow. Structures components can be composed of irrigation system design, construction that is built for the allocation and distribution, operation based allocation, determining distribution, and the maintenance of the structure within the framework of sustainability and efficiency of the acquisition, allocation, distribution, and water removal; 3) Organization for sustainability of human effort in institutional forms.

CONCLUSION

To achieve a fair, efficient and sustainable water allocation in irrigation management is, both technical and non technical efforts are needed. This paper illustrate two examples of technical efforts, that are distribute water in tertiary and engineering fields, while the non-technical measures could be through increasing of farmers participation.

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