INTEGRATED APPROACH ON SUSTAINABILITY OF IRRIGATION SCHEME

Gatot Irianto[1]; Samsul Huda[1]; Istiqlal Amien[2] and Hilman Manan[1]

ABSTRACT

Irrigation network is vitally important for distributing water to fulfill crop water requirement at precise timing, quantity and quality to ensure good agricultural production both in terms of quantity and quality. Due to the economical crisis from 1997 up to know, most of irrigation networks in Indonesia have been deteriorated, and are not yet performed well till present. This problem causing the system of irrigation networks are unable to fully provide water demand sufficiently.

For resolving this problem, an integrated approach and effort are demanded to save the existing water, rehabilitate irrigation networks and sustaining irrigation management for future generation. Irrigation development in Indonesia has been started since The First Long-term Development Plan, during the period of 1970-1990, technical irrigation areas have increased more than 2.6 million hectares from 1.5 million to 4.1 million hectares. Under this achievement, rice production was reached to a magnitude of 15 million ton/year, and by the year of 1984 Indonesia has attained self sufficiency in rice production. Unfortunately, this self-sufficient condition can not be maintained for a long time, and instead Indonesia has been transformed into rice importer. The decreasing of water quantity, quality and continuities are amongst the important constraints of the transformation into rice importer.

Accordingly, a strategy needs to be formulated in order that the function of the existing irrigation schemes could support providing irrigation water in accordance with the economic time horizon with proper management to ensure its sustainability. For this, the basic concept of integrated approach under the era of regional autonomy will be discussed in this paper. This concept is divided into three major aspects, namely: management, integrated, and revolving fund system approach. Due to the past planning and development policy of irrigation, which emphasized the “top-down” approach, the entire management on irrigation networks became the government domain, with very limited involvement of the farmers as the end users. Incidentally, however, due to continuous financial crisis, the government could no longer fully provide the operation

1- Directorate General of Land and Water Management
Gatot_irianto@deptan.go.id; gatot_irianto@yahoo.com
2- Agency for Agricultural Research and Development of Ministry of Agriculture Indonesia; Jalan Taman Margasatwa No. 3 Jakarta Selatan – Indonesia.

and maintenance costs. On the other hand, the management transfer of irrigation to the farmers, are not acceptable, having understood that the government should take the full responsibility for developing and managing irrigation. Based on this experience, participatory approach among the stakeholders on planning, development and management should be strengthening.

Key Words: Integrated Approach, Sustainable Irrigation Management

BACKGROUND

The function of irrigation network is vitally important in distributing the water for obtaining crop water requirement at precise timing, quantity and quality to ensure good agricultural production. Presently, various problems are widespread concerning water resources. Among others are decreasing of irrigation water supply on the one hand, and increasing water demand on the other. The decreasing water supply is currently due to the effect of decreasing dependable water resources due to the escalating degradation of the catchments-area of the rivers. Meanwhile, the increasing water demand is due to the increasing population and escalating economics growth. Water use efficiency is generally low among others because of the poor condition of irrigation networks, the water user association (WUA's) are not performing and functioning as expected, and the application of efficient water management technology has yet extensively adopted. In addition, the water quality is also decreasing due to the underlying contamination from industrial disposal, household wastes, agriculture, and sea-water intrusion.

The above problem has therefore causing water scarcity both spatially and temporally, where the system cannot cater the water demands. Eventually, the water scarcity brought about unfair competition in water use among sectors or sub-sectors. Without concerted efforts in solving the problems above, it will be very difficult to be able to save or conserve the existing water resource for future generation.

PRESENT CONDITION OF IRRIGATION IN INDONESIA

Irrigation development in Indonesia have been started since the First Long Term Development Planning **(PJP I)** of the country. During the first two decades (1970-1990) technical irrigation areas have increased by more than 2.6 million hectares from 1.5 million to 4.1 million hectares. The irrigated land has boosted paddy production by about 15 million ton/year, almost one-third of the national requirement **(Afif, 1992).** By the year of 1984 Indonesia has attained self sufficiency in rice.

However, due to the impacts of insufficient maintenance together with natural disasters, the irrigation infrastructure experienced of extensive deteriorations. Floods have damaged the irrigation networks at about 100,000 hectare per year. In the year of 2002 the flood damaged had come up to about 172,000 hectares. In 2004 the earthquake and tsunami in Nanggroe of Aceh Darussalam and Nias Island, destroyed more than 21,000 ha of irrigated agriculture. Most recently, the quake and volcanic eruption in Yogyakarta and Central Java, as well as the tsunami event in Pangandaran, West Java (July 2006) also damaging significantly on irrigation infrastructures as well as agricultural lands in the said areas.

From the data of 2002 the irrigation networks developed in Indonesia have a total capacity to serve 6.77 million hectares of rice fields. Of which, about 48.3% of irrigation networks are in Java, 27.1% in Sumatra, 11.7% in Sulawesi, and 6.8% in Kalimantan, while the remaining, 6.1% in Bali, Nusa Tenggara, Maluku, Papua, and West Irian Jaya Provinces. Of the total of irrigation developed above, it is estimated that around 1.67 million hectare, or almost 25% has yet functioning well as expected. These poor-functioning irrigation networks due to a number of problems and constraints, including the yet completed network system, inadequate water sources, some of the paddy fields has yet to be fully developed, or even due to the non existence of the farmers and farmer's organization in some areas. Similarly, this matter is also happened in the lowland irrigation networks – of the 1.80 million hectare that had been developed, only about 0.8 million hectares (44%) are currently functioning. Complementary to these, the non functioning irrigation networks also suffered from damages due to the low quality of operation and maintenance. At present, the total estimated area that experience damages on their irrigation networks had almost come up to about 30%, and most of damages occurred in the national rice producing areas on Java and Sumatra Islands.

The problems are exacerbated by the degradation of the catchment areas. The degraded lands in the upstream areas are almost come up to the magnitude of about 40 million hectares. On the other hand, the problems are also worsened by to the increasing population, which entailed with rapid rate of agricultural lands conversion into non agricultural utilization. In 1984 degraded catchment areas was 22 locations, but by 1994 the magnitude became 39 locations of degraded catchment-areas. Most recent statistics indicated that in 1998 the degraded catchment areas had reached 62 locations. This degradation has significantly brought about negative impacts on the continuity of dependable water flows.

Beside the poor condition of irrigation infrastructures, the water use efficiency is also very low. In many cases, the precious water is wasted unnecessarily when it abundant in the main, secondary and farm levels without proper distribution management. Meanwhile, the quality of irrigation water for the agricultural sector is also degraded by the contamination of industrial disposal, domestic and urban wastes, as well as the sea water intrusion.

Climate anomaly add to the problems with uneven distribution of the intra-seasonal, seasonal and annual water distribution. Drought triggered by El-Nino phenomenon in 1997, for example have caused damages of paddy crops in more than 500,000 ha and 88,000 ha of the areas suffered from crop failures. Other than El-Nino the cooling of eastern part of Indian Ocean as also known as positive dipole mode (IODM) in 2003 have caused more than 500,000 ha damage paddy crop and more than 117,000 ha of crop failures.

Agricultural lands conversion to non agricultural uses such as industrial, housing, and infrastructure in last ten years has increased to 100 % from 40,000 ha per year to 80,000 ha per year. All the above conditions have been happened and have negatively influenced the performance of irrigation systems. Therefore, a strategic actions need to be formulated in order that irrigation schemes could be well performed, and hence provide irrigation services in accordance with expected the economic age and sustainable management of the entire irrigation schemes.

CONCEPT OF INTEGRATED MANAGEMENT APPROACH

A. MANAGEMENT APPROACH

The concept of integrated approach in irrigation scheme has to be carried out from early stage of the development up to the operation and maintenance stages – i.e. from development planning, technical design, construction execution, operation and maintenance and eventually monitoring and evaluation as well as follow up actions for subsequent improvement. In the past, the development policy on irrigation infrastructures were emphasized on the top-down approach, that had created many problems, including technical as well as non technical , particularly during the operation and management stages. For resolving the underlying predicaments, this orientation should be shifted to ***bottom-up approach***. In general, the concept of integrated approach on irrigation water management must be carried out, among others by:

- Involving the relevant parties and stakeholders concerned both in terms of ***vertical*** as well as ***horizontal*** organizational structures.
- Utilizing all the locally existed practices in the society (local broad-based empowerment) with special attention on ***indigenous technology*** and ***knowledge*** as well as ***practical experiences***.
- Appropriate technical guidance and other requirements of local community concerning ***natural endowment that evolved into cultural experiences***.

In the new Water Law *(Undang-undang No. 7)* year 2004 regarding water resources that was enacted after prolonged debates irrigation water at farm level shall be managed and handled fully by the farmer through water user association. Consequently irrigation development shall involve farmers since the planning process. This requires a participatory irrigation management system. The concept of participatory irrigation system is now growingly adopted worldwide.

The benefit of participatory irrigation management approach is the growing ***sense of belonging and responsibility*** from all participants, ensuring that the development results would be similar to the expected requirement, including the improvement of the ability of the farmers to utilize the development outputs, clearly defined working process in the field, and strengthening the ability of farmers to manage further irrigation networks.

In principle, participatory irrigation system is positioning the farmers as the main water user and become the focal point on decision making processes. Together with other stakeholders, all the irrigation development activities are conducted within the entire development and management process, from planning, implementation, until its operation, and the entire decision making are discussed and decided to together.

In relation with the participatory approach, there are several preconditions that must be fulfilled, those are: demand driven, participatory, transparency, flexibilities, decentralization, openness, accountabilities, and integrity both in the social and technical aspects. ***Demand driven*** is means that all activities proposed and conducted by the members so in such a way that they comprehend their duty and responsibility. Hence, involvement of all farmers through their organization in management of

irrigation network is imperative by means of ***participatory*** approach. Meanwhile, ***transparency*** means that all the funds have to be expended properly and informed all the participants openly. ***Flexibility*** means that any specified rules can be executed when necessary, without a rigid bureaucratic process. Decision making process also involving all the member without dependency on one particular person or organization (***decentralization***). ***Openness*** means that every report can be accessed by all farmer members. ***Accountable*** means that any income obtained and expenditure spent have to be technically and administratively audited. ***Integrity of socio-technique*** means that irrigation is not simply technical problem but also social cultural problems, therefore, the sound understanding on local tradition and customs must be considered in planning and managing of irrigation infrastructural development.

B. INTEGRATED APPROACH

The concept and approach of integrated approach in irrigation area management is involving entire stakeholders actively from early stage (planning, construction) to operation and maintenance, as well as monitoring and evaluation stages. According to the **U.U. SDA 7 - 2004** (Water Law) that farmers or WUA have responsibility in the management of on-farm irrigation network. But when the farmers or WUA are not yet able to manage the network for effective operation and maintenance, the government will assist them.

Conception of integrated approach is focused on the participation of all stakeholders in management of network (operation and maintenance). Therefore the government side (Central, Provincial and District Government Administration) and farmers are partners in the management of irrigation networks. For illustration, based on experiences that had been conducted in many years on the sharing of the expenses, **Table 1** presents some examples of budget sharing in participatory irrigation management. The central government, province and district government together with the farmers/WUA sharing the Operation and Maintenance budgets for financing the activities such as repairing channels, making of water receptacle, appropriate water allocation, procurement of water pump and preparation of diversion boxes and other such on the farm level infrastructures and operational expenditures.

From the data that are presented in **Table 1**, it is highly plausible that the existence of adequately high willingness and awareness of the farmers to manage irrigation in improving farming production are amongst the determinant factors of the failure of success of participatory approach.

Table 1. Budget Sharing on Participatory Irrigation Management in some selected frovinces (East Java, Central Java, and Lampung Provinces).

(Rp. 000,-)

No	Location	Central	Province	District	Farmers	Output
1	Gebangan, Krejengan, Probolinggo, East Java	44,783 (39%)	25,000 (22%)	4,000 (3%)	41,010 (36%)	Rehabilitate of irrigation canal, gate and pumps
2	Kemuning, Kramat, Tegal, Central Java	43,683 (22.6%)	108,000 (55%)	1,260 (0.7%)	42,390 (21.7%)	Pipe irrigation Diversion box, pumps.
3	Sukanegara, Bangun Rejo, Central Lampung, Lampung	43,102.5 (36.85%)	21,550 (18.43%)	9,850 (8.42%)	42,444 (36.30%)	Diversion box and rehabilitation of irrigation canal

C. REVOLVING FUND SYSTEM APPROACH

Present issues regarding irrigation in Indonesia are related to the lack of participation and contribution of farmers and water users in the operation, maintenance and management. Until present, the government still takes dominant role in irrigation management and development. Irrigation system is still treated as public infrastructures or utilities that must be managed by the government. Farmers and water users are positioned only as beneficiaries. As the result, farmers and water user associations tends to be inresponsive and ignorant to the system condition.

Along with the financial problem and economic crisis, the capacity of the Government of Indonesia to cover the costs for operation and maintenance of irrigation system has declined sharply. As a result, more than 60% of the irrigation system has decreased and still decreasing in their performances.

Through experiences, it had been identified that the key factor of the sustainability of irrigation systems is laid highly dependent upon the presence of sustainable financial source (and support) for operation and maintenance. Continuously relying on the government budget is obviously far from possible, while instantaneous budget from donor, that the farmer used to rely in the past, is also unsustainable. For which, strategy for financing irrigation operation, maintenance and investment in terms of ***Revolving Fund System for Irrigation*** is presently recommended.

The concept of revolving fund system for irrigation implies that for the WUA the water fee shall be divided in two parts, one part is for operation and maintenance, and another part shall be kept as repayment of the improvement cost. Experience indicates that the ideal composition of water use fee is 60% for operation maintenance and 40% is for cost recovery. The Management of Revolving Fund System for Irrigation Investment is presented in **Chart 1,** below.

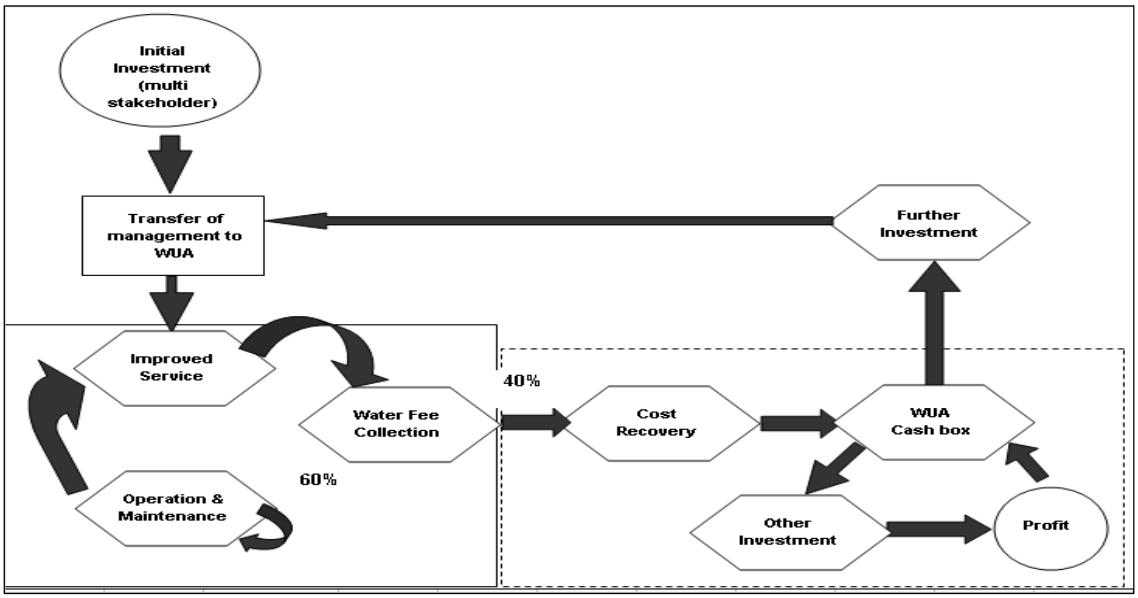

Chart 1. Management of revolving fund system for irrigation O&M investment

CONCEPT OF SUSTAINABILITY OF IRRIGATION SCHEME

The concept of sustainability in irrigation scheme is not a quilt of some aspects as technical, social, cultural and economic aspects. A sustainable irrigation scheme can be attained when:

- Management of irrigation scheme including operation and maintenance (O&M) should be shifted from supporting ***monoculture only (paddy)*** to become providing water to ***various crop types (diversified crops)***.
- Management of irrigation has to develop flexible irrigation (reliability, flexibility, equity), that can provide irrigation water to various crop types, this requires the ***change in existing irrigation system device and pattern of O&M.***
- Irrigation is basically has the character and function fundamentally as supporter of agricultural or farming activities. Therefore, irrigation must be fitted with agricultural and farming activities. In other words ***irrigation scheme is develop to support agriculture not the other way around***.
- Policy in the development and management of water resources should be ***balanced between downstream and upstream areas***. Presently, too much attention are given to downstream areas, and consequently the upstream areas became degraded.
- Improvement of community participation from all stakeholders in irrigation management from planning, construction execution, O&M, as well as monitoring and evaluation.
- Increasing the efficiency of irrigation water management through ***appropriate technological innovation*** to the small scale farming.

- Fair utilization, conservation and protection of water resource with consideration of social justice have to be implemented and become common goal. Utilization, conservation and protection of water resources by applying fair share is the common interest of the society without any discrimination on the right to get or access to water resources.
- Policy management of water resources to support food security is not only for annual food crop sub-sector, but also for other ***sub-sector as horticulture, estate crop and livestock***.
- Integrating the irrigation development and management with the agricultural sector is fundamentally important. Negligence of the integration will result in expensive social and economic risks, as revealed by unutilized irrigation networks.
- ***Preventing the conversion of agriculture farms to another functions*** such as industrial, housing, and others. A step in the prevention is the preparation and enaction of legislation as well as regulatory instruments.
- A new policy formulation relating to water resources management in accordance with ***decentralization and regional autonomy*** has to be formulated and enacted judiciously. These policy formulation consist of proper distribution of delegation of authority, duty and responsibility among institutions at central, provincial and district levels.

BIBLIOGRAPHY

1. Republic of Indonesia, 2004. Pemerintah Republik Indonesia, 2004, ***Undang Undang SDA 7*** Tahun 2004 (Indonesian Water Law No. 7/2004).
2. Republic of Indonesia, 2004. ***Rencana Pembangunan Jangka Menengah Pengairan TA. 2004-2009***, Intermediate Long Term Planning for Irrigation Development; Irrigation and Water Resources Bureau, Bappenas, 2004.
3. Anonymous, 2005. ***Kebijakan Operasi dan Pemeliharaan Prasarana Pengairan Mendukung Ketahanan Pangan***, Directorate of Water Management, Directorate General of Land and Water Management, Ministry of Agriculture, 2005
4. Anonymous, 2003. ***Pedoman Pelaksanaan SPFS Indonesia***, Food Security Board, Ministry of Agriculture 2003.
5. Anonymous, 2004. ***Model Pengelolaan Irigasi Partisipatif***, Directorate of Water Management, Directorate General of Agricultural Facilities, Ministry of Agriculture, 2004.
6. Robert Chambers, 1992. ***Managing Irrigation Canal***, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1992.

ABOUT THE AUTHORS

Hilman Manan born 2 July 1951 in Bandung. He got master from IHE-Delf, Nederland. Specialist in hydraulic and expertise on water resources development

and management. He is now director general of land and water management, Ministry of Agriculture.

Istiqlal Amien is senior scientist and knowledge engineer at the Indonesian Agro-climatology and Hydrology Research Institute, Bogor. Holds master degree in soil chemistry from State University of Ghent, Belgium and Ph.D in soil management from University of Hawaii, USA. Soil scientist by training, Agro-meteorologist by profession and environmentalist he has experienced in developing expert systems.

Gatot Irianto born, 24 October 1961 in Halmahera Tengah. He obtained Ph.D. in Hydrological modeling, Ecole National Superieure Agronomique Rennes, France. He is now director of water management, Ministry of Agriculture. Hydrology scientist, lecturer, author on many newspaper, proceeding, etc.

Samsul Huda born 2 May 1968 in Nganjuk. Hold master in irrigation water management from Indian Institute of Technology Roorkee, India. Engineer, Specialist in irrigation water management and evaluation performance of irrigation system.