# PROBLEMS AND PERSPECTIVES OF PARTICIPATORY IRRIGATION MANAGEMENT UNDER THE SMALL LAND-HOLDING CONDITION: WITH A SPECIAL REFERENCE TO INDONESIAN PRACTICE©

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## ABSTRACT

Indonesia achieved remarkable progress in water resources development within thirty years till 1997 through government led development projects. However, the institutional development to sustain this progress got insufficient attention. From the lessons learned before the multidimensional crisis, it has been recognized that the severe crisis had been due to the chronic neglect of the farmers' roles in almost the entire process of development, rehabilitation, and routine operation and maintenance of irrigation infrastructures.

In an attempt to resolve the dilemmatic situation to maintain sustainable rice production on the one hand, while keeping pace the productivity level with the increasing population growth on the other, an emphasis has been given to irrigation development and management based on participatory approach. The program had been set up to reduce central government's burden on Operation and Maintenance (O&M) costs aiming for sustainable irrigation O&M by virtue of "Participatory Irrigation Management – PIM" approach.

Under the said program, a number of policy adjustments on water resources had been enacted. Further to this, PIM attempts have also been carried out including: turning over to the Water User Association – WUA, of small irrigation schemes; encouragement of irrigation service fee (ISF); Irrigation Management Transfer (IMT); Participatory design and construction program; "field laboratories" for visual process of "learning by doing", and other such government initiatives. However, it turned up that the attempts has been going very slowly and yet, still tended to be least sustainable. This has been partially suspected by the fact that the economy of the farmers and farming conditions under the fragmented land ownership, which in fact, are already small, has been marginalizing the

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already marginal incomes. As a result, the small income farmers are hardly available to participate with the PIM's endeavors.

To facilitate resolving the problems, the newly enacted Water Law No. 7/2004, together with the Government Regulation No. 20/2006 about "Irrigation", prescribe that the O&M responsibility for primary and secondary canals belongs to the Central Government, Provincial as well as Local Autonomous Government with certain role sharing criteria settled down by the Government Regulation on Irrigation Management. For reducing the burden of the farmers, they assigned responsibility to operate and maintain the tertiary canals through their water users associations (WUA).

This paper intends to discuss a series of practices, problems, and perspectives on participatory irrigation management under the small land holding condition, the implication of the new policies on technical and traditional irrigation schemes, institutional and legal aspects of O&M, as well as the role of WUA's. These include technical, institutional, and financial, as well as regulatory instruments, and other such measures toward sustainable PIM implementation.

**Key Words:** Irrigation Management; Small Land Holding; PIM Approach; and Indonesia

## I. INTRODUCTION

Indonesia, with the total population of 72 million at the time of Indonesia's independence in 1945, has now stepped into the fourth most populous country in the world, with an estimated population of about 220 million inhabitants. The population growth rate has been reduced significantly from 2.9 percent fifty years ago to about 1.9 percent now. It is projected that the population growth will be about 280 million people by the end of 2025. At that period, it is estimated that 52% of the nation's people are predicted to live in urban areas.

The excessively rapid expansion of the country's population concurrently with high rate of urbanization has brought about a special problem on the provision of adequate rice (the staple food) to feed its people. About 70% of the populations are traditional rice farmers living in rural areas. This matter has even created more crucial problems to the provision of adequate food supply for the country's population. (See **Figure 1**. and **Figure 2**. for the general projection of population growth, rice demands and potential.)

One of the most apparent constraints on rice production is that the land ownership per farming household is somewhat too small, that the farmer cannot fully dependent upon the farming income for supporting their life with their families. For this reason, the farmers are forced to earn additional income in the urban areas. This alone inhibits special problem on the continuity of their agricultural lands being left occasionally and hence unable to maintain consistent care of their plants. In addition, it is apparent that the size of land holding is increasingly decreasing due to the impact of land fragmentation, and the continuing land conversion to non agricultural utilization, as well as transfer of land ownerships.

### 1.1. PRESENT STATUS OF LAND USES FOR FOOD PRODUCTION

In order to feed the currently 220 million inhabitants, it is estimated that at least 50 million tons of paddy rice per year is required. Paddy in Indonesia is produced in

irrigated lands, wetlands, as well as in the rain-fed upland areas with a grand total of about 12.34 million ha, and with the average cropping intensity at about 1.37.

The most immediate problem has been associated with the capacity to sustain the food production, in the mean time, with population growth rate of, say 1.5% per annum, rice production should increase by about 900,000 tons per year to catch up the increasing demands. With the same assumption, this food demand is roughly equivalent to about 140,000 ha of additional land areas annually. This figure has yet counted for the annual land conversion from agricultural lands to other land use categories -- which is estimated at the range of 25,000 and 40,000 ha annually.

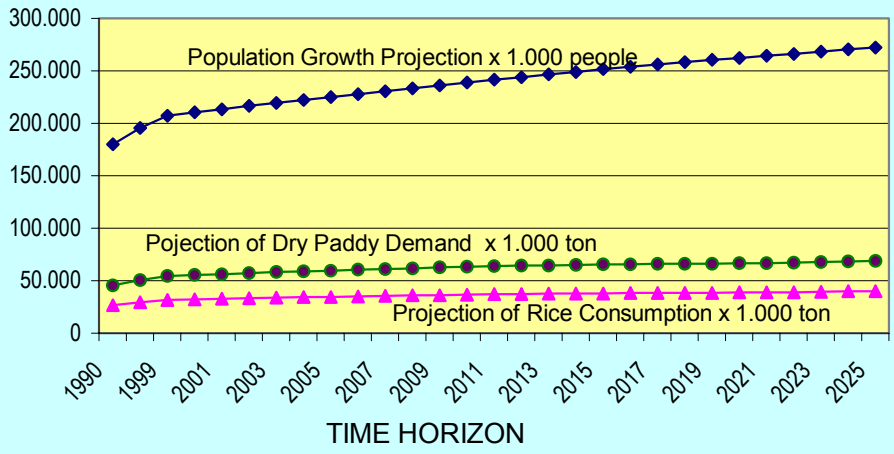
## II. IRRIGATION DEVELOPMENT AND MANAGEMENT

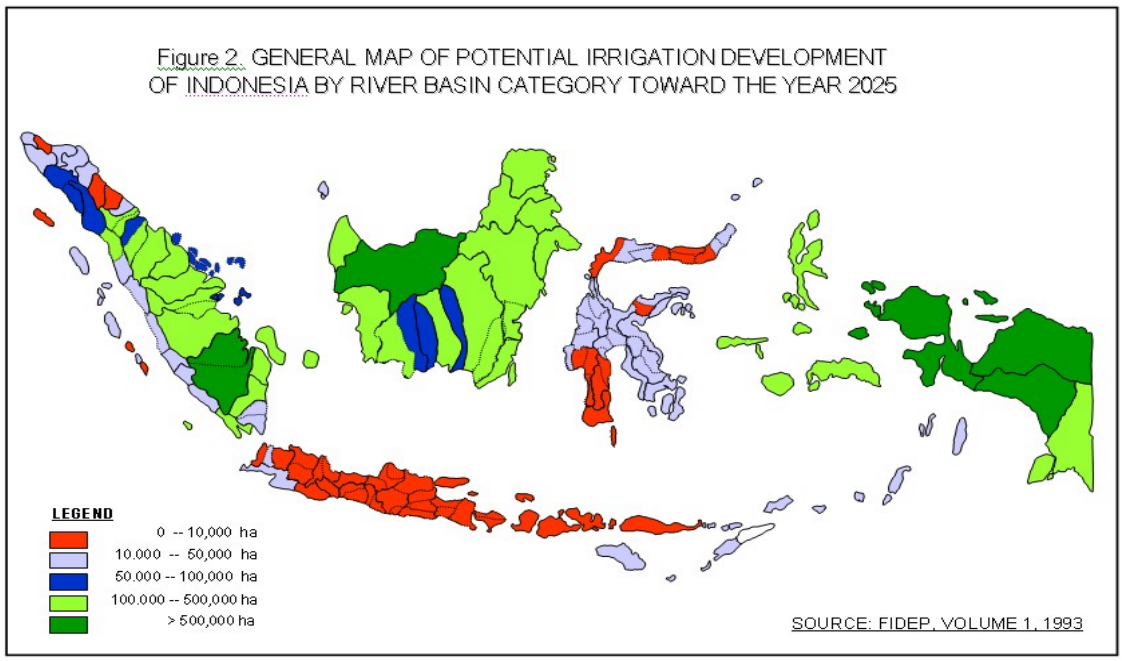
### 2.1. IRRIGATION SYSTEM AND MANAGEMENT

The newly enacted Government Regulation No. 20/2006 defines irrigation as the means of provision, regulation and releasing of irrigation water for appropriate support to agricultural implementation, having some categories as surface irrigation, swamp irrigation, sub surface irrigation, pumping irrigation and fish ponds.

Basically, the government responsible for operation and management of the main system (primary and secondary networks), while the farmers, through the water users' association (WUA), responsible for operation and management of tertiary irrigation schemes. In this regards, the government (Central Government) is responsible for conducting irrigation O&M of independent irrigation scheme having a total commanding area of more than 3,000 ha. The Provincial Government responsible for managing irrigation scheme having independent commanding area between 1,000 and 3,000 ha. While the local government (Regency or Municipality), responsible for managing irrigation schemes having less than 1,000 ha per individual scheme, and the Village Government responsible for development and management, as well as rehabilitation, reconstruction and upgrading of village irrigation scheme.

Figure 1. PROJECTION OF POPULATION GROWTH, RICE CONSUMPTION, AND PADDY PRODUCTION TOWARD THE YEAR 2025






Meanwhile, the water user's community is further responsible for: (1) Implementation of tertiary irrigation development and management; (2) Maintaining an effective and efficient operation and management of tertiary irrigation schemes; (3) Approval for development, utilization, as well as reconstruction, rehabilitation and upgrading of tertiary irrigation scheme on the basis of participatory approach. For this, the participatory irrigation development and management approach has to involve the farming community from the initial decision making, throughout the entire process of development, upgrading, operation, maintenance, as well as rehabilitation of irrigation schemes.

In principle, irrigation water management covers the management of irrigation networks and irrigation water has to be implemented based on participatory, integrated, transparent, accountable and sustainable principle. Water management activities in the main system, which is referred to as **"water distribution and drainage management"**, are managed by the government while water management at the tertiary and quaternary canals as well as direct application of water to the crops, which is referred to as **"on-farm water management"** are managed by the farmers.

## 2.2. PRESENT STATUS OF IRRIGATION DEVELOPMENT

During the past few decades, the government policy in irrigation development has been implemented in line with the National Development Policy. At present, the status of irrigated lands for paddy production in Indonesia (based on 2003 data) has a grand total of 10,176,069 ha including the irrigated paddies, upland and rain fed (See **Table 1.**) for further details. From this table, it is apparent that the total production of irrigated paddies at about 48,794,000 tons of dry un-husked rice, contributes almost 95% of the total production of about 51.48 million tons. Hence the upland and rain fed paddy contributes only 2.682 tons or 5% of the total paddy production of Indonesia.

**Table 1.** Irrigated land and paddy production in Indonesia, (2002)

| Island | Area (ha) | Cropping Area (ha) | Total Yield (ton) *) | Average Yield (ton/ha) |
|---|---|---|---|---|
| Sumatra | 2,401,697 | 2,674,589 | 10,826,103 | 4.048 |
| Java | 3,396,299 | 5,263,179 | 27,615,900 | 5.247 |
| Bali & Nusa Tenggara | 370,192 | 527,965 | 2,435,966 | 4.614 |
| Kalimantan | 1,366,520 | 781,851 | 2,519,011 | 3.222 |
| Sulawesi | 904,597 | 1,201,876 | 5,327,109 | 4.432 |
| Maluku & Irian (Papua) | - | 22,629 | 74,147 | 3.100 |
| **Indonesia** | **8,439,305** | **10,472,089** | **48,794,236** | **4.659** |
| Sugarcane | 496,000 | | | |
| Total irrigated lands | 8,396,205 | | | |
| Upland Paddies | 1,239,864 | 1,058,583 | 2,682,343 | 2,534 |
| **Total Paddy **)** | **10,176,069** | **11,530,672** | **51,476,579** | **4,464** |

**Source:** Statistical Year Book of Indonesia 2003, BPS Statistics Indonesia

*) Dry un-husked rice;
**) Total irrigation areas for paddy, including upland and rain fed paddies.

### 2.3. INTER-AGENCY COORDINATION FOR IRRIGATION MANAGEMENT

To ensure the efficient and effective use of irrigation for supporting agricultural implementation as well as for serving other functions and purposes of irrigation are established. There are several categories of irrigation commission namely; Provincial Irrigation Commission; *Kabupaten* (District) Irrigation Commission; and Inter-provincial Irrigation Commissions. The composition of these irrigation commissions are as follows:

**Provincial Irrigation Commission:** The commission establishes by the Governor composed of the representatives of irrigation commissions of the regencies and/or municipalities within the province concern, representative of water users' associations, representative of the provincial government and the representative of water users having proportional representation.

**District Irrigation Commission:** The commission establishes by the Regent (The *Bupati*, or Mayor) composed of representatives of the local government and other government agencies, representative of water users' associations, representative of water users having proportional representation.

**Inter-Provincial Irrigation Commission:** The commission establishes by the concerned Governors composed of the representatives of irrigation commissions of the regencies and/or municipalities within the province concern, vice chairpersons of provincial

irrigation commissions, representative of water users' associations, representative of the provincial government and the representative of water users having proportional representation.

Coordination of irrigation activities are usually conducted by irrigation commissions within the provincial jurisdiction, district or municipalities as well as for inter-provincial irrigation commission. However, for a large irrigation system, the service area is usually located under more than one provincial or district government administrations. In such the case irrigation development and management are implemented jointly with the provincial or District Irrigation Commissions under the coordination of the inter-provincial or provincial irrigation commission concerned.

## III. EXPERIENCES ON PARTICIPATORY IRRIGATION MANAGEMENT

Government assistance in irrigation construction has usually been followed by a continuing bureaucratic role in O&M, with farmers' responsibilities limited to their own fields and tertiary areas of a size usually in the range of 50 to 150 hectares. Management of dams, primary and secondary canals, tertiary gates and the first fifty meters of tertiary canals are the responsibility of the government. Concern about how irrigation systems could be better operated and maintained the Indonesia's 1987 Irrigation Operation and Maintenance Policy Statement, advocated the following policies: (1) Gradually turn over irrigation systems smaller than 500 hectares to WUA; and (2) Institute irrigation service fees (ISF) for systems larger than 500 hectares; (3) "Starter" On-Farm Water Management Development.

### 3.1. TURNOVER OF SMALL SCALE IRRIGATION SYSTEMS

The main objective of the transfer of small irrigation systems from the government to Water Users' Associations (WUAs) is to enable better use of farmers' knowledge, skills and other resources to manage the local irrigation systems, while the intermediate objective is to turn over all irrigation systems smaller than 500 ha to WUA, and gradually turn over the larger schemes.

Following government policy, the Ministry of Public Works has issued an ordinance as a guideline for turning over of small scale irrigation system and management authority to the WUA. The scope of activities of the turnover of small scale irrigation including: (a) the turnover of assets of small scale irrigation systems; and (b) the turnover of jurisdiction, duties and responsibilities of O&M.

The World Bank, the Asian Development Bank, and the Ford Foundation were supporting funding of the turnover activities at that stage. Under ISSP-I, the turnover activities began in 1987 in West Java and West Sumatra. In 1988/1989 fiscal year project activities expanded to four provinces, West Java, Central Java and Yogyakarta, and West Sumatra; and in 1989/1990 the turnover program was expanded to seven provinces, West Java, Central Java, East Java, West Nusa Tenggara, Yogyakarta, South Sulawesi and West Sumatra. Up to the beginning of April 2000, the total areas of 385,000 ha have been turned over to WUAs. The program has been slowing down few years after due to the urgent priority of the government to recover the economic crises.

### 3.2. INVOLVEMENT OF THE FARMER (PARTICIPATORY DESIGN AND CONSTRUCTION)

Within the design and construction phase, requests are ranked according to farmers' priorities. These requests are used in the preparation of the technical design for construction and improvement works. In the follow-up stages, involvement of the farmers in the construction and implementation provides an opportunity to strengthen farmer's organization through participation in collecting information, planning improvements and contributing to construction.

Water user associations are developed and registered with the *Bupati*, Head of District Government, and then further training is given to the WUAs in O&M activities. After the necessary training has been implemented, the irrigation systems assets and management responsibility are officially transferred to WUAs. The Provincial Public Works will continue to play a role in supporting the activities in line with the technical assistance which are beyond farmers' capacity to perform by them.

### 3.3. PILOT SCHEMES (FIELD LABORATORY) FOR MAJOR IRRIGATION SYSTEMS

Following the success of turn over of some 385,000 ha of small scale irrigation under the small scheme transfer policy, a number of pilot projects for transferring the larger schemes at the average of 1,000 ha were undergone (for learning by doing process) at 10 schemes in the Eastern Region with the total area of about 15,000 ha, and four schemes in Java with a total area of 62,425 ha, or 77,425 ha altogether. Similar to the above attempts toward Participatory Irrigation Management, the pilot schemes also suffered from a number of technical and non-technical constrain parallel with the severe economic crises. Despite that the projects have different level of success; the activities have been slowing down since then.

### 3.4. IRRIGATION SERVICE FEE (ISF)

Irrigation Service Fee (ISF) is a contribution in the form of money by farmers as the beneficiaries of irrigation water, in order to finance the O&M of irrigation networks. In principle, ISF is not a tax, rather, it is a way to encourage participation of the beneficiary to pay for the sustainable O&M of the schemes by themselves; thus, the farmer is only pay this contribution in lieu of irrigation service they obtained.

The introduction of ISF is one of the government policy on irrigation O&M in order to minimize the government subsidy in providing O&M budget, and ultimately this ISF become a major source in providing O&M budget for irrigation networks. For actual implementation of ISF within the entire irrigation areas in Indonesia, four principles had been suggested: (1) Maintaining a proper balance of ISF collection; (2) Application of direct use of the collected fee; (3) Application of simplified tariff; and (4) Fostering sustainable implementation.

### 3.5. LESSONS FROM EXPERIENCES

In an attempt to accelerate the implementation of participatory irrigation management (PIM), a number of efforts have been implemented without considering the problems and constrains of each specific locations. The standardized approach was then implemented nationwide – despite the diversity of social, economy, geography, as well as climate and cultural background. As a result, a number of traditional and local practices have been set aside and apply alien technologies instead. During which, the country's economy has concurrently been suffered from multi-dimensional crisis, and hence the project implementations have also been significantly affected. This had been due to a number of inter-related problems and constrains both internally within the farming circumstances as well as external matters which are beyond the institutional capacity to tackle with. Parallel with the multi-dimensional crisis and the need to implement the policy on "Local Autonomy" within the country, the pilot projects have also been slowing down, and currently suffer from inadequate attention.

In order to quickly recover from the impacts of multi-dimensional crisis the government has been taken some policy reforms, including the review of irrigation policy and follow up implementation. This has been stipulated in the newly established Water Law No. 7/2004 about Water Resources; and subsequently followed by the Government Regulation No. 20/2006 about Irrigation. The regulatory instruments have been established with special consideration on the past experiences, and then the subsequent implementation will be based on the newly established legal and regulatory instruments.

## IV. CONSTRAINTS OF SMALL LAND HOLDING FOR PIM

### 4.1. IRRIGATION AND WATER RESOURCES POLICY REFORM

In 1987 the government of Indonesia released a national policy on O&M of irrigation. The purpose of this policy has been to ensure adequate funding for O&M and improve irrigation management. Government committed to increase budget allocation for O&M, strengthen land and property taxes, as well as mobilizing more resources from beneficiaries. After a long process, the Government of Indonesia has recently been managed to enact the new Water Resources Law (UUSDA No.7/2004). For subsequent implementation, a new Government Regulation – PP No. 20/2006 regarding irrigation has subsequently been established. The Law prescribes delegation of responsibility to local autonomous government to conduct irrigation operation and management based on categorization of irrigation areas in conjunction with the coverage area of the provincial and local government administrative boundary.

### 4.2. CONSTRAINTS OF SMALL LAND HOLDING

**Farmer's Household:** About 50% of households in Indonesia are food crops farmers (mainly paddy, secondary crops, and horticulture). The total farm household (FHs) for food crops in the provinces vary from 46% to 78%. The highest levels of food crop farmers were in Maluku and Irian Jaya (Papua) Provinces at about 78%, while the lowest level was in Sumatra and Java at an average of about 47%.

Agricultural Census of 1983 and 2003 show the increasing number of land holding farm household, particularly food crops farm household (FCFH) recorded at 24,458,000 FHs increased to 27,446,000 FHs in 2003 (increased by 12.2%). The total number of food crops farm household by main islands. The national average of land control by the farmer household is 0.83 ha. The largest is Kalimantan Island at 1.98 ha, followed by Sumatra at 1.24 ha, and Sulawesi at 1.21 ha. **Table 2** shows the average land controlled by Land Holding Farm Household.

**Table 2.** Average land controlled by land holding farm household by main islands in 1993

| No. | Province | Land Tenure ( (x $10^{-6}$ ha) | Number of LHFH (x $10^{-6}$) | Average Land Controlled (ha) |
|---|---|---|---|---|
| 1 | Sumatra | 5.885 | 4.765 | 1.24 |
| 2 | Java | 5.461 | 1.563 | 0.47 |
| 3 | Bali & Nusa Tenggara | 1.150 | 1.323 | 0.87 |
| 4 | Kalimantan | 2.393 | 1.207 | 1.98 |
| 5 | Sulawesi | 2.013 | 1.664 | 1.21 |
| 6 | Maluku dan Irian Jaya | 580 | 509 | 1.14 |
| | **Indonesia** | **17.482** | **21.031** | **0.83** |

**Source:** Agricultural Census 1993, BPS Statistics Indonesia

**Land Tenure:** Nearly 50% of farm households control less than 0.5 ha of land per household and only 22% control 0.5 – 1.0 ha of land per household. Farm households control two to three ha of land only at about 7.4%. **Table 3** below shows the Land Holding Farm Household (LHFH) by Size of Land Controlled in 1983 and 1993.

Given the diversity of land holding features in each island within the archipelago in addition to the problem of land fragmentation and land conversion, the most apparent impact is that the number of land holders (especially on Java Island) is increasingly larger and larger.

**Table 3.** Land Holding Farm Household by area of land controlled in 1983 and 1993

| Size of Area Controlled (ha) | 1983 | | 1993 | |
|---|---|---|---|---|
| | Total LHFH | % | Total LHFH | % |
| < 0,05 | 1,271,067 | 6.52 | 646,372 | 3.28 |
| 0,05-0,09 | 1,167,370 | 5.99 | 948,296 | 4.81 |
| 0,10-0,24 | 3,155,471 | 16.18 | 3,570,371 | 18.11 |
| 0,25-0,49 | 3,938,317 | 20.19 | 4,417,121 | 22.41 |
| **< 0,5** | **9,532,225** | **48.90** | **9,582,160** | **48.60** |
| 0,50-0,74 | 2,797,812 | 14.35 | 2,934,875 | 14.89 |
| 0,75-0,99 | 1,445,451 | 7.41 | 1,438,870 | 7.30 |
| **0,5 – 0,99** | **4,243,263** | **21.80** | **4,373,745** | **22.20** |
| 1,00-1,99 | 3,297,609 | 16.91 | 3,312,218 | 16.80 |
| 2,00-2,99 | 1,294,048 | 6.64 | 1,457,561 | 7.39 |
| >3,00 | 1,134,312 | 5.82 | 988,122 | 5.01 |
| Total | 19,501,457 | 100.00 | 19,713,806 | 100.00 |

**Source:** Agricultural Census 1983 and 1993, BPS Statistics Indonesia

## V. THE IMPACTS OF SMALL LAND HOLDER ON WUA'S MANAGEMENT

### 5.1. DEMAND FOR WATER USER'S ASSOCIATION

Among the variety of problems encountering the irrigation water management, the lacking of skill and funds for O&M of the main system has been obvious. In addition, the inability of the farmer to provide adequate fund for O&M of irrigation networks, low collection rate of O&M funds due to a number of technical, institutional and other non-technical problems are also most dominant. Consequently, the sustainability of irrigation schemes has been declining and eventually entailed with deferred maintenance. Therefore, it is highly important to put special attention on encouraging participation of the beneficiaries to work together through the locally organized association. In this particular context, for accelerating the progress and promoting more successful PIM, special attention has been prioritized for empowering the WUA.

### 5.2. BASIC PRINCIPLE OF WUA

**Establishment of WUAs:** In attempting to foster the participatory approach in irrigation water management at the farm level, since 1980s the government has been actively promoting the WUA as the forum where the farmers are organized to work mutually for managing irrigation water management at the farm level as efficient and as effective as possible. The basic principles of WUAs' establishment are: (1) Demands for working mutually through the management of the group; (2) Establishment based on the

initiative of members, by members and for members; and (3) Consistent technical guidance from the government and other related institutions.

**Operational Principles:** The operational guiding principles of the WUAs among others are: (1) Managing the water at the farm level within the tertiary blocks (at an average of about 50 to 100 ha per unit) – depending upon the size of the tertiary block and other administrative boundary of the villages; (2) Operating and maintaining the tertiary or village irrigation systems effectively and efficiently; (3) Determining collecting and managing the resources contribution of the members in terms of money, in kinds, or in terms labor for sustaining the O&M performance of the schemes; (4) Conducting a continuous guidance for their members toward innovative irrigated agricultural implementation. These particularly refer to the newly established irrigation schemes where no such a WUA had been practiced before.

**Present Status of WUA:** Basically, there are three categories of the present state of the WUAs: (1) Already developed, for the WUA that has been fully in operation with legally bound status, or the legal status is being processed; (2) Still developing, for the WUA that is being in the process of establishment for technically and legally; and (3) Least developed category for the WUA that has been organized but it may have legal status but has yet had the full capacity to run the organization.

The three categories are currently summing up the national total of 33,078 WUAs, of which 2,660 WUAs are already having the full legal status, 26,835 WUAs are being processed, with the total coverage irrigation areas of 4,011,197 ha or about 36% of the total existing irrigation and drainage lands.

**Future Requirement for WUA:** With an assumption that the commanding area of WUA ranging between 50 and 100 ha or averaging at about 66 ha, the overall requirement for WUAs in Indonesia for 7,588,012 ha irrigation areas and 1,676,786 ha of drainage lands, would be at about 140,375 WUAs. Therefore, the present status of WUAs altogether at about 24% of the total demands.

Despite the current pilot schemes for larger irrigation schemes, in order to be able to organize the WUAs in the larger scope of services and geographical distribution, it is highly essential for the future program to establish and strengthen the organizational arrangement of the WUAs – for instance at the large schemes, at secondary level, or scattered areas – in terms of WUA's Federation (WUAF).

### 5.3. REVIEW ANALYSIS ON THE POTENTIAL LEVEL OF FARMERS' PARTICIPATION

Despite the establishment of such a large number of WUAs mentioned previously, it is evident that the effectiveness of their operation had been very poor. This had been suspected by the impacts of small land holding condition, which brought about farm incomes which are far from adequate for the farmers to fully participate in the irrigated farming activities.

**Farm Budget Analysis:** From analysis conducted by **Gany, 1978** (M.Sc. Thesis, Southampton University), it was concluded that the maximum size of land holding for irrigated paddies in Indonesia that could be performed by relying the family labor only

is 1.72 ha per farm household. This size of land holding is slightly above the level of marginal subsistence farming. Any size smaller than this figure is potentially suffered from the risk of negative income, and hence not likely possible to contribute adequate financial or labor resources for securing sustainable O&M of irrigation schemes. In fact, the land holding category up to 0.50 ha per farm household – which dominates the irrigated land areas of the country at 48.60% – is considered to be marginal subsistence farming, and hardly expected to participate sharing any contribution for sustainable O&M. The land category of > 0.5 < 1.00 ha and of >1.00 <2.00 ha are currently stood at about 22.2% and 16.80 % of the total agricultural land of the country respectively.

From analysis of financial return, the same analysis concluded that the land holding category of >0.5 ha; 1.0 ha and 2.00 ha produces the net value of production of US$91.6; US$463.51; and US$1,119.53 respectively. These figures have been based on irrigated paddy at 1.30 cropping intensity, after deducting indirect costs such as materials and labor, and indirect costs such as taxes, home consumption, and yet, without imposing any irrigation service fees.

**Potential Capacity for Farmer's Participation**: Based on the above figures, a review of potential level of farmers' participation is further scrutinized by using some assumptions, including the basis for full participation for the land holding rounded (for simplification) to 2.00 ha per farm household. The size of commanding area for the WUA at 100 ha/WUA, while the average commanding area for water users' association federation (WUAF) at 1,000 ha per WUAF. The estimated potential level of participation for sustainable O&M have been based on farm budget analysis and empirical estimate (expressed in terms of magnitude between 10 and 100), at the magnitude of 20 for the land holding category of smaller or equal to 0.5 ha; the magnitude of 30 for the land holding category of >0.5<1.00 ha; the magnitude of 80 for the land holding category of >1.00<2.00 ha; and the magnitude of 95 for the land holding of >2.00<3.00 ha. The remaining capacity to participate in irrigated farming activity must be dedicated to non agricultural employment in the urban areas (seasonal urbanization). See **Figure 3** for analysis result of the farmers' potential capacity to participate on the sustainable irrigation O&M.

Form **Figure 3** below, it is apparent that the WUA's institution as amongst the important prerequisites for implementation of PIM suffers from a number of non technical constraints among others: (1) Too many farmers are involved as the member in the WUA under the small land holding condition. For illustration, a WUA with an average land holding of 0.50 ha would compose of 200 farmer households working in an area of 100 ha; in addition to the average capacity to participate at the magnitude of 20 out of 100, since they have to seek seasonal employment in the urban areas. For the national average of land holding at 0.83 ha/farm household, a single WUA of 100 ha command area, would involve about 120 farm households, with the capacity to participate at only about 30 out of 100, for they have to share their time for earning non-farming extra income in the urban area.

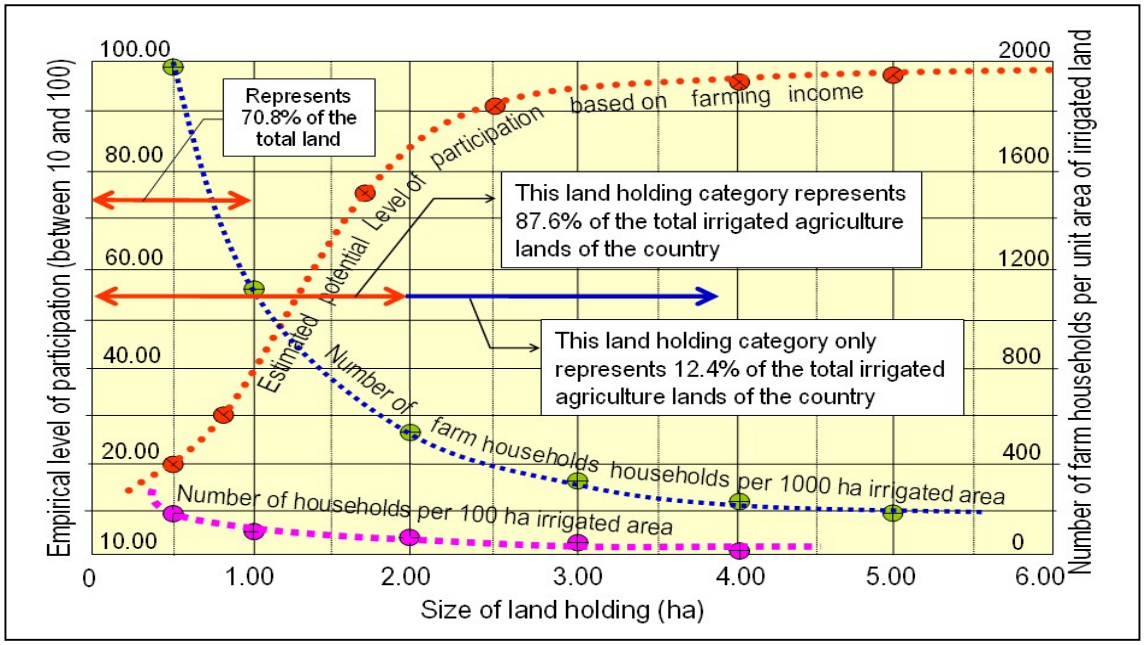



**Figure 3.** Analysis result of the farmers' potential capacity to participate on the sustainable irrigation O&M.

During their absences, their participation (in person) in the routine irrigation management are hardly possible – a size of irrigated farming organization, too diversified sosio-economic conditions, with low level of potential participation, which is far from manageable. If we take the optimum size of land ownership (2.00 ha/farm household) as the determinant parameter for establishing WUA, the number of members would be 50 farmers, which is reasonably manageable, however, such the optimum size of land holding only represent about 15% of the total national irrigated agricultural land.

**Rationale of the Low Level of Participation:** From the analysis results presented above, it is evident that the farmer's participation in O&M of irrigation is not merely the question of technical and economic perse', but far from those matters, there remains a complicated constrain on socio-cultural as well as organizational predicaments. The rationale of the currently low participation of the farmer is not only because of the farmers are unwilling participate, but it is quite a logic explanation that the farmer, under the extremely small land ownership, would naturally set up his own priority in mind, whether to participate partially or seeking non-farm extra-incomes elsewhere.

**Alternative Measures to Address the Constraints:** Under the diversified levels of education, experience, size of land-holding, and socio-economic as well as cultural backgrounds, it would not be easy to ask the farmer to participate voluntarily in O&M activities, on top of a hardly manageable number of members in the single WUA. In an attempt to address the constrains there are several alternative measures to mention, among others: (1) Transformation of paddy mono-culture (particularly for the land ownership smaller then 2.00 ha per unit) into diversified crops that have significant potential for higher financial returns – this alternative should be followed by consistent, post-harvest processes, storage and maintenance, as well as competitive market; (2)

Reformation and reclamation of land ownership plots and land administration into a sort of cooperative farming, operated by professional irrigated agricultural, and agro-based industries; (3) Consistent regulation and subsequent enforcement on the issues of land fragmentation and land conversion into non-agricultural utilization; (4) Consistent water saving and conservation implementation; (5) Provision of incentives to small land holder for cultivating high financial return crops, including encouragement of leisure agriculture in the rural areas for fostering the multifunctionalities of irrigated agriculture – with some leeway for flexibility to make adjustment with local circumstances. These alternative measures, however, are subject to further scrutiny and comprehensive studies, which are still widely opened for further interdisciplinary studies and experiments in the upcoming years.

### 5.4. LESSONS LEARNED FROM TRADITIONAL WUA

Learning from the traditional agricultural irrigated agricultural practices in Indonesia, it has been obvious that the existence of WUAs in this country had a long history. Among the most famous traditional WUAs are *"Subak"* in Bali Island, *"Keujreun Blang"* in the Special Province of Aceh; *"Tuo Banda"* in West Sumatra Province; *"Raja Bondar"* in North Sumatra Province; *"Mitra Cai"* in West Java Province; *"Dharmo Tirto"* in Central Java; *"Tudang Sipulung"* in South Sulawesi and several others to mention. In principle, all the traditional practices are embracing the similar democratic principle, mutual aids, cooperative working principles, consensus (oral or written), transparency, participatory, and other such a togetherness principles. The following illustration represents the Subak System.

**The *"Subak"* Irrigated Agricultural Management System in Bali:** The *Subak* system is an ancient irrigated-agricultural practice in Bali Island. Like most irrigation scheme in Indonesia, the *Subak* system also serves small-land holders where lowland paddy mono-culture is practiced in majority. The exact date of *Subak* was unknown; however, some stone inscription indicated that the *Subak* system was known to be part of the Balinese life since hundreds of years ago (*DPU Propinsi Bali, 1972*).

**Principles of "Autonomous and Religious Ties of the *Subak* Practice".** The *Subak* employs a principle of independence and religiously tied practices in managing irrigation system under the irrigated agricultural endeavor. The Subak members, thus, establish and maintain irrigation infrastructures through mutual cooperation through judicious and fair dispersion of obligation, right, and responsibilities. These activities are implemented through mutually agreed regulation which is referred to as the *Awig-Awig*. The organization structure of Subak is highly autonomous, representing the farmer from the grass-root to the highest organizational entity. The highest representation of subak member – which is known today as the WUA Federation – has long been practiced by Subak through the so called *Sedahan Agung*.

**Coverage Area of Subak:** The average area covered by one *Subak* organization is about 100 ha, depending upon the magnitude of the area covered by the irrigation command area of the *Subak* system. However, due to individual variation of the topographical condition, one *Subak* organization may cover an area in the range of 10 to 800 ha. Under the very special condition, one independent *Subak* area, however, may cover an area even smaller than 10 ha. *(Gany and Faisol, 1975:10)*. The boundary area of each individual *Subak* is usually formed by natural creeks, small valleys, small rivers or

village roads. In the entire Bali Island, there are 1,283 independent *Subak* systems, with distinct irrigation infrastructure, farmers' organization and awig-awig regulation.

**Lesson Learned from *Subak*:** Despite the fact that the *Subak* system and its practices were invented long time ago, it is quite amazing to know that much of their techniques are still convertible to the modern practices that the people understand today. The more we can comprehend the traditional irrigated-agricultural practices the more we learn about their technicalities. In fact, there is a reason to believe that the traditional agricultural practices adopted by the *Subak* organization were based on systematic observations. Today, there remains a lot more phenomend of the ancient agricultural practice – including PIM Principles – that need to be uncovered from tradidional WUAs in terms of scientific explanation.

## VI. CONCLUDING REMARKS

Learning from experiences to implement the massive irrigation development program, Indonesia has now been concentrating its policy on efficient O&M of irrigation. Since 1987, the Government of Indonesia has formulated a set of policies for addressing fundamental issues related to the provision of financial support for O&M and other expenditures required for irrigation development and management.

After a long process, the Water Law No. 7/2004 about Water Resources has eventually been managed to be enacted; and subsequently followed by the Government Regulation No. 20/2006 about Irrigation. The regulatory instruments have been established with special consideration on the past experiences, and then the subsequent implementation will be based on the newly established legal and regulatory instruments.

Despite the establishment of a large number of WUAs, it is evident that the effectiveness of their operation had been very low. This had been suspected by the impacts of small land holding condition, which brought about farm incomes which are far from adequate for the farmers to fully participate in the irrigated farming activities.

From agricultural labor analysis, it was concluded that the maximum size of land holding for irrigated paddies in Indonesia that could be performed by relying the family labor only, is 1.72 ha per farm house hold. This size of land holding is slightly above the level of marginal subsistence farming. Any size smaller than this figure is potentially suffered from the risk of negative income, and hence not likely possible to contribute adequate financial or labor sources for securing sustainable O&M of irrigation schemes.

The farmer’s participation in O&M of irrigation is not merely the question of technical and economic perse’, but far from those matters, there remains a series of complicated constrains on socio-cultural as well as organizational predicaments. The rationale of the currently low participation of the farmer is not only because of the farmers are unwilling participate, but it is quite a logic explanation that the farmer, under the extremely small land ownership, would naturally set up own priorities, whether to participate partially of seeking non-farm extra-incomes. Logically, the remaining capacity to participate in irrigated farming activity shall be dedicated, in lieu to non agricultural employment in the urban areas, which entailed seasonal urbanization.

Under the diversified level of education, experience, size of land-holding, and socio-economic as well as cultural backgrounds, it would not be easy to ask the farmers to participate voluntarily in irrigation management, on top of a hardly manageable number of members in the single WUA. In an attempt to address the constrains there are several alternative measures to mention, among others: (1) Transformation of paddy mono-culture (particularly for the land ownership smaller then 2.00 ha per unit) into diversified crops that have significant potential for higher financial returns – this alternative should be followed by consistent, post-harvest processes, storage and maintenance, as well as competitive market; (2) Reformation and reclamation of land ownership plots and land administration into a sort of cooperative farming, operated by professional irrigated agricultural, and agro-based industries; (3) Consistent regulation and subsequent enforcement on the issues of land fragmentation and land conversion into non-agricultural utilization; (4) Consistent water saving and conservation implementation; (5) Provision of incentives to small land holder for cultivating high financial return crops, including encouragement of leisure agriculture in the rural areas for fostering the multifunctionalities of irrigated agriculture, with some allowance for flexibility to make adjustment with local condition. These alternative measures are subject to further scrutiny and comprehensive studies, which are still widely opened for further interdisciplinary studies and experiments in the future.

Concerning the traditional irrigated agricultural practices, it has been obvious that the existence of WUAs in this country had a long history. In fact, all the traditional practices are embracing the similar democratic principle, mutual aids, cooperative working principles, consensus (oral or written), transparency, participatory and other such a togetherness principles. In reality, a number of experiences may be adopted from the traditional practices, including the principle of WUA Federation (in terms of *Sedahan Agung*).

It is expected that through the accelerated efforts, to address the constrains of small land holder along with appropriate incentives for encouraging greater participation of water users on the O&M, and making better use of staff resources, the **participatory irrigation management** will be more successful, and hence attaining the fully sustainable irrigation systems as well as sustainable water resources development and management.

## BIBLIOGRAPHY

1. Asian Development Bank (ADB), 1996. Toward Effective Water Policy in the Asian and Pacific Region.
2. Bappenas, PU, JICA, 1993. FIDP – The Study for Formulation of Irrigation Development Program in the Republic of Indonesia.
3. Booth, Anne.1987. Irrigation in Indonesia, Part I and II. Bulletin of Indonesian Economic Studies (Vol. 13 No. 3.4.).
4. Departemen Pekerjaan Umum dan BAPPENAS, 1982. Water Resources for Sustainable Use in Indonesia. Proceedings of the International Seminar Sponsored by National Planning Agency and Ministry of Public Works, Cisarua, Bogor, October 29-November 1, ’92.

5. Departemen Pekerjaan Umum dan BAPPENAS, 1982. Water Resources for Sustainable Use in Indonesia. Proceedings of the International Seminar Sponsored by National Planning Agency and Ministry of Public Works, Cisarua, Bogor, October 29-November 1, 1992.
6. Gany, A.H.A. and Zakaria, Ir. F., 1975 *Persubakan di Bali* (Suatu Laporan peninjauan, untuk studi perbandingan dengan permasalahan pengairan di Lampung). A Report for the Provincial Government of Lampung, 1975.
7. Gany, A.H.A., 2001. Subak Irrigation System in Bali: An Ancient Heritage of Participatory Irrigation Management in Modern Indonesia, Research Center of Water Resources, MPW, Bandung, Indonesia, 2001.
8. -------, 1994. Manajemen Sumberdaya Air Terpadu, Majalah Pekerjaan Umum edisi Khusus No. 03/1994/XXVII.
9. --------, and Halli, S.S., 1993. Land Development and Transmigrant Farmers in Southern Sumatra, Indonesia. In International Migration. Quarterly Review Vol. XXXI No. 4, 1993. International Organization for Migration (IOM), PO Box 71, 1211 Geneva, Switzerland.
10. -------, 1989. Field Water Management Impacts on the New Irrigated Area. In Rydzewski J.R. (ed), Irrigation, Theory and Practice, John Wiley and Son. Ltd. & Pentech Press.London.
11. -------, 1978. Comparison of Estate and Small Holder Irrigation Projects in Their Impacts on Rural Development. M.Sc. Thesis, Southampton University, U.K., Southampton, October 1978.
12. Grader, C.J., 1960. *The Irrigation System in the Region of Jembrana*, Bali, Studies of Life, Thought and Ritual. Selected Studies on Indonesia, Vol. V. Les Editions A. Manteau S.A., Bruxelles W. van Hoeve Ltd. The Hague and Bandung. Edited by W.F. Wertheim et. al.
13. IPB, and University of Udayana, 1974. *Subak, Organisasi Tata Guna Air pada Tingkat Desa di Bali*, Institute of Agriculture Bogor, And University of Udayana, Bali, November 1974.
14. Park, Kee Sung, 1976. *Subak Irrigation System in Bali, Indonesia.* Japan International Cooperation Agency (JICA), 1976.
15. Republic of Indonesia, 2004. Laws No. 7/2004 regarding Water Resources.
16. Republic of Indonesia, 2006. Government Regulation No. 20/2006, regarding Irrigation.
17. Teken, I.B., 1967. *Organisasi Pengairan Pedesaan Subak di Bali*. A case study: Subak in Desa Luwus, Tabanan, Bali., Bogor Institute of Agriculture.
18. Winaya, P. Djapa, 1973. *Organization of Water Association in Bali.*, A paper specially prepared and presented as a lecture for the American Students from the Lewis and Clarke College, Oregon, U.S.A., at the Udayana University, Denpasar, Bali.