Inventory of Irrigation Systems: Notes from Bali, Indonesia

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INTRODUCTION

An inventory of irrigation systems has been conducted in Bali. The objectives of the activity were two fold. Firstly, to describe social-institutional and physical characteristics of the irrigation systems. This can be used as basic information for further development and management planning of irrigation systems. Secondly, the activity was also expected to produce a tested method on inventorying irrigation systems in Bali, which could later be used by government agencies to conduct irrigation system inventories.

Three regencies were selected for the first round of the inventory, namely Gianyar, Badung and Tabanan regencies.

The inventory obtained several basic data which differed from available secondary data. This paper discuss some of the findings and lessons learned in undertaking the said inventory.

In line with the efforts of the Indonesian government to achieve self-sufficiency in rice (rice being the staple food of its population), extensification and intensification of rice production has been a priority program for national development. Irrigation development has been a priority investment area. Massive irrigation projects have been carried out, both for rehabilitation of existing irrigation systems and construction of new ones.

In Bali, irrigation development focussed on rehabilitation of existing irrigation systems, because of limited land available for extensification. Rehabilitation efforts ranged from a single system, to the merger of a number of small-scale systems into one bigger system.

Despite its significant role in increasing rice production, government intervention in the Balinese traditional irrigation systems has been severely criticized because it created negative impacts (Sutawan et al. 1987; Sutawan 1984; and Pitana 1989). Such were caused by the lack of basic data on the irrigation systems being assisted, especially socio-cultural and institutional data about the nature of irrigation systems along river courses and the nature of "*irrigation networks*" along a river basin.

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THE NEED FOR INVENTORY

Although traditional irrigation systems in Bali (the so-called *subak*) have long been intensively studied, the nature of inter-subak coordination along a river basin is still not comprehensively understood. This is because previous studies focussed mostly on individual systems. Due to the density and topography of Bali, one can not clearly understand a system without understanding the coordination or network of the systems along a river. The water distribution system employed is highly influenced by upstream systems. In Bali for instance, the *"water borrowing system or rotation"* exists and plays an important role in the water distribution scheme.

Available data regarding irrigation systems along rivers in Bali is inconsistent, and is worst at the provincial level. For example, different sources of data report different numbers of subak. According to the Provincial Office of Public Works (DPUP), the number of subak in Bali is 1,733 with 100,430 ha service area; according to the Office of Agricultural Service (Distan Tanaman Pangan), there are 1,235 subak covering 93,000 ha. While the Provincial Office of Internal Revenue (Dispenda) records the number of subak at 1,274. This implies the inconsistency and unreliability of other data which could be even worse in some cases. Hence, they are very weak basis for development planning. In view of this, making inventories of irrigation systems in Bali is considered an immediate need.

Moreover, inventory of irrigation systems in Bali is deemed very important for the following reasons:

1. It would provide general descriptions of irrigation systems along a river (including their system of coordination with one another);

2. It would provide direction for the "outsiders", (including the government) in prioritizing development needs;

3. It would provide the government with a basis for defining a more feasible management scheme, whether the system will be managed by the government, fully managed by the farmers or a joint management scheme; and

4. It would be able to provide information as to the preliminary activities that must be done prior to the turnover process.

OBJECTIVES

Based on the above-mentioned expected benefits, the objectives of the inventory were:

1. To obtain a profile of the physical characteristics of each single system in the area covered by the inventory such as:

   a. the primary and secondary source(s) of irrigation water (spring, river, or both);

b. location of the weir(s) and location of the area covered, i.e. geographic location relative to others, location along the river (upstream, midstream, or downstream), administrative location (village, district, etc.);

c. the size of the service area;

d. physical status of the systems (weir, canal, division structures, etc.);

e. water sufficiency; and

f. cropping patterns and cropping intensity.

2. To obtain a profile of the social-institutional aspects of the systems, to include:

a. number of water users' association (subak) using the system and their leaders;

b. number of farmers; and

c. the existence of intersubak coordinating bodies (subak-gede).

3. To identify the present management status of the system, whether they are managed solely by the government, by the farmers, or jointly by the government and the farmers; and

4. To describe the relationship/coordination of systems along a river course.

It is noteworthy that aside from the above mentioned objectives, the inventory was also intended to develop methods of conducting an irrigation inventory in a Balinese setting which could later be used by government agencies.

METHODS

Methods used in doing this inventory were basically a combination (and modification) of methods introduced by Romana (1985), Andalas (1988) and Pitana (1989). The methodology consists of: 1) secondary data collection 2) walk through and observations and 3) interviews. For these, observation and interview guides were developed. It is worthwhile noting that the inventory was started from the end of the downstream of the river moving upward. The assumption was that the farmers in the downstream generally had more knowledge about the upstream systems than the other way round. This knowledge is considered very useful, especially in exploring the coordination between adjacent systems.

The results of the inventory were presented in matrixes of individual systems together with a description of a system along a river course.

For the first round, the inventory was conducted in three regencies (out of 8 regencies) in Bali, that is, Tabanan, Badung, and Gianyar regencies.

RESULTS

It was found that there were considerable differences between the data produced by this inventory and those available in government agencies. The number of irrigation systems found in the inventory was much higher than that of government figures. It was found that in the regencies of Tabanan, Badung and Gianyar, the number of irrigation systems were 459, 93, and 136 respectively, which were higher than DPU records (142, 20 and 112, respectively). On the other hand, the area of riceland was found to be smaller. Comparison of the selected data produced from the inventory with those of DPUP for the three regencies aggregatively can be seen in Table 1.

Table 1. Comparison Between Data of DPUP and the Results of the Inventory

No.	VARIABLE	DPUP(*)	INVENTORY
1	Number of Irrigation System	274	688
2	Number of Subak	763	1.147
3	Riceland (ha)	63,123.07	60.367,85
4	Number of Weir	n.d.	696
	a. Gov't Rehabilitated Weir	140	168
	b. Traditional(farmer's)**	n.d.	528
5	Number of Subak Gede	n.d.	96

Notes:
* Analysed from "Buku Pintar DPUP 1989"
** Including spring without weir structure
n.d. no data

LESSONS LEARNED

The difference in the number of irrigation systems found by the present inventory from that of DPUP was due to the varying definitions used. In defining an *"irrigation system"*, DPUP follows the unit of *"irrigation development project"*. One irrigation project sometimes consists of several small-scale systems, which were individually rehabilitated. Even without any physical connecting one to another, DPUP, insists on counting the rehabilitated systems as one irrigation system. On the other hand, this inventory defines an irrigation system based on Government

Regulation (PP) No. 23/1982, which mentions that *"irrigation system is a complex of ricefield getting irrigation water from a single irrigation network"*. Hence, one system in DPUP records often consists of more than one system as found in the inventory.

The difference in the number of subak was also complicated by the difficulty of identifying a subak in the field. It seemed that DPUP was inconsistent in defining what a subak is. In addition, the farmers often interchange the terms subak, tempek (sub-subak) and subak-gede (which refer to system, sub-system and supra-system levels respectively).

As to the area irrigated, the different figures might have been caused by one or more of the following factors: 1) newly expanded riceland could not be recorded during the field work; 2) in some cases, the size of the ricefield was purposely overestimated to qualify the small-scale systems for government assistance because there was a rule that a system can only be rehabilitated by the government if its size is more than 150 ha; 3) for the newly rehabilitated projects where the riceland had not yet been expanded, DPUP had recorded the planned expansion areas as actual areas and 4) in some irrigation systems, the area of the riceland had been reduced (converted into other uses such as clove, grave, or vanilla plantation as well as for non-agricultural uses), but DPUP records still reflects the riceland area before the conversion.

This inventory also discovered that a lot of irrigation systems used by several subak have not yet developed a coordinating body (*subak-gede*). Each subak independently concentrates in their own areas, while operation and maintenance of the main system is the responsibility of the government (DPUP). If these systems are to be turned over to the farmers, it is recommended that the organization covering the system as a whole be strengthened (namely, the formation of *subak-gede*). In the systems where *subak-gede* have been in operation, the government should strengthen their management capability.

For small-scale systems which are considered single systems by DPUP, it is recommended that if the government should define its position as to whether it will turn over the management of the systems to the farmers.

Since this inventory has revealed a number of significant results, it is deemed necessary that it be continued to cover the other five regencies (Jembrana, Buleleng, Karangasem, klungkung and Bangli). It is recommended that the methods developed by this inventory be used to guide the collection of consistent and reliable information.

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MATRIX A. IDENTIFICATION OF IRRIGATION SYSTEM

No.	CODE OF I.S.	NAME OF I.S.	MANAGE -MENT STATUS	LOCATION OF WEIR		SUPPLE-MENTARY WATER SOURCE	WEIR CONS-TRUCTION	LENGTH OF THE WEIR	DISTANCE OF OTHER WEIR (m)	EXISTENCE OF COORDINATION
				RIVER	VILLAGE					

MATRIX B. IRRIGATION FACILITIES AND COMMAND AREA

NO.	NAME OF I.S.	LENGTH OF MAIN CANAL (Km.)				YEAR OF REHABILITATION	RICELAND		
							LOCATION		SIZE (Ha.)
		LINED	EARTHEN	TUNNEL	TOTAL		VILLAGE	DESA ADAT	

MATRIX C. FARMERS' ORGANIZATION

NO.	NAME OF I.S.	NAME OF SUBAK	LOCAL TERMS	NUMBER OF SUB-SUBAK	SERVICE AREA (Ha.)	NUMBER OF MEMBER	NAME AND ADDRESS OF LEADER	REMARKS

MATRIX D. CROPPING PATTERNS AND CROPPING INTENSITY

NO.	NAME OF I.S.	CROPPING PATTERNS	CROPPING INTENSITY		
			RICE	SECONDARY CROPS	TOTAL