

Inventory of Farmer Managed Irrigation Systems in Indonesia: A Basic Concept

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INTRODUCTION

The Government of Indonesia has long been aware of the importance of making inventories of irrigation systems, as stated in several laws and regulation on water resources or irrigation.

Through a programme called "handing-over of small scale irrigation system" the Government of Indonesia intended to turn over the right and responsibility to manage small scale irrigation system to the concerned Water Users Association (WUA). The experiences in implementing the said programme will be the basic reference of this paper.

An irrigation inventory may have great importance as the data and information are the basis for evaluating system performance, preparing irrigation plans, designing rehabilitation and modification works as well as increasing water use efficiency.

Provincial Irrigation Services have the responsibility to undertake inventories of Farmer-Managed Irrigation Systems (FMIS), which to some extent may be done, in cooperation with WUA.

An inventory of FMIS should cover the physical facilities of the system, performance and institutional status of the system. Data taken from the field survey can then be divided into: basic data, periodical data and supplemental data.

At the lowest level, a field survey can be carried out in cooperation with farmers or village officials. The next inventory process can be undertaken by the Irrigation Service at different levels.

Two-stage verification should be applied to the data obtained from survey. However, the other data may be processed further. Computer aided data processing will be very helpful in this regard.

The outputs of such inventories are Inventory Resume, Correction Sheet and Detailed Inventory which should be furnished to appointed institutions.

The inventory process should be on an annual basis, but data collection should follow the irrigation period.

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There are two main beneficiaries of the inventory, firstly, the Irrigation Service and secondly, the WUA.

The total irrigated area in Indonesia is 4,334,654 hectares, out of which some 1,885,742 hectares (43.5%) are covered by 25,304 small scale irrigation systems or the so-called "village irrigation systems" managed by village authority or farmers through Water Users' Association (WUA).

The Government of Indonesia (GOI) has long been aware of the importance of the inventory of irrigation systems. In fact, Article 3 of Law No. 11/1974 on Water Resources states the obligation of the Local Government to make an inventory of irrigation systems inside its administrative boundary, while Article 9 of Government Regulation No. 23/1982 on Irrigation states the need to undertake an inventory of water resources all over the country.

Many inventories of irrigation systems have been made available at regional or lower levels, but there were only two prominent inventory systems that had been established at the national level, for FMIS and government managed irrigation systems (GMIS). Unfortunately, these inventories reflect only the technical and engineering aspects of the irrigation systems studied.

In 1987, the Directorate of Irrigation (DOI) in Indonesia established a programme which specifies that small scale irrigation system formerly managed by the Government would be handed over to WUAs. One of the activities of the programme was the inventory of the irrigation systems. The inventory was used to evaluate the physical condition of the irrigation systems, institutional status of the WUAs and performance level of the system either at the main and the tertiary levels, so that a detailed action plan can be prepared and implemented before handing over the irrigation system and its management responsibility to WUAs.

The inventory experience related to the above mentioned turn over programme is one of the most important reference of this paper.

THE OBJECTIVES OF THE INVENTORY

The main objective of the inventory is to provide detailed data and information on irrigation systems to be used as a data base for evaluating system performance, preparing irrigation plans, designing rehabilitation or modification works, increasing water use efficiency and other planning activities.

IMPLEMENTATION RESPONSIBILITY

As stated in Article 2 Paragraph 2 of the Government Regulation of the Republic of Indonesia No. 23/1982, the rights to manage irrigation water and irrigation networks at the farm level and in village owned irrigation systems or Farmer-Managed Irrigation Systems (FMIS), shall be given to WUA(s) or village authorities, with the assistance from local government authority through the Provincial Irrigation Service.

Based on the government policy, it is clear that the WUAs should be responsible for carrying out the inventory programme of their own irrigation system. Due to their limited skill, knowledge as well as financial resources, the WUA itself seemed not capable of carrying out such an inventory programme. Therefore, the local government through its Irrigation Service implemented the programme and the active participation of the WUAs was one of the conditions of its implementation. Appendix 2 shows the areas of responsibility of the Irrigation Service at different levels in the implementation of the inventory.

It is important to note that there was no need to establish a special operational unit or project to undertake the inventory, since this was part of the duties of the irrigation staff. However, efforts were exerted at the beginning of the programme to collect and manage basic data as a benchmark to the next step in the inventory process.

SCOPE OF INVENTORY

The inventory of the small-scale systems covered three aspects:

- a. **Inventory of the physical facilities of the irrigation system.** Through this activity the technical data on all irrigation facilities, i.e. structures, canals and infrastructures were compiled, including their present condition.
- b. **Performance of the system.** Consists of records of the streamflow, reliability of the flow, water requirement, water balance, the seasonal irrigated area, level of irrigation efficiency, cropping pattern, cropping intensity, yield and production and other related variables.
- c. **Institutional status.** Existing WUA(s), number of members, efficiency of the organization, their financial status and other data which expressed the institutional profile of the WUA.

A comprehensive data compilation will be a great contribution to the users, but the tendency to provide detailed information with broader range of data should be avoided as this will require a large scale inventory activity that needs special efforts, skills, manhours and, most importantly, an adequate budget that may go beyond the capacity of the irrigation service to conduct. Exception is given to the benchmark survey where detailed basic data will be kept as benchmark inventory.

DATA SPECIFICATION

Data taken from an inventory survey can be divided into three types:

- a. **Basic data.** All data that will not change within a short period, such as command irrigation area, area of ricefield, technical specification of the headwork, canal and structures. In general, this specification is closely related to technical and engineering data.
- b. **Periodical data.** Data that should be renewed in a certain period, for example seasonal cropping area, harvested area, crop yields, cropping intensity and others. Usually, the data are needed to evaluate the performance of the system.
- c. **Supplemental data.** Such as hydroclimatological data, streamflow and others. The data can be classified as secondary data and may be obtained from other sources.

DATA COLLECTION

Data is collected through a field survey by means of inventory instruments, such as a questionnaire, inventory sheets etc. The instrument should be of standardized form so that standardized data can be obtained although they are taken from different surveys and/or different for periods. The lowest rank of the Irrigation Service (i.e. Subbranch Irrigation Service, SBRIS, or Irrigation Supervisor) together with the WUA(s) of the irrigation area, are responsible to carry out the field survey. The field survey schedule should be arranged with respect to the schedule of irrigation activities in the field as several data can only be obtained during a certain period of time.

An Inventory Book and Correction Sheet will be produced as the result of the survey, and sent to the higher rank office i.e. branch irrigation service (BRIS). The Inventory Book consists of compiled raw data from the survey, while the Correction Sheet is the verified data from the survey.

A manual of the inventory system is important. This explains the terms, methodology, instruments, procedures, data processing and analysis, distribution of information and others. Inventory objects should be described into several categories according to its complexity and diversity, so that the inventory can be compiled on a systematic file. The procedure should be completed with flowchart as well as barchart.

DATA PROCESSING

Data obtained from the field survey should first be verified, especially with regards to the validity and completeness. Doubtful data should be checked by comparing present correction sheet with the previous one(s), and if it does not give any good result, then those ambiguous data must be resurveyed in the field.

Some data may be processed further, for example cropping area data, together with stream flow and hydroclimatological data which could be used to derive the water requirement and water balance. Estimation of cropping intensity will require data on irrigation command area as well as cropping area.

Data that needs further processing and the expected output are seen in Appendix 3.

FLOW OF DATA PROCESSING

Verified (new) data is used to renew the previous inventory book(s). In case a computer was made available in the BRIS Office to aid the inventory process then all data in the book should be entered to disk(s). A special software designed for the inventory will be very helpful. Otherwise, worksheets using Lotus 123 or other similar software may be applicable. A personal computer with a 20 megabyte hard disk onboard will be preferable. If possible, a MODEM facility can be installed in the computer, but sending a printout or hardcopy seem to be the cheapest way to send the data from BRIS offices to Provincial Irrigation Service (PRIS).

PRIS should verify the data received from BRIS before entering it to higher level data management where a Master File should be available. The available Master File in PRIS Office must be renewed using the new data. Appendix 2 shows the process flowchart for data processing.

INVENTORY OUTPUT AND THE DISTRIBUTION

Besides an Inventory Book for each irrigation area, the inventory activity will produce other outputs. Those are:

1. **Resume of the Inventory of Irrigation Systems.** With the authorization from the Head of the District this document will be returned to the BRIS for filing.
2. **Correction Sheet.** Consists of verified data form the survey shall be returned to SBRIS to be used for the next survey.
3. **Detailed Inventory.** Shall be delivered to each corresponding WUA for filing.

INVENTORY IMPLEMENTATION SCHEDULE

Although the inventory activities may be done annually, data collection should be carried out periodically in accordance with the irrigation activities in the field.

Since the output of the inventory shall be used as inputs for planning irrigation operation and other activities, it is suggested that all inventory output should be issued and delivered before the beginning of the planting season. The tentative schedule for an inventory of a FMIS can be seen in Appendix 4.

UTILIZATION

There are two beneficiaries of the FMIS inventory. Firstly, the Irrigation Service which is responsible to technically assist and promote the activity of WUA(s) in managing the irrigation water at the farm level. Using the inventory, the PRIS would be in a better position to monitor and evaluate the performance of FMIS's. Moreover, any detailed action plan for improving irrigation system performance would may be prepared more easily using inventory results.

Secondly, the WUA(s) themselves which could make use of the inventory to improve the management of the irrigation system in particular irrigation planning, irrigation water distribution schemes, and operation and maintenance of the system.

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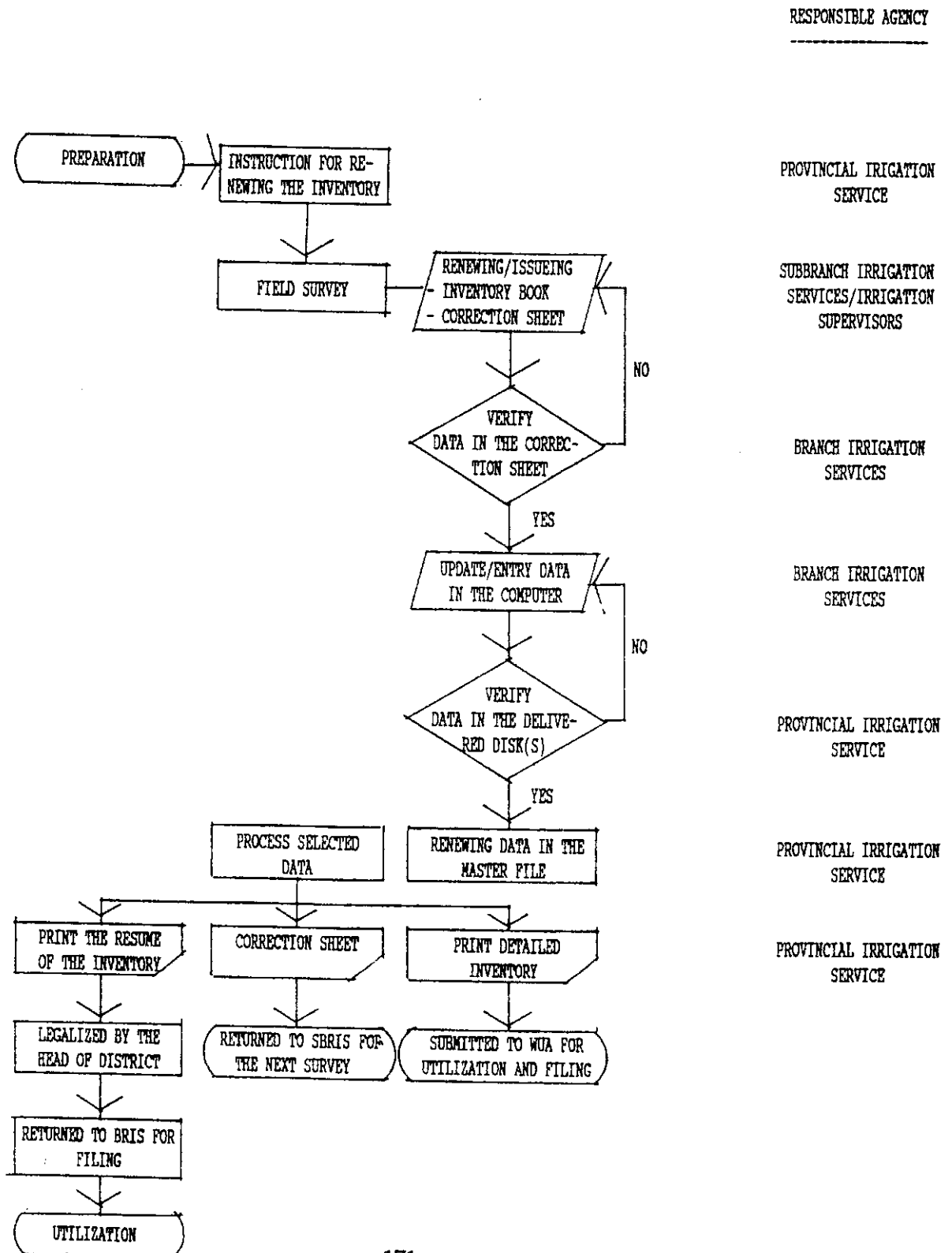
Appendix 1. List of data for the inventory of FMIS

CODE NUMBER	DATA CLASSIFICATION	SPECIFICATION
B.	BASIC DATA	
B.1.		Name of irrigation area.
B.2.		Number of tertiary blocks.
B.3.		Names of tertiary blocks.
B.4.		Command area of each tertiary block.
B.5.		Technical specification of the headwork;
	B.4.a.	Type.
	B.4.b.	Length of weir.
	B.4.c.	Number of intake gates.
	B.4.d.	Number of sluice gates.
B.6.		Technical specification of the canal;
	B.5.a.	Length of primary canal.
	B.5.b.	Length of secondary canal.
	B.5.c.	Length of tertiary canal.
	B.5.d.	Design capacity of the primary canal.
B.7.		Number of irrigation structures;
	B.7.a.	Regulator.
	B.7.b.	Turnout.
	B.7.c.	Slide spillway.
	B.7.d.	Drop structure.
	B.7.e.	Check structure.
	B.7.f.	Measuring device.
	B.7.g.	Culvert.
	B.7.h.	Syphon.
	B.7.i.	Flume.
B.8.		Drainage system.
	B.8.a.	Length of drainage canal/ditch.
	B.8.b.	Type and number of structures.
B.9.		Irrigation infrastructure;
	B.9.a.	Number of office building.
	B.9.b.	Number of staff housing.
	B.9.c.	Number of bridges.
	B.9.d.	Length of inspection road.

CODE NUMBER	DATA CLASSIFICATION	SPECIFICATION
B.	BASIC DATA	
B.10.		Water Users Association;
		B.10.a Number of WUA in the irrigation area.
		B.10.b. Number of WUA member.
		B.10.c. Availability of by-laws.
P.	PERIODICAL DATA	
P.1.		Wet season cropping area (in ha)
		P.1.a. Rice.
P.2.		P.1.b. Upland crops.
		Dry season cropping area (in ha)
		P.2.a. Rice.
P.3.		P.2.b. Upland crops.
		Third season cropping area, if any (in ha)
		P.3.a. Rice.
P.4.		P.3.b. Upland crops.
		Wet season harvested area (in ha)
		P.4.a. Rice.
P.5.		P.4.b. Upland crops.
		Dry season harvested area (in ha)
		P.5.a. Rice.
P.6.		P.5.b. Upland crops.
		Third season harvested area, if any (in ha)
		P.6.a. Rice.
P.7.		P.6.b. Upland crops.
		Average discharge of the primary canal (in liter/second)
P.8.		Average rice yields (tonnes/ha)
		P.8.a. Wet season.
		P.8.b. Dry season.
		P.8.c. Third season (if any)
P.9.		Average yields (tonnes/ha) of;
		P.9.a. Peanut.
		P.9.b. Soybean.
		P.9.c. Corn.
P.10.		P.9.d. Others; _____
		Total number of farmers in the irrigation area.

CODE NUMBER	DATA CLASSIFICATION	SPECIFICATION
P.11.		Effectiveness of the WUA;
P.11.a.		Frequency of members' meeting.
P.11.b.		Frequency of mass field activity.
P.11.c.		Number of structures constructed/rehabilitated since the last survey.
P.11.d.		Length of canal constructed/rehabilitated since the last survey.
S.	SUPPLEMENTAL DATA	Daily records of streamflow. Daily records of rainfall. Monthly evapotranspiration. Daily discharge in the primary canal. Daily discharge to each tertiary block. Deep percolation rate.
MD	MAP AND DIAGRAM	Topographic map of the irrigation area. Irrigation Network Schematic Diagram. Organizational structure of WUA.
MD.1.		
MD.2.		
MD.3.		

Appendix 2. Flowchart of data processing for the inventory of FMIS



Appendix 3. Data processed further and the output

CODE NUMBER	SPECIFICATION	OUTPUT
B.4. P.10.	Command area of tertiary block Total number of farmers	Land ownership
B.4. P.1. P.2. P.3.	Command area of tertiary block Wet season cropping area Dry season cropping area Third season cropping area	Cropping pattern Cropping intensity
P.1.	Wet season cropping area	Crop water requirement
S.2.	Daily rainfall	Irrigation water requirement
S.3. S.6.	Monthly evapotranspiration Deep percolation rate	
S.1.	Irrigation water requirement Daily records of streamflow	Water balance
S.4.	Irrigation water requirement Daily discharge in the primary canal	Overall irrigation efficiency
S.5.	Crop water requirement Daily discharge to each tertiary block	Irrigation efficiency at tertiary level

Appendix 4. Tentative schedule of the implementation of inventory of FMIS

CODE NUMBER	SPECIFICATION	CROPPING PERIOD												REMARKS	
		WET SEASON				DRY SEASON				THIRD SEASON					
		1	2	3	4	5	6	7	8	9	10	11	12		
B.1.	Name of irrigation area.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.2.	Number of tertiary blocks.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.3.	Names of tertiary blocks.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.4.	Command area of each tertiary blocks.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.5.	Technical specification of the headwork.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.6.	Technical specification of the canal.	:	:	:	:	:	:	:	:	:	:	:	:	##	Benchmark data
B.7.	Number of irrigation structures.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.8.	Drainage system.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.9.	Irrigation infrastructure.	:	:	:	:	:	:	:	:	:	:	:	:	##	
B.10.	Water Users Association.	:	:	:	:	:	:	:	:	:	:	:	:	##	
P.1.	Wet season cropping area.	:	##	:	:	:	:	:	:	:	:	:	:		Seasonal
P.2.	Dry season cropping area.	:	:	:	:	:	:	##	:	:	:	:	:		Seasonal
P.3.	Third season cropping area.	:	:	:	:	:	:	:	:	:	##	:	:		Seasonal
P.4.	Wet season harvested area.	:	:	:	:	##	:	:	:	:	:	:	:		Seasonal
P.5.	Dry season harvested area.	:	:	:	:	:	:	:	:	##	:	:	:	##	Seasonal
P.6.	Third season harvested area.	:	:	:	:	:	:	:	:	:	:	:	:		Seasonal
P.7.	Average discharge of primary canal.	##	##	##	##	##	##	##	##	##	##	##	##	##	Monthly.
P.8.	Average rice yields.	:	:	:	:	##	:	:	:	:	##	:	:	##	Seasonal
P.9.	Average yields.	:	:	:	:	:	:	:	:	:	:	:	:	##	
P.10.	Total number of farmer in the irrigation area.	:	##	:	:	:	:	:	:	:	:	:	:		
P.11.	Effectiveness of the WUA.	:	:	:	:	##	:	:	:	:	##	:	:	##	Seasonal
S.1.	Daily records of streamflow.	:#####													
S.2.	Daily records of rainfall.	:#####													
S.3.	Monthly evapotranspiration.	##	##	##	##	##	##	##	##	##	##	##	##		
S.4.	Daily discharge in the primary canal.	:#####													
S.5.	Daily discharge to each tertiary block.	:#####													