Technological and Operational Changes Related to Irrigation Management Transfer (IMT)

A Case Study of the Sumani Pumping Irrigation Project in West Sumatra Province, Indonesia (A Discussion Paper)

Sjofjan Asnawi[1]

ABSTRACT

THE PAPER ATTEMPTS to provide a better understanding of the nature of the process of changes in irrigation management from a traditional management of a gravity irrigation system to a modern management of a pump irrigation system in the Sumani Pumping Irrigation Project in West Sumatra Province, Indonesia.

It shows that the transfer process needs a farmers' institution, so that in each pump irrigation system a Water Users Association (WUA) was established. Factors affecting the success or the failure of the WUAs are analysed and performances of the WUAs are compared, not only in the aspect of irrigation management transfer (IMT), but also in terms of yield and profit of the rice farms.

The paper also discusses the way to transfer the new technology and management of an irrigation system to farmers through various activities such as workshops, seminars, trainings, and comparative studies (e.g. Java-Madura Study Tour). The impact of those activities are also analysed in this paper. Future prospect of the project based on its performance at the end of the project in 1990 is also analysed. The paper will be started with background, objective and organization of the project. At the end, the summary and conclusions are given.

INTRODUCTION

Background of the Project

The area of the Sumani Pumping Irrigation Project (SPIP) is located between 0° 40' to 2° 45' south latitude and between 100° 35' to 101° 38'east longitude (DGWRD 1978:1), or about some 65 kilometers (km) north-east of Padang, between Solok municipality and Singkarak lake (Figure 1). The gross area covered by the project is about 17 km^2. It is in a valley with some uphill area where the gravity irrigation schemes are located with a rice area of about 600 ha. The tail ends of the gravity schemes are with rainfed rice cultivation covering an area of about 938 ha (SDC 1988:13).

Before the project is implemented, there were two main problems. **First**, parts of the *irrigation water of the gravity schemes are polluted by boron and sulphur* which hampers rice growing and in some areas rice had not been grown at all for some twenty years due to that problem. **Second**, the Sumani river crossing the area and the Singkarak lake cannot be used for gravity irrigation as the valley area is situated at a *higher level than the river and the lake.* However, these resources could be used with pump lift irrigation technology.

Based on the request of the traditional leaders of the area, the district head of Solok on June 2, 1976 proposed to the central Government in Jakarta through Public Work Department for the Sumani pumping irrigation project. On November 1, 1976, the Public Work Department made a request to the Government of Switzerland through the Swiss Embassy in Jakarta for technical assistance for the pumping irrigation project proposed by the Solok district head. On January 13, 1978, the Embassy approved to cooperate in the project so that in June 1978, the first memorandum of understanding (MOU) between the Governments of Indonesia and Switzerland was signed to carry out the project (DGWRD,1978).

In 1986, the construction of all pump irrigation systems in the project area was completed and was in operational condition (Asnawi et al. 1987). Pump lifting stations, their capacities, and command areas irrigated are shown in Table 1, and their locations in Figure 2. In 1990 the project was completed and was handed over to the Water Users Associations (WUAs) by Swiss Development Cooperation (SDC) through the government of Indonesia which was represented by the Public Works Department (PWD) office in Padang (SDC 1990).

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[1]Director, the Centre for Irrigation Studies Andalas University, Padang, West Sumatra.

The Objectives of the Project

The objectives of the project are: (1) to increase rice production in the project area to contribute to the national self sufficiency in rice production; (2) to increase the income of the farmers, tenants and rural labourers in the project area; and (3) to prevent rural-urban migration by creating new employment opportunities for the rural population (SDC 1990:7).

Another objective is to transfer the pump irrigation technology to the farmers through WUAs. It means that at the end of the project (in 1990) the WUAs will be able to operate and manage the pump irrigation schemes autonomously not only in managing it but also in financing the pump irrigation schemes, including the replacement of the pump units with the new ones after the old ones are replaced (Asnawi et al. 1987:1-9).

Organization of the Project

Based on the first MOU between the Governments of Indonesia and Switzerland, the project is governed by a Steering Committee (SC) at the national level in Jakarta, and Project Monitoring Board (PMB) at the provincial level in Padang, and Project Management at the project level (Figure 3).

The SC members were represented by the Directorate General of Water Resource Development (DGWRD) of the PWD and DGRD (Directorate General of Regional Development) of the Home Affairs Department (HAD) on behalf of the government of Indonesia which are responsible for the implementation of Indonesia's obligation on the project. The Swiss Government is represented in the SC by SDC of the Swiss Embassy in Jakarta which is responsible for the implementation of the Swiss Government obligation on the project.

The members of the PMB at the provincial level were represented by the Governor of West Sumatra on behalf of the DGRD and the SDC Team Leader of the project on behalf of the SDC. Other members were representatives of the West Sumatra offices of the departments of public works, agriculture and cooperative, Solok district head. The Governor assigned the chairman of West Sumatra Development Planning Board to coordinate the PMB activities. The PMB is responsible for: (1) setting up their statutes and rules; (2) advising the Governor and SDC Team Leader in project related decisions; (3) advising and representing their respective institutions in project related matters; (4) guiding and instructing the project management as far as in line with the MOU; (5) approving and commenting the project planning documents and other important documents; and (6) obtaining and approving project reports and other information in regular intervals and on specific occasions.

At project level, the responsibility rests with the project manager assigned by the West Sumatra Public Works Office. Project staff were seconded by representatives of West Sumatra offices of the departments of public works, agriculture and cooperative.

Objectives of the Paper

The main objectives of this paper are: (1) to analyse how far the objectives of the project had been realized by the end of the project in 1990; (2) to show factors affecting the success or the failure of the technological and management transfer from the project to farmers through WUAs; and (3) to discuss the impact of the project to the welfare of the community in the project areas.

THE AREA OF THE SUMANI IRRIGATION PROJECT[2]

General

The climate of the project area is classified as Zone D (three to four consecutive wet months and two to six consecutive dry months). The annual fluctuation in temperature is relatively
small; it ranges from about 22° C to 29° C (monthly average). Humidity of the atmosphere ranges from 60 to 95 % (monthly averages).

The soils in the project area are classified as Tropaqueps (inceptisols) and Aquents (entisols). The inceptisols were found in the lower parts of the project area and the entisols in the terraced areas. They are mostly fine textured and have low permeability and are quite suitable for wetland rice cultivation. The limiting factors are boron and

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2. The sources for the discussion under this sub-heading are DGWRD (1978), SDC (1988;1988a) and [Asnawi et.al. (1988).]

perhaps also sulphur pollution, poor drainage and danger of floods. Almost all of the project area is used for rice production.

Administrative Framework

The project area is located in three sub-districts namely sub-districts of X Koto Singkarak, Kubung and Lubuk Sikarah which are located within two districts namely district of Solok and Solok municipality. There are four Nagaris (equal to villages)in the project area namely Nagaris of Singkarak, Sumani, Koto Sani (in X Koto sub-district), and Nagari Tanjung Bingkuang (in Kubung sub-district).

Infrastructure and Services

There is a good road network in the area. Minor roads as well as the main road of Solok-Padang Panjang road are asphalted. Main electricity was brought into the area from Solok municipality in 1985.

Education and health services are considered to be satisfactory. Domestic water supply is, however, a problem in the lower part of the valley along the main road, especially for Sumani and Singkarak where the households have only traditional wells in the garden. In Saning Bakar (in the area of gravity scheme) the inhabitants depend upon Batu Bagiriak rivulet where the water of this stream is considered to be of bad drinking-water quality. The inhabitants of Nagari Koto Sani have access to a good water supply system with good quality and clean water from the hills.

The educational system is well developed. Only about 5 % of the farmers are still illiterate a rate which are very low compared with the Indonesian average of about 17 %. About 22.5 % of the farmers interviewed attended junior high school.

There are four Village Unit Cooperatives (VUC) in the project area which are providing cooperative services. Only one of them is properly functioning while the other three are hardly funcioning. There are also government village unit banks in Singkarak and Sumani to serve the people with banking services especially savings and credit facilities. In Singkarak and Sumani, weekly markets take. These markets are important for the farmers in the northern part of the project area while the Solok municipality provides these services to the southern part.

There is a field agricultural extension officer in each sub-district helping the farmers to introduce new technologies in agriculture such as introducing new high yielding varieties, fertilizers, pesticides, and crop production technology especially in rice cultivation.

Local Economy

The Sumani valley appears to be a relatively prosperous area. Agriculture is the main economic activity but most of the farmers have some income from other activities such as small business and semi government positions. The main income stems from rice growing, labour wages and animal husbandry. In the area where boron polluted water makes rice production impossible,fish breeding plays an important role in the local economy. Perennial crops, mostly tree crops are grown for domestic consumption and as a cash crop in the home gardens adjacent to the villages.

In the X Koto Singkarak sub-district where about two thirds of the population of the project area live; the traditional migration pattern of the male population out of the area or province can still be observed. It is seen that the people of the hilly areas are more on the move than those in the project area. The hilly areas are usually more isolated and conservative. But the young men in the hilly areas like to seek their fortunes with migration because the right to use the lineage land (usually the rice fields) is given to the female population according to the Minangkabau tradition.

The population of the three sub-districts in which the project area is located in 1983 was about 19,000 persons. The average family size is about 5.0 persons per family. Family planning seems to be commonly practiced.

PROJECT IMPLEMENTATION

The pumping irrigation system is very different from the gravity irrigation system. In a gravity irrigation system the water is supplied without any mechanical device and there is absolutely no cost to the farmer for the water supply. On the other hand, the water for the pumping irrigation system is supplied by pumps which need[s] a careful evaluation both technical and financial.

Since rice farmers in the project area before the implementation of the project got water from the gravity irrigation system or only from rainfall, the Sumani pumping irrigation project is a technological and new water management transfer project to the farmers.

There were three phases in constructing pump lift irrigation systems in the project area. The first phase (1978-1982) was the construction of the irrigation systems of Pumps I, II, III and IV which were completed in 1982.

The second phase (1982-1983) was the construction of the canal network and intake of Pump V irrigation system which was completed in mid 1983. The third phase (1983-1985) was the construction of the irrigation systems of Pumps VI and VII which was completed by mid 1985 (SDC 1988a:13). The location of the pump irrigation systems can be seen in Figure 2, while their capacities and area to be irrigated are shown in Table 1.

During the construction phases, the local community was involved not only in terms of labourers and providing material for the construction but also in discussing the project planning with the leaders (formal and non formal leaders) of the community with a regular meeting with the project management. In the operation of the pumping irrigation system, pump operators were also taken from the community by giving a special training first. To speed up the transfer of technology to the farmers, they have been organized in water users associations (WUAs), each irrigation system having one WUA.

As mentioned above, since 1986, all of the pumping irrigation systems of the project have been operational. In that year, the project was evaluated by an evaluation mission in order to have the real picture of the project not only about the success story but also of the weakness of the project to be minimized in the next phase until the end of the project in 1990 (see Asnawi et al 1987).

The evaluation mission report stressed that the crucial part of the project design is the institution of WUA which is expected to operate the irrigation systems on its own in the long run. It has been established that WUA can raise funds from its members to an extent sufficient to cover operation costs. It is unclear at that time whether WUA could raise funds exceeding that level. Since the project should aim to hand over the irrigation systems to WUAs as early as possible, it is essential that the WUAs develop the capacity to raise sufficient financial means to carry out their functions in the long run, the report added. Another conclusion of the report was that the project effects are positive and the evaluators rank the project as successful until that time (Asnawi et al 1987:1-4).

WATER USERS ASSOCIATIONS AND HANDING OVER PROCESS

One of the objectives of the project is to hand over the pumping irrigation systems to the WUAs. For this, the WUAs should be able to operate and to manage the pump irrigation systems autonomously not only in managing them but also in financing the pump irrigation systems is the long run. This is not an easy task. As mentioned by Enos (1989):

"Different reasons are given for the difficulty of transferring agricultural technology internationally. Among others are the limited scope of technologies chosen for transfer which discourages their acceptance by recipients; difficulties in increasing the scope of the technologies transferred, because of bureaucratic specialization. Moreover, deficiencies arise out of a complex network of institutions with overlapping mandates, lack of skilled personnel and scientific critical mass in key organizations, unstable funding levels unrelated to organizational needs, neglect of important research areas, and inadequate responsiveness to national needs as determined by policy makers."

Therefore, the development of WUAs capable of managing and financing the pump irrigation systems after handing over is very important. The SDC established a special section for WUAs in its organization for this purpose. The main function of this section is to increase the quality of the WUAs according to the criteria specified by the project.

Criteria of Handing Over

The criteria to judge the suitability of WUAs in the project [to which pump schemes were to be handed over] were prepared by the WUA section with inputs from other sections of the project. They assess aspects of infrastructure, agricultural extension, economics, water management and administration planning, organization and management of the schemes. It means that by the end of the project in 1990 the following conditions should be fulfilled : the infrastructure should be completely improved; the agricultural extension be equipped to carry out appropriate field extension and experimentation of the alternative crop schedules; pumping water management should be handled by the WUA; administrative ability and capability of the WUA should have reached maximum levels; economically the most profitable crop schedules should have been identified; O & M of the technical infrastructure of the pump irrigation schemes should be managed by the WUA properly; planning, organization and management of the schemes should be carried out by the WUAs (SDC 1990:54-56).

Vermillion (1991:17) suggested four components for assessments of irrigation turnover and self- management, namely: (1) identifying basic physical and social characteristics of the resource; (2) describing relationship between management functions and institutional arrangements; (3) assessing institutional performance; and (4) criteria for effective turnover processes and self-management.

The Activities of WUA Section of the Project

To achieve the above criteria, various training courses, workshops and study tours were carried out by the WUA section along with other sections in the project, such as: training course in book keeping, water management, O&M of the project, and in organizational management; workshops on institutional development of WUAs, and on the future prospects of the project.

The participants of the training courses and workshops were not only composed of WUA representatives, but also of the members of WUAs Development Teams (WDT) of each sub-districts in the project area, Irrigation Committee members, Village Heads,the chairman of KAN (Traditional Nagari Leaders Meeting), representatives of the Regional Development Planning Board, and other related institutions.

Three study tours were conducted. First, for the project staff to Java and Madura. Second and third to Java and Bali (with different members), for WUA board members, the WDT members, Regional Development Planning Boards representatives, West Sumatra and Solok district officials of the departments of the public works and agriculture, and the project staff.

To increase the capability of the WUA Section staff, all staff were sent to attend a training course on management and development of self reliance in Bogor, West Java, from August 1 to September 2, 1988. Some members of the staff who had attended that course were sent to attend a special short course on Rural Extension and Management of Extension Programs in Wageningen, Netherland from June 6 to July 23, 1988. These staff members were also sent to attend a short course on water management at Utah State University, USA, from June to July 1989.

The Condition of Water Users Associations

The number of WUAs in the project area were still nine in 1990, namely six WUAs in pumping irrigation area and three WUAs in the gravity irrigation area (Table 2). It should be noted that the irrigation system of Pump IV has not been operated anymore since 1987 due to technical reasons, so that a WUA for that system was not established either. The water source for Pump IV is not from the Sumani river but from the primary canal of Pump III system.

The condition of WUAs in the pumping irrigation project area varies. However, WUAs in phase I , namely WUAs of Pumps I, II and III, are much more progressive than those in phase II (Pump V) and phase III (Pumps VI and VII). But since 1989, the condition of WUA of Pump VII has been better than that of Pumps V and VI. The management of the WUA of Pump II was awarded the price for the best WUA in West Sumatra for the year 1989/90 (SIP,1990:35).

There are many problems in the WUAs of Pumps V and VI. The areas of the WUAs are too wide, i.e. more than 250 ha for each WUA. Moreover, the area of Pump V consists of two villages (Sumani and Koto Sani villages) in one sub-district (X Koto Singkarak), while the area of Pump VI not only consists of three villages but also of two sub-districts (Sumani and Koto Sani villages in X Koto Singkarak sub-district, and Tanjung Bingkung village in Kubung sub-district). In addition, before the pump irrigation is implemented, farmers in Koto Sani village (uphill) gave water to farmers in Sumani village (downhill), but now after the project it is the reverse where farmers in Koto Sani have to ask water from Sumani because the pump station is located in the Sumani village. Moreover, many leaders in Koto Sani have different motives in facing the pump irrigation project.

Other problems which are still unresolved until 1990 in the pump irrigation project area (mostly for Pumps V and VI) were: (1) Lack of dedication by WUA members, WUA board members, and WUA Development Board members; (2) lack of organizational capacity in managing the SPIP in Nagari Koto Sani which occupies a large extent and tail-end areas of Pump V and VI; (3) due to both problems, it is difficult to collect Irrigation Service Fees (ISF) in the Koto Sani area (see Table 3), so that it is not possible for the WUAs to function fully. The rate of the ISF is US$ 37.50 per ha/season for O&M only. It will be US$ 70.00/ha/season if costs for big repairs and replacement of pump units are included.

The Problems of the Project Handing Over

As mentioned above one of the objectives of the SPIP is at the end of the project (in 1990), the WUAs will be able to operate and manage the pump irrigation schemes autonomously not only in operation and maintenance (O&M) of the schemes but also in financing them, including the replacement of the pump units with the new ones after the old ones are replaced.

However, based on the condition of the WUAs and the above criteria of readiness, WUAs in phase I (i.e. Pumps I,II and III) and in phase III (Pump VII), were ready for handing over in 1989. For this, they have collected Irrigation

Service Fee (ISF) since 1985 (Pump III), 1986 (Pumps I and III), and 1987 (Pump VII) and deposited them in bank saving accounts in 1987/88 (Table 3). But because the Central Government of Indonesia had not given its acceptance, the handing over could not be realized at that time. Based on the approval of the Governor of West Sumatra though, the handing over of the SPIP was accomplished on January 6, 1990, for Pumps I,II and III, and on March 26, 1990 for Pump VII from the project to the WUAs, the handing over being restricted to the responsibility for operation and maintenance (O&M) of the pump irrigation schemes. The assets of the project are still owned by the government (SDC 1990:2). The impact of the government decision was that the WUAs did not continue to deposit in bank saving accounts since 1988/89 (Table 3), but the ISF is continuously collected to finance the O&M of the pump irrigation systems.

It seems that the government decision is consistent with the opinions expressed in the seminar on the future prospect of the SPIP, sponsored by West Sumatra Agricultural Food Crops Service on March 2, 1989 in Padang, where there were two opinions on this matter. First, handing over to WUAs was only on O&M of the pump irrigation schemes, while the major repairs of the schemes and replacement of the pump units are the responsibility of the government. Second, handing over of the project to WUAs not only on O&M but also on major repair and costs of the new pump units.

In conclusion, the handing over of the SPIP to WUAs was only on the operation and maintenance aspect. Other aspects of the SPIP are still the responsibility of the government through the department of public works.

THE IMPACT OF THE PROJECT

The Economic Benefits in General

The development of pump irrigation for the Sumanai valley has had a positive impact on the economy of the area. Rice output has risen from 2.91 ton/ha/annum to 7.94 ton/ha/annum. This is due particularly to: (1) an increase of cropping intensities from 1.33 (before the project) to 2.0 (after the project); (2) an increase of the yields from 2.19 ton/ha/crop season (before the project) to 3.97 tons/ha/crop season (in unhulled rice) after the project. The increase of cropping intensities and the yields is due to the availability of a reliable water supply and to the use of new technologies in rice cultivation (SIP 1990:56).

Economic Benefits to the Farmers

Crop net returns (calculated with 1990 constant local market prices) increased 113 % from US$ 237.22/ha/season, before the project, to US$ 504.44/ha/season after the project (US$ 1 = Rp 1,800) due to the increased production (SIP 1990:56). Since the average farm size per family in the Sumany valley is only 0.3 ha and cropping intensities increased from 1.3 to 2.0 the real crop net returns increased from US$92.52/family/year to US$302.66/family/year by assuming that the net returns of the second crop is the same as the first crop. Since the average family size is 5.0 persons, the real crop net return/capita/year increased from US$18.50 to US$60.53, or it increased 227.2 % from before to after the project situation. The benefit of paddy production can be calculated by the ratio between paddy price and cost of production. If the ratio is greater than one it is profitable and it is not profitable if it is less than 1.0 (see Table 7).

According to the results of Sumani Farm Survey conducted in 1987 (see SDC 1988) , the average per capita income of the farmers in the project area was US$ 287.66 and only 34.25 % of it stems from paddy production, i.e. about US 98.52. The other sources of the per capita income are other agricultural pursuits (32.55 %) and non agriculture (33.20 %). Thus, the source of income is mainly from agriculture (66.80 %) where rice is the most important source from the agricultural sources (Table 4).

If we compare the per capita income of the farmers in different pump irrigation systems, it is quite clear that the income of the farmers at the Pump II area is the highest, followed by Pumps III, I, VI and VII, gravity areas, and Pump V (Table 5). This is due to lower income from paddy production of the Pump V (only US$ 61.10/capita/annum) than from other pump areas; i.e. US$ 115.54 for Pump I; US$ 124.87 for Pump II; US$ 124.38 for Pump III; US$ 90.75 for Pump VI; and US$ 76.81 for Pump VII. The variation of the income from paddy production is particularly due to the variation of yields, and the variation seems to be related to the management quality of related WUAs.

Based on land tenure criteria, as shown in Table 6, it is obvious that the average per capita income of the owner operator is much higher (US$ 340.71/capita/annum) than that of share cropper (US$ 222.42). The average per capita incomes of West Sumatra and Indonesia at that time were US$ 373.08 and US$518.43 respectively. Thus the average income per capita of the owner operators is higher than that of West Sumatra but lower than that of Indonesia. Moreover, the per capita income of the share croppers was also below the poverty line (US$235.94) of West Sumatra. The low per capita income of the share croppers is due to the facts that: (1) the share croppers have

to give 50 % of their paddy production to land owners as land rent, so that the income of the share croppers from paddy production (US$ 48.96) is much lower than that of the owner operators (US$ 102.87); and (2) the income of the share croppers from non agriculture (US$ 66.66) was much lower than that of owner operators (US$ 150.89).

The Role of Paddy Production

The main role of rice production for the farmers is to provide household rice consumption where about 77 % of the net production was used for consumption and only 23 % was sold. On the average, the farmers obtained a surplus in rice production except the share croppers who were not self-sufficient in rice production. To fulfill other basic needs, non-basic needs and for investment or to cover costs of production they used [other income sources from other agriculture and non agriculture.]

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Summary and Conclusions

The Sumani Pumping Irrigation Project (SPIP) originally came from the request of the informal leaders of the community of the Sumany valley area to the head district of Solok in 1976. In June 2, 1976, the district head of Solok requested the national government through the Ministry of Public Works in Jakarta to establish the SPIP. Based on this request, the government of Indonesia asked the Swiss Government, through the Swiss Embassy, to support three small irrigation projects including the SPIP in West Sumatra, in November 1976. In January 1978, the Government of Switzerland approved the SPIP and a Memorandum of Understanding for this project between the governments of Indonesia and Switzerland was signed, and the implementation of the SPIP was started in 1978. In 1986, all SPIP which consist of seven pump irrigation schemes were completed and have been operated since. In 1990, the operation and maintenance of all irrigation pump schemes of the SPIP, with the exception of Pumps V and VI, were handed over to related Water Users Associations by the SPIP through the Government of Indonesia.

The objectives of the project were to increase the rice production of the areas through increasing yield and cropping intensity, and to increase the income of the farmers reached.

Another objective of handing over of the PSIP to farmers through WUAs is not only to grant operation and maintenance responsibilities but also the assets of the project to make WUAs manage the SPIP autonomously. However, the desired level of management and financing of the project including big repairs and the replacement of pump units, could not be achieved due to various problems.

One basic problem is that the pumps function as standby sources of water, only, in rugged terrain of elongated valleys with many inflows of gravity water. The costs of constructing, maintaining and managing the pump schemes are relatively high while the perceived needs by the farmers for such expensive water are often relatively low, depending on the location of their rice fields. Therefore, many farmers are reluctant to pay ISF for the O&M of their pump schemes.

Recommendations

Based on the remaining problems in the Sumani area, it is recommended to continue the pilot project efforts by the local government involved. The goals should be: (1) guidance for the WUAs, WUA's Development Team, and other organizations involved in WUAs guidance; (2) building up of experience in guiding WUAs and support organizations; (3) monitoring of developments in these pilot WUAs; and (4) making full use of the base camp in Sumani and providing mechanical services from the workshop in the base camp to the SPIP and other irrigation schemes.

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Table 1. Installed water lifting capacity of Sumani Irrigation Project, 1986.

PUMP LIFTING STATION NUMBER	PUMP TYPE	TOTAL LIFTING CAPACITY l/sec	DELEVERY HEIGHT m	COMMAND AREA ha	IRRI-GATION l.sec/ha
I	AXIAL	2 X 110	7	160	1.4
II	AXIAL	1 X 145	7	101	1.4
III	CENTRI	1 X 150	3	80	1.9
IV	CENTRI	1 X 160	8	70	2.3
V	CENTRI	3 X 230	17	308	2.2
VI	AXIAL	3 X 155	15	271	1.7
VII	AXIAL	1 X 160	14	84	1.9

Source: Asnawi et al (1987: Table 1).

Table 2. WUAs situation in Sumani Valley Irrigation Project Area 1989.

No.	Names of WUAs	Total members	Establish date	Approved date*)	ISF Collection Start	Times
1.	Alam Lestari of Pump I	465	24.02.86	08.09.86	1986/87	7
2.	Alam Sejahtera of Pump II	295	20.07.85	04.10.85	1986	9
3.	Alam Permai of Pump III	260	16.07.84	13.08.84	1985/86	9
4.	Alam Bakti of Pump V	1290	21.04.86	23.12.86	1986/87	4
5.	Alam Saiyo of Pump VI	935	12.07.86	12.10.87	1987/88	5
6.	Alam Takambang of Pump VII	335	25.04.86	17.10.86	1987	5
7.	Alam grvitasi Singkarak	n.a	28.01.88	n.a	n.a	0
8.	Gravitasi Imang Saiyo	n.a	20.03.88	n.a	n.a	0
9.	Gravitasi Tuah Sakato	n.a.	30,05.88	n.a	n.a	0

Source: SIP (1990: Table 6.1)
*) Approved by head of Solok district and by the major of Solok municipallity (for Pump VII only);
n.a = not yet registered or approved

Table 3. The results of ISF Collection for each WUA (and sub-WUA) in SPIP Areas up to 1989 crop season.

Pump Scheme / Name of WUA / Area and member	Crop Season	ISF Collection US$	ISF Collection %	Outstanding ISF (US$)	Bank Interest (US$)	Expenditure (US$)	Saldo (US$)	Remarks
Pump I	1986/87	2,544.65	47.52	0	0	1,324.25	1,220.40	
Alam Lestari	1987	1,076.15	20.10	0	0	0	1,076.15	
102.2 ha	1987/88	2,133.40	39.84	136.55	217.46	2,355.11	132.31	deposit: US$ 1,500.00
465 farmers	1988	3,031.85	56.62	68.25	180.28	3,136.56	143.82	saving : US$ 18.25
	1988/89	3,373.10	62.99	0	194.23	3,666,25	(98.92)	
	1989	1,853.15	34.61	141.00	100.00	2,394.70	(300.55)	not all operational
Total/average	1986-1989	14,012.30	43.61	345.80	691.96	12.876.86	2,173.21	
Pump II	1986	1,021.90	26.66	0	0	0	1,021.90	
Alam Sejahtera	1986/87	2,119.25	55.30	0	0	2,179.53	(60.28)	
102.2 ha	1987	1,909.43	49.82	0	0	0	1,909.43	
295 farmers	1987/88	2,224.90	58.05	0	46.15	2,520.90	(249.85)	deposit:US$ 1,500.00
	1988	2,905.70	75.82	0	66.31	2,867.08	104.94	saving: US$ 797.32
	1988/89	3,117.65	81.35	0	355.22	2,958.58	514.29	
	1989	280.50	7.33	0	0	0	280.80	not all operational
Total/average	1986-1989	13,579.62	50.62	0	467.68	10.526.08	3,521.22	
Pump III	1985/86	2,625.93	87.20	0	0	0	2,625.93	
Alam Permai	1986	0	0	0	0	2,208.30	(2,208.30)	wereng pest
80.30 ha	1986/87	2,108.33	70.01	0	22.54	2,208.30	(77.44)	
260 farmers	1987	2,694.55	89.48	0	0	2,354.74	339.82	
	1987/88	2,580.83	85.71	30.00	0	2,176.65	434.18	
	1988	2,908.15	96.58	99.85	81.25	2,200.45	888.80	deposit: US$ 1,000.00
	1988/89	2,168.68	72.02	0	82.19	2,686.30	(435.43)	saving : US$ 432.19
	1989	1,518.00	50.41	678.50	95.00	1,514.70	776.80	
Total/average	1985-1989	16,604.45	68.93	808.35	280.97	15,349.43	2,344.34	
Pump V	1986/87 dan							
Alam Bakti	1987	3,068.70	29.23	0	0	1,418.09	1,650.62	
280 ha	1987/88	0	0	0	0	0	0	not operational due to:
1290 farmers	1988	779.03	7.42	133.32	59.35	1,618.80	(647.11)	organizational problem:
	1988/89	0	0	0	0	0	0	not operational
	1989;	2,429.13	23.13	420.00	8.25	2,356.85	500.53	
	Sumani		48.52					
	Koto Sani		5.92					
Total/average	1986-1989	6,276.86	9.96	553.32	67.60	5,393.74	1,504.04	saving: US$ 679.45
Pump VI	1987/88	1,586.60	15.61	0	0	143.00	1,443.60	
Alam Saiyo	1988	492.95	4.85	0	0	448.30	44.65	
271 ha	1988/89	0	0	0	0	0	0	not operational
935 farmers	1989;	1,162.30	11.44	830.85	18.05	2,701.15	(689.96)	
	T.Bingkung		33.92					
	Koto Sani		3.12					
Total/average	1987-1989	3,241.85	6.38	830.85	18.05	3,292.45	798.30	saving: US$ 508.09
Pump VII	1987	1,674.80	53.17	0	0	594.50	1,080.30	
Alam Takambang	1987/88	643.85	20.44	216.93	0	1,467.85	(607.08)	
84 ha	1988	590.18	18.74	940.60	14.90	1,795.00	(249.33)	
335 farmers	1988/89	2,404.95	75.35	295.75	188.38	1,683.85	1,205.23	saving: US$ 4.90
	1989	1,559.63	49.51	0	0	2,938.25	(1,378.63)	
Total/average	1987-1989	6,873.40	43.64	1,453.28	203.28	8,479.45	50.50	

Source: SIP (1990:Table 6.2)

Table 4. Sources of Income of farmers in the Sumani Pumping Irrigation Project, West Sumatra, Indonesia, 1986/87.

Source of Income	Amount (US$)*) per family	Amount (US$)*) per capita	Percentage of per capita
Paddy	591.18	98.53	34.25
Labour wages	200.88	33.48	11.64
Animal husbandry	174.05	29.01	10.08
Perennial crops	65.40	10.90	3.79
Other annual crops	56.78	9.46	3.29
Fishery	51.75	8.62	3.00
Forestry	7.17	1.19	0.42
Home garden	5.69	0.95	0.33
Agriculture	1,152.01	192.15	66.80
Profits	233.17	38.86	13.51
Salaries	170.43	28.41	9.87
Others	95.22	15.87	5.52
Rent	60.57	10.10	3.51
Home industries	13.71	2.29	0.79
Non Agriculture	573.10	95.52	33.20
TOTAL	1,725.98	287.66	100.00

Source: SDC (1988:Table 4); *) US$ 1 = Rp 1,000.00

Table 5. Income per capita (in US$) of the Sumani Irrigation Project according to pump areas and gravity area 1986/87.

Irrigation Area	Income per Capita	Score	Ranking
Pump I	340.09	118	3
Pump II	470.07	163	1
Pump III	410.29	143	2
Pump V	232.96	81	7
Pump VI	287.03	99	4
Pump VII	268.05	93	5
Gravity	242.41	84	6
All samples	287.66	100	-

Source: SDC (1990:Table 5)

Table 6. Income per capita of farmers in SIP areas according to land tenure status 1986/87.

Source of Income	Owner Operator US$	Owner Operator %	Share Cropper US$	Share Cropper %
Agriculture	**189.82**	**55.7**	**156.76**	**70.3**
Paddy	102.87	30.2	48.96	22.0
Other crops	24.25	7.1	12.55	5.7
Animal husbandry	27.16	8.0	38.28	17.2
Fisheries	10.90	3.2	3.22	1.5
Forestry	0.81	0.2	2.17	0.9
Labour wages	23.84	7.0	50.58	22.7
Non Agriculture	**150.89**	**44.3**	**66.66**	**30.0**
Rent	16.19	4.8	3.90	1.8
Salaries	41.04	12.1	19.56	8.8
Home industry	1.35	0.4	5.03	2.3
Profits	45.94	13.5	28.85	13.0
Others	46.37	13.6	9.31	4.1
Total	**340.71**	**100.0**	**222.42**	**100.0**

Source: SDC (1990: Table 6)

Table 7. Ratio between paddy price and costs of paddy production according to pumping areas and land tenure system, Sumani Irrigation Schemes, 1986/87 wet season.

ITEMS	Pumping Areas							Land Tenure System		All Samples
	Pump I	Pump II	Pump III	Pump V	Pump VI	Pump VII	Gravity	Owned	Share	
Cash Cost (US$/ha)	391.11	406.25	428.51	458.73	403.50	439.95	306.31	421.95	779.40	416.43
- Hired labour	296.31	311.26	336.13	365.30	330.58	366.48	246.33	324.49	319.53	316.94
- Material	55.80	57.49	54.88	55.93	72.92	73.07	59.98	59.96	65.17	61.99
- ISF(Irrig.Serv.Fee)	39.00	37.50	37.50	37.50	0	0	0	37.50	37.50	37.50
- Rent of land	0	0	0	0	0	0	0	0	357.20	0
Imputed cost (US$/ha)	401.42	515.61	519.97	531.57	536.17	592.73	422.27	489.64	158.35	496.41
-Family labour	82.25	82.25	89.25	182.56	209.05	186.34	132.44	151.35	146.59	148.80
-Owned land cost	308.42	423.11	420.22	337.81	314.03	395.83	278.06	326.83	0	336.10
-Seeds	10.75	10.25	10.50	11.20	13.09	10.56	11.77	11.46	11.76	11.51
TOTAL COST (US$/ha)	792.53	921.86	948.48	990.30	939.67	1032.68	728.58	911.59	937.75	912.84
Yield (kg paddy/ha)	3,674	4,810	4,809	3,912	3,601	4,505	3,232	3,887	4,183	3,965
Cash cost/kg paddy($)	0.106	0.084	0.089	0.117	0.112	0.098	0.095	0.109	0.186	0.105
Tot. cost/kg paddy($)	0.216	0.192	0.197	0.253	0.261	0.229	0.225	0.235	0.224	0.230
Farm gate paddy price: (US$/kg)	0.218	0.214	0.211	0.213	0.210	0.208	0.217	0.211	0.210	0.213
Paddy price/cashcost/: kg paddy	2.06	2.55	2.37	1.82	1.88	2.12	2.28	1.94	1.13	2.03
Paddy price/tot.cost/: kg paddy	1.01	1.11	1.07	0.84	0.80	0.91	0.96	0.90	0.94	0.93

Source: SDC (1988:Table 7.3).

Figure 1. Location map.

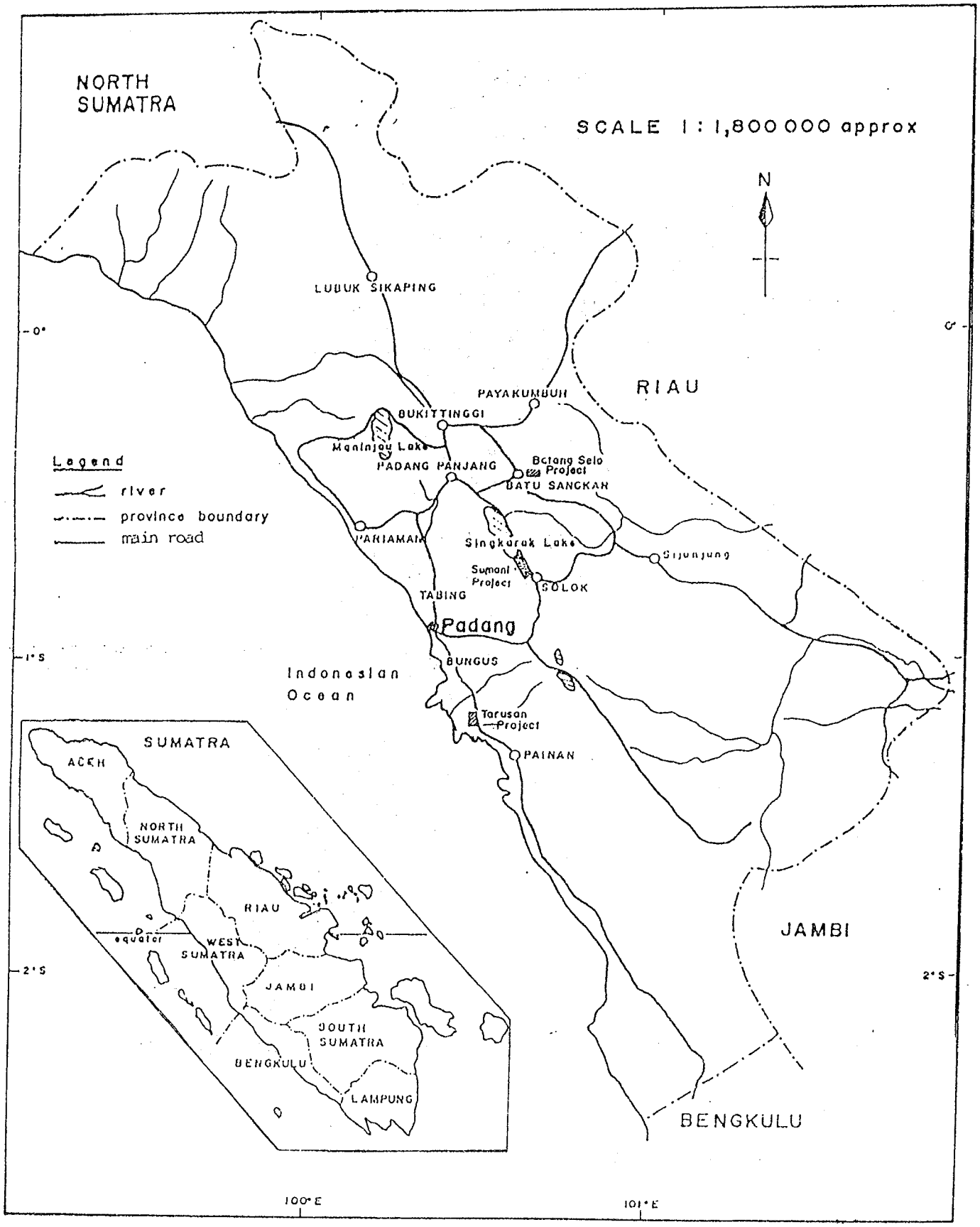


Figure 2. Project micro-location.

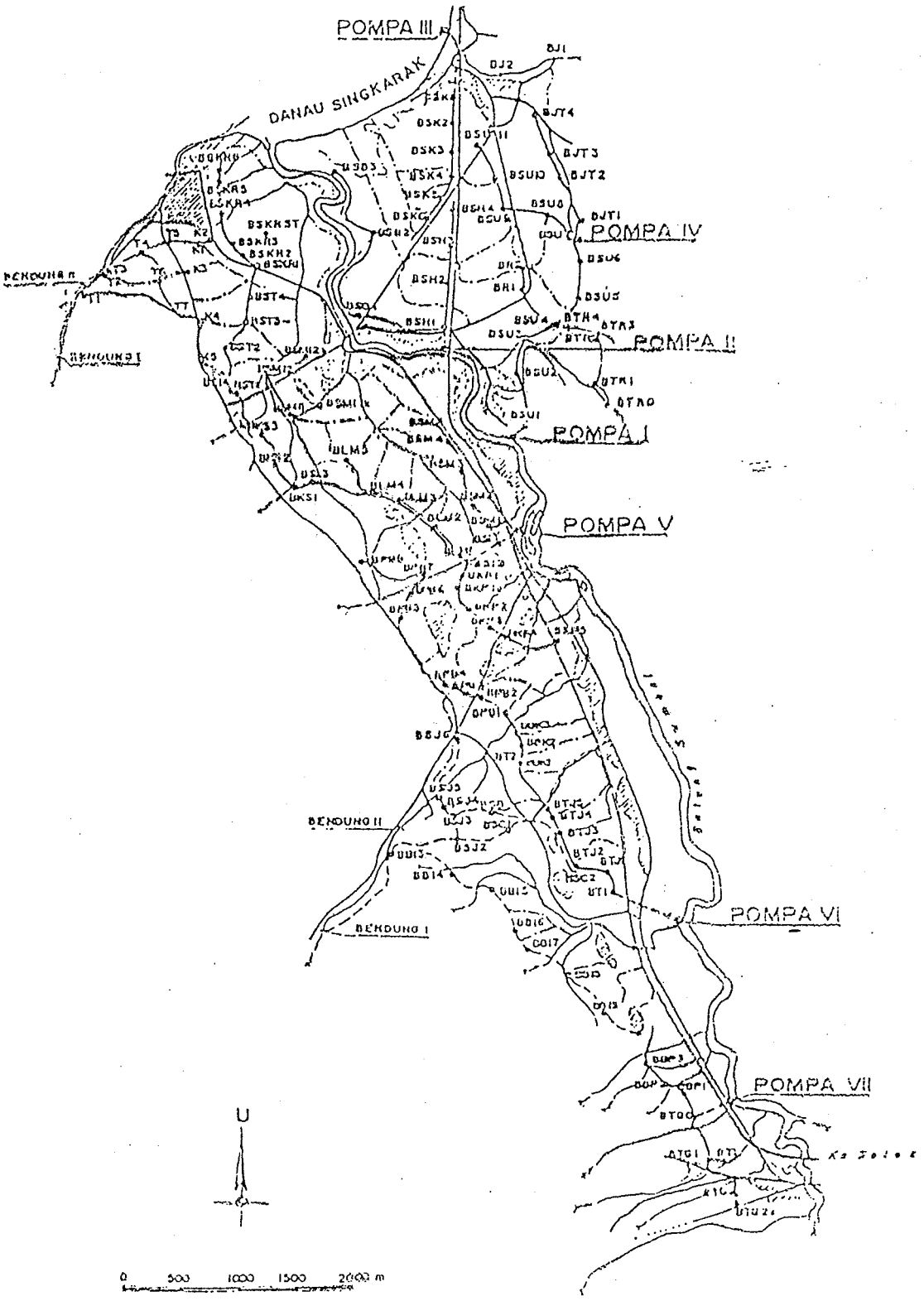
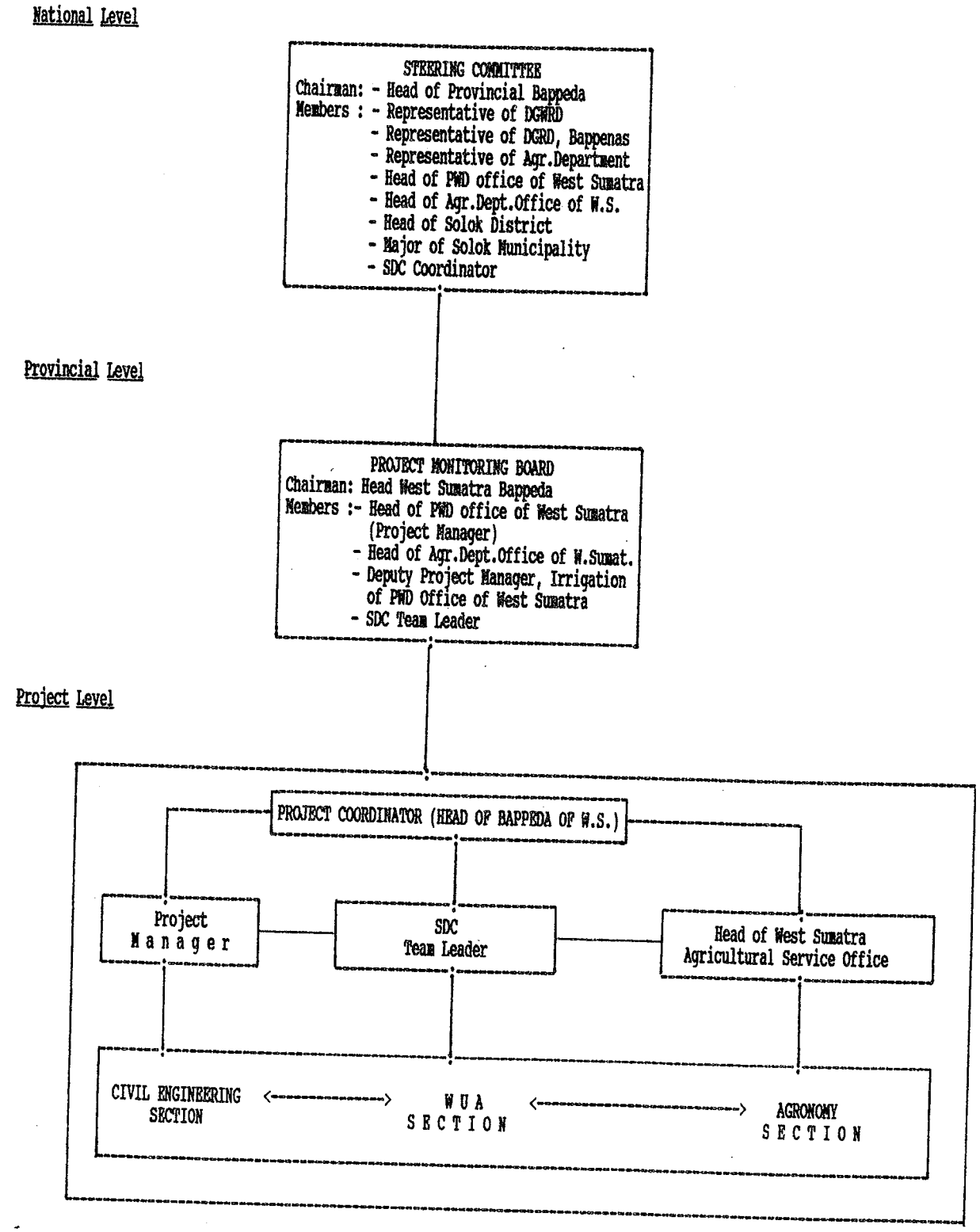


Figure 3. Sumani Irrigation Project Organization during MOU from July 1987 to October 1990.



Source: SIP (1990:Figure 3.2.)