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NATIONAL PUMP IRRIGATION STUDY: MATERIAL DEVELOPED DURING INCEPTION ACTIVITIES JANUARY 14 – 8 FEBRUARY 1991

Effendi Pasandaran

ASSESSMENT OF CONJUNCTIVE USE IN MAHARASHTRA MINOR IRRIGATION SYSTEMS

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Papers in this set:

1 *Groundwater Development on Madura, Indonesia: Gender Issues in an Irrigation Project* by Margaret Casey.

2 *Development of Water User Associations on the Madura Groundwater Irrigation Project, Indonesia* by Robert Jackson.

3 *National Pump Irrigation Study: Material Developed* ***During Inception*** *Activities, January 14-8 February* by Effendi Pasandaran; *Assessment of Conjunctive Use in Maharashtra Minor Irrigation Systems* **by T S** Sheng, et al.

4 *Conjunctive Water Use for Irrigation: Good Theory, Poor Practice* **by** Linden Vincent and Peter Dempsey.

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1. CURRENT RESEARCH ON **PUMP IRRIGATION PROGRAMS IN INDONESIA**

While the major rice producing areas of Indonesia have benefitted from irrigation development, the drier areas of Indonesia, where the scope for gravity irrigation is very limited, have not received an equal share of GOI (Government of India) investment. As a result, incomes in areas without irrigation are significantly below those found in the more intensely irrigated areas. An increased concern for eliminating poverty and reducing the income gap in Eastern Indonesia and other bypassed areas, combined with the recognition of the potential for rapid agricultural development through utilization of groundwater supplies for irrigation, has encouraged the government and donors to pursue programs to develop increased irrigation supplies through the introduction of pumps. These pumps can be used to extract groundwater as well as pump available water supplies from rivers, streams and smaller water bodies.

Although relatively speaking, a very small percentage of the total irrigated land in Indonesia is irrigated using pumps, there have been numerous programs developed around groundwater and surface pump irrigation. These programs range from large, deep tubewells serving in excess of 100 ha, to small well points serving less than 5 ha. Similarly, there are river lift schemes ranging between those serving more than 250 ha to small, portable pumps serving less that 10 ha. In general, where the government has taken the lead, the investment has included a large subsidy in capital investment and, in many cases, in operations and maintenance (O&M) costs, as well. In contrast, private investments by the farmers have not involved any subsidies, while programs organized by NGOs have stressed farmer involvement in investment and O&M, although there has usually been some element of implicit subsidy in the capital investment as well as in the services of the NGO staff. Along this spectrum there lies a broad range of other

approaches tried by different agencies with funding from a wide variety of sources.

Each of these approaches has had some degree of success, and some have had a high rate of failure. Unfortunately, due to the wide dispersion of the projects, there is at present no overall understanding of the important elements required for a successful pump irrigation project, nor has there been any type of comprehensive survey of the past approaches. An increased concern for the less well developed areas and more emphasis on private sector approaches, appears to be conducive to expanded pump irrigation investment. Yet, there are a number of unanswered questions that need to be addressed before successful expansion of pump irrigation can be ensured. These questions include:

- Technical capacity of government agencies to develop and implement pump irrigation schemes;
- Institutional mechanisms to develop and sustain strong farmer water user associations;
- The economic viability of pump irrigation for rice and non-rice crop production and the agricultural services, including marketing, for non-rice crops;
- Provision of appropriate financing institutions and the ability of the farmers to pay for the capital, as well as the O&M costs for pump irrigation;
- The appropriate role of the private sector and NGOs in the development and rapid expansion of pump irrigation;
- The environmental sustainability of large-scale groundwater development in Indonesia.

2. STUDY FOCUS

As pressure builds for rapid expansion of pump irrigation in Indonesia, there is a danger that the subsidies associated with past pump irrigation programs will be a major part of the new programs. Not only do these subsidies place a burden on the national budget, they also tend to encourage inefficient use

of Indonesia's increasingly scarce water supplies. In addition, as has been documented in a number of countries, subsidies often act as a deterrent to the formation of strong water user associations and, thus, encourage a dependency by water users on the government for future assistance.

A better understanding of the necessary and sufficient conditions for successful development of pump irrigation in Indonesia is critical to the planning and implementation of the large investments, both public and private, in pump irrigation that are now being developed for the next decade. Yet, given the many actors involved in pump irrigation and the wide variation in types of systems and institutional approaches, the GOI is not well equipped to learn from past investments. Lack of reliable information on the current state of pump irrigation schemes is a significant constraint on the GOI's ability to formulate pump irrigation programs for the less productive regions of the country. This is particularly crucial with respect to Eastern Indonesia as the GOI develops programs to absorb the poverty reduction funds earmarked by the donors for investment in this region. Given the limited human capital and infrastructure in Eastern Indonesia, it is clear that the area has a severe constraint on its ability to absorb large amounts of new investment. Therefore, there is a clear danger than investment models that have proven successful in Java and the more developed areas of Sumatra and Sulawesi, will be totally inappropriate for Eastern Indonesia.

There are also uncertainties about the technical capacity of the relevant implementing agencies to develop pump irrigation. Questions remain concerning the economic viability of pumping, financing arrangements, sustainable pumping levels, agricultural support services for non-rice crops, and the legal and institutional supports needed for strong farmer water users associations. Without addressing these issues, especially the economic ones, there is a danger that the explicit and implicit subsidies endemic to past public sector promotion of pump irrigation will produce unsustainable practices and/or environmental degradation. Among the possible negative environmental effects of overly subsidized or inappropriate pump development could be declining groundwater levels which impact on village water supplies and lead to increased pumping costs, salt water intrusion from over-depletion of groundwater and river water supplies, and accelerated contamination of water supplies from the increased use of agro-chemicals associated with high value irrigated agriculture. These issues concern long-term aquifer management, and can only be resolved if an adequate base of information is created about both the nature and potential of pump

irrigation and about past experiences with the process of developing additional water supplies utilizing pumps.

Understanding these emerging issues will be crucial for the formulation and implementation of large investments in pump irrigation now being planned in the next five years. Yet, there is, however, no known inventory or comparative assessment of the various approaches being used, nor is there adequate monitoring of either the agro-economic benefits, sustainability, or the environmental impact of pump and groundwater irrigation throughout the country. Thus, the GOI has limited reliable information on which to base its planning and its requests to donors for expanded pump irrigation development.

Particularly critical is the GOI's capacity to formulate appropriate pump irrigation activities to absorb the increased funds the state and donors have earmarked for Eastern Indonesia, a region designated as a "neglected area". Increased attention to the problems in Eastern Indonesia is welcome, yet the capacity of much of this part of the country to exploit new technologies and to effectively absorb and use large capital investment, even if dispersed among many small pump sites, is relatively low. And there is the danger that in developing pump irrigation in these regions, there may be a bias toward introducing the "standard" technologies already in use in Java and other more economically integrated and densely populated parts of the country. These technologies, which may not even prove economically viable or sustainable in Western Indonesia, may be transplanted to Eastern Indonesia without careful consideration of their appropriateness or potential impact, and could even prove to be counter-productive in the longer term.

Stemming from these concerns, the National Pump Irrigation Policy Study has been formulated. The Study, to be jointly funded by Ford Foundation (FF) and the United States Agency for International Development (USAID), and to be implemented by the Center for Agro-Socioeconomic Research (CASER) and the Irrigation Support Project for Asia and the Near-East (ISPAN), respectively, has the following objectives.

3. STUDY OBJECTIVES

The main purpose of the National Pump Irrigation Policy Study is to provide an overview and assessment of past and present experiences with pump irrigation throughout Indonesia. The Study is expected to be an important

and timely step in assisting the GOI in developing viable policies for development, expansion, and monitoring of pump irrigation and in preparing effective and appropriate proposals for donor assistance in this sector. The Study will:

(a) Seek the approximate extent of existing pump irrigation and pumping capacity throughout the country. Identify the number and extent of different types of pump irrigation, and according to their key features, such as location, size, agro-ecological zone, hydrologic setting, etc.

(b) Identify the range of approaches that have been tried in Indonesia for developing pump irrigation schemes, including those sponsored by government agencies, non-government organisations, and the private sector.

(c) Assess through case studies a representative sample of pump irrigation approaches, identifying the essential elements of each and describing the conceptual and implementation processes used. Examine their suitability and adaptability for various hydrologic and agro-socio-economic contexts. Evaluate their effectiveness with respect to technical, economic, financial, and institutional viability and sustainability. The Study will determine in particular:

- the formation processes and effectiveness of water users' associations (WUAs) in the development and operation of pump irrigation schemes, including the key elements found in successful approaches to organizing and strengthening WUAs in pump irrigation schemes;

- the legal framework and institutional supports needed for successful and sustainable WUAs in pump irrigation systems;

- the relationship between public agencies, the farmers, the WUAs in each scheme, and the extent to which roles, responsibilities, and functions are explicit, understood, and implemented. Assess the potential for expanding the rights and responsibilities of WUAs, and the role of the private sector, including the provision of technical and management services to WUAs;

- the composition of investment (farmer, private business, local and central government, and donor) during the planning, implementation, and operational stages. Determine operation and maintenance costs and funding sources. Assess the economic and financial viability of selected schemes.

(d) Provide assistance in determining and prioritizing critical near- and long-term policy issues for the expansion of pump irrigation throughout the country, particularly Eastern Indonesia.

- identify and assess near-term policy options, and recommend follow-up actions such as environmental and agro-economic monitoring programs, pilot and demonstration projects, and action research needed to evaluate various development scenarios;

- identify long-term policy issues and prioritize steps for future study.

(e) Recommend steps to improve viability and sustainability of pump irrigation systems.

4. STUDY ORGANISATION

As the overall purpose of the Study is to influence future pump investment in Indonesia, particularly new investment in Eastern Indonesia, a steering committee will be created. The committee will be composed of representatives from the National Planning Agency (BAPPENAS), and the Ministry of Agriculture, the Ministry of Public Works, the Ministry of Interior, and the Ministry of Mines and Energy. Recognizing the policy focus of the Study, the steering committee will be chaired by a representative of BAPPENAS.

5. STUDY APPROACH

Given the dispersed nature of pump irrigation in Indonesia, the Study has been designed to combine data of a number of different types collected from a wide variety of sources. The majority of the data will be collected by staff from CASER which has divided itself into three teams: (1) West

Java; (2) Central Java and Sulawesi; and (3) East Java and NTB. As indicated, assistance will be provided by expatriate experts in the fields of irrigation economics and policy, groundwater hydrology and institutional management. In addition, data concerning technical aspects of engines/motors and pumps will be collected by staff from the Faculty of Agricultural Engineering from the University of Gadjah Mada (UGM), Yogyakarta. The five major types of data to be collected include: (1) Development of a database that inventories the extent of pump irrigation in the country; (2) Collection of general agricultural, technical and institutional data specific to selected pump irrigation research sites; (3) Detailed technical data concerning technologies in use at the selected research sites; (4) Collection of structured survey data from farmers, operators and other concerned personnel at the selected research sites; and (5) Using a case study methodology, collection of data that documents how the institutional approach actually functions within the different research sites.

(a) *Inventory* .Data-Compilation of available statistics on actual irrigated area served by pumps is complicated by the wide number of agencies and organisations involved in pump irrigation, the complex array of past and present programs and the lack of clearly defined government organisation that is responsible for maintaining this information. As a result, developing an inventory of present pump irrigation requires collection of data from public sector firms such as the Department of Environmental Geology, the Department of Irrigation II-Project for Pumping from Groundwater (P2AT), the Department of Irrigation I, the Department of Agriculture and numerous Local Government Agencies. From the private sector, sugar mills, palm oil plantations and other estate crops are major users of large-scale pump technology, while individual farmers and groups of farmers have made significant investments in small-scale groundwater and river pumping systems. Non-governmental organisations as diverse as Bina Swadaya and CARE have also had a continuing involvement in development of pump irrigation.

(b) *General Agricultural, Technical and Institutional Data-General* data related to each research site, including the surrounding area, is available from a wide variety of sources. This data will be collected by one of the three CASER teams assigned to the different sites. Sources for this data will include:

- Agricultural service *(Dittos pertaniari)*
- Irrigation service *(Dinas pengairan)*
- District government office *(Kecamatari)*
- Project office
- Project documents
- Non-government organisations (LSMs)
- Village data.

(c) *Specific Technical Data* -Technical data about each pump, well and engine/motor such as information concerning size, type, age, investment, operation, maintenance and repair costs as well as trend data related to pumping hours, depth to water, drawdown and downtime. This data will be collected by staff from the Faculty of Agricultural Engineering from UGM. Sources for this data will include:

- Project reports
- Data from files in the project office
- Data from water users association records
- Data collected in the field
- Field measurements such as discharge rate and fuel consumption
- Government data series including climatic and river flow data
- Data and information from other local government offices.

(d) *Structured Survey* Data-Socio-economic data will be collected by CASER staff. Interviews of water users in the area using a structured questionnaire will be held on both a random basis and a focused basis, depending on the purpose of the group to be sampled. In research sites, the primary approach of the structured survey will be to select 1/10 to 1/4 of the large pumps and, within the service area of each to pump to select approximately a 15% sample of the farmers. In addition, staff will interview a selected smaller number of farmers in the area that use well points, shallow wells, and open wells for irrigation. The intent of this exercise is to quantify the situation within the command areas of the different pumps. Thus, the primary source of data is:

Structured interviews with farmers and other concerned individuals.

(e) *Case Study* Data-Detailed data collected by an unstructured approach in a limited number of pump command areas. This data will be collected primarily by graduate students from the Institute of Agriculture at Bogor (IPB) who will reside in the area 2-3 months, as required. The approach will be that of a case study with more an emphasis on qualitative understanding than on quantitative documentation. Case study data will be collected over an extended time frame as constant observation and discussion is required to gain a broad appreciation of the personal relationships and actual functioning of the irrigation systems in the area: Sources of data will include:

- Actual observations in the field and at meetings held in the area
- Interviews with farmers, association leaders, and other villagers
- Discussions with P2AT, NGOs, agriculture and local government officials
- Information compiled from irrigation and P3A records and files
- Insights gained from key observers and other individuals
- Measurements taken in the fields
- Data from project documents, evaluations, and other sources.

In order to ensure the data are complete, and to provide a means of cross checking the data, the structured surveys and technical data will be collected on the same set of pumps in each site. Case study data will be collected on a sub-set of these pumps. Thus, there will be technical data available for each pump site where socio-economic data are collected and there is also a mechanism to cross-check case study and interview data.

6. SITE SELECTION

During the initial discussions for the Study, research site locations were proposed for five provinces. These included:

1. West Sumatra
2. West Java
3. East Java
4. South Sulawesi
5. West Nusa Tenggara

However, after further exploration and discussions with a number of agencies and consultants in irrigation, a decision was made to explore locations that had a large number of pump projects with five or more years of production experience. Thus, during the first phase of the project the following sites were explored in depth, including multiple visits and collection of secondary data and project documents for each location.

1. Subang and Purwakarta areas of West Java
2. Sragen and Pati areas of Central Java
3. Gunung Kidul area of Yogyakarta
4. Madiun, Kediri and Nganjuk areas of East Java
5. Area around Pamekasaan in Madura.

These visits have identified six major types of pump irrigation with respect to technology:

1. Large River Pump
2. Portable Pump
3. Deep Well
4. Intermediate Well
5. Shallow Well
6. Well Points (no pumps).

In addition, there are three possible institutional approaches: private investment, public investment with continuing public backstopping and assistance, and public investment with little or no continuing assistance. In general, the first two approaches are the major ones in Indonesia and the primary ones that can be studied in any detail. With six technologies and two possible institutional approaches, there are 12 possible individual case studies that could be carried out. However, as 12 exceeds the budget, staff capability and time available (the project was originally designed for four or five research sites), a sub-set of these or a combination of different types and approaches at a single location are required in order to have a reasonable number of research sites.

The sites visited also do not provide locations outside Java and Madura, which is clearly one important element of the Study. However, fortunately, staff from UGM carried out a detailed study in Lombok of 7 public deep wells and 3 bank loan funded deep wells. The results of this study are well

documented[1] and provided an excellent base line set of data for a follow-up study of the same wells. This can be done by a graduate student from UGM and will provide a valuable cross check against data obtained from the other sites.

[1] Laboran Akhir, Survai Agro Ekonomi di Daerah Rencanna Ekploitasi 7 Sumur Pumpa di Gerung, Tahap I and Tahap II, Maret 1981. Oleh Fakultas Teknologi Pertanian, Universitas Gadjah Mada.