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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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ECONOMICS OF PUMPSETS IN EAST JAVA

By

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ABSTRACT

A survey of 64 farmer respondents, 8 from each of 8 villages in East Java, was conducted to investigate the impact of the introduction of tubewells. All respondents were adopters and the analysis was conducted on a before compared to after basis. The results indicated that cropping intensity increased after adoption of water pumps, as did the average wages of family and non-family labor. Labor use increased, although the composition altered, there being more male and less female labor employed. Water pump projects were found to be financially feasible with an Internal Rate of Return at approximately 40% for individual farmer and co-operative (KUD) owned pumps and 18% for village managed pumps.

INTRODUCTION

East Java is perhaps the most important rice producing region in Indonesia. Of the country's total food production, almost 40% is produced in this province. Consequently, efforts for increasing production are extremely important in order to provide food for the rapidly increasing population.

East Java has an area of 47,922 km². This area technically irrigated agriculture covers only 578,000 ha, partially technical (setengah teknis) covers 120,000 ha, simple (sederhana) an area of 202,000 ha, rainfed 291,520 ha, and non-irrigated agricultural land (tegalan) covers 1,725,459 ha.

Thus, the area in East Java that does not have improved or technical irrigation systems is still substantial. Therefore, improving irrigation systems in East Java for increasing food production is extremely important. Consequently, the role of water pumps (pump-sets) to expand the irrigated area needs to be greatly increased. Using these water pumps, irrigation water can be taken from the rivers and canals to the poorly irrigated agricultural lands. Hopefully, this effort will also increase the farmers income.

At the present time, the use of water pumps in East Java is still primarily on a trial basis sponsored by the Government. Several village cooperatives and a few farmers have begun to use water pumps. The farmers' knowledge of the usefulness of these pumps is quite limited. Consequently, the main purpose of this study is to examine the influence of water pumps on the farmers' income.

Research Methodology

The selection of the areas was purposive sampling which mean that the areas had to be near a river or canal and water pumps were used by some of the farmers in the dry season. Based on this criteria, four Kabupatens were selected and two villages in each one chosen. As is shown in Table 1 there were eight respondents in each village.

Data Analysis

To fulfill the main purpose of this study, the main tool of analysis was the benefit cost ratio. Comparisons were made before and after the farmers used water pumps in order to determine the economic impact.

FARMERS OPERATIONS BEFORE AND AFTER THE WATER PUMPS

Cropping System

The crops planted by these farmers in each of the villages varied. The differences were primarily caused by the ecological situation which was primarily the soil, weather, and height above sea level.

Based on the interviews, the cropping system in Pandan Pancur (Lamongan) before the use of water pumps in the first season was rice, while in the second and third seasons the land was fallow and no crops were planted. Consequently, they were only able to get one crop per year. Thus in the wet season they planted rice but in the dry season they left their fields empty.

However, after the farmers in Pandan Pancur village used water pumps during the year they planted rice twice and one crop of fresh water fish.

In Sri Rande village the situation was similar. Thus, before the water pumps they could only plant one crop of rice per year, and after the pumps they planted rice, fish or rice, and fish which meant a change from one crop to three crops per year.

In Gunung Kidul village (Nganjuk) before water pumps were used they planted rice, soybeans, and corn. Based on the field research, before the use of water pumps 75% of the sample farmers planted rice twice a year and 25% planted rice-rice or soybeans or corn for a total of three crops per year. Yet, after the introduction of water pumps, the crops remained the same but the number of farmers planting 3X increased to 87.5% and 4X per year was 12.5% of the respondents.

In Kramat village (Nganjuk) before the introduction of the water pumps, they also planted rice, soybeans, and corn.

Yet, only 25% of the respondents planted two crops and 75% planted three crops. Then, after the water pumps the intensity increased to 50% planting three times and 50% planting four crops per year.

In a similar fashion, Bekara village's (Ponorogo) respondents planted rice, corn, soybeans and green beans. Before the use of the water pumps, 12.5% of the respondents planted one time per year, and 87.5% two times per year which was rice-corn. After the water pumps, they all planted three crops which were rice-green beans or rice-soybeans or rice.

The situation was similar in Nampak village, before the use of the water pumps by the respondents, 25% planted one time and 75% two times per year. After the pumps, they all planted three crops per year.

In Brondot village (Jombang) they planted rice and corn before the pumps. After the pumps the intensity increased from two crops per year to three crops (rice-rice-corn).

Whereas in Bangsri village (Jombang) all of the farmer respondents before the pumps had a cropping pattern of rice-corn in the year, while after the use of the water pumps the intensity increased and they planted rice-rice-corn.

Consequently, in the eight villages the use of water pumps increased the cropping intensity for the respondents.

Wages of Agricultural Laborers

In general these laborers' wages are paid either in cash or in the form of rice, corn, soybeans, etc. In this analysis, the wages in kind have been converted to rupiah using the local prices. Table 2 gives the average wages of family and hired laborers per day before the introduction of the water pumps in each village. As is clear in this table the wages vary greatly among villages and between hired and family, male and female.

In order to compare what has occurred, in Table 3 the average wages after the introduction of the water pumps is shown.

In Pandan Pancur village the wage for female hired laborers was actually higher than male laborers and was the highest wage in all of the villages. In four of the villages the non-family hired laborer wage was substantially higher than the family wage but in the other four villages it was about the same.

To compare the changes by villages, Table 4 gives the percentage increase or decrease in the average wage before and after the use of the water pumps.

Therefore, in this table it is clear which villages had respondents who reported higher wages after the water pumps. In three of the villages, family wages declined slightly and non-family declined in only one village for males. Apparently, the major gains were by female workers, where the increases reached between 123% and 409%, though some villages did not reach this level.

Use of Workers

In this analysis the workers will be defined as including those from the family and non-family and can be the family head, wives and children.

Table 5 presents the percentages of labor used from the family and non-family hired labor in rice production before the introduction of the water pumps.

As is shown in Table 5 the share of family labor used in rice cultivation was a very small part of the total. In all eight villages the percentage was less than 10% except in Gunung Kidul and Kramat villages where it was 38% and 22% for male family workers.

In order to make comparisons, Table 6 gives the percentages of family and non-family labor in rice cultivation after the introduction of the water pumps. The respondents estimated how much labor and the sources for the before and after situation.

In Table 6 the percentage still reflects the fact that non-hired labor is very important in rice cultivation even after the farmers begin using water pumps. However, comparing Tables 5 and 6 there has been a shift in the share of non-family male and female workers participation in rice production. The changes in share of labor, before and after the water pumps is given in Table 7 in order to show how the pumps affected the use of male and female workers. The greatest change after the use of water pumps was the shift from female hired labor to more male hired labor in rice cultivation. The greatest change occurred in Pandan Pancur village where female hired labor use declined by 25% after the pumps.

Size of Farm Operation and B/C Ratio

To examine the impact of the water pumps on the farmers operations and returns, the average size and Benefit/Cost ratio have been estimated for the eight respondents in each of the eight villages. In Table 8 are the average sizes of operation and the B/C ratios. After the respondents used water pumps in their agricultural operations, their returns increased as is shown by the large increase in the B/C ratio. Seven of the villages had percentage increases from 38% to 109% in the B/C ratio after using the water pumps. Only in one village was the percentage increase rather small (12%) but the B/C ratio was the highest before the use of the pumps.

Project Evaluation

In these eight villages there were three types of water pump projects. The first was individual farmers purchasing and operating the pumps. The second type was the village buying and maintaining the water pumps. And, the third was the village cooperative (K.U.D.) that bought, maintained, and managed the water pumps.

In order to evaluate these investments by the three different groups of people and/or institutions in the eight villages, the information has been combined into the three types and analyzed for the villages where that type existed. To evaluate the investment the author has estimated the Net Present Value (NPV), the Internal Rate of Return (IRR), and the Benefit Cost Ratio for the three types of project: individual farmers, village, and cooperative (KUD). The individual farmers had reasonable I.R.R. percentages and NPV's as did the cooperative, though the village managed pumps appeared to be less profitable.

CONCLUSIONS

Based on the analysis of the farmers who have used water pumps, the following can be concluded:

1. The use of water pumps in the eight villages in East Java has caused an increase in cropping intensity during the one year period. Most of the farmers were able to plant three crops after using the pumps whereas before the pumps they were only able to plant once or twice a year.
2. The average wage rates for both family member and non-family hired laborers increased after the introduction of the pumps. Although other factors also affected the increase, it was felt that the water pumps were also partly responsible for the increased wage.
3. Labor use in agricultural production increased due to the use of the water pumps. However, the composition of the laborers changed with the percentage of hired female laborers declining and male hired laborers increasing after the use of the pumps. The share of family labor in cultivation remained low.
4. The returns to the farmers increased after using water pumps.

5. The water pump projects which were financially feasible were managed by individual farmers and the cooperative. The less feasible projects were managed by the village.

RECOMMENDATIONS

The regional government should make credits available to the farmers to purchase water pumps in order that these farmers are able to water their crops in the long dry season.

The larger water pumps with higher horse power should be managed by the cooperative and should have a permanent installation. The smaller less expensive pumps should be managed by individual farmers and moved from location to location.

Table 1. Location of the respondents.

KABUPATEN	KECAMATAN	VILLAGE	NUMBER OF RESPONDENTS
Lamongan	Deket	Pandan Pancur	8
		Sri Rande	8
Nganjuk	Kota	Gunung Kidul	8
		Kramat	8
Ponorogo	Bungkal	Bekare	8
		Nambak	8
Jombang	Perak	Brondot	8
	Plandaan	Bangsri	8
Total			64

Table 2. Average wage per day before introduction of water pumps.

V I L L A G E	F A M I L Y		NON-FAMILY HIRED LABOR	
	Male (Rp)	Female (Rp)	Male (Rp)	Female (Rp)
<u>Lamongan Kabupaten</u>				
Pandan Pancur	401.	300.	711.	281.
Sri Rande	211.	201.	107.	461.
<u>Nganjuk Kabupaten</u>				
Gunung Kidul	464.	421.	497.	660.
Kramat	542.	682.	555.	461.
<u>Ponorogo Kabupaten</u>				
Bekara	520.	190.	364.	182.
Nambak	478.	225.	242.	207.
<u>Jombang Kabupaten</u>				
Brondot	215.	175.	575.	455.
Bangsri	246.	151.	551.	426.

Source: Interviews in the villages.

Table 3. Average wages after the introduction of water pumps.

V I L L A G E	F A M I L Y		NON-FAMILY HIRED LABOR	
	Male (Rp)	Female (Rp)	Male (Rp)	Female (Rp)
<u>Lamongan Kabupaten</u>				
Pandan Pancur	349.	210.	1145.	1429.
Sri Rande	573.	449.	1384.	1196.
<u>Nganjuk Kabupaten</u>				
Gunung Kidul	510.	820.	503.	437.
Kramat	569.	691.	641.	465.
<u>Ponorogo Kabupaten</u>				
Bekara	389.	212.	249.	215.
Nambak	439.	214.	242.	208.
<u>Jombang Kabupaten</u>				
Brondot	436.	275.	871.	767.
Bangsri	364.	336.	953.	861.

Source: Interviews in the villages.

Table 4. Percentage change in average wages after use of water pumps.

V I L L A G E	F A M I L Y				NON-FAMILY HIRED LABOR			
	M a l e		F e m a l e		M a l e		F e m a l e	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
<u>Lamongan Kabupaten</u>								
Pandan Fancur	-	13	-	30	61	-	409	-
Sri Rande	171	-	123	-	29	-	210	-
<u>Nganjuk Kabupaten</u>								
Gunung Kidul	1	-	95	-	1	-	-	34
Kramat	5	-	1	-	16	-	1	-
<u>Ponorogo Kabupaten</u>								
Bekara	-	25	12	-	-	32	18	-
Nambak	-	8	-	5	0	-	0	-
<u>Jombang Kabupaten</u>								
Brondot	102	-	57	-	51	-	67	-
Bangsri	48	-	123	-	73	-	102	-

Source: Calculated from Tables 2 and 3.

Table 5. Percentage of family and non-family labor used by the farmers in rice cultivation before using water pumps.

V I L L A G E	F A M I L Y		NON-FAMILY HIRED LABOR	
	Male (%)	Female (%)	Male (%)	Female (%)
<u>Lamongan Kabupaten</u>				
Pandan Pancur	7	2	19	72
Sri Rande	4	4	24	68
<u>Nganjuk Kabupaten</u>				
Gunung Kidul	38	7	39	16
Kramat	22	6	53	18
<u>Ponorogo Kabupaten</u>				
Bekara	8	8	59	25
Nambak	9	6	61	23
<u>Jombang Kabupaten</u>				
Brondot	2	2	25	71
Bangsri	3	3	32	62

Source: Interviews in the villages.

Table 6. Percentages of family and non-family hired labor used by the farmers in rice cultivation after the use of water pumps in the eight villages in East Java.

V I L L A G E	F A M I L Y		NON-FAMILY HIRED LABOR	
	Male (%)	Female (%)	Male (%)	Female (%)
<u>Lamongan Kabupaten</u>				
Pandan Pancur	10	4	40	46
Sri Rande	6	4	34	55
<u>Nganjuk Kabupaten</u>				
Gunung Kidul	32	6	46	16
Kramat	26	9	43	22
<u>Ponorogo Kabupaten</u>				
Bekara	10	7	64	20
Nambak	13	7	64	17
<u>Jombang Kabupaten</u>				
Brondot	3	3	31	62
Bangsri	3	4	36	57

Source: Interviews in the villages.

Table 7. Percentage change in proportion of labor used in rice cultivation with the use of water pumps in the eight villages in East Java.

V I L L A G E	F A M I L Y				NON-FAMILY HIRED LABOR			
	M a l e		F e m a l e		M a l e		F e m a l e	
	Increase	Decline	Increase	Decline	Increase	Decline	Increase	Decline
<u>Lamongan Kabupaten</u>								
Pandan Pancur	3	-	2	-	21	-	-	25
Sri Rande	2	-	1	-	10	-	-	13
<u>Nganjuk Kabupaten</u>								
Gunung Kidul	-	7	-	1	7	-	0	-
Kramat	4	-	2	-	-	10	4	-
<u>Ponorogo Kabupaten</u>								
Bekara	2	-	-	2	5	-	-	5
Nambak	4	-	1	-	2	-	-	9
<u>Jombang Kabupaten</u>								
Brondot	1	-	1	-	7	-	-	9
Bangsri	1	-	0	-	5	-	-	5

Source: Calculated from Tables 5 and 6.

Table 8. Comparison of the average size of rice farm operation and B/C ratio before and after use of water pumps in the eight villages in East Java.

V I L L A G E	BEFORE USE OF WATER PUMPS		AFTER USE OF WATER PUMPS		PERCENTAGE CHANGE IN B/C (%)
	Ave size (ha)	B/C	Ave size (ha)	B/C	
<u>Lamongan Kabupaten</u>					
Pandan Pancur	1.00	2.36	1.00	3.12	32
Sri Rande	1.04	2.14	1.04	2.89	35
<u>Nganjuk Kabupaten</u>					
Gunung Kidul	.76	1.51	.96	2.17	44
Kramat	.60	1.59	1.40	2.34	47
<u>Ponorogo Kabupaten</u>					
Bekara	.50	1.39	.50	2.91	109
Nambak	.41	1.66	.41	3.02	82
<u>Jombang Kabupaten</u>					
Brondot	2.25	2.39	2.22	3.29	38
Bangsri	2.00	2.89	2.00	3.25	12

Source: Interviews in the villages.

Table 9. Evaluation of the investment in water pumps in the eight villages in East Java by individuals, villages, and co-operatives.

I N D E X

Individual Farmer

NPV	6,540	68,208	12,896	5,382	15,880
Net BCR	1.02	1.02	1.04	1.02	1.03
IRR (%)	41	39	48	47	20

Village Management

NPV	14,579	4,185	245
Net BCR	1.03	1.01	1.003
IRR (%)	18	18	18

Cooperative (KUD)

NPV	6,795,510
Net BCR	1.27
IRR (%)	40

Source: Calculation are based on information from interviews of farmers.

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