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FACTORS INFLUENCING PAYMENT OF IRRIGATION SERVICE FEES

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Abstract

This article attempts to identify factors affecting participation in payment of irrigation service fees. There are five variables comprising demographic and economic of land variables were tested to find the variables that influenced the participation significantly. The five variables tested consisted of age and formal education as demographic variables; land productivity, land size, and land tenure as the economic of land variables. The results showed that formal education (demographic variable) had positive relationship and land size (economic of land variable) had negative relationship with the participation. Positive relationship between formal education and participation in payment of irrigation service fees meant that the participation increased as farmers' education increased. Meanwhile, negative relationship between land size and the participation in payment of irrigation service fees showed that the farmers' participation would increase as the land size owned by farmers decreased. In other words, participation in payment of irrigation service fees was higher among farmers with small lands rather than that among farmers with large lands.

Keywords: pump irrigation, factor influencing participation, logistic model

Introduction

Pump irrigation has uphill role in Indonesian agriculture as an alternative to traditional gravitation irrigation, which has been developed far earlier. Since it has good prospect, such irrigation is being developed by government as well as non-government organisation to raise paddy production. Effendi and Adreng (1999) found that pump irrigation is important because of several benefits: (1) independent of seasonal changes, particularly deep-well pump; (2) no much time is needed to establish the irrigation, thus it can yield fast results; (3) no dam is required, thus it costs little; and (4) easy to manage as it can be established on a small scale. In addition, the use of pump irrigation in the areas where gravitation irrigation is unavailable can increase planting intensity from 156 percent to 242 percent. In the areas where gravitation irrigation is available, planting intensity increases from 223 percent to 253 percent. Planting intensity is the percentage of actual planting frequency to the ideal of three-time planting within one-year duration.

Government and non-government organisation (NGO) at much lesser number are usually to be the sources of loan or grant for pump irrigation development. Farmers with government or NGO would build this pump irrigation, and farmers would manage it after the irrigation was completed. NGOs as well as the government used revolving funds to finance the pump irrigation development. The revolving fund is a zero interest loan, which must revolve from one project to another in order to build pump irrigation with the same funds in other areas. Farmers had to repay their loans in instalments within an agreeable period, which is paid after harvesting when the irrigation was completed. For every harvest, farmers had to allocate some amount from their production income to repay loans as well as irrigation service fees for pump operation and maintenance of pump and canal. The pre-determined amount of irrigation service fees and periodic loan instalment repayments were based on mutual agreements that have been reached with the farmers.

Although a good number of pump irrigation systems have been constructed for more than one decade, a complete assessment of farmer's participation on the project has not been prepared. Nevertheless, some information about irrigation service fee payments concluded that farmers' participation is low. For example, after the pump was in operation, farmers refused to repay the loan. Pakpahan in his research found that farmers were prepared to pay only for pump operation and repairs or to buy a new one, but they were

not prepared to repay loans (Sumaryanto and Pakpahan, 1999). In another case, Pakpahan also found that farmers were reluctant to repay their loans and the irrigation service fees. As a result, this pump could not be operated continuously because of was no funds allocated for it.

Policy makers have not known the problem as to why many pumps could not be made functional, so that they did not possess a good way of overcoming it. Therefore, there was a need to get exact reason what really affects farmers to participate more. The information needed in enhancing farmers' cooperation to pay irrigations service fees was related to the question: "Which factors do influence farmers to participate in paying irrigation service fees?" There were socio-demographic and economic of land factors influencing them to be active in paying the fees. In this study, the researcher tried to understand and examine which factors contributed most to encourage farmers to participate in the pump irrigation project, especially in paying irrigation service fees. In line with the problem faced in pump irrigation, objective of the study is to identify factors influencing payment of irrigation service fees.

Methodology

Location of the Study

This study was carried out in three villages, namely Villages of Karangtumaritis, Kertanegara and Wanakaya in Haurgeulis District in Indramayu Regency, West Java Province. These three villages were the location of a pump irrigation project which was managed by Persatuan Petani Pemakai Air (P3A) Tirtabumi developed by YBSD, an NGO collaborating with the government of Indramayu Regency. There was one other similar location in the same district, but the P3A Tirtabumi was chosen in consideration of better availability of information about the project. Besides that, the pioneer farmers of the project in both locations, from whom much information of the project implementation would be colleted, came from the former location.

The P3A pump irrigation project Tirtabumi is located in an inland area of North Seashore, belonging to Haurgeulis District, Indramayu Regency, West Java Province. It is situated some 150 kilometres from Jakarta. From Jakarta, the location is passed through by trains and buses, but one can be easier to reach the location by train. Going by bus to reach the place is somewhat difficult as one has to stop-over in Patrol, before continuing travelling by public vehicle to the location.

Selection of Respondents and data collection

The data in this study came from the farmers of P3A Tirtabumi who were selected randomly for survey technique purposes. In this survey technique, 21 percent of 210 farmers, i.e., 45 farmers, were selected as respondents comprising 23 respondents from Karangtumaritis, 12 respondents from Wanakaya, and 10 respondents from Kertanegara.

Survey technique was employed to get representative quantitative data from farmers that have been selected randomly. In this particular technique, structured questionnaire, with mostly close-ended questions, was used. In data collection, the researcher assisted by enumerators administered the questionnaire method.

Data Analysis

Data analysis employed in this study was carried out by using SPSS software programme. The data on payments of irrigation service fees collected from farmers showed that logistic regression would be fit to analyze the data. The data were not fit to be analyzed with usual regression, because the data of dependent variable was not as varied as the independent ones. The data of the dependent variable were concentrated only on few numbers. The data could be analyzed using logistic regression by converting the data into two categories, 0 and 1. In this case, 0 represents partial payment of irrigation service fees, and 1 represents full payment of irrigation service fees. The data on payment of irrigation service fees can be converted into two categories by firstly determining the mean value of the data. Mean value is the sum of the values of the observations divided by the number of observation (Abu Samah and Suandi, 1999). The mean and other lesser values become 0 category or not full payment of irrigation service fees, while the mean and other higher values become 1 category or full payment of irrigation service fees.

The logistic model had been widely used in various fields of study in both exact and social researches. In social field research, for example, the logistic model was once used by Tikkanen (1998) to analyse participation. According to Hutcheson and Sofroniou (1999), the equation of logistic model is as follows:

$$\text{Logit}(p) = \beta 0+\beta 1\times AGE+\beta 2\times FED+\beta 3\times LSZ+\beta 4\times LPR+\beta 5\times LTN \ldots \quad (1)$$

Where:

Logit(p) = log[p/1-p]

[p/1-p] = odds

p = probability of a full payment of irrigation service fees happening

1-p = probability of a full payment of irrigation service fees not happening

AGE = age
FED = formal education
LSZ = land size
LPR = land productivity for paddy
LTN = land tenure
β0 = constant
β1- β5 = regression coefficient

Participation in the payment of irrigation service fees of farmers was measured by the percentage of payment of irrigation service fees to the committed amount (386 kg/hectare). For instance, if the farmers pay irrigation service fees fully (386 kg/hectare), then the payment is 100 percent. Meanwhile, if the farmers pay only one-half (193 kg/hectare), then the percentage of payment is 50 percent, and if the farmer does not pay at all the fees, then the ratio of his payment is zero, and so forth.

According to Hosmer and Lemeshow (2000), an easier interpretation of the regression coefficient can be obtained from the odds, which is obtained by taking the inverse of the natural log of logit(p), e^{β}. The e^{β} term represents the change in the odds in which it is associated with a unit change in x and is commonly called the odds ratio. The formula of the odds ratio comes from the equation below (Hosmer and Lemeshow, 2000):

OR = $\dfrac{\pi(1)/[1-\pi(1)]}{\pi(0)/[1-\pi(0)]}$, where π = probability of full payment in irrigation service fees happening

Because the specific form of the logistic regression model is:

$$\pi(x) = \frac{e^{\beta_0+\beta_1 x}}{1+e^{\beta_0+\beta_1 x}}$$

The equation will be as follows:

$$\text{OR} = \frac{\left(\dfrac{e^{\beta_0+\beta_1}}{1+e^{\beta_0+\beta_1}}\right)\Big/\left(\dfrac{1}{1+e^{\beta_0+\beta_1}}\right)}{\left(\dfrac{e^{\beta_0}}{1+e^{\beta_0}}\right)\Big/\left(\dfrac{1}{1+e^{\beta_0}}\right)}$$

Then the formula can be simplified as the followig:

$$= \frac{e^{\beta_0+\beta_1}}{e^{\beta_0}}$$

$$= e^{(\beta_0+\beta_1)-\beta_0}$$

$$= e^{\beta_1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Variables Description

This section attempts to describe all variables used in the model. The description starts with the dependent variable: payment of irrigation service fees. In the next part is the description of independent variable, namely age, formal education, land size, productivity of land for paddy, and land tenure.

Payment of Irrigation Service Fees

The data for payment of irrigation service fees showed that more than 62,2 percent of the respondents pay in the range of 75,5 – 100,0 percent (Table 1). The Table 1 also shows that there are only 6.7 percent respondents who pay 0 – 50,0 percent of the irrigation service fees. Among them, there were three respondents who did not pay their dues at all.

As stated earlier, the data for payment of irrigation service fees needed to be converted into two categories: not full and full payment, for analysis purposes. Using mean value of 85,07, as the central value, the statement of payment can be divided into two categories. The amount of payments from zero to 85,075 percent represent the not-full payment of irrigation service fees or low participation category, and 85,080 – 100 percent payments represent the full payment of irrigation service fees or higher participation category. The number and percentage of respondents after the data are divided into two categories is shown in Table 2.

Table 1. The Payment of Irrigation Service Fees in Rainy Season 2000/2001

Amount of Payment (percentage to the committted amount)	Number of Respondents	Percentage of respondents	Cumulative Percentage of respondents
0 – 25,0	3	6.7	6.7
25,5 – 50,0	0	0	6.7
50,5 – 75,0	14	31.1	37.8
75,5 – 100,0	28	62.2	100
T o t a l	45	100	

Source: Primary Data, 2001

Table 2. Range of Payment of Irrigation Service Fees (in percentage) and the Category of Participation

Amount of payment (percentage to the fixed amount)	Category
0 – 85,075	Not full payment/low participation
85,080 - 100	Full payment /high participation

Source: Primary data, 2001

Table 3. Average, Maximum, Minimum and Standard Deviation of Variables Included in the Model

Variable	Average	Max.	Min.	Standard Deviation
1. Age (year)	55,5	80	34	12,6
2. Formal education (year)	0,9	12	0	2,5
3. Land size (Ha)	0,67	3,8	0,175	0,62
4. Productivity of the land for paddy (ton/ha/year)	9,5	13,6	5	1,7
5. Land tenure	Owned	Rented	Shared	Mortgaged
	59%	26%	9%	6%

Source: Primary data, 2001

Age

The age of respondents ranged from 34 years to 80 years, in which the average age was 55,5 years (Table 3). The average of 55,5 years is categorized as old age compared with the standard age of a government officer who must retire from his job when he reaches the age of 55. This is a common phenomenon among Indonesian farmers since the orientation of young farmer is not to agricultural sector. This trend was due to the land for agricultural sector that became smaller and smaller over the years, and incomes from the same sector become more insufficient, thus unreliable. Younger farmers thus were inclined to migrate from their village into towns to find non-farm jobs.

Farmers who cultivate their own land did not see the need to work as hard as those who worked on other farmers' land. Landowner farmers especially with large lands could gave some field jobs, such as hoeing, planting, weeding, and harvesting to laborers. This enabled aged farmers to manage their farms more easily because they did not use their own physical energy. On the other hand, small farmers had to utilize members of their families for much-needed manpower to avoid much expense. Otherwise, they would find their profits from farming very little. Nevertheless, small farmers could not do all aspects of work on their farms. Almost all kinds of farming work demanded fast work, thus necessitating additional manpower. Besides that, there was a norm among village communities that rich farmers or those having large land should give their fieldwork to landless farmers to give the latter a chance to earn their living.

Education

The farmers' level of literacy was commonly very low; most of them were uneducated. On average, farmers' education was only 0,9 years (Table 3). This situation happened among old farmers in particular, because when they were children they had no chance for schooling. Educational facilities were very limited, their parents' appreciation of education was low, and most parents in village particularly had no money for their children to go to school. However, the literacy level of the younger generations has improved because they are in the era where educational amenities are more available and better. Furthermore, financial support is currently available and better appreciation of the community on education is also improving. For instance, elementary schools that would not easily be seen in villages 50 years ago can now be found anywhere in any villages.

Farmers with higher education could also be found in the villages. In fact, such educated farmers belong to younger generation who also work as traders, teachers or other professions. Farmers with higher education do not depend too much on farming for their incomes because of their jobs. Some of them are new comers in farming, since they have other job previously. They were engaged in farming after they have enough money to buy a piece of land. In addition, other farmers of slightly educated who inherited land from their parents are of younger category.

Land Size

The size of lands cultivated by farmers under pump irrigation system ranged from 0,175 to 3,8 hectares with the average of 0,67 hectare per tract of land (Table 3). Lands included in the pump irrigation project were the only field for most farmers, so they depended much on these lands. All farmers cultivated paddy fields in rainy and dry seasons. Only nine percent of farmers own cultivable lands, which were classified as either wetland or dry land located outside the project area. They planted paddy in the wetland and chose to plant other suitable crops in the dry lands.

The size of lands cultivated by farmer changed from one season to another. This was mainly because land rent became popular among the farmers, some of whom rented additional, while others stopped or reduced their rent. There were many farmers both from their own locality and other villages who came to the pump irrigation project area to rent lands for farming, especially paddy cultivation. They rented paddy fields

for one or two seasons, and continued for another season if the cultivation could give enough profit. Constant selling of paddy lands also caused the change of land size being cultivated. As has been stated previously, small farmers inclined to sell their lands because they could not derive sufficient incomes from these lands. Ultimately they came to develop the willingness to change their profession. Rich farmers planning to add paddy lands possession, on the other hand, tempted the small farmers to sell their lands.

Land Productivity

Land productivity for paddy varied between 5 and 13,5 tonnes with the average of 9,5 tonnes per hectare a year (Table 3). The difference of land productivity might not come from the disparity of land fertility since these lands were having smaller sizes and soil fertility was also the same. The most possible distinction in productivity might be due to variation of applying farming technology such as use of fertilisers, pesticides, planting space, time length of paddy seedlings, and difference of acquiring sufficient water.

The differences in technological application were often found among the farmers. Some farmers applied farming technology as recommended by extension agencies; some others applied only part of the technology package, and the rests applied their own traditional farming practices. Farmers who availed of new and complete farming technology would find their productivity higher than those of outdated and incomplete technological application. Besides, sufficiency of water supply was possibly to be one of the factors that resulted in such variances in land productivity. This was supported by an evaluation of the YBSD in 1994. Such evaluation showed that some of the pump irrigation areas got sufficient water supply, while other areas did not. Differences in water sufficiency thus determined differences of land productivity.

Land Tenure

Land tenure was relatively varied, consisting of: owned, mortgaged, rented, and shared status. A land is called owned status when the farmers cultivated their own lands. Mortgaged status was a condition in which a farmer cultivated a piece of land temporarily as a guarantee for money that is borrowed by the land owner. Rented status was a condition in which farmers cultivated a piece of land under rented system within an agreeable period of time. Shared status was a condition in which someone cultivated a piece of land on sharing basis with the landowner.

Most of the lands in the pump irrigation project area were owned by farmers themselves, accounting for 59 percent. The second major portion of lands was of rented status, accounting for 26 percent, while shared and mortgaged status was only between 9 and 6 percent respectively (Table 3). The lands which were owned by farmers themselves were declining in size because the small land farmers tends to sell their lands to the large land farmers. Rich farmers with bigger land areas, needless to say, could save much of their income from their paddy harvests. On the other hand, poor farmers with very small lands would incline to sell their lands because they could not earn enough income from paddy farming. They may decide to earn other forms of livelihood elsewhere.

Analysis of Binary Logistic Regression

Objective of the analysis of binary logistic regression is to determine factors that influence the payment of irrigation service fees. The analysis provides information on the relationship between dependent and independent variables. The relationship includes the direction and the magnitude of the logit from full payment of irrigation service fees happening when independent variables change. The magnitude of association between coefficient and logit from full payment of irrigation service fees occurring can be obtained from the odds of full payment of irrigation service fees phenomenon, which are obtained by taking the inverse of the natural log of the logit, e^{β}. The e^{β} represents the change in the odds of full payment of irrigation service fees happening which is associated with a unit change in x and is commonly termed the odds ratio.

The results of logistic regression show that $R^2 = 0,77$, which means that the proportion of the response variable that can be explained by all regressors included in the model is 77 percent. The rest of 23 percent is determined by other factors outside the model, it may be the factors that are difficult to measure.

There are two variables that are highly significant, namely formal education and land size. Formal education variable has positive relationship with logit of full payment of irrigation service fees happening with the coefficient 0,5144, while land size variable has negative relationship with the coefficient –1,3275. The odds ratios of formal education and land size are 1,67 and 0,27 consecutively (Table 4). The odds ratio of 1,67 of formal education variable means that as formal education increases by one unit, the odds ratio of full payment of irrigation service fees happening will change to 167 of its previous value, an increase of 67 percent. On the other hand, the odds ratio of 0,27 of education variable means that as land size increases by one unit, the odds ratio of full payment of irrigation service fees happening will change to 27 percent of its previous value, a decrease of 73 percent.

Table 4. Results of Binary Logistic Regression on Payment of Irrigation Service Fees

Variable	Coefficient	Probability	Odds Ratio (e^{β})
Constant	3,576	0,174	-
1. Age	-0,00497	0,855	1,00
2. Formal education	0,5144*	0,049	1,67
3. Land size	-1,3275**	0,060	0,27
4. Land productivity	0,02080	0,349	0,98
5. Land tenure	-1,1720	0,113	0,31

* Significant at $\alpha = 0,05$
** Significant at $\alpha = 0,1$
$R^2=0,77$

The estimated logit of full payment of irrigation service fees is shown by the following equation:

Logit(p) = 3,576 – 0,00497×AGE + 0,5144×FED – 1,3275×LSZ + 0,02080×LPR – 1,1720×LTN

A positive relationship between formal education with full payment of irrigation service fees means that the higher education of the farmers would be, the more prepared were they to pay irrigation service fees in full. This is consistent with some research findings conducted by many researchers that education can increase people's participation (see for instance, Perlstadt, et al, 1998). Farmers with higher education level were prepared to pay irrigation service fees in full because they could make better vision over the continuity of pump irrigation in relation to their income prospect. They realized better that without full payment of irrigation service fees, the pump operation would be interrupted so that their incomes were threatened to end up in the red.

A negative relationship between land size with full payment of irrigation service fees meant that the more land the farmers possessed in the project area, the less prepared were they to pay irrigation service fees in full. The reluctance of farmers owning larger lands to pay irrigation service fees in full was because they tended to see irrigation service fees from an absolute quantity they paid. They did not look at the relationship between these fees and the land size that they cultivated. They did not want to pay more because they had paid much more than other farmers. The payment collector had reminded them many times but they remained adamant not to pay more because they thought they were doing the right thing.

The willingness of small farmers to pay irrigation service fees in full was surprising, considering their low income. This condition might explain the tolerance and empathy of small farmers. According to Hornby (1998), tolerance is the willingness or ability to allow something that one does not like or agree with to happen or to continue, while empathy is the ability to imagine and share one's feeling and experiences with another person, and the like. Such attitudes could be seen from the very beginning of project implementation. For example, they were more prepared to work since the project began. They were willing to contribute labour for all farmers, even for the rich farmers. Other than that, their position in their own community was one of weakness due to inability to pay their dues completely to assure continuity of the pump irrigation project without interruption.

Conclusion and Recommendation

The results showed that formal education (demographic variable) had positive relationship and land size (economic of land variable) had negative relationship with participation in payment of irrigation service fees. Positive relationship between formal education and participation in payment of irrigation service fees showed that the participation increased as farmers' education increased. Meanwhile, negative relationship between land size and the participation in payment of irrigation service fees meant that the farmers' participation would increase as the land size owned by farmers decreased. In other words, participation in payment of irrigation service fees was higher among farmers with small lands rather than that among farmers with large lands.

The findings of the research suggested that farmers' education and land size that were cultivated by farmers should get much attention in running projects. It was necessary to approach educated beneficiaries in project area since they could participate more compared to those who were uneducated. Likewise, there was a need to ensure that small farmers would remain in the project because the same group could participate more than the large land farmers. In short, the project run in the area in which the farmers were educated and mostly small land would be more successful.

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