Bulgarian Journal of Agricultural Science, 24 (No 4) 2018, 574–580

Social economic factors that affect cattle farmer's willingness to pay for artificial insemination programs

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Abstract

Sirajuddin, S. N., Sudirman, I., Bahar, L. D., Al Tawaha, A. R., & Al Tawaha, A. R. (2018). Social economic factors that affect cattle farmer's willingness to pay for artificial insemination programs. *Bulgarian Journal of Agricultural Science*, *24*(4), 574–580

There is a serious problem in Indonesia in the field of animal husbandry, that is the low productivity and genetic quality of cattle. To solve the problem, artificial insemination (AI) was done to improve the productivity of cattle and farmer's income. But actually the farmer's willingnes to pay (WTP) affects the AI programs. This research aimed to understand the social economy factors that affected beef cattle breeder's WTP for artificial insemination programs in Barru Regency, South Sulawesi Province, Indonesia. The research was conducted from May to July 2017 in the Balusu district, South Sulawesi Province, Indonesia. The type of research is explanatory quantitative. The populations were all of the farmers that do artificial insemination in cattle in Balusu district, a total of 85 farmers. The data sources were primary data and secondary data; data types were qualitative and quantitative. Analysis of data used multiple regression analysis. The results showed that simultaneously age factors, formal education, social care, and the attitude, AI's knowledge, business scale and extension significantly affected the farmers WTP for artificial insemination of their cattle. However, the social care factors, location, and the farmers' attitude in separate, partial regressions were also significantly influential. So, it is necessary to increase knowledge about AI with intensity of counseling higher on Bali cattle breeder. As the conclusion, age factor, formal education, social awareness, knowledge about AI, business scale, counseling and location significantly influence the willingness to pay farmers in applying artificial insemination to Bali cattle.

Keywords: artificial insemination; cattle; cattle farmers; willingness to pay; Indonesia

Abbreviations: AI – Artificial insemination; WTP – Willingness to pay; GBIB – Gertak Birahi Inseminasi Program; SIWAB – Sapi Betina Wajib Bunting

Introduction

Indonesia's problems in the field of animal husbandry remain low productivity and the genetic quality of cattle. Moreover, this situation occurs for many reasons such as the majority of farmers are still conventional dairy farmers, seed quality, technology use and skills for the farmer are still relatively low (Said, 2015). Artificial insemination (AI) is an alternative technology that is being developed as an effort to increase Indonesian cattle productivity through breeding technology, and the results have been relatively quick and have satisfactorily expanded and implemented cattle livestock cross breeding with superior imported stock (Hastuti, 2008; Morrell, 2011; Nedelkov et al., 2015).

The implementation of AI is aided by the application of appropriate technology and influenced by several factors. The factors include health and nutritional management of the herd (Barth, 1993) and some factors that are proven by another study results. Prior research has shown that such factors are scale of business, age, income, formal education, family responsibility, knowledge of the payment (Arifah, 2008), psychological information, personal satisfaction (Vanslembrouck et al., 2002), the family as labor (Zbinden and Lee, 2005), social awareness (Mzoughi, 2010) and farmer's knowledge about artificial insemination (Hartati, 2010; Rohani et al., 2017; Sirajuddin et al., 2017a, 2017b).

There is one problem that influence the process of AI program called Willingness to Pay (WTP), it's means that the farmer is not willing or able to pay for services (Ahuja and Redmond, 2001). There are advantage and disadvantage of WTP including it's a valuable and simple tool in performing cost-benefit analysis in AI program (advantage) (Mariani and Pêgo-Fernandes, 2014) but WTP analysis can cause producing of widely varying values (Burrows and Brown, 1992). WTP is heavily influenced by demographic aspects including education, income level, age and gender and individual preference for goods/services offered (Day and Mourato, 2000). In addition, whether or not the people pay will also be determined by the presence or absence of benefits they will get if they are asked to pay some money (Ajuha and Redmond, 2001; Salamah, 2012).

Regarding to advantage and disadvantage of WTP, since 1993, AI has been adopted in the Balusu District. There are many government programs that support the development of AI in the district. For instance, an artificial insemination program is held every year by the Province's Department of Animal Husbandry and Animal Health, the *Gertak Birahi Inseminasi Program* (GBIB) in 2015 and UPSUS SIWAB (Sapi Betina Wajib Bunting) in 2017. UPSUS SIWAB is expected to increase the cattle population, as well as increasing farmer income and can optimize the performance of Bali cattle (Bahar, 2017).

To assess overall AI activity it is necessary to know the socio-economic factors that affect farmer WTP for AI activities in Balusu, Barru regency. WTP is defined as the willingness of individuals to pay for an environmental condition or an assessment of natural resources and natural services in order to improve the quality of the environment. WTP calculates the ability of each individual or society in aggregate to pay or spend money in order to improve the environmental conditions to suit their desired conditions. WTP is the potential value of the use of natural resources and environmental services (Hanley and Spash, 1993; Arifah, 2008). Household WTP is less than the sum of household members' individual WTP. Implications for the choice between household and individual measures of WTP are considered, and issues in the elicitation of household WTP are addressed in Quiggin (1998). Consumers are willing to pay a premium price mainly to purchase better quality products. Premium price means the normal price surcharge of a product and represent the WTP of goods consumers (Castellini et al., 2014). With the given background, the objective of this study was aimed to determine the effect of business scale factors, age, income, formal education, family responsibility, knowledge of payment, information from other farmers, extension, location and psychological attitude, personal satisfaction, family as labor, social awareness and farmer knowledge about artificial insemination on WTP for AI.

The Research Method

The study was conducted from April to November 2017 in Balusu District, Barru Regency, South Sulawesi Province, Indonesia. This research was explanatory quantitative research, which analyzes the relations of research variables by testing the formulated hypothesis. This research is an observational survey with a cross-sectional approach, which is research done with a momentary observation or in a certain period of time and each subject has only one observation during the research.

The population in this research is Bali cattle farmers who adopt the artificial insemination technology that reside in Balusu district, as many as 548 scattered in six districts/villages.

Due to the large population size it is necessary to withdraw the sample. The method used to determine the sample size in this study used Slovin formula (Umar, 2001) as follows:

$$n = \frac{N}{1 + Ne^2}$$

where: n = number of samples; N = total population; e^2 = precision (allowance rate of 10%)

So, the size of the sample was 85 respondents, from which the data were obtained. Data types used in this research are qualitative and quantitative data. Data resources used primary and secondary data. The data collection methods were observation and interview. Analytic tools used were statistics inferential as Linear Multiple Regression. This analysis was used to find the factors that influence women's participation in the cattle business using SPSS Statistics 22. Multiple regression models can be written mathematically as (Sugiono, 2010):

$$Y = a + b1X_1 + b2X_2 + b3X_3 + b4X_4 + b5X_5 + + b6X_6 + b7X_7 + E \quad (1)$$

Description:

Y: Willingness to pay (IDR)

a: Constants

b1–b7: Regression coefficients (rate of increase or decrease of variables)

x1: Age (Year)

x2: Education (Year)

x3: Business scale (Heard)

x4: Knowledge about AI (Scoring)

x5: Social awareness (Scoring)

x6: etension (Scoring)

x7: location and Attitude (scoring)

E: Standard Error

To determine the factors that were significantly or not significantly influential, F test and t-tests were used.

Results and Discussion

Analysis of farmer's WTP for artificial insemination

Multicollinearity test

The purpose of the multicollinearity test was to determine whether the relations between independent variables have a multicorrelation problem (multicollinearity symptoms) or not. Multicorrelation tests needs to be done if the number of independent variables was more than one (Sarjono and Julianita, 2011).

Table 1 show that VIF of age is 0.949, formal education is 0.964, business scale is 0.931, knowledge of AI is 0.183, social care is 0.954, extension is 0.373 and location is 0.146. The VIF value of each independent variable is smaller than 10; thus, it can be concluded that there are no variations of multicollinearity among independent variables. Thus, this regression model was an independent regression model.

Table 1
Collinearity statistics of the model

Model	Collinearity statistics	
	Tolerance	VIF
(Constant)		
Age	0.949	1.054
Formal education	0.964	1.037
Business scale	0.931	1.075
Knowledge about AI	0.183	5.477
Social awareness	0.954	1.048
Extension	0.373	2.678
Location	0.146	6.838

Source: Primary data processed, 2017

Test normality needs to be done to determine the normal or not the distribution of data because the data is normally distributed is a requirement to do parametric-test. Normal data means having a normal distribution as well. Thus, the data is considered to represent the population (Sarjono and Julianita, 2011).

Model feasibility test

Whether or not the model is used, it can be seen in the significant value. The significant value of the model used in this study can be seen in Table 2.

Table 2
ANOVA results of multiple linear regression analysis

Model	Sum of squares	Df	Sig.
Regression	19.490	7	0.000[b]
Residual	15.686	77	
Total	35.176	84	

Source: Primary data processed, 2017

Table 2 shows the testing of the various regression models. In the significant column ("sig.") is a number indicating the level of significance of the model, which was assessed using an $\alpha < 0.05$ For instance, a value "0.000" is significant because it is below the $\alpha < 0.05$ threshold. A significant value means an independent variable significantly affects the dependent variable (Y) and should be included in the model.

Simultaneous effect test (Together) of WTP for artificial insemination

The simultaneous effect test (Together) of WTP factor for artificial insemination can be seen in Table 3.

Table 3
Recapitulation of multiple linear regression data

	Multiple R	R Square (r^2)	F_{count}	F_{table}	Sig
Step	0.744[a]	0.554	13.668	2.222	0.000

Source: Primary data processed, 2017

Based on Table 3, which shows the results of using multiple linear regression analysis, the independent variables (age, education, social awareness, knowledge of AI, business scale, extension and location) simultaneously affected the farmer's WTP for artificial insemination. The calculated F statistic obtained was 13.668, larger than theoretical F value of 2.222 at $\alpha = 0.05$, such that the effect was significant. In relation to the above, the hypothesis was accepted (Ha accepted) where age, education, business scale, social awareness, knowledge about AI, counseling and location together give a significant influence on farmer WTP for artificial insemination.

Sugiyono (2010) states the guidelines to provide interpretation of the correlation coefficient as follows:

- 0.00 – 0.199 = very low
- 0.20 – 0.399 = low
- 0.40 – 0.599 = medium
- 0.60 – 0.799 = strong
- 0.80 – 1.000 = very strong

To find out how strong the influence between independent and dependent variables it can be seen from the guidelines listed above. Clear result of double correlation between independent and dependent variables can be seen in Table 4.

Table 4
Results of multiple correlation analysis and R Square determination coefficient

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.744[a]	0.554	0.514	0.451

Source: Primary data processed, 2017

Table 4 shows an R number of 0.744. R value shows multiple correlations, that is correlation between independent variable to dependent variable. R value ranges from 0 to 1, if close to 1, the relationship is closer. Conversely, if close to 0, the relationship is weaker. The number of R is 0.710 which means correlation between independent variables (X1), education (X2), business scale (X3), social awareness (X4), knowledge of AI (X5), extension (X6) and location (X7) to the WTP of farmers (Y) is 0.744. This is in the range of 0.60 to 0.799, which means that there is a "strong" relationship as defined in Sugiyono (2010). It can be concluded that age, education, social awareness, knowledge about AI, business scale, strongly affect WIP of farmer's for artificial insemination.Table 4 also shows the values of the coefficient of determination (Adjusted R2). Priyanto (2011) states that the determination analysis is used to determine the percentage contribution of independent variables to the dependent variable. Furthermore, Santoso (2011) states that for regression with more than two independent variables, Adjusted R^2 is used as the coefficient of determination.

As seen in Table 4, Adjusted R^2 was 0.554. This means that the joint contribution of age variables (X1), education (X2), business scale (X3), social awareness (X4), knowledge of AI (X5), extension (X6) and location (X7) on the WTP of farmers (Y) was to 55.4% and the remaining 44.6% was influenced by other factors. This suggests that there are still other factors that affect the WTP of farmers for artificial insemination.

According to Arifah (2008) other factor that influence farmer WTP is knowledge of payment. Increasing knowledge of farmers about the management fee, the farmers will increase the contribution fee. Extension workers are local people who are embedded in relatively small and remote communities so help facilitate collaborations based on trust, social capital and strong ethos of knowledge. Local governments have the most inherent knowledge, but can also be most vulnerable to misallocation of targeted funding for conservation (Horan et al., 2009; Sudrajat et al., 2017).

Knowledge is a prerequisite for responsible environmental behavior (Schultz and Zelezny, 1999). The general acceptance of management strategies depends on community knowledge and support for land management policies. Knowledge of technology influences farmers' participation to pay. Incentive policy designs are increasingly designed to provide payment services, requiring knowledge of the potential benefits of conserving biodiversity, management decisions and understanding of what is required to motivate farmers to participate in policy (Van der Horst, 2011).

For very little knowledge research has been done in relation to identifying the relative importance of non-economic motives such as the level of individual farmers, the various types of motives that are to farmers, and to what extent non-economic constraints can be overcome by offering higher economic incentives (Christensen et al., 2011; Kvapilik et al., 2015).

The results of the analysis using multiple linear regression influence independent variables (age, education, business scale, social awareness, knowledge of AI, extension and location) to the dependent variable (willingness to pay) in artificial insemination in Bali cattle can be seen in Table 5.

Table 5
Recapitulation of multiple linear regression analysis results

Independent variable	Dependent variable	Coefficient of regression (B)	T asym	Sig	Description
Constanta	*Willingness to pay (Y)*	2.133	4.270	0.000	
Age (X1)		-0.069	-1.378	0.172	Not significant
Education (X2)		0.054	1.009	0.316	Not significant
Scale of business (X3)		-0.084	-1.412	0.162	Not significant
Knowledge about AI (X4)		0.204	1.444	0.153	Not significant
Social concern (X5)		0.583	7.839	0.000	Significant
Counseling (X6)		0.286	3.107	0.003	Significant
Location (X7)		-0.460	-3.052	0.003	Significant
Multiple R = 0.744		F_{count} = 13.668			T_{Table} = 1.664
R Square = 0.554		F_{table} = 2.222			Sign = 0.000

Source: Primary data processed, 2017

Using the values provided in Table 5, a multiple linear regression equation can be formed as follows:

$$Y = a + b1X_1 + b2X_2 + b3X_3 + b4X_4 + b5X_5 + + b6X_6 + b7X_7 + e \quad (2)$$
$$Y = 2.133 - 0.069\ X_1 + 0.054\ X_2 - 0.084X3 + + 0.204\ X_4 + 0.583\ X_5 + 0.286\ X_6 - 0.460\ X7 + e$$

From the equation we can see that the intercept value of age influence constant (X1), education (X2), business scale (X3), knowledge of AI (X4), social awareness (X5), counseling (X6) and location (X7) on willingness to pay (Y) in artificial insemination is 2.133.

The value of the regression coefficient of each independent variable affecting the willingness to pay farmers against artificial insemination is as follows:

The coefficient of age regression or X1 of -0.069 means that any increase in age value will lead to a decrease in the value of WTP of farmers for artificial insemination of 0.6%, assuming the other independent variables are constant. Meaning in this study, the age variable has no positive effect on WTP of breeders for artificial insemination. Certain factors such as location and attitude were significant. The results obtained are not in accordance with Vanslembrouck et al. (2002), who states that the availability to participate in agricultural enterprises is significantly influenced by age, education and language, and is also influenced by the scale of livestock enterprises and their development potential. Negative forecasts for age-categorical variables confirm the hypothesis that willingness to participate declines with increasing age of farmers.

Partial effect test (self-factor) for age factor, education, business scale, knowledge of AI, social care, counseling and locations on willingness to pay farmers in applying artificial insemination

After testing the influence of independent variables simultaneously, the influence of independent variables on dependent variables was tested partially using a t-test at the 95% confidence level. To see the effect individually or partially, each of the independent variables will be described as follows:

1. Influence of age (X1) on WTP (Y) for implementing artificial insemination

A person's age is an individual characteristic that can affect the biological and psychological functions of the individual. The results with a t-test showed that the age variable does not significantly affect the WTP of farmers for applying artificial insemination in Bali cattle (p = 0.172), in contrast to the findings of Vanslembrouck et al. (2002) and Sudrajat et al. (2017), as noted above. Negative forecasts for age-categorical variables confirm the hypothesis that willingness to participate declines with increasing age of farmers.

2. Effect of education (X2) on WTP (Y) for implementing artificial insemination

The t-test results obtained show that the educational variables (X2) owned by farmers have no significant effect (p = 0.316). This is not in accordance with Arifah (2008), who states that the higher level of education of farmers, the farmers increasingly minimizes the willingness of farmers to pay dues. This phenomenon can occur because most of the characteristics of the farmers of the respondents have a low level of education, so they are likely to accept the policy to be enacted. As with other farmers who have higher levels of education, they tend to consider in advance the policies that will apply. This is based on the higher level of education of farmers and the more developed mindset of the farmers (Bachev et al., 2017).

3. Effect of business scale variables (X3) on WTP (Y) for implementing artificial insemination

The result of the t-test showed that business scale (X3) variable has no significant effect (p = 0.162). This is in line

with Nurlina and Alim (2007) and Ivanov et al. (2017), who state that the business scale variable is less supported in the implementation of AI.

4. Influence of knowledge about AI (X4) on WTP (Y) for implementing artificial insemination.

The result of the t-test showed that knowledge variable about AI (X4) owned by farmers has no significant effect ($p = 0.153$). This is not in accordance with Sudrajat et al. (2017), who state that there is a low positive relationship between the level of knowledge of breeders with the success of S/C and CR for AI realization in Boyolali, Central Java.

5. Influence of social concern (X5) on WTP (Y) for implementing artificial insemination

The result of the t-test shows that social care variable (X5) measured has a significant effect on Y variable ($p < 0.0001$). Thus, social awareness variable has a positive influence. This means that the higher the career's awareness with the social environment, the higher the willingness to pay they have. This is consistent with Vanslembrouck et al. (2002) and Řiha and Bezdiček (2016), who found that farmer attitudes and prior experience had significant effect on participation in the size of afield margin extensification program.

6. Effect of extension (X6) on WTP (Y) for implementing artificial insemination

The results obtained from the t-test showed that the extension variable (X6) had a significant effect ($p = 0.003$). This is in accordance with Van der Horst (2011), who sees that the desire to pay increases if the farmer obtains information from other farmers. A study of farmer motivation has yielded evidence that farmer networks can be an important channel for distributing information and influencing decisions, but the patterns and consequences of these network effects are unclear.

7. Influence of location (X7) on WTP (Y) for implementing artificial insemination

The result of hypothesis testing showed that the measured location variable (X7) has a significant effect on Y variable ($p=0.003$). This means the closer the farmer's location to the inseminator's location the higher the WTP they have. This is in accordance with the opinion of Van der Horst (2011), although empirical work on the spatial pattern of environmental absorption of agribusiness schemes is less common. Battershill and Gilg (1996), cited in Van der Horst (2011), have studied the role of geographical location on the taking of a number of voluntary conservation schemes in southwest England. Locations and attitudes are found far more important as determinants of adoption than socio-economic characteristics. Hastuti (2008) notes that human factors, facilities and field conditions are very dominant factor in the success of the AI program.

Concluding remarks

Simultaneously, age factor, formal education, social awareness, knowledge about AI, business scale, counseling and location significantly influence the willingness to pay farmers in applying artificial insemination to Bali cattle. However, individually (partial), social care, extension and location factors have a significant effect. However, both simultaneously and partially, some of these factors have very significant effect on farmer's willingness to pay in using AI technology in Bali cattle. So that we recommend that it is necessary to increase knowledge about AI in related with willingness to pay with intensity of counseling higher on Bali cattle breeder.

Acknowledgements

Authors thank to Department of Social Economic (Faculty of Animal Husbandry), Department of Management (Faculty of Economics and Business) and Agribusiness Study Graduate Program, Hasanuddin University, Makassar, South Sulawesi, Indonesia for facilitating this study.

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