Farmer’s decision in selecting the bull semen for artificial insemination in Central Java

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Abstract. This paper aims to analyze the decision of the farmers in selecting the bull semen at the time of insemination. There are several bull semen which are often used in artificial insemination, such as Simmental, Limousine, Ongole Grade or Peranakan Ongole (PO), Brahman, and others. Thus, farmers have to select one of those suits to their needs. Research was conducted to collect data from 200 farmers as respondents who were selected by multistage random sampling in Grobogan, Sukoharjo, Karanganyar, Sragen, Klaten, Rembang, and Blora, Central Java. Results showed that farmers were more interested in breeding their cow with bull semen from Simmental and Limousin. An expected policy outcome can be considered in determining the supply of bull breed semen for artificial insemination in accordance to the demand of the farmers.

1. Introduction
The increasing beef productivity in Indonesia requires the technology intervention such as Artificial Insemination (AI) which is related to the cattle reproduction efficiency. Naturally, a superior bull can only mate 1 to 5 cows, but through AI one superior bull can mate hundreds of cows [1]. Therefore, AI is rated as an effective and efficient technology in increasing beef cattle productivity through the genetic improvement. Reproduction technology is considered as on-going diffusion process in Indonesian society with more efficient in time, good conception rate, breeders no need to have superior bull to be mated with their cow, availability of competent human resources in AI field, cheaper cost, and produce healthy offspring [2]. Meanwhile, adoption rates are influenced by bull semen prices, insemination costs, insemination success rates, and breeder characteristics [3].

Selection and provision of superior bulls, semen production and distribution are the most important factors as the main benefit of AI activities in the maximum utilization of superior bull. This is possibly occurred through the improvement of production and distribution of selected superior bull semen [1]. The importance of the bull role in AI makes the breeder have to choose the appropriate bull to be mated to their cow. Some of the bull breeds are often used in AI, such as Simmental, Limousin, Brahman, and Ongole Grade or Peranakan Ongole (PO). In fact, there are also several other breeds, such as Aberdeen Angus, Frisian Holstein, and others, which were largely distributed to the farmers. Therefore, the aim of this study is to analyse the decision of the farmers in selecting the bull breed at the time of AI in particular areas in Central Java.

Several variables were used in this research to describe respondent’s characteristics (Table 1). These characteristics provide information about socio-economic condition of the farmers as respondents. We hypothesized that farmer’s decision making in selecting bull breed can be influenced by several
independent variables. For instance age, formal education, size of household, total number of cattle kept by farmer, AI’s cost, total area of land, cow breed which lastly inseminated, and farmer’s participation in socio-economic group. Adoption among smallholder farmers is associated with their socio-economic characteristics [4].

Table 1. Definition of variables and type of measurement

| Variables          | Definition                                                                 | Type of Measurement               |
|--------------------|---------------------------------------------------------------------------|-----------------------------------|
| Dependent variable | Bull semen                                                                | Frozen semen of bull breed that divided into 5 codes. | Dummy (1=Simmental, 2=Limousin, 3=PO, 4=Brahman, and 5=others*) |
| Independent variables | Age                                                                       | Age of the farmers in years       | Continuous                      |
|                     | Education                                                                 | Formal education of the farmers in years | Continuous                      |
|                     | Size hh                                                                   | Total number of people in the household | Continuous                      |
|                     | Cattle                                                                    | Total number of cattle kept by farmer in Animal Unit (AU) | Continuous                      |
|                     | AI’s Cost                                                                 | Some money spent by farmers to inseminate their cow breed in IDR | Continuous                      |
|                     | Land size                                                                 | Total area land manage by farmer in m² | Continuous                      |
|                     | Cow breed                                                                 | Cow breed which lastly inseminated | Dummy (1=PO, 2=Simmental-PO, 3=Limousin-PO, and 4=others) |
|                     | Participation                                                             | Farmer’s participation in a socio-economic group | Dummy (1=Yes, 0=No) |

2. Materials and methods
The study was designed as a cross-sectional research by involving 200 farmers as respondents who were selected by multistage random sampling in Grobogan, Sukoharjo, Karanganyar, Sragen, Klaten, Rembang, and Blora, Central Java. Those regencies were selected because they have more than 60% beef cattle smallholder farmers [5]. Data were collected from February to July 2018 through personal interviews based on structured questionnaire. Descriptive analysis with cross tabulation was applied as the estimation approach. We used IBM SPSS version 16 to analyse this data.

3. Results and discussion
A breeding process is started by selecting several superior bulls and taking the semen to be used as a frozen semen stock. To select several superior bulls, farmers must be took a decision. Decision making process which made by smallholder farmers as bull semen consuming, usually was influence by opinion from the opinion leader or people around it [8].

Farmers who participated in this study were those who have land area about 1,610.9 ± 4,119.7 m² with 3.67 ± 1.29 family members. Respondents can be classified as smallholder farmers that is basically defined as a farmer who manages land by less than 5,000 m² with approximately four family members [4]. Age of respondents were about 50.66 ± 11.87 with 6.58 ± 3.60 years formal education. The total number of cattle ownership is 1.93 ± 0.98 cattle / household. Table 2 showed characteristics of farmers as respondents that may effect in decision making process. This descriptive statistics divided into 5 groups based on frozen semen from bull breed in this research. Whereas, Table 3 showed the result of cross tabulation between cow breed and bull semen.

Table 3 showed that farmers were most interested in breeding their cattle with bull semen from Simmental breed. Simmental was the most preferred breed by farmers (88 respondents or 44%), followed by Limousin with 55 respondents or 27.55%. Simmental is one of the exotic breeds imported
by Indonesia government in 1980’s to provide semen [6]. In addition, farmers believe that Simmental cattle provide more benefit because it may result higher body weight and provide better price in market than local or indigenous cattle.

Table 2. Descriptive statistics of the respondents

| Variable       | Unit | Min | Max | Total Mean | Groupb mean ± S.E | 1 (n=88) | 2 (n=55) | 3 (n=20) | 4 (n=8) | 5 (n=29) |
|----------------|------|-----|-----|------------|-------------------|---------|---------|---------|---------|---------|
| Age            | Year | 24  | 80  | 50.66      |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |
| Education      | Year | 0   | 16  | 6.58       |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |
| Size hh        | Number | 1  | 12  | 3.67       |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |
| Number of Cattle | AUb      | 0.25 | 6  | 1.93       |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |
| Al Cost        | IDR   | 0   | 80000 | 24,775     |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |
| Land size      | m²    | 24  | 45000 | 1,610.9    |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |
| Cow breed      | Dummy | 1  | 4   | 4          |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |
| Participation  | Dummy | 0  | 1   | 1          |                   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   | ± ± ±   |

aSize hh is total number of people in the farmer household
bAU is Animal Unit where a mature cow equals 1 AU and a calve equals 0.25 AU
Groups of bull breed (1 = Simmental, 2 = Limousin, 3 = PO, 4 = Brahman, and 5 = other)

Table 3. Cross tabulation between cow breed and bull semen

| Cow Breed   | Bull Semen | Total |
|-------------|------------|-------|
|             | Simmental  | Limousin | PO | Brahman | Othersb |       |
| PO          | 28         | 14      | 19 | 1        | 10      | 72    |
| %           | 38.9 %     | 19.4 %  | 26.4 % | 1.4 %  | 13.9 %  | 100 % |
| Simmental-PO| 40         | 14      | 0  | 2        | 9       | 65    |
| %           | 61.5 %     | 21.5 %  | 0  | 3.1 %    | 13.8 %  | 100 % |
| Limousin-PO | 6          | 11      | 0  | 1        | 6       | 24    |
| %           | 25 %       | 45.8 %  | 0  | 4.2 %    | 25 %    | 100 % |
| Others      | 14         | 16      | 1  | 4        | 4       | 39    |
| %           | 35.9 %     | 41 %    | 2.6 % | 10.3 % | 10.3 %  | 100 % |
| Total       | 88         | 55      | 20 | 8        | 29      | 200   |
| %           | 44 %       | 27.5 %  | 10.0 % | 4 %    | 14.5 %  | 100 % |

aOthers is cow breed from Peranakan Limousin, Simmental-Limousin-PO, and Limousin-Madura
bOthers is farmers who don’t know what type of bull semen that inseminated to their cow.

Farmers who have PO as their cow breed prefer to choose bull semen from Simmental breed than others (38.9%). PO cow breed X Simmental bull semen became preferred breed because of the shiny red coat, yellow lips, and unselective feeding habits [7]. PO cow breed X Limousin bull semen choose...
by farmers because they have more rough hair, less shiny skin, and black lips [7]. Farmers in Java believed that crossbred cattle reached higher price and body weight [6]. Indonesia government introduce European beef breed, such as Simmental and Limousin, to increase meat production of local cattle [6].

Bull semen from Simmental breed mostly choose by farmers who have Simmental-PO as their cow breed (61.25%). Limousin bull semen mostly choose by farmers who have Limousin-PO as their cow breed (45.8%). Farmers with PO cow breed tend to choose PO bull semen (26.4%). In the decision making process, there are two important aspects that influencing beside consideration from the production side. The important aspects of the farmer choice are farmer’s prior knowledge and farmer’s prior experience [9]. Prior knowledge can influence the types of information processed, the altering heuristics, and the form of choice used by farmers [9]. Farmers with prior knowledge and experience have likelihood to select such standards earlier in the choice process than farmers with none of prior knowledge. Therefore, farmers tend to select bull semen from the same breed with their cow because they have an existing knowledge to maintain the chosen breed. Furthermore, farmers are able to prepare to maintain calves produced from successful AI.

From Table 3, there are 29 respondents (14.5%) do not know what breed to be inseminate with their cow. They just follow the inseminator suggestion. They believe that the inseminator will give the best bull semen that suitable for their cow. In this case, inseminator regarded as opinion leader by smallholder farmers. It called by leadership communication. Leadership communication is a process when an opinion leader influences other people in informal way [8].

4. Conclusions
Farmers were more interested to cross their cow cattle with bull from European beef breed, such as Simmental and Limousin. Frozen semen from Simmental breed became the most preferred breed by farmers, followed Limousin breed. Javanese cattle farmers believe that the crossbred cattle provide beneficial price as feedback. However, some of farmers tend to choose breeding their cow with bull semen from same breed because they have an existing knowledge to maintain the chosen breed. Furthermore, farmers are able to prepare to maintain calves produced from successful AI. In the other hand, some of farmers do not know what breed to be inseminate with their cow. They usually follow the inseminator’s decision as their opinion leader.

References
[1] Saili T and M Toelihere 2015 Pengelolaan Sement dan Inseminasi Buatan [Management of Cement and Artificial Insemination] (Bogor: Faculty of Veterinary Medicine, Institut Pertanian Bogor)
[2] Rathod P, Chander M and Sharma C G 2017 Adoption status of artificial insemination in Indian dairy sector: application of multinomial logit model multinomial logit model Journal of Applied Animal Research 45 pp 442-46
[3] Howley P and Heanue K 2012 Factors affecting farmer's adoption of agricultural innovations : a panel data analysis of the use of artificial insemination among dairy farmers in Ireland Journal of Agricultural Science 4 6 pp 171–79
[4] Putra R A R S, Liu Z and Lund M 2016 The impact of biogas technology adoption for farm households : empirical evidence from mixed crop and livestock farming systems Indonesia J.RSER 11 p 164
[5] BPS [Central Bureau of Statistics] 2013 Ministry of Agriculture based on census (Jakarta: Central Bureau of Statistics)
[6] Widi TSM 2015 Mapping the impact of crossbreeding in smallholder cattle systems in Indonesia (Netherland: Wageningen University)
[7] Sutresniwati, Fokje A S and Henk M J U 2004 Proc. Int. Conf. on Animal Production and Sustainable Agriculture in Tropics (Yogyakarta) ISBN 97997243-9-2 pp 461-66
[8] Schiffman L G and L L Kanuk 1999 Perilaku Konsumen [Consumer Behavior] (Jakarta: PT Indeks)
[9] Bettmen J R and Park C W 1980 Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis. *Journal of Consumer Research* 7 pp 234–48 (https://doi.org/10.1086/208812)

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