Farmers’ economic perceptions of demonstration plot development of kaliandra (*Calliandra calothyrsus* Meisner) biomass energy at Parungpanjang research forest: findings from a focus group discussion

K A Hendarto*, Desmiwati, Danu, D Syamsuwida, N Yuniarti, N W Siregar, A Aminah, Y M M A Nugraheni, D D N Cahyono, and A R Hidayat

Balai Penelitian dan Pengembangan Teknologi Perbenihan Tanaman Hutan, Ministry of Environment and Forestry 16001 Bogor, Indonesia

*Email: kresnoah@yahoo.com

Abstract. Energy needs in Indonesia are increasing and have inverse impacts on the source and production of energy itself. One effort that can be done to overcome this problem is to use biomass energy sources, especially for home industries and people surrounding the forests. This research aims to describe the perceptions of farmers, as potential workers, about the development of *Calliandra calothyrsus* Meisner wood energy demonstration plot. The Focus Group Discussion (FGD) was conducted in the Parungpanjang research forest. Qualitative content analysis methods were used to explore the data collected from FGD. The results showed that farmers have a positive perception of the development of wood energy demonstration plots. However, they only assume that being a worker in the demonstration plot is only a side job.

1. Introduction

1.1. Background

Indonesia is a country with the largest energy consumption in Southeast Asia and ranked fifth in the largest primary energy consumption in the Asia Pacific after China, India, Japan, and South Korea. On the other hand, Indonesia has turned into a net-importing country since 2004. In 2016, one-third of the fuel oil has been supplied by import. If the increasing need for predominantly fuel oil energy is not well anticipated through a well-arranged energy consumption pattern, especially in the transportation sector, energy resilience and sustainability will be disrupted [1].

Rencana Umum Energi Nasional (the National Energy Master Plan), henceforth is called RUEN for short, is the Central Government’s policy on the national energy management that elaborates the National Energy Policy. The cross-sectoral policy aims to achieve the goals of the National Energy Policy. The official signing of RUEN by the President to be the tool of energy management is expected to anticipate the current and future need for energy. The final objective is the establishment of energy resilience and independence towards sustainable development [2]. Energy resilience is the availability of supply source, affordability indicated by the per capita national income, and accessibility for energy users to move on life and economy, as well as sustainability. Energy
independence is the nation and state’s ability to utilize the diverse kinds of energy by harnessing the natural, human, social, and economic resources as well as the dignified local wisdom [3].

What do the forests play in RUEN? Principally, forests play two important roles: direct and indirect roles [4]. Directly, forests are the producers of biofuel for renewable energy, i.e. biodiesel and bioethanol (nyamplung and sugar palm). Indirectly, forests serve the role of providing environmental services and non-productive forest area utilization to produce biofuel materials [5]. On the other hand, the role of forest sub-sector in RUEN includes: (a) optimizing the economic benefits from the cultivation of energy-producing plants; (b) utilizing wood wastes and biomass to become the new and renewable energy; (c) creating work opportunities and improving public income of the people around the forests [6].

In Indonesia, most previous studies on new and renewable energy in forestry have focused on the role of forestry sub-sector in the economic utility from the cultivation of energy-producing plants [7-11] and utilization of wood wastes as the new and renewable energy [12-18]. Only a few studies on the creation of job opportunities and increase of public income have been conducted. Therefore, the objective of this research is to explore public perception on the planned development of the Kaliandra demonstration plot, as one of the energy-producing plants, in the research forest of Parungpanjang. The difference of this research from the previous studies is that the perception is explored before the development of the demonstration plot.

1.2. The value-expectation theory

The value-expectation theory is an incentive attitude theory [20]. The analysis of subjective value and expectation action has had a long history [21]. Such a history is well described in the book written by Feather in 1959 and Atkinson in 1982. They both referred to the contribution of Lewinian analysis about the goal-oriented behavior or aspiration introduced by Lewin, Dembo, Festinger, and Sears in 1944 and the purposive behavior analysis and action principles introduced by Tolman in 1938 and 1955. They also referred to the expected subjective utility analysis and decision analyzing by Edward in 1954; the social learning and clinical psychology by Rotter in 1954; and also their studies in 1957 and 1959.

The value-expectation theory reveals that an individual's behavior is the function of the value expected to result from behavior. The higher the probability that behavior results in a specific outcome and the higher individual’s perception about that, then the more likely that an individual will do it. In this theory, decision-making is based on (1) the possible value of a decision; and (2) the level of expectation of the decision [20]. This theory has been frequently applied to test persuasion. Persuasion is defined as an explicit effort to affect other people’s belief, attitude, and behavior [22]. This theory suggests that the development and change of attitude derive from the loss-and-benefit consideration from different kinds of attitude, and the people will choose the best possible attitude [23]. For example, we have to decide whether we have to take the scholarship from X University (abroad) or Y University (domestic). Then we will consider the expectation and value of our choices to study at X university (meeting more new people, having to adapt to a new culture, etc.). Likewise, when we choose Y University: meeting fewer new people, not having to adapt to a new culture, etc. When the decision is accepting the scholarship from X University, then we think that adaptation difficulties to the new culture are not equivalent to the great pleasure to meet more new people. On the other hand, when we choose to accept the scholarship from Y University, then meeting more people will not be equivalent to the little problem to adapt to the new cultures. In other words, this theory assumes that people are very calculative, active, and rational [24].

2. Material and Method

2.1. Data Collection

The data of this research was collected using Focus Group Discussion (FGD). FGD was introduced in sociology and is understood as a technique in qualitative research in the form open discussion based
on the guided questions, and is expected to obtain insights and ideas about particularly interesting topics from the selected participants’ communication [25]. FGD is intended “not to conclude but to understand, not to generalize but to set up the range, not to describe the population but to provide insights about how people feel the situation” [26]. FGD is an important method to explore the descriptive variable related to human attitude and behavior [27]. FGD is suitable for social essentialist and constructionist frames [28]. The essentialist frame assumes that individuals have their perception, while in the social constructionist frame such an assumption is not applicable. In the context of social constructionist, the perception will be developed collaboratively through the interaction among the informants.

2.1. Participants
The main emphasis of exploratory research is the exploration of ideas and inputs [29]. Further, it is stated that exploratory studies seldom use the probability-sampling plan. Therefore, the sampling (informants) in this research was determined using a purposive sampling method. The criteria of informants selected for this research are: (1) domiciled around the research forest of Parungpanjang; and (2) voluntarily willing to take part in the research. This research employs a qualitative approach. Data was collected through FGD (N = 8). Purposive sampling techniques were employed to recruit the population target. The recruitment involved collaboration with the manager of the research forest of Parungpanjang.

2.1.2. Procedure
The Data collected in this research was primary data. The data was explored from the participants using a semi-structured guided interview. To stimulate the discussion and to obtain good data, initially, the facilitators provided a brief narration about the topic that will be discussed. After that, the facilitator asked for arguments or opinions from the informants. It is conducted for approximately 60 minutes. The arguments or opinions from the informants were recorded and transcribed. FGD was conducted in 2018 in the area of research forest of Parungpanjang.

2.2. Data Analysis
2.2.1. Validity Testing.
The recorded and transcribed data of FGD was then analyzed by the content analysis. In the content analysis, validity is not a significant matter [30]. With a careful definition and good and appropriate indicator selection, the coding sheet is assumed able to measure what is expected to be measured. The validity in this content analysis is tested with the content validity or face validity [31]. What we did was sending letters describing the objective of the research, transcript, and coding sheet to the researchers in Pusat Litbang Sosial Ekonomi, Kebijakan and Perubahan Iklim (Centre for Research and Development on Social, Economic, Policy, and Climate Change). From this, we obtained some feedback on suggestions and comments about the coding sheet qualitatively. From the inputs, we replace some operational definitions in the coding sheet.

2.2.2. Reliability Testing.
In addition to face validity, the coding sheet also has high reliability. The importance of reliability relies on the guarantee that the obtained data is independent of the events, instruments, or the people who measure it [32]. Besides that, the reliability test will measure if the coding sheet can result in the same output when two different persons measure it. There are three ways of reliability testing for the coding sheet. They are stability, reproducibility, and accuracy. Due to the simple nature, most researchers use content analysis with reproducibility [33]. In this research, reliability was tested by identifying the value of the coefficient of reliability with the following formula [34].
\[ R = \frac{2(C_{1,2})}{C_1 + C_2} \]

where:
- \( C_{1,2} \) = the number of category assignments on which all coder agree
- \( C_1, C_2 \) = The sum of all category assignments by all coder

The transcribed results were analyzed with descriptively content analysis. Descriptive content analysis is carried out by contextualizing the transcribed data. The contextualization is performed by coding the consensus and differences among the informants and includes the statements from the informants involved in the FGD to support the arguments.

3. Results and Discussion

The development of the coding sheet was consulted to a researcher from The Centre for Research and Development on Social, Economic, Policy, and Climate Change. After that, with the support from two researchers not involved in the data collection, the reliability was tested. The reliability was tested by asking the two researchers (coders) to fill up the coding sheet. The completed coding sheets were then compared and the similarities of the two coders were calculated.

There are similarities in determining the threshold of the acceptance of the reliability coefficient. The lower threshold of the acceptance of the reliability coefficient is 0.6 [35] above 0.75 [36]; the coefficient value is between 0.79 and 0.96 [30]. The calculation of the reliability shows the value of 0.94 and is between the values suggested by [30].

This research indicates that the tendency that the FGD employed a partial model. For approximately 60 minutes, seven participants gave their comments. After the coding, the results of the analysis of the FGD would be presented in the form of quoted statements about the similarities (consensus) and differences.

Figure 1. Map of *Calliandra calothyrsus Meisner* Demonstration Plot (Source: Primary data)
3.1. General Description
There are three villages at the direct borders to the research forest of Parungpanjang. They are Desa Jagabaya, Desa Gintung Cilejet, and Desa Tapos [37] (Figure 1). The Informants involved in the FGD derive from the hamlets (Dusun) at the direct borders to the location of the planned development of the Kaliandra demonstration plot and intercrop in Parungpanjang. All informants were males who work as farmers whose last income was lower than the Regional Minimum Wage or UMR (Upah Minimum Regional) applied in Bogor Districts. The youngest age of the informants was 36 and the oldest was 85 years. Most of the informants had more than three dependants and only one informant had one dependant.

3.2. What is the primary job of the informants?
The primary job is defined as the main means of livelihood. Results of the FGD reveal the information that the primary means of livelihood of all informants was farming. They had their own fields, although they are only small plots. They had the small plots they had inherited from their parents. Some extent of the plots has been taken over for the project of the housing developer. Although the fields have been sold, they are still allowed to utilize the fields before the developer utilizes them. This is clearly stated by them:

This land is not mine, you see
This land belongs to another person...

Well, most farmers do not have their own field.
They work up the corporate land, ma’am, PT Sumarecon.

The fields have been sold for a housing complex
Yes, only about 30% was left, more or less...

Meanwhile, their secondary job was bamboo plaiting. The raw material for the plaiting was the bamboo that derives from the areas around Parungpanjang. They take the side job to earn some extra income in their spare time.

I earn some money (from) the plaiting works such as baskets, fans, and trays.
Well, whatever we can do

Sometimes we make satay sticks.

Thank God.
We make anything while we are at rest.
Sometimes we make at our own initiative (to be sold), but sometimes we get a contracted work (in bulk) from the traders (the persons who put an order)...

So far, they sell the plaiting products through the road or to the railway. The problem is that the road from and to Parungpanjang is damaged. Based on the UU of 34 / 2004, since the road connects two Kabupaten, i.e. Kabupaten Bogor and Kabupaten Tangerang, the road from and to Parungpanjang has categorized the provincial road. With the status of the provincial road, the province of West Java holds the responsibility to take care of the road. The poor condition of the provincial road has resulted from the massive operation of large vehicles (dump trucks) that contain type-C mining materials. The unrealized tolled road of Serpong-Balaraja is another contributor to the damage of this provincial road.

Concerning the railway, the Railway Station of Parungpanjang (PRP) is a large railway station in Parungpanjang, Bogor. The station is located at the altitude of +54 meters in the Operation Zone I Jakarta. This Station is one of the three west terminus stations for the of KRL Green Line’s route of
Tanahabang–Parungpanjang, Tanahabang–Maja, and Tanahabang–Rangkasbitung. To support the smooth transport of the KRL, Parungpanjang Station was constructed in two storeys at the area of 756 m². Initially, there was a master plan of the ring railway development for outer Jakarta developed by the Department of Communication of the Republic of Indonesia at the early decade of the 1990s. It was expected that the commodity trains do not enter the region of DKI Jakarta. The route was that from this station, they would go to Cikarang Station. However, the Asian financial crisis in 1997 has caused the halt of the plan so that the railway only extends from Citayam Station to Nambo (Wikipedia, 2018).

3.3. Informant’s knowledge about the types of Kaliandra plant
Kaliandra plant is not the native Indonesian plant. This plant originated from Central America. It was introduced to Indonesia at the end of the 1936s [39]. Further, it is stated that since it grows well, has a good appearance, and is one of the pioneer plants Kaliandra is extensively grown in the 1970s at the area of 30,000 ha. The texture of Kaliandra (1) is quite solid; (2) is easily dried; (3) is easily burned; (4) has the specific gravity between 0.5 and 0.8; (5) can produce the heat of 4,200 kcal/kg so that Kaliandra is ideal for firewood or charcoal (Herdiawan et al, 2005). For the cattle’s green food, Kaliandra is the plant in the group of Leguminosae that has been used as the woof by farmers. Kaliandra is potential woof since it contains 20-25% proteins [40].

Nearly all information about the plant of Kaliandra was presented in the FGD. This is represented in the following statement:

Kaliandra is like Lamtoro
It is often planted for stakes
However, here (well) the purpose of (the planting of) Kaliandra is to produce firewood with high energy. When we cook, we can use one cubic of Kaliandra and one cubic of Mahogany, for instance, maybe 1 cubic of mahogany (=) the half, can be, another half is Kaliandra (for cooking). However, we do not intend to cook with it, (but) to make pellet. Pellet is also fuel, just the same.

Generally, the planting space of Kaliandra is 2 x 1. It has many benefits. In addition to the firewood, we use the leaves for cattle food.

Initially, it was planted in critical lands. Therefore, in Sukabumi (Desa Kertajaya, Kecamatan Simpenan) where is it... it was planted in the steep slopes. Finally, it is needed to supply the firewood, when there is extra produces, we cannot sell it since nobody wants to buy it. Why? It is difficult to take it... because it grows in the slopes. The transportation cost is...

From the aforementioned characteristics, the informants recognize and know Kaliandra. This is apparent when the informants reveal the name of the area where the plant grows.

Buset...here we call it (local name of Kaliandra)...  

3.4. What is the informant’s perception about the development of Kaliandra demonstration plot and intercrop?
In Kamus Besar Bahasa Indonesia (Indonesian Thesaurus), perception is defined as (1) direct response (acceptance) to something; absorption and (2) process of knowing something through the five senses. Perception is a process in which an individual regulates and interprets the sensory impression to give meaning to the environment [41]. The thesaurus also explains why perception is important. It is important since human behavior (in organizational behavior) is based on their perception of reality instead of the reality itself.
Figure 2. Factors that influence perceptions [41]

Figure 2 illustrates how individuals can differently perceive the same thing. Three factors may distort perception. They are the factor located in the senses, the factor located in the target, and the factor in the situation in which the perception is made. Using the case in this research, Figure 2 can be interpreted as follows. When the informants see or hear something and attempt to interpret it, their interpretation will be affected by their characteristics of attitude, motivation, interest, previous experience, and expectation. In addition, the characteristics of target and context also affect perception. The characteristic of the target includes, for example, novelty, background, and similarity; while the characteristics of context (for example, time) will affect the informants’ perception.

The collected data reveals that informants had the homogenous positive perception of the development of the Kaliandra demonstration plot and intercrop. This is apparent in their statements that they were prepared to be involved in the activities.

The side job that the informants do is the plafting work. What do they expect from the development of Kaliandra demonstration plot and intercrop? They gave the following answers:

**What is important is money**

My expectation is that I will get a good (better) and much (higher) income.

I expect that it can be used for rice farming if possible a larger extent of the field and longer and sustainable duration is expected.

*What can I say, mam...*

I tell you what because most people have participated (here)

We can take part too...that is just it

So... (Whatever) they give us. I think...

It may be fertilizer, or other good plants (seeds), we need help (from the government), to increase our income so that the plant from the government is better...

God’s willing it can increase (our) income

From the statements, they expect that with the development of Kaliandra demonstration plot, they can get a side job to earn extra money (to increase their income).
3.5. How can they allocate their time to the development of the demonstration plot?
As has been stated previously, generally, there are two main activities in the development of a demonstration plot. They are (1) land preparation and planting; and (2) plant maintenance actively involving the people through the intercrop method. For the first purpose, the informants were willing to allocate their time every day. Meanwhile, for the second purpose, they differently allocated their time. This is apparent in the following statements of the informants:

*Only when I have time...*
*Three times a week*
*Once in 3 days*
*Twice a week*
*Once a week*

The answers reveal that the activity of intercrop is a side job just like the plaited work.

4. Conclusions and Suggestions

4.1. Conclusions
The purpose of this research is to explore public perception about the plan to develop Kaliandra demonstration plot. As preliminary research, this research uses FGD to collect the data. Results of the analysis revealed that people had a positive perception of the plan to develop the Kaliandra demonstration plot and intercrop.

This research contributes to the improvement of our knowledge about public preference in responding to the development of the Kaliandra demonstration plot. The perception was affected by their evaluation of the loss and benefits that they would receive. They would always compare the loss and benefits that may result. The choice that provides the highest incentives and benefits will be preferred. Preference would also be made when it resulted in the fewest disadvantages.

4.2. Suggestions
This research used FGD to collect the data. The main weakness of such this method of data collection is that the informants have known to each other so that they likely give similar answers. As preliminary research, this research has to be followed by further studies. The factors that are supposed to predict public perception about the development of Kaliandra demonstration plot and intercrop (such as attitude; motivation; interest other than money) have to be considered in future research.

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ICFP 2019

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**Acknowledgements**

We gratefully acknowledge the participants picked up by pak Makmun, pak Adim, pak Maman, and pak Muhammad from Balai Litbang Teknologi Perbenihan Tanaman Hutan, Bogor; and also the anonymous reviewers for their comments on this article.