Community social capital in supporting biomass development at The Purwakarta Forest Management Unit, West Java

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Abstract. Biomass plantations are starting to become an option for developing renewable energy sources. Socio-economic problems related to management regulations, trust, and networks in the biomass energy plantations-developing process need to be resolved. This study aims to determine the capacity of community social capital in supporting the development of biomass plantations. The location of the study was at Purwakarta Forest Management Unit (FMU). Data collection was carried out by observation, household surveys using questionnaires, and Focus Group Discussion. Data were analyzed using a descriptive qualitative method. The results show that, in general, the community has strong social capital in building biomass plant partnerships, especially in the aspect of trust. Farmer’s trust in those who assist in the management of biomass plants is relatively high, namely Perhutani, the farmer group leader, and the community leaders. The farmers will be motivated to develop biomass crops if successful examples exist. The social norms and sanctions for farmers in the biomass plant management at Purwakarta FMU are very low, but the community is still obedient to the social norms. The networking ability of farmers is relatively low, so intensive assistance in developing biomass farming must be improved, either in technical assistance or intensive extension.

1. Introduction
Fossil energy such as oil and coal is non-renewable, and its availability is dwindling. The utilization of fossil energy occurs continuously along with the increase in human needs. There are many alternative sources of renewable energy, one of which is biomass. The government continues to encourage the development of this biomass, one of which is energy plantations. Biomass plants are starting to become the choice of renewable energy sources. Biomass energy is one type of renewable energy that can support economic growth in line with sustainable development goals [1]. Perhutani is a state-owned enterprise in the form of a public company (Perum) which has the duty and authority to manage state forest resources on the islands of Java and Madura. Perum Perhutani also contributes to the development of biomass plantations for renewable energy with a focus on calliandra (Calliandra calothyrsus) and gamal (Gliricidia sepium) species [2].

There are many challenges faced in the development of biomass plantation, primarily related to the socio-economy of communities living around the forest. They have high dependencies on forests land. The bioenergy plantation development involves many stakeholders, so it is necessary to form the appropriate partnerships [3]. The Socio-economic problems related to management regulations, trust, and networks in the biomass energy plantations-developing process need to be resolved [4].
The study [2] stated that in the development of biomass plants, Perhutani involves farmers by applying an agroforestry system pattern with a composition of 70% biomass plants and 30% crops. The development of biomass energy plantations has faced many challenges and obstacles, especially related to the habit of the community around the forest planting teak or other Perhutani perennials. Community perceived that teak plants are more profitable than biomass plants are the challenges. For this reason, the management and development of sustainable Biomass energy plantations require strong social capital.

The study results [5] stated that one of the social capitals is to interact with each other and become an important force for the community's economic life and other social existences. Based on the socio-economic problems underlying the development of the biomass energy plantations, it can be concluded that there is a strong relationship between social capital, namely trust, norms, and networks. Management rules, trust, and networks in the process of developing biomass energy plantations are following the core concept of social capital proposed by Fukuyama, Putnam, Coleman [6]; [7]; [8]; [9]. Therefore, this study aims to determine the capacity of community social capital in supporting biomass development in Purwakarta FMU, Perum Perhutani region III, West Java. Hence, Perum Perhutani can develop biomass energy plantations with the right policies.

2. Methodology

2.1. Study location

This research was conducted in Purwakarta FMU, at BKPH (Sub area of FMU) Sadang and BKPH Cipeundeuy. These locations were chosen purpossively based on the priority of developing biomass plantations by Perum Perhutani.

2.2. Data collection

Data collected includes primary data at the local level (BKPH) and secondary data at the national level (Perum Perhutani). Primary data is based on the economic and social household survey – was designed to explore the development of biomass plants in Purwakarta FMU. The data was collected through documentation studies, in-depth interviews, household surveys, field observations and directional group discussions (FGD) both at the local and national.

| Method                  | Data source/Respondent                                      | Location    |
|-------------------------|------------------------------------------------------------|-------------|
| Data collection         | Perum Perhutani, Government institutions, official reports | Local, National |
| Interview               | Farmers group members and key persons                       | Local       |
| Field observation       | Condition and management technique of biomass plantation in Perum Perhutani | Local       |
| Focus group discussion  | Stakeholders and farmers                                   | Local, National |

2.3. Data analysis

Data tabulation was done for data processing. Furthermore, the data were analyzed using a qualitative descriptive method based on social capital criteria. Qualitative descriptive is a research method that moves on a simple qualitative approach with an inductive flow. This inductive flow begins with an explanatory process or event that can finally be drawn a generalization which is a conclusion [10]; [11].

Triangulation analysis was first carried out to test the level of confidence of the data used when interpreting to draw research conclusions. The steps of qualitative data analysis include data reduction, display, and drawing concluding. [12]; [10]; [11]. In this study, a discussion of social capital is carried out from the dimensions of trusts, norms, and networks.
The level of trust, norms and networks are measured by giving respondents some structured questions. These stages are:

1. Data reduction emphasizes focusing the data on being taken related to social capital. This process takes place from the beginning of the research questions until the research data is collected.
2. Data display is carried out in brief descriptions, charts, relationships between categories from the dimensions of trust, norms, and networks. It aims to understand what happened and plan the right policies based on the results of the social capital study. Answers from all respondents were calculated and averaged, then presented in descriptive statistics.
3. The third step in qualitative descriptive data analysis is concluding and verifying the dimensions of trust, norms, and networks.

3. Result and discussion

3.1. General description

The Purwakarta Forest Management Unit (FMU) is one part of the Perum Perhutani management unit located in the work area of the West Java Regional Division. Purwakarta FMU was formed based on the Decree (SK) of the Minister of Agriculture No. 92/Um/54 dated August 31, 1954. Divided into 2 sub-FMU (SFMU) consisting of 10 BKPH and 35 RPH (Sub area of BKPH). The Purwakarta FMU area is located in 3 regencies, namely the Purwakarta Regency with 28.30%, Subang Regency 32.52%, and the largest in the Karawang Regency 39.18% of the total area.

Geographically, the Purwakarta FMU area is located at 5° 56’ - 6° 45’ LS-107° 02’ - 107° 40’ east longitude with the North boundary bordering the Java Sea, in the East bordering the Indramayu FMU and Sumedang FMU areas, to the east. In the South, it borders the North Bandung FMU area and Cianjur FMU. In the West, it borders the Bogor FMU area [13]. The Purwakarta FMU area was determined based on the Decree of the Board of Directors of Perum Perhutani Number: 903/KPTS/DIR/2013 dated August 30, 2013, concerning the Division of Forest Areas in Purwakarta Forest Management Units, is 60,609.83 Ha.

The topography of the Purwakarta FMU forest area starts from the lowlands to the mountains with an altitude ranging from 10 meters to 490 meters above sea level. Generally, the shape of the field is flat, sloping, wavy, ridged, and hilly, especially the Pine Company Class which has a sloping to slightly steep slope [13]. Based on the climate type, the Purwakarta FMU forest area is suitable for developing teak, pine, mahogany, eucalyptus, and biomass plants.

Figure 1. Map of the location of biomass plants in Purwakarta FMU.
The biomass plants' development in KPH Purwakarta is carried out in two BKPH, namely Cipeundeuy and Sadang. The types of biomass plants developed are gamal and calliandra, with gamal being the most expansive area. In total, the Gamal planting target in 2019 is 680.63 hectares and in 2020, it is 645.25 hectares. As for the calliandra plant, the planned planting in 2019 and 2020 is 10.53 hectares and 237.8 hectares [2]. The cultivators for the development of biomass plants in KPH Purwakarta come from 8 forest village community organization (LMDH) as many as 468 people.

Table 2. Several biomass plant cultivation in Purwakarta FMU.

| No | BKPH   | RPH     | LMDH name          | The number of cultivators (People) |
|----|--------|---------|--------------------|-----------------------------------|
| 1  | Sadang | Ciloji  | Mekar Mukti       | 16                                |
|    |        |         | Wana Abadi        | 21                                |
|    |        | Cijangkar | Wanajaya      | 27                                |
|    |        | Cicadas | Wahana Lestari    | 38                                |
| 2  | Cipeundeuy | Cibatu | Jati Mulya      | 39                                |
|    |        |         | Wana Jaya        | 14                                |
|    |        | Pondoksalam | Tani Jaya   | 15                                |
|    |        |         | Kadu Mekar       | 153                               |
|    |        |         | Mulya Mekar      | 145                               |

Total Number: 468

Sources: [13]

Communities around the forest in KPH Purwakarta have a high dependence on forests managed by Perum Perhutani, and this can be seen from the number of cultivators with a total of as many as 468 in the BKPH Sadang and BKPH Cipeundeuy area. The expected interaction forms are positive interactions that can increase land productivity, forest function, and environmental quality. Around the forest-villages are administratively located in and or around forest areas that interact with forest areas [13].

3.2. Social capital

Social capital has several elements that are citizens’ sources and energy in the community. The strength of social capital can be known through the elements inherent in the community's social structure [14]; [15]. In principle, social capital comes from trust in someone in interacting. The role of social capital is very much needed in building the foundation to support the business owned by the farmer’s group [16]. According to Gannon & Roberts [17], social capital is multi-dimensional and explores how these dimensions coincide with its theoretical constructs. In this research, social capital is used to know community support in developing biomass plants at Purwakarta FMU, where social capital consists of trust, norms, and networks.

The trust arises when both parties believe each other, so they are willing to share resources without worrying that one party will take advantage of them. Tsai & Ghosal, (1998) in Luciana and Margadinata [18]. Meanwhile, this norm usually contains social sanctions that can prevent individuals from doing something that deviates from the prevailing habits in society. Networks are strategic and potential resources that can be utilized by community groups, such as raw material networks, market networks, information networks, and capital in natural resource management [19]. As Putnam’s (1993) definition cited in [8] above, the three main pillars of social capital are trust, norms, and networks.

The respondent's age level needs to be considered in the social aspect because the respondent has knowledge and insight about the environment based on age, which is related to life experience with...
the environment where respondents interact directly or indirectly with the surrounding environment [20].

Table 3. Distribution of respondents by age group.

| No | Age Group (Year) | BKPH Sadang (%) | BKPH Cipeundeuy (%) |
|----|------------------|-----------------|---------------------|
| 1  | 20-30            | 11.11           | 10.00               |
| 2  | 31-40            | 20.99           | 27.50               |
| 3  | 41-50            | 22.22           | 17.50               |
| 4  | >51              | 45.68           | 45.00               |
|    | Total            | 100             | 100                 |

Average age (years) 48 40

Sources: Processed of primary data

Based on table 3 above that respondents' age was divided into four groups where the youngest was 20 years old with the assumption that this age was considered quite capable of knowing their environment and able to communicate their perspective up to the age of 51 years and over which was estimated to represent the oldest age who could be interviewed. BKPH Sadang respondents of productive age (40 years and over) showed the largest percentage. It is possible because, at that age, the respondent is easy to find. The information obtained is more useful because the experience in using natural resources is longer. Meanwhile, BKPH Cipendeuy is not much different from BKPH Sadang, where the productive age of farmers is 51 years and above.

3.3. Trust

Taking Putnam's definition, the most non-transferable dimension of social capital is trust, which in its interpersonal form is by definition are specific and contextual. Trust is a product of social capital, not a product of its components. Trust is the most crucial element in social capital formed intentionally as the beginning of establishing a social bond that arises between two or more people to relate to each other [21]. The trust dimension discusses the expectations that arise in a community that behaves normally, honestly, and cooperatively, based on shared norms, for the benefit of other members of the community [22]; [9]; [23]. Social capital is a condition that must be met for human development, economic development, social, political, and democratic stability, including natural resource management [24].

The program's triumph is also influenced by the positive perception of the community so that they are willing to be involved in the program[25]. Thus, it takes trust from the community to accept the program from Perhutani regarding the development of biomass energy plants. The management of biomass energy plants is not only carried out by farmers or sharecroppers but many parties are involved in it, so to build confidence in the success of this program, it varies widely.

Biomass planting is carried out on vacant and unproductive land, with a cemplongan pattern, namely 70% biomass plants and 30% others. The advantage of biomass is that it is an alternative energy source, useful in reducing imports of fossil fuels. Farmers of Purwakarta FMU have a high level of dependence on wood plant species so that farmers' trust in the Perhutani program is quite high. It is a good social capital for the Biomass plant’s development in Purwakarta FMU.

Table 4. The trust level of Purwakarta FMU farmers in the management of biomass plants.

| The Parties          | Trust Level (%) | Average |
|----------------------|-----------------|---------|
|                      | BKPH Sadang     | BKPH Cipeundeuy |
| 1 The Fellow Farmers | 85              | 97      | 91 |
| 2 The Community Leader | 90           | 95      | **92.5** |
3. The Farmer group
   committee 92 87 89.5
4. The farmer group leader 90 100 95
5. The Village Government 90 92 91
6. LMDH 89 71 80
7. The Regional government 90 76 83
8. The Extension
   officer/foreman 97 84 90.5
9. Perhutani 95 97 96
10. Trader 88 94 91
11. Broker 63 42 52.5
12. Industry 76 85 80.5

Sources: Processed of primary data

Figure 2. Average of the trust level at Purwakarta FMU farmers in the management of biomass plants.

Based on Table 4, it can be seen that the highest level of farmer trust in the parties that assist in the management of Biomass plants in the Purwakarta FMU is Perhutani, the head of the farmer group and community leaders. This shows that both parties can provide adequate assistance to the success of the biomass energy development program. While brokers only get low trust from farmers, the broker's function is only an intermediary, especially in marketing crops, and does not provide other assistance. Other parties also showed a relatively high level of farmer confidence in the management of biomass plants.

3.4. Norm
According to Fukuyama 1999 and Coleman 1988 in [4], norms are a set of formal and informal rules that arise from the understanding, religious values, morals, hopes, and goals of a group. To cooperate and coordinate among members in achieving common goals. Norms are expected to be obeyed and followed by community members in a particular social entity. This norm usually contains social sanctions that can prevent individuals from doing something that deviates from the prevailing habits in society [26]. Social norms can be defined as a set of rules that bind individuals in a particular
community. Norms have a significant role in controlling behavior that grows in a community because norms usually contain sanctions [27].

In this research, the community norms that affect the community in the management of biomass plants are customary norms, community traditions, written rules, and unwritten rules or agreements. The existence of norms and sanctions that arise due to non-compliance with the rules in the research at Purwakarta FMU can be seen in Table 4.

Perum Perhutani hopes that the community will support and can take benefit from the biomass plants. There is no social conflict potency, and the local government is very intense in providing understanding to the residents related to the Perhutani program that does not reduce the cropping patterns model, provisions, and rules that are usually carried out by the community, especially the nature of cooperation. The level of community dependence on Perhutani land is relatively high. Therefore in the development of biomass, it is necessary to think about how aspects of cultivation can generate economic value for smallholders, even with conventional methods, and prioritize the development of biomass plants.

| Table 5. Percentage (%) of community perception about the existence of norms related to biomass plant management. |
| No. | Norms                  | The existence (%) | Average |
|     |                        | BKPH Sadang | BKPH Cipeundeay |           |
| 1   | Custom                 | 30         | 27             | 8.5       |
| 2   | Community tradition    | 68         | 27             | 47.5      |
| 3   | Written rules          | 40         | 0              | 20        |
| 4   | Unwritten rules        | 39         | 0              | 19.5      |

Sources: processed of primary data

| Table 6. The existence of Sanction (%). |
| No. | Norms                  | The existence (%) | Average |
|     |                        | BKPH Sadang | BKPH Cipeundeay |           |
| 1   | Custom                 | 44         | 9               | 26.5      |
| 2   | Community tradition    | 40         | 0               | 20        |
| 3   | Written rules          | 9          | 0               | 4.5       |
| 4   | Unwritten rules        | 33         | 27              | 30        |

Sources: processed of primary data

Tables 5 and 6 showed that the social norm's existence in the community around the low biomass plantation area is below 50%. It indicates that customary norms, community traditions, and written and unwritten rules have less role in land management determining success. Social norms are a collection of rules that include commands or prohibitions mutually agreed upon in the community and are honest, firm, and transparent. With the less existence of these social norms, the sanctions imposed or applied are also very low, this is because the control of the community is low.

The norm that farmers mostly used is a tradition that exists in the community (Table 5). Community traditions related to land management, in the form of joint irrigation management and community service. Based on table 6, that there are unwritten norm sanctions that are agreed upon by the community in land management. Among the unwritten rules are related to the reduced trust to work on Perhutani's land.
Table 7. The Compliance level of the farmer to the norm (%)

| No. | Norms                                  | The existence (%) | Average |
|-----|----------------------------------------|-------------------|---------|
|     |                                        | BKPH Sadang       | BKPH Cipeundey |         |
| 1   | Custom                                 | 92                | 44       | 68      |
| 2   | Community tradition                    | 88                | 63       | 75.5    |
| 3   | Group rules                            | 62                | 91       | 76.5    |
| 4   | Perhutani rules                        | 73                | 100      | 86.5    |
| 5   | Community rules                        | 70                | 88       | 79      |
| 6   | Extension officer encouragement        | 81                | 91       | 86      |
| 7   | The encouragement from capital/industry owners | 39                | 100      | 69.5    |

Sources: processed of primary data

Figure 3. Average of the percentage of the social norm of farmers at Purwakarta FMU in the management of biomass plants

The existence and sanctions applications of social norms of farmers in the management of biomass plantations are very low. However, the community is still in compliance with these forms of social norms. Table 7 shows that farmers' compliance with existing rules such as regulations issued by Perhutani, extension rules, and the community leader's rules are quite high, implying that the community will obey any Perhutani rules.

3.5. Network

Social capital in the form of networks allows the emergence of strategic and potential resources to be utilized by individuals and community groups in land supply networks, seed procurement, harvesting, markets, information, and sources of capital in resource management [19] [28]. In this study, farmer networks in managing biomass crops are grouped into technical aspects of forestry, marketing, capital, and institutional. In the network, you can see which parties are most frequently contacted or contacted by farmers in land management.
These parties are limited to the farmer group’s leader, landowner, extension worker, village government, foreman/LMDH/Perhutani, merchants, and financial institutions. Respondent farmers also choose not to know/none if they do not know whom to turn to for information if they encounter a problem, or if no one has ever contacted them in various aspects of land management. The social network in Purwakarta FMU is shown in Table 8.

The Farmers hope that results from the community and Perhutani’s agreement and cooperation are contained in a Cooperation Agreement (PKS). The role of merchants/big traders is very helpful for farmers, especially in selling crop products and providing fertilizer. LMDH’s role is to socialize the Biomass plantation program. Farmers’ trust in community leaders and the head of the farmer group is high in Purwakarta FMU, usually, the head of the farmer’s group is also the head of LMDH. Farmers are very proactive and collaborate very well with local government including forestry officials.

Table 8. Interaction between farmers and resources person in biomass plant management (%).

| No | The Parties                        | Forestry Technical | Marketing | Institutional | Capital |
|----|-----------------------------------|--------------------|-----------|---------------|---------|
|    |                                   | D      | M      | D      | M      | D      | M      | D      | M      | D      | M      | D      | M      | D      | M      |
| 1  | The Farmer’s group leader         | 16     | 14.5   | 0      | 0      | 14.5   | 3.5    | 0      | 0      |        |        |        |        |        |        |
| 2  | The Landlord                      | 8      | 4.5    | 0      | 0      | 0      | 0      | 0      | 0      |        |        |        |        |        |        |
| 3  | The Extension worker              | 9.5    | 2.5    | 1      | 2.5    | 0      | 0      | 0      | 0      |        |        |        |        |        |        |
| 4  | The Perhutani’s Foreman           | 22     | 16.5   | 2.5    | 0      | 4.5    | 4.5    | 1      | 0      |        |        |        |        |        |        |
| 5  | The Local Goverment/LMDH          | 0      | 3.5    | 0      | 5      | 2.5    | 5      | 0      | 5      |        |        |        |        |        |        |
| 6  | The merchant/The wholesaler       | 4.5    | 0      | 14.5   | 7      | 0      | 0      | 4.5    | 4.5    |        |        |        |        |        |        |
| 7  | The big traders/Private           | 0      | 4.5    | 7.5    | 0      | 0      | 0      | 5      | 0      |        |        |        |        |        |        |
| 8  | The financial institutions        | 0      | 0      | 0      | 0      | 0      | 0      | 1      | 1      |        |        |        |        |        |        |
| 9  | Independent                       | 3.5    | 0      | 10     | 7.5    | 4      | 3.5    | 11     | 7.5    |        |        |        |        |        |        |
| 10 | Jangleng’s planting               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      |        |        |        |        |        |        |
| 11 | Does not know/any                 | 36.5   | 54     | 64.5   | 78     | 74.5   | 83.5   | 77.5   | 82     |        |        |        |        |        |        |
|    | Total                             | 100    | 100    | 100    | 100    | 100    | 100    | 100    | 100    |        |        |        |        |        |        |

Remark : D = be contacted, M = be contacting
Source: processed of primary data (2020)

Table 8 describes the interaction between farmers and resource persons in biomass plantation management. In the network aspect, there is a tendency that the farmer does not understand which resources person should be contacted for all aspects, technical aspects of forestry, marketing aspects, institutional aspects, and capital aspects. This means that communication between the parties is not optimal. To cope with this issue, farmers hope for getting more intense socialization and assistance regarding the planning of the development of biomass plantation in the Purwakarta FMU so that this program works effectively.

4. Conclusion and recommendation

Knowing and understanding social capital we can arrange the strategy for a biomass development at Purwakarta FMU, that based on level of trust the parties for biomass development on managing forest are Perhutani, Farmer group leader, Community leader. The involvement of farmers in biomass development is highly dependent on the success stories that have existed. Farmers will be motivated to
develop biomass crops if there are already successful examples. The current involvement of farmers is as a workforce for biomass development in Perhutani. The existence of social norms in the community around biomass plantation areal, generally below 50%, indicates that customary norms, community traditions, written and unwritten rules have less role in land management as a determining factor for success. The norm that farmers mostly used is a tradition that exists in the community. There is an unwritten norm sanctioned by the community in land management. Farmers' compliance with existing rules such as regulations issued by Perhutani, extension rules, and the community leader's rules are quite high. The farmer network does not understand which resources person should be contacted for all aspects (technical of forestry, marketing, institutional, and capital).

By knowing the social capital of the community around the forest, it is hoped that Perum Perhutani can provide policies that can benefit all parties. High farmers' trust in Perhutani is the main social capital, to be able to develop biomass plants. Improving networking through socialization and intensive assistance so that communication can be optimal. So that the biomass development policy can benefit Perhutani and improve the welfare of farmers.

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