Role and interaction between local actors in community-based forest management in Upper Citarum Hulu

Inas Yaumi Aisharya[a], Budhi Gunawan[ab], Oekan S. Abdoellah[ab], Wahyu Gunawan[c], Jhon Jhohan Putra Kumara Dewa[d]

[a] Department of Anthropology, Faculty of Social and Political Sciences, Universitas Padjadjaran, Bandung, 45363, Indonesia
[b] Center for Environment and Sustainability Science, Universitas Padjadjaran, Bandung, 45363, Indonesia
[c] Department of Sociology, Faculty of Social and Political Sciences, Universitas Padjadjaran, Bandung, 45363, Indonesia
[d] Department of Civil Engineering, Universitas Bangka Belitung, Bangka, 45363, Indonesia

Abstract. *The role of the community and their collaboration with other actors are the attempts that are assured to ensure the sustainability of forest management. This study analyzes the role of determining the powers and interests as well as to classify groups by analyzing the interests and influences and analyzes actor-network by using Social Network Analysis (SNA) with Kumu application. PHBM is a form of collaboration between Perum Perhutani as the program designer and forest communities. The key actors in PHBM Programs are Perum Perhutani, Coffee Farmers, Middleman R, Farmer Group Leaders, LMDH P, and LMDH A. The LMDH institution is identified as main actor since it is a Context Setter who has the highest degree of centrality, betweenness, closeness, and eigenvector. LMDH's roles and interactions support the success of community forest management.*

INTRODUCTION

Communities play an important role in the sustainable management of natural resources. Communities have a direct control role in managing and utilizing natural resources to avoid the tendency to destroy natural resources and the public's disinterest in conservation (Boonzaaier, 2012). Ostrom (1999) states that local communities can manage and develop local institutions to regulate the sustainable use of forest resources when granted management rights over forests. Supporting this, Thondhlana *et al.* (2015) revealed that the barriers to collaborative natural resource management include lack of participation in decision-making, information dissemination, transparency, trust, power relations, and unequal access to natural resources. The community, as one of the stakeholders in various forest management efforts, has been involved in problem formulation, developing resolution strategies to decision making to achieve sustainable forest management (Gunawan *et al.*, 2004; Martins and Borges, 2007; Chen *et al.*, 2013; Bartlett, 2018; Pujo *et al.*, 2018; Desmiwati and Christian, 2019). The results of these studies confirm that collaborative forest management is one of the efforts believed to be able to ensure sustainable forest management (Carter and Gronow, 2005; Akamani and Hall, 2019).

Using the idea of collaborative forest management for sustainable forest management, Perum Perhutani established Pengelolaan Hutan Bersama Masyarakat (PHBM) program throughout Java, including in forest areas in the Upper Citarum watershed. PHBM was developed with the concept of agroforestry. In the forest area of the Upper Citarum Watershed, the PHBM program which was started in 2003/2004, has developed agroforestry with

coffee plants as the main commodity. The PHBM program implies success. Purwita *et al.* (2009) examined the household economy of the people in the Upper Citarum Watershed, which experienced an increase due to the PHBM program. Bahruzin *et al.* (2014) examined the effectiveness of PHBM institutions in the Upper Citarum Watersh, which resulted in the institution's impact positive on household economy and forest ecology.

The purpose of this paper is to understand and reveal the role of actors or stakeholders in collaborative, sustainable forest management in the PHBM program. Similar research has been conducted, such as Syahputra *et al.* (2019) that maps the actor interactions in community-based mangrove management using Social Network Analysis (SNA) and shows that forest management unit holds the role to build relationships collective action, and also connect and collab with other actors. However, the discussed case was different with different roles of actors. Stakeholder analysis that is held in PHBM case is Prasetia *et al.* (2017) that identifies stakeholders into Interest and Influence Matrix. In similar research, Hudiyani *et al.* (2017) also analyzed the stakeholder mapping on agroforestry community forest management, which is different results for different management activities. These research, however, does not provide the network analysis between stakeholders. It only shows the stakeholders relationship based on the potential pattern of the relationship. Consequently, this paper discusses stakeholder's interests and influence, as well as the social network analysis in PHBM Program. An understanding of the role of actors and networks in the PHBM program will provide positive input to add new sources of knowledge as well as become a reference for policies on community involvement in collaborative forest management, especially for people who have a very high level of dependence on forests.

METHODS

Location and Time of Research

The object of research in this study was all actors involved in the community forest management program in the Citarum Hulu Watershed, West Java Province, especially in Lebak Muncang Village, Ciwidey District, Bandung Regency, as one of the implementing villages for the PHBM program. The research was conducted in February-March 2021. The scope of interest and influence is more focused on the economic aspect.

Data Collection

This research is descriptive of the case of the community involvement system in the PHBM Program. Data were obtained from primary data sources conducted by conducting interviews with relevant stakeholders based on purposive informant retrieval techniques. In this study, the adjustment of informants was also carried out with additional informants based on sufficient local knowledge from previous informants, so in this study, the snowball selection of informants was also applied.

Data Analysis

The analysis was carried out using the interest and influence analysis model developed by Reed *et al.* (2009). It is important to understand who is influential and influences the form of action and the power that they have in influencing the outcome (Freeman 1984 in Reed *et al.* 2009). The analysis is carried out by: (1) identifying the stakeholders involved in the PHBM program; (2) analyzing the interests and influence of each stakeholder on the PHBM program; and (3) investigating the relationship between stakeholders.

Identification of actors is conducted through in-depth interviews with snowball sampling. The results of the identification are mapped in the table of effects and impacts. The operational criteria and definitions in the interest and influence analysis are presented in Table 1, then plotted in an interest and influence diagram that distinguishes actors into 4 (four) quadrants, i.e. key players, subjects, actors who can influence other actors/context setters, and disturbing actors/crowd. The classification of actors is presented in Figure 1.

Table 1 Assessment method of the interest and influence level

Operational Definition	Assessment Criteria	Value	Operational Definition	Assessment Criteria	Value
INTEREST			INFLUENCE		
Perception of PHBM Program	Thought the program was Important	2	Position of the actor in program implementation	Support/Reject Program.	3
	Thought the program was quite important	1		Contrary to most programs (more than 2 or more actors).	2
	Thought the program was not important	0		Contrary to a small number of Programs (with a maximum of 2 specific actors).	1
				Neutral to program.	0
Involvement in PHBM Program	Directly involved in the program	2	Actor's ability to influence other programs/actors	Can stop/disturb on a large scale	3
	Indirectly involved in the program	1			
	Not involved in the program	0		Influential/on a moderate scale (Large following, most actors follow)	2
Economic benefits derived from the PHBM program	Program as Main Source of Income	2		Influencing on a small scale (small group or 2 actors)	1
	Program as a source of Additional Income	1			
	The program does not provide economic benefits	0		Affect on a very small scale (self and family)	0
Total Value of Interests/Actors		1-6	Total value of influence/actor		1-6

Source: Interpretation of interests and influence criteria from Reed *et al.* (2009), Note: a) Score 6: Very Strong Interest/Influence Degree; b) Score 5: Strong Interest/Influence Degree; c) Score 4: Strong Enough Interest/Influence Degree; d) Score 3: Average Interest/Influence Degree; e) Score 2: Weak Interest/Influence Degree; f) Score 1: Very Weak Interest/Influence Degree
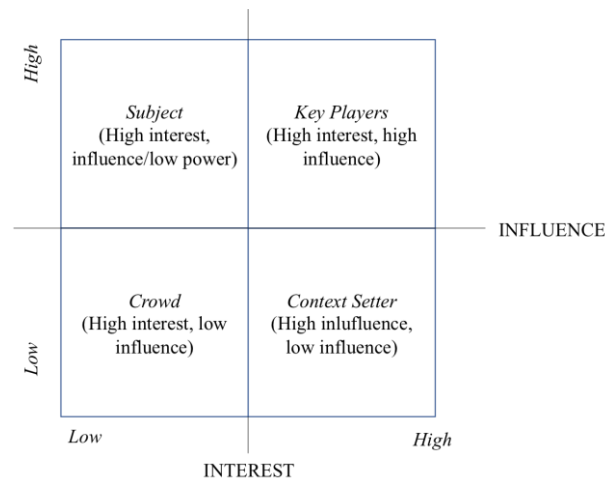
Figure 1 Interests and influence diagram

The relationship between actors was analyzed by SNA using the Kumu Program. A social network is a social structure formed by individuals or organizations that are connected by one or more relationships (Syahputra *et al.*, 2019). SNA is used to assess the social structure, especially the interaction relationships of the actors (Syahputra *et al.*, 2019). SNA will detect the importance of actors in a network. By understanding the pattern/structure of the social network that works, it will provide a fairly realistic picture of how important an actor is in the structure of the social network. It also gives an idea of how important the actors are in natural resource management (Bodin and Crona, 2009). The way to understand this is to look at the position of centrality and network flow (Borgatti, 2005). Network analysis with SNA will describe the position of actors in the network by looking at the degree of centrality, betweenness centrality, closeness centrality, and eigen vector centrality.

RESULTS AND DISCUSSION

Agroforestry in Community Forest Management

PHBM was initiated by Perhutani in Lebak Muncang Village, which was started in 2005, and was also the establishment of LMDH (Forest Village Community Institution). Prior to the PHBM, communities around the forest intercropped by planting vegetables, as well as illegal logging for the community's economic needs-this threatened sustainability. PHBM in Lebak Muncang Village is an effort to reduce illegal encroachment in the forest and improve the economy of the village community by planting *Coffea arabica* coffee.

At the beginning of coffee cultivation in agroforestry, the community continued to grow vegetables between coffee trees and wood trees. However, when the coffee tree starts to grow, the vegetables cannot survive because they require a large amount of sun exposure, while the maximum exposure to sunlight required by coffee plants is 60%. Therefore, in 1 hectare of land, a maximum of 2 500 coffee trees are allowed. If well maintained, 1 hectare of land can produce 2 to 3 tons of coffee cherry. Vegetables are grown only when the coffee plants are still small as income before the coffee harvesting. This is also limited to vegetable crops that do not require tillage.

The character of coffee trees that need shade makes coffee farmers maintain trees in the forest. Therefore, since the community planted coffee in the middle of the forest, illegal logging activities in the forest in Lebak Muncang Village have decreased. In addition, if tree felling is carried out, it will also damage the surrounding coffee trees.

The shade trees in coffee agroforestry include Rasamala (*Altingia excelsa*), Puspa Tree (*Schima wallichii*), Surian Tree (*Toona ciliate*), and Pine tree (*P. merkusii*). The community does not complain much about the types of plants, although there are some shortcomings for each type of tree, such as the Puspa Tree which is too dense so that it requires pruning every 2 years, and the Pine Tree that does not absorb water, or the Surian Tree which is vulnerable to felling because the wood is easily sold to local people store building. Currently, LMDH is planting

338

woody fruit trees in the forest, such as tamarillo (*Solanum betaceum*), jackfruit tree (*Artocarpus heterophyllus*), and avocado (*Persea Americana*). This is intended to further reduce the opportunity for logging because shade trees have economic value, not wood.

Logging still occurs today, but very little is seen in the increase in the number of coffee farmers and the decrease in illegal farming. If it is known that there was an illegal logger, the first step is for the perpetrator to be reported to the group leader and LMDH to be reprimanded and resolved amicably. However, if this method does not deter the perpetrator, it will be reported to the Village Head. The division of arable land in the PHBM program in Lebak Muncang was initially carried out by mutual agreement which was reported to LMDH. But over time, seeing the success of coffee cultivation, many have secretly expanded their land or opened up new land. This is mostly carried out by farmers who initially worked as farm laborers and were landless. As a form of legality for this matter, the data for arable land is updated in the Perhutani Decree every two years.

Perhutani set 20% of income during the PHBM program, then reduced it to 10% during the social forestry program. However, the sharing payment mechanism is carried out based on the area of land owned by using the assumption of productivity of 2 kilograms of coffee per land stake, in accordance with the prevailing coffee price-the actual product itself is different for each owner. This productivity assumption is in accordance with the farmers' agreement, which in addition to being more profitable for farmers, can also motivate farmers to take care of their gardens and increase their productivity. Sharing payments are made once a year when harvesting Perhutani through LMDH.

Influence and Interest of Involved Actors

The actors involved in the PHBM program include Perum Perhutani, forest village communities who have an occupation as coffee farmers, LMDH, LMDH Management, Coffee Collectors, and Non-Governmental Organizations. Each of these actors has a role, interest, and influence in the PHBM Program. The roles played by these actors in the PHBM program, in general, include determining program plans, monitoring programs, conducting dialogue with the community, and running PHBM programs. The actor's roles are described in the following explanations.

Perum Perhutani

Perum Perhutani was the first to initiate and establish a PHBM program to involve the community. Perhutani holds Forest Land Management Rights as a main stakeholder in providing forest access to the community. Perhutani oversees forest management, maintains the sustainability of forest functions and the resulting economic benefits, and determines the amount of profit-sharing provided by farmers who manage forests. The description of interest and influence of Perum Perhutani within its score mentioned on Table 2.

Table 2 Interests and Influence by Perum Perhutani

Interest		Influence	
Description	Score	Description	Score
Is the initiator of the program, actively and directly involved in the program. However, the economic benefits derived from the PHBM program are not the main profit generator	Strong 5	As the initiator of the program, is the holder of forest management rights (supports the program), has a very big influence/can stop the whole program (big influence).	Very Strong 6

Coffee Farmers

Coffee farmers utilize land owned by Perhutani to grow coffee commodities that require shade from stands in the middle of the forest, known as the agroforestry system. Planting this coffee commodity makes the community participate in forest conservation. Since the community planted coffee in the middle of the forest,

illegal logging activities in the forest in Lebak Muncang Village have decreased. In addition, if tree felling is carried out, it will also damage the surrounding coffee trees. Previously, logging was not considered, so a lot of tree felling went unnoticed. Trees are still being cut down to meet urgent needs by selling the wood.

Coffee farmers are obliged to pay for the sharing when the harvest season arrives. Although the percentage of sharing has been determined, in practice in the field, sharing payments are made based on the area of land owned by using the assumption of productivity. Some coffee farmers do not obey the determined rules, following the group they belong to. The description of interest and influence of coffee farmers within its score is mentioned on Table 3.

Table 3 Interests and influence by coffee farmers

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Actively involved in the program. Program as the main source of income.	Very Strong 6	It is the main objective of the program, how to improve the economy but not destroy the forest. The increasing number of farmers explains the position of farmers who support the program. Farmers gather in groups and are accommodated, the absence of farmers can stop the whole program.	Very Strong 6

Forest Village Community Institution (LMDH)

LMDH was established on a mandate from Perum Perhutani to legalize coffee farmers. From one LMDH agency, they are divided into groups known as *Kelompok Tani Hutan* (KTH), i.e., community groups that manage coffee land in the forest whose grouping is determined based on the proximity of the cultivated land. Technically, LMDH acts as a bridge between farmers and Perhutani, or other stakeholders such as related agencies, such as sharing payments made by LMDH, as well as an information center for programs from the government and from Perhutani. The description of interest and influence of LMDH within its score is mentioned on Table 4.

Table 4 Interests and Influence by LMDH

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the farmer's economy. Actively involved in the program as a communicator, "hand of Perhutani" and Farmer Representative. The program does not provide income to LMDH.	Strong Enough 3	Is the main mediator and communicator: Extended Hand of Perhutani as well as Farmer's Representative (Has influence to all farmers and Perhutani). Without LMDH the program is not running optimally, the Perhutani sultanate manages the large number of investors (their presence supports the program).	Very Strong 6

LMDH P

LMDH P is the current chairman of LMDH. LMDH P has a role in proposing aspirations to Perhutani based on suggestions from members (farmer groups), conveying information from and to the community both formally and informally, conducting internal and external coordination regarding the implementation of the PHBM

program, initiating and implementing nurseries and planting of standing trees in the form of fruit trees on degraded land or open forestry plantations, as part of the PHBM program. LMDH P has a main business as a fruit seller whose successful planting of fruit trees in the forest will have a positive impact on LMDH P's business, as well as benefit the fruit farmers involved. Planting fruit trees in degraded areas, if successful, will have a positive impact on forest conservation and provide benefits for Perhutani. The description of interest and influence of LMDH P within its score mentioned on Table 5.

Table 5 Interests and influence of LMDH P

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Actively involved in the program. Program as a source of additional income.	Strong 5	Is the leader of LMDH who acts as a mediator. Without LMDH P, as long as there is LMDH, the program can still run (neutral to the program). LMDH P initiated a fruit crop program in open land that can provide diversification of the PHBM model, now it has affected several farmer groups.	Weak 4

LMDH S

LMDH S is the treasurer of LMDH, who collects profit sharing from each farmer to be handed over to Perhutani. Together with LMDH P, LMDH S is the driving force behind the LMDH function. He is also a pioneer in coffee cultivation. LMDH S's main business is coffee collectors and sellers from 4 farmer groups (106 Coffee Farmers), as well as processing coffee beans into green beans for sale. The description of interest and influence of LMDH S within its score mentioned in Table 6.

Table 6 Interests and influence of LMDH S

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Actively involved in the program. Program as the main source of income.	Very Strong 6	Is the treasurer of LMDH who acts as a collector of profit sharing. Without LMDH S as long as there is LMDH, profit sharing can still be collected (Neutral to the program). LMDH S acts as collector and has influenced for a small number of farmers (106 Farmers)	Weak 2

LMDH U

At the beginning of PHBM, LMDH U was the former secretary of LMDH, but along the way, he discovered that there was a lack of transparency in the management of LMDH, so he influenced his coffee farmers, a number of 106 farmers, not to pay profit sharing through LMDH, even though during the election of LMDH chairman, LMDH U was a supporter of LMDH P. This issue can lead the credibility of LMDH itself. LMDH U is a coffee collector for 106 farmers by processing coffee beans into green beans for sale. The description of interest and influence of LMDH U within its score mentioned in Table 7.

Table 7 Interests and influence of LMDH U

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Actively involved in the program. Program as the main source of income.	Very Strong 6	Is a former secretary of LMDH. Contrary to some actors, especially LMDH S and LMDH, it is triggered by the issue of transparency (contrary to certain programs/actors). Provoking their fostered farmer groups (106 farmers) not to pay profit sharing through LMDH.	Average 3

LMDH A

LMDH A is the pioneer of LMDH as well as the chairman of the previous LMDH, who often provides capital assistance to the community. LMDH A plays an important role in supporting PHBM, especially in providing capital for small farmers. LMDH A has extensive coffee and tea processing (outside the LMDH area) access rights. Even though he is no longer the head of LMDH, LMDH A continues to provide capital assistance to farmers in need. The description of interest and influence of LMDH A within its score mentioned in Table 8.

Table 8 Interests and influence of LMDH A

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. No longer directly involved with the program. Program as a source of additional income.	Strong Enough 4	He is the former chairman of LMDH. Acting as a voluntary financier, initially very helpful for the program, but over time, farmers have become independent in capital (supporting the program). Has an influence on most farmers who view that the previous LMDH period was better because it was able to provide capital assistance.	Strong Enough 4

Coffee Middleman

Coffee Middlemen have a role as intermediaries between coffee farmers and the coffee market. Coffee Middlemen also have a place for processing coffee to form green beans for sale to the market. Generally, sales are made to PT Sari Makmur Tunggal Mandiri for re-export. Coffee Middlemen buy coffee from farmers every year. These farmers are not trained specifically but on the basis of trust or emotional connection that has been built during the PHBM process. The collectors buy at a price that matches the market price, there is a price difference, but it is not significant (an average of IDR 50-100/Kg). The description of interest and influence of coffee middlemen within its score mentioned in Table 9.

Table 9 Interests and influence of coffee middlemen

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Not directly involved with the program. Program as the main source	Strong 5	Acting as a buyer and manager of coffee supports farmers' businesses (supports certain stakeholders in the program). The large number of	Average 3

Interest		Influence	
Description	Score	Description	Score
of income.		collectors causes the coffee price to be safe enough to benefit farmers, directly and indirectly, supporting the program.	

Middleman R

Just like other coffee middlemen, middleman R is also a coffee processor for sale to the market. However, middlemen R is also the head of a farmer group of 150 farmers whose group has cooperation with NGO Sunda Hejo and PT. Olam provides certain standards for planting and processing coffee so that the quality is maintained. Currently, LMDH is trying to get other farmers to run the program and sell their coffee to PT. Olam. The existence of middlemen R, who has succeeded in increasing the productivity and quality of coffee production by their fostered farmers, has a positive impact on PHBM. As a middleman, he is greatly influenced by the success of PHBM, because the more successful coffee production is with forest conservation, the higher the potential profit he will get. The descriptption of interest and influence of Middleman R within its score is mentioned on Table 10.

Table 10 Interests and influence by Middleman R

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Get directly involved with the program. Program as the main source of income.	Very Strong 6	Act as a coffee buyer and manager as well as a coach for a number of farmer groups to achieve better quality and production. It supports farmers' efforts (supports specific stakeholders in the program). Its existence has influenced LMDH to initiate similar programs for other farmers.	Strong Enough 4

NGO

The NGO provided socialization and guidance on how to produce quality coffee facilitated by PT O as well as bridging the sale of coffee to the company PT O. The existence of an NGO that provides socialization and direction and has been successfully implemented by Middleman R's member farmers with better productivity and quality of coffee production than other farmers. The existence of an NGO has a positive impact on PHBM. The description of interest and influence of NGO within its score is mentioned on Table 11.

Table 11 Interests and influence of NGO

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Not involved in the program. Do not get economic benefits from the program. Have a perception that views the program as important for the economy and sustainability. Not involved in the program. No economic benefit from the program.	Weak 2	Together with R, develop a number of farmer groups to achieve better quality and production. It supports farmers' efforts (supports specific stakeholders in the program).	Weak 2

Forest Ranger (**Polisi Hutan/Polhut**)

A Forest ranger is the field officer of Perhutani who plays a role in overseeing forest destruction. In some cases, they asked for profit-sharing money that should have been channeled through LMDH to Perhutani. The behavior of *Polhut* personnel "forcing" some farmers to pay profit sharing to *Polhut* will damage the system that has been built. The description of interest and influence of forest ranger within its score is mentioned on Table 12.

Tabel 12 Interests and influence of forest ranger

Interest		Influence	
Description	Score	Description	Score
Have a perception that forests need to be preserved. Not directly involved in the program. The program has no economic impact.	Average 3	The existence of forest rangers tends to conflict with the program, especially because they often force farmers to pay profit sharing through them. Meanwhile, the role of the forest rangers in monitoring is currently being carried out more independently by farmers who have an awareness of forest sustainability that supports coffee productivity. However, their ability to influence farmers tends to be small because several times the farmers do not pay the forest rangers but complain to the group leader and LMDH to facilitate the settlement.	Average 3

Head of Village (**Kepala Desa/Kades**)

The Village Head plays a role in mediating and resolving conflicts or problems related to forest destruction and coffee cultivation, which cannot be resolved internally at the group or LMDH level. The function of the village head is to resolve conflicts at the village level, including those related to potential problems, in wise ways that provide strength for the solidity and sustainability of the PHBM program. The village head has the potential to manage village funds to improve the quality of PHBM management, considering that most village communities work and are involved in the PHBM program, but it has not been maximized. There is an impression that the current village head does not have the same understanding as to the current LMDH chairman. This causes the village's potential to support PHBM to be constrained. The description of interest and influence of head of village within its score is mentioned on Table 13.

Tabel 13 Interests and influence of head of village

Interest		Influence	
Description	Score	Description	Score
Having the perception that PHBM is the welfare of farmers. Directly involved as a farmer. Get economic benefits from the program even though it is not the main source of income.	Strong 5	By not paying special attention to village policy programs, it appears that the position of the village head is not high enough to support the program, he tends to conflict with the current LMDH chairman. However, the village head has a strong influence on farmers and the village community.	Average 3

Leaders of Farmer Group

The Leaders of the Farmers' Group play a role in distributing information from LMDH to farmers, resolving internal conflicts at the group level, and carrying out bookkeeping/reporting/data collection related to farmers' land area, production, and profit-sharing that must be handed over to Perhutani. Some group leaders act as coffee middlemen as well.

In his role, the head of the farmer group has the ability to influence the farmers in his group. The head of the farmer group is the main actor who provides a database related to land tenure and the amount of profit-sharing provided. The truth of the information provided affects the sustainability of the PHBM program. As a distributor of information, the group leader is the first person to receive information directly from LMDH, if this role is cut off, the role of LMDH will become more severe, requiring extra energy to reach directly to the farmer level. Each farmer group leader has an average of 20-30 members. The description of interets and influence of leaders of farmer group within its score is mentioned on Table 14.

Table 14 Interests and influence of leaders of farmer group

Interest		Influence	
Description	Score	Description	Score
Have a perception that views the program as important for the economy and sustainability. Get directly involved with the program. Program as the main source of income.	Very Strong 6	The head of the farmer group supports the PHBM program, they have a strong influence on the farmer group in their group,	Strong Enough 4

Based on the results of the analysis above, a plot is made on the position of the actors in the interest and influence matrix as presented in Figure 2. There are four classifications of actors in PHBM, i.e key players, context setters, subjects and crowd. The key players are Coffee Farmers, Perum Perhutani, Middleman R, Farmer Group Leader, LMDH P, and LMDH A. Context Setters is only LMDH institutionally, LMDH U, LMDH S, Coffee Middlemen, and Head of Village are Subjects. Lastly, NGO and forest rangers are crowds.
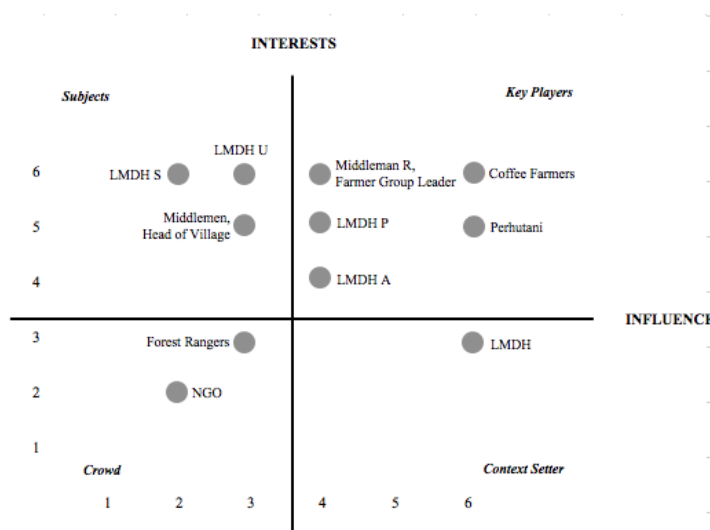

Figure 2 Interests and influence of actors in PHBM

Key players are the main actors in the PHBM program because of their high importance and influence. Coffee farmers are the main subject of the PHBM program, which was held because the forest encroachment in previous years was rampant so that PHBM is a middle way between forest sustainability and farmers' livelihoods.

Based on this, farmers have a high interest and influence in the PHBM program. Since coffee farmers would follow the group to obey the rules or not, leader of coffee farmer group is also the main actor.

Other key players are Perum Perhutani, the actor who initiated the PHBM program, and LMDH P as the current chairman of the LMDH. With his various roles in conducting dialogue with the community so that the community feels involved in the PHBM Program, he has a great influence, as well as running a fruit plant nursery program as a forest stand so that he also gets material benefits from the forest. The reason is, LMDH is an institution without any profit being taken, it is also a social institution without any income from the management.

Middleman R is also key player in the PHBM program. He earns income from forest products and has influence in implementing more ideal technical operational forest management in collaboration with NGOs. LMDH A is another key player in the PHBM program because he was the initial figure in the implementation of PHBM and was the first LMDH chairman during the early days of PHBM.

Actors Interaction in PHBM Program

The importance of actors in the network is not only seen from the level of interest and influence of these actors but also determined by the relationship with actors in the network. The following is the result of SNA which shows the value of the centrality of the relationship between actors. The centrality degree actor network described in Table 15.

Table 15 Centrality degree actor network

No	Actors	Centrality Degree	Betweenness Degree	Closeness Degree	Eigenvector
1	Perum Perhutani	4	0.002	0.59	0.06
2	Coffee Farmers	10	0.255	0.77	0.12
3	LMDH	17	0.51	0.87	0.17
4	LMDH P	9	0.09	0.75	0.11
5	LMDH S	6	0.01	0.65	0.08
6	LMDH U	5	0	0.59	0.07
7	LMDH A	3	0	0.53	0.04
8	Coffee Middlemen	2	0	0.46	0.03
9	Middlemen R	4	0.167	0.55	0.04
10	NGO	2	0	0.38	0.01
11	Head of Village	3	0	0.54	0.05
12	Leaders of Farmer Groups	7	0.02	0.69	0.10
13	Forest Rangers	5	0.008	0.65	0.07

Source: Primary Data Processing, 2021

In this study, it can be seen that the community and LMDH have a high centrality value. Degree Centrality indicates that actors in the network are trying to connect with other actors. Actors who have multiple ties have influence because they share knowledge and information with other actors (Hanneman and Riddle, 2015). Thus, LMDH is the actor who has the most relationships with other actors. The Degree Centrality of Actors is illustrated at Figure 3.

In the betweenness degree, it is known that the actor with the highest score is LMDH. This actor is considered to be the actor who plays the most important role in controlling the flow of information in the network. Thus, LMDH acts as a liaison and information dissemination within the network. In other terms, actors with high betweenness degree are called information brokers who have relationships with other actors. The Betweenness Degree of Actors is illustrated at Figure 4.

In the centrality degree, it is known that the actors with the highest value are LMDH and coffee farmers. Actors with high centrality degree are actors who interact quickly and easily with other actors because they tend to have shorter communication lines. LMDH is an intermediary center with all stakeholders. While the community is the main subject in the PHBM program so that many actors provide information to the community regarding the program. The actor who has a high eigenvector value is LMDH. The eigenvector shows how well the actor is connected with other actors, and shows how important it is that the actor has a network with other actors. The Closeness Degree and Eigenvector of Actors is illustrated at Figure 5 and Figure 6 respectively.
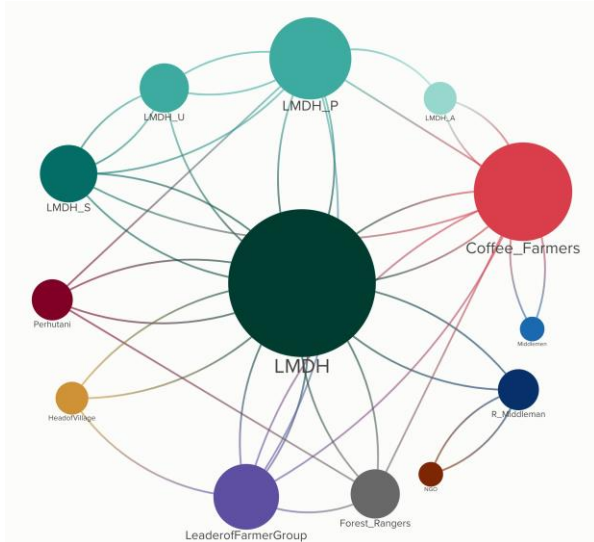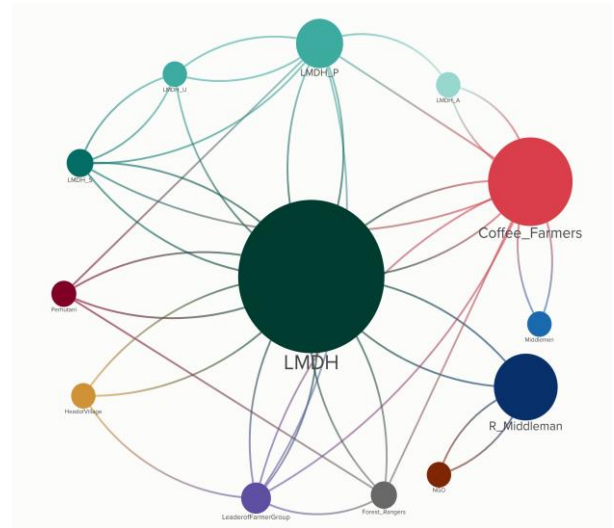

Figure 3 Centrality degree of PHBM actors

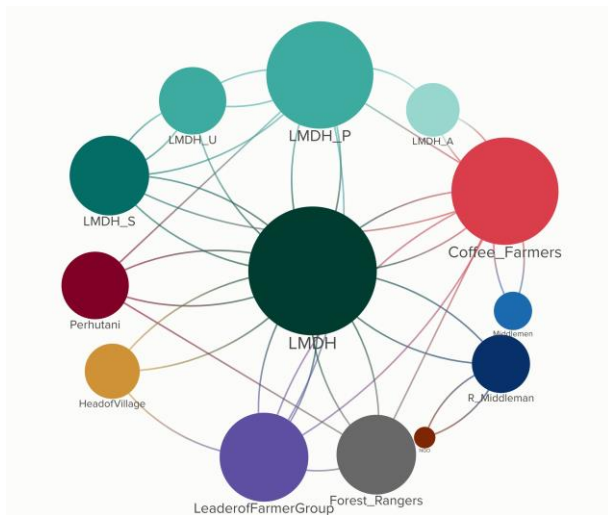

Figure 4 Betweenness degree of PHBM actors

Figure 5 Closeness degree of PHBM actors

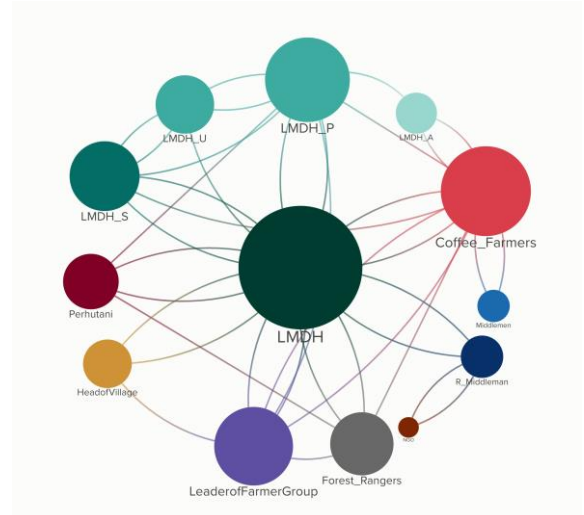

Figure 6 Eigenvector of PHBM actors

DISCUSSION

From the results of the interest and influence analysis as well as social network analysis, the actor who becomes the main agent of change is LMDH, this happens because it is the main center for distributing and controlling information, but it has little interest with high influence. This result is different from Prasetia *et al.* (2017) that identified regulator function in key player, but Angst *et al.* (2018) state that actors who have a position in the middle, which is close to the community but can also reach more macro perspectives, tend to be the center of a program.

The existence of this LMDH fulfills the factors that support the success of communal resource management in the community, i.e., the community's ability to create management institutions, equal participation, and trust among community members. Institutions in community-based forest management programs have a role in the effectiveness of improving the economic and ecological conditions of forests and social stability (Bartra, 2007; Bahruzin *et al.*, 2014). Institutions at the local level, such as LMDH, also apply polycentricity as stated by (Ostrom, 2010), which can alleviate and solve many problems in the regulatory circle by considering various levels, both local and larger, because regulations will be increasingly inefficient in complex hierarchies. Stakeholder analysis by Pradana and Wiyono (2017) has also resulted that LMDH has a clear program and conflict resolution mechanism. Interaction and deep communication between LMDH and coffee farmers can also increase community capacity (Pujo *et al.*, 2018). This is supported by Bloomfield *et al.*, 2019 that argue that increasing community capacity can also assist stakeholders in achieving natural resource restoration.

Unfortunately, there is a threat to the credibility of LMDH, due to the problem of not being transparent in reporting and recording profit sharing provided by farmers to Perhutani through LMDH. As a result of this transparency issue, the secretary of LMDH (LMDH U) resigned and influenced 106 farmers in his group not to make profit sharing payments through LMDH. This conflict threatens as well as pressure for how LMDH manages internal conflicts in a wise way to create a transparent representative institution that is also able to voice the interests of farmers. Talley *et al.* (2016) say that representation of resource users in the dialogue process should be able to strengthen the voices of marginalized parties and can be the basis for more systemic reforms so that it is necessary to pay attention to transparency and the process of profit sharing (Poudyal *et al.* 2020).

Furthermore, the weakness of LMDH institutionally is not getting economic benefits from the PHBM Program, the daily management does not receive a specific salary from PHBM. The actor who can manage the fund for PHBM is Head of Village, but he does not support PHBM program in this new LMDH leader era because he has different vision for PHBM because the fact that current LMDH era is established by the leaderhip of former head of village. Reversely, in the supporting Head of Village, Syahputra *et al.* (2019) identified Head of Village with the highest degree centrality, closeness centrality, and betweenness centrality.

Consequently, it turns out that this weakness can be minimized by recruiting farmers as well as collectors who benefit from the PHBM program to become daily administrators, this can be turning conflicts of interest into positive strengths. Although the chairman of LMDH, in this case is LMDH P, is not a farmer or coffee collector. LMDH P, has an interest in bringing a new program in PHBM, namely making degraded forest lands that can be used for planting woody fruit trees, so that there are other alternatives besides coffee commodities. But, the most important thing is that LMDH P's business as a fruit seller can develop, with the availability of various fruits from the village that can be sold to the city. This condition is supported by Pradana and Wiyono, 2017 that the leader of LMDH should be facilitating the program as well as having entrepreneur side. Meanwhile, Tridakusumah *et al.* (2021) stated that the leader could be influencing because, besides the entrepreneur aspect of an actor, the actor is rich and be the place to ask related to marketing and prices, just like LMDH A who is the former of LMDH's leader. In that research (ibid.), stated also that the leader plays the central role and responsibility regarding farmer's welfare.

Since the farmer is the key actor and places the 2nd place in the case of centrality, closeness, betweenness, and eigenvector, another thing that needs to be understood for the stability of the PHBM program is to ensure that farmers continue to experience profits. Therefore price fluctuations, cartel issues, fertilizers, agricultural facilities, farmer insurance, lack of capital, and production quality, are important issues to be managed with the right mechanism in the country's trade level because if farmers lose money, PHBM tends to fail. Related to this, Ruiz-Mallén *et al.* (2015) said that what can stimulate the community in community-based conservation, among others, is an incentive-based conservation policy. It is what Middleman R does to encourage farmers by implementing a more ideal concept of PHBM and collaborating with NGO. Soon that concept will be adapted by LMDH to all the farmers. Kimengsi *et al.* (2019) also said that people are motivated to participate in forest management because they get income from the forest to get a stable and secure livelihood.

Assessing the pattern of interaction and the role of actors when linked in the context of good natural resource governance, the function of control and supervision becomes important to provide confidence that resource utilization does not exceed the carrying capacity of the environment. The supervisory function in the PHBM system belongs to the farmers, although there are also forest rangers, but these actors tend to be antagonistic towards the program. The idea of giving supervisory authority to farmers is supported by Tridakusumah *et al.* (2021) that stated farmers are needed to maintain forest security and conservation. The PHBM program can actively involve the community in the agroforestry system so that in accordance with the definition of access to forests according to Ribot and Peluso (2003) namely by involving the community in managing forest resources, community access to forests is opened and can be used as the main livelihood for the community, and reduce poverty levels (Sunderlin *et al.*, 2007; Santika *et al.*, 2017).

CONCLUSION

The mapping of influence and interest of stakeholder in PHBM program identifies that the key actors in PHBM Programs are Perum Perhutani as the program initiator, Coffee Farmers as the implementator, Middleman R as the culture broker, Farmer Group Leaders, LMDH P as the current chairman of community institution, and LMDH A as the former of chairman of community institution with different roles. Meanwhile, LMDH is identified as context setter since it has low interest with high influence. Based on SNA that LMDH resulted as the actor who has the highest degree of centrality, betweenness, closeness, and eigenvector, therefore, LMDH can be the main actor in resulting the success of communal resource management and equal participation. LMDH has many functions in the network, such as actors who have many ties to have influence because these actors share knowledge and information with many other actors, liaisons, and disseminators of information in the network or in other terms known as information brokers, as well as actors who are close to the other actor's network because they tend to have shorter lines of communication.

ACKNOWLEDGEMENT

REFERENCES

Akamani K, Hall TE. 2019. Scale and co-management outcomes: assessing the impact of collaborative forest management on community and household resilience in Ghana. *Heliyon*. 5(1): 1-29. doi: 10.1016/j.heliyon.2019.e01125.

Angst M, Widmer A, Fischer M, Ingold K. 2018. Connectors and coordinators in natural resource governance: Insights from swiss water supply. Ecology and Society. 23(2): 1-15. doi: 10.5751/ES-10030-230201.

Bahruzin, Hidayat A, Putri EIK. 2014. Analisis efektivitas kelembagaan pengelolaan hutan bersama masyarakat (PHBM) di kesatuan pemangkuan hutan (KPH) Bandung Utara Jawa Barat. *Jurnal Ekonomi Pertanian, Sumberdaya dan Lingkungan*. 1(1): 1-11.

Bartlett AG. 2018. Factors affecting the success of collaborative forestry research in Papua New Guinea. *Australian Forestry*. 81(2): 116-128. doi: 10.1080/00049158.2018.1462546.

Bartra VA. 2007. An institutional framework for a more efficient use of natural resources. *Minerals and Energy - Raw Materials Report*. 22(1-2): 48-61. doi: 10.1080/14041040701445841.

Bloomfield G, Meli P, Brancalion PHS, Terris E, Guariguata MR, Garen E. 2019. Strategic insights for capacity development on forest landscape restoration: Implications for addressing global commitments. *Tropical Conservation Science*. 12: 1-11. doi: 10.1177/1940082919887589.

Bodin Ö, Crona BI. 2009. The role of social networks in natural resource governance: What relational patterns make a difference?. *Global Environmental Change*. 19(3): 366-374. doi: 10.1016/j.gloenvcha.2009.05.002.

Boonzaaier CC. 2012. Towards a community-based integrated institutional framework for ecotourism management: The case of the masebe nature reserve, Limpopo Province of South Africa. *Journal of Anthropology*. 2012: 1-11. doi: 10.1155/2012/530643.

Borgatti SP. 2005. Centrality and network flow. *Social Networks*. 27(1): 55-71. doi: 10.1016/j.socnet.2004.11.008.

Carter J, Gronow J. 2005. *Recent Experience in Collaborative Forest Management: A Review Paper*. Bogor (ID): CIFOR Occasional Paper.

Chen H, Zhu T, Krott M, Maddox D. 2013. Community forestry management and livelihood development in northwest China: Integration of governance, project design, and community participation. *Regional Environmental Change*. 13(1): 67-75. doi: 10.1007/s10113-012-0316-3.

Desmiwati, Christian FY. 2019. Levelling up the collaborative forest management in Indonesia: A review. *IOP Conference Series: Earth and Environmental Science*. 285: 1-8.

Gunawan B, Takeuchi K, Tsunekawa A, Abdoellah OS. 2004. Community dependency on forest resources in West Java, Indonesia. *Journal of Sustainable Forestry*. 18(4): 29-46. doi: 10.1300/j091v18n04_02.

Hanneman RA, Riddle M. 2015. A brief introduction to analyzing social network data. In: Scott J, Carrington PJ, editors. *The SAGE Handbook of Social Network Analysis*. London (GB): SAGE Publication Ltd.

Hudiyani I, Purnaningsih N, Asngari PS. 2017. An analysis of stakeholders in agroforestry community forest management in Wonogiri Regency, Central Java Province, Republic of Indonesia. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*. 32(3): 164-185.

Kimengsi JN, Bhusal P, Aryal A, Fernandez MVBC, Owusu R, Chaudhary A, Nielsen W. 2019. What (De)motivates forest users' participation in co-management? Evidence from Nepal. *Forests*. 10(512): 1-15. doi: 10.3390/f10060512.

Martins H, Borges JG. 2007. Addressing collaborative planning methods and tools in forest management. *Forest Ecology and Management*. 248(1-2): 107-118. doi: 10.1016/j.foreco.2007.02.039.

Ostrom E. 1999. *Self-Governance and Forest Resources*. Bogor (ID): CIFOR Occasional Paper.

Ostrom E. 2010. Beyond markets and states: Polycentric governance of complex economic Systems. *Transnational Corporations Review*. 2(2): 1-12. doi: 10.1080/19186444.2010.11658229.

Poudyal BH, Maraseni T, Cockfield G. 2020. Scientific forest management practice in Nepal: Critical reflections from stakeholders' perspectives. *Forests*. 11(1): 1-20. doi: 10.3390/f11010027.

Pradana RY, Wiyono. 2017. Analisis kelembagaan dalam program pengelolaan hutan bersama masyarakat (PHBM) di Desa Sambak Kabupaten Magelang [undergraduate thesis]. Yogyakarta (ID): Universitas Gadjah Mada.

Prasetia DA, Hardjanto, Hero Y. 2017. Stakeholder analysis on community forest management partnership and independent. *Media Konservasi*. 22(3): 293-303. doi: https://doi.org/10.29244/medkon.22.3.293-303.

Pujo, Sofhani TF, Gunawan B, Syamsudin TS. 2018. Community capacity building in social forestry development: A review. *Journal of Regional and City Planning*. 29(2): 113-126. doi: 10.5614/jrcp.2018.29.2.3.

Purwita T, Harianto, Sinaga BM, Kartodihardjo H. 2009. Household economic analysis: case study of community based forest management at Pangalengan Bandung Selatan. *Jurnal Penelitian Sosial dan Ekonomi Kehutanan*. 6(1): 53-68.

Reed MS, Graves A, Dandy N, Posthumus H, Hubacek K, Morris J, Prell C, Quinn CH, Stringer LC. 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*. 90(5): 1933-1949. doi: 10.1016/j.jenvman.2009.01.001.

Ribot JC, Peluso NL. 2003. A theory of access. *Rural Sociology*. 68(2): 153-181. doi: 10.1111/j.1549-0831.2003.tb00133.x.

Ruiz-Mallén I, Schunko C, Corbera E, Rös M, Reyes-García V. 2015. Meanings, drivers, and motivations for community-based conservation in Latin America. *Ecology and Society*. 20(3): 1-15. doi: 10.5751/ES-07733-200333.

Santika T, Meijaard E, Budiharta S, Law EA, Kusworo A, Hutabarat JA, Indrawan TP, Struebig M, Raharjo S, Huda I, *et al.* 2017. Community forest management in Indonesia: Avoided deforestation in the context of anthropogenic and climate complexities. *Global Environmental Change*. 46: 60-71. doi: 10.1016/j.gloenvcha.2017.08.002.

Sunderlin WD, Dewi S, Puntodewo A. 2007. *Poverty and Forests: Multi-Country Analysis of Spatial Association and Proposed Policy Solutions*. Bogor (ID): CIFOR Occasional Paper.

Syahputra OH, Nugroho B, Kartodihardjo H, Santoso N. 2019. Networking Powers of Actors in Community-Based Mangrove Management in Aceh Province. *JPSL*. 9(2): 380-393. doi: http://dx.doi.org/10.29244/jpsl.9.2.380-393.

Talley JL, Schneider J, Lindquist E. 2016. A simplified approach to stakeholder engagement in natural resource management: The five-feature framework. *Ecology and Society*. 21(4): 1-10. doi: 10.5751/ES-08830-210438.

Thondhlana G, Shackleton S, Blignaut J. 2015. Local institutions, actors, and natural resource governance in Kgalagadi Transfrontier Park and surrounds, South Africa. *Land Use Policy*. 47: 121-129. doi: 10.1016/j.landusepol.2015.03.013.

Tridakusumah AC, Supyandi D, Arari M, Kurnia G, Sukayat Y. 2021. The analysis of farmers' access mechanism and social network in community-based forest management programs in Garut Regency, West Java Province Indonesia. *E3S Web of Conferences*. 316: 1-9. doi: 10.1051/e3sconf/202131604007.