Journal of Natural Resources and Environmental Management
12(3): 485-500. http://dx.doi.org/10.29244/jpsl.12.3.485-500
E-ISSN: 2460-5824
http://journal.ipb.ac.id/index.php/jpsl

Sandalwood (*Santalum album* Linn) development strategy to improve the economics society in Timor-Leste: community views

Adelino Rojario[a], Omo Rusdiana[b], Iin Ichwandi[c]

[a] Master Student of Tropical Silviculture, Faculty of Forestry and Environment, IPB University, IPB Dramaga Campus, 16680, Indonesia [+62 81319605759]
[b] Lecturer of Tropical Silviculture, Faculty of Forestry and Environment, IPB University, IPB Dramaga Campus, 16680, Indonesia [+62 8129303348]
[c] Lecturer of Forest Management, Faculty of Forestry and Environment, IPB University, IPB Dramaga Campus, 16680, Indonesia [+62 81287639777]

Article Info:
Received: 21 - 05 - 2022
Accepted: 01 - 07 - 2022

Keywords:
Community perception, economic society, sandalwood, strategy development

Corresponding Author:
Omo Rusdiana
Lecturer of Tropical Silviculture, Faculty of Forestry and Environment, IPB University;
Tel. +628129303348
Email: orusdiana@apps.ipb.ac.id

Abstract. *Sandalwood (*Santalum album *Linn) is an endemic plant of Timor-Leste that has high economic value and needs to be developed to achieve prosper society and the country. This research aims to discover people's perceptions of sandalwood development in Timor-Leste. Data is obtained using questionnaires, surveys, observations, and documentation. The population from this study is 84 respondents consisting of 15% of the family head in both villages Maudemo and Aidabaleten based on the agricultural census 2019. Data was collected using a 15% sample. Data are analyzed descriptively with statistical percentage techniques with every possibility of the answers obtained from sharing the frequency received by the number of samples multiplied by 100%. The results showed that 100% of the community knew sandalwood well and its economic value. Many people have not planted and adopted government programs to grow sandalwood, community 8% have land above 1 hectare. The community 100% and 98% in both villages know that the government has conducted a planting program. The public has not adopted government programs, with respondents 88% in the village of Maudemo and 36% in the village of Aidabaleten. The community does not have business capital, so it needs seedling subsidies with respondents 100% and 69%, incentives 100% and 95%, and bank credit 100% and 88% in both villages. Massive sandalwood development requires government policies to socialize programs, laws, and regulations on sandalwood development. Therefore, a policy from the government is required to provide seedlings, incentives, and bank credit to the community.*

How to cite (CSE Style 8th Edition):
Rojario A, Rusdiana O, Ichwandi I. 2022. Sandalwood (*Santalum album* Linn) development strategy to improve the economics society in Timor-Leste: community views. JPSL **12**(3): 485-500. http://dx.doi.org/10.29244/jpsl.12.3.485-500.

INTRODUCTION

Sandalwood (*Santalum album* Lin) is an endemic tree species in Timor-Leste (Thomson 2020), with very high economic value (Li *et al.* 2021) and high demand on global markets (Kucharska *et al.* 2021). Therefore, sourcing sandalwood products in sustainable international markets will be provided by Australia, Asia, and Pacific countries until 2040 (Thomson 2020). In addition to having a high economic value, sandalwood is also a native species to Timor-Leste that grows in all areas of Timor-Leste. Therefore, sandalwood is one of the

world's proudest high-value species of plants (Niu *et al.* 2021). Furthermore, sandalwood trees are very economically valuable because of their fragrance (Fatima *et al.* 2019). Its distinctive aroma makes sandalwood used as a high-priced sandalwood perfume ingredient because it contains sotalol (see also Burdock and Carabin 2008; Diaz-Chavez *et al.* 2013; Kucharska *et al.* 2021; Niu *et al.* 2021).

Sandalwood is expected to improve the economics of society and country of Timor-Leste. Currently, the country depends on oil revenues which is 89%, so choosing sandalwood is one of the mainstays of the national economic (Gov. Resolution, no 11/2017). Therefore, it is necessary to the government and parties seriously to develop sandalwood. The seriousness of developing sandalwood into an alternative to the country's economy creates impactful innovation requiring serious government support (Wahyuningtyas *et al.* 2022). The government is the actor who has the authority to make policies and strategy need to involve the community in the development of sandalwood. Creating authoritarian policies will reduce public participation (Schaaf *et al.* 2020). Sandalwood development requires a strategy. Sandalwood's development strategy is to make policies, laws, and regulations that become the driving force of a program. In addition to policies, laws, and regulations, standards and operations for sandalwood development are also provided.

The Timor-Leste government started to develop sandalwood on 6 hectares in the village of Maudemo Covalima in 2004, and 100 hectares in the village of Aidabaleten Bobonaro in 2017. Sandalwood development needs to involve parties such as the government, academics, entrepreneurs/Non-governmental Organization (NGOs), and the community. The implementation of government development programs is not carried out alone but needs to involve parties such as entrepreneurs, NGOs, and the community (Halbe *et al.* 2020). The parties play an essential role in the development of Sandalwood. As a sandalwood development business actor, the community needs to be asked for his views on sandalwood development. One of the involvements of the parties is their response to the prospects of sandalwood development. Public perception is needed by managers, in this case, the government as a policymaker, to include the community in the management and development of sandalwood. People understand and have the intention to develop sandalwood will be easy for them the development of sandalwood on their land. Implementation and assessment of the performance of a program or business require perception so that the policies taken are efficient and prosper the people involved in the program (Abukari and Mwalyosi 2020).

Perception is a way of expressing circumstances or facts. Perception is also one of the instruments for assessing performance or a program. Perception is one of the important instruments to assess the performance of project implementation and development so that better policies are taken to answer various problems so that the development process runs well following the intended objectives (Abukari and Mwalyosi 2020). Good public perception of a program becomes one of the indicators of engagement and level of adaptability to the program. Good perception of sandalwood development programs spurs people to participate. This research aims to illustrate people's perception of sandalwood development as a strategy for developing sandalwood on a large scale to improve the economy of people and countries that are currently dependent on oil and gas. Perception is one of the tools for policy making. This research is important because the development of sandalwood, which is of high economic value at a high price, brings in the country's foreign exchange and improves the economy of the community. This research will provide input and recommendations to the government and the parties to develop sandalwood better and massively in the present and future.

METHOD

Location and Time

The study area was located in the Village of Maudemo Municipality of Covalima and Village of Aidabaleten, Municipality of Bobonaro Timor-Leste. The selected research site is the location of sandalwood plants planted by the government in 2004 and 2017. The locations shown in Figure 1.

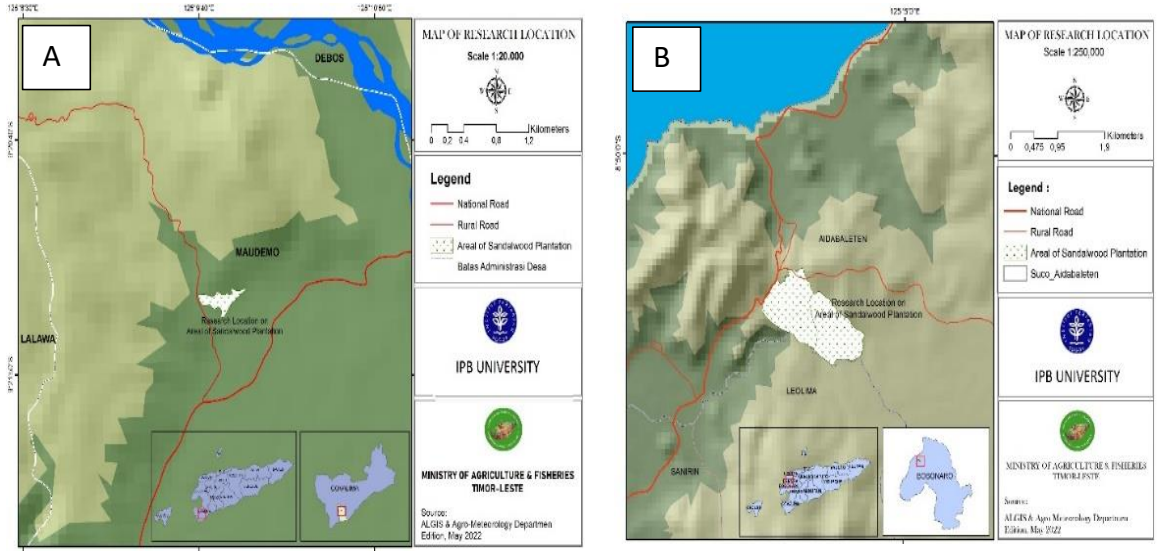

Figure 1 Location of study; (A) Maudemo Village and (B) Aidabaleten Village Field data collection for research was carried out in October-December 2021

Data Collection Method

The method used in the study is a quantitative method by conducting a survey of the community living around the sandalwood planting site. About 84 family heads (FH) were used as the respondents. The respondents lived in Maudemo Village, Tilomar Sub-district, Covalima Municipality, and Aidabaleten Village, sub, district of Atabae, Bobonaro Municipality. The respondents were asked questions through questionnaires. As for the following questions: knowledge of sandalwood (Q1), knowledge of its market value (Q2), growing sandalwood in the garden (Q3), community collect and sold sandalwood (Q4), community have land to grow sandalwood (Q5), community manage the land with agroforestry system (Q6), community aware the sandalwood planting program by the government (Q7), peoples come and work on-site of sandalwood planting (Q8), community adopts the sandalwood planting by the government (Q9), the community got seedling subsidies by the government (Q10), government socializes the sandalwood cultivation program (Q11), law and regulations known by the community (Q12), awareness laws and regulations by government (Q13), the community got any subsidies from the government (Q14), the community needed incentives and bank credit (Q15), and conditions of natural sandalwood (Q16). Data was collected using a 15% sample based on Slovin (1960) with the formula:

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

Where: n = number of respondents; N = Number of family head; e2 = Precision value of 15%

Data Analysis Method

The results of the data are analyzed descriptively with statistical percentage techniques with every possibility of the answers obtained from sharing the frequency received by the number of samples and multiplied by 100% using the formula:

$$P = f/n \times 100\%$$

Where: P = presentase; f = the frequency of each selected answer; n = number of family head; 100% = constant

RESULT AND DISCUSSION

Characteristics of Respondents

The number of respondents in this study was 84 Heads of Families (HF) residents consisting of 41 respondents from Maudemo village, Subdistrict, Tilomar, Covalima Municipality, and 43 respondents from Aidabaleten Village, Atabae District, Bobonaro Municipality. Respondents were taken based on Timor-Leste's agricultural census in 2019. The data collected includes gender, age, occupation, level of education, and the number of families covered. The characteristic of respondents can be seen in the following Table 1.

Table 1 Characteristics of Respondents

Characteristics of Respondents Questions	Type of Questions	Total of Respondents Maudemo/ Covalima	Percentage (%) Maudemo/ Covalima	Total of Respondents Aidabaleten Bobonaro	Percentage (%) Aidabaleten Bobonaro
Gender	Man	38	93	40	93
	Women	3	7	3	7
Age	17-25 years	3	7	0	0
	26-35 years	15	37	7	16
	36-45 years	11	27	8	19
	46-55 years	9	22	13	30
	56-65 years	2	5	13	30
	>66 years	1	2	2	5
Level of Education	Illiterate	0	0	13	30
	Elementary	3	7	12	28
	Junior high School	12	29	6	14
	Senior High School	18	44	12	28
	Bachelor	8	20	0	0
Number of Respondents' Families	< 3 persons	11	27	3	7
	3-6 Persons	23	56	22	51
	> 6 Persons	7	17	18	42
Profession	Farmers	33	81	39	91
	Civil Servant	2	5	2	5
	Private Sector	5	12	1	2
	Others	1	2	1	2
Total of Respondent		41	100	43	100

From the table, it can be seen that the male gender dominated the gender of the respondents in this study. Both Maudemo Village and Aidabaleten Village are 93%, while female respondents are only 7%. Characteristics of respondents based on age on the table identified that for Maudemo villages, the higher age of 26–35 was 37%, followed by the age of 36–45 with 27%, while the lowest was the age of >60 with 2%. While in Aidabaleten Village aged 46–55 and 56–65 the highest is 33% and the lowest at the age of >66 years with 5%. When viewed from the respondent's education level in Maudemo village, the Senior high school is 7%. While in Aidabaleten village, the respondents with the largest are illiteracy with 30%, followed by the level of elementary and high school education, which is 28%. In comparison, the distribution of the smallest respondents is 14%, namely the first school (SMP). For characteristics based on work in Maudemo village, the most respondents were jobs as farmers, which was 81%, followed by entrepreneurs with 12% and the other lowest at 2%. While in Aidabaleten village, respondents who work with farmers are higher with 91%, and the

lowest is the respondent entrepreneurs with 2%. When viewed from the number of dependents in the family in Maudemo village, the number of family dependents is dominated by 3–6 people, which is 56%, while the number of family dependents in Aidabaleten village is highest with family support of 3–6 people with 51%.

The characteristics of respondents in the study consisted of gender, age, education level, occupation, and number of dependents. The results presented in Table 1 show that men with 93% of respondents, dominate the average respondent in this study. In comparison, women only 7% show that the community is mostly men who do agriculture and land processing. There needs to be gender equality, which involves more women's communities in terms of sandalwood development in Maudemo and Aidabaleten villages. The lack of female involvement is also due to a patrilineal culture that prioritizes men as the head of the family and responsible for the welfare of the family.

The characteristics of respondents based on age on the table identified that for Maudemo Village, the highest age of respondents was between 26–35 years old with 37%, while in Aidabaleten Village, the age of respondents was 46–55 years and 56–65 years old the highest was 33%, this shows that there is a difference in the age of the farming community in the two villages. In the Village of Maudemo, which is produced with knowledge of sandalwood and its economic value is spelt in subsidized seeds and incentives, the community will be productive in developing sandalwood in their gardens. For characteristics based on work in Maudemo Village, 81% of respondents worked as farmers as well as in Aidabaleten Village, 91% of respondents were farmers. There is no alternative job available in Maudemo and Aidabaleten Village. The farmer's profession is a forced-choice because there is no other job.

Thus farmers in Maudemo and Aidabaleten Villages are not productive farmers but subsistence farmers where the products are only for daily consumption. From the level of education in Maudemo Village, 44% of respondents are in High School, while in Aidabaleten Village, the illiterate population still dominates. If judging from the number of dependents in the family in Maudemo Village, the number of family dependents is dominated by 3–6 people, which is 56%, while the number of family dependents in Aidabaleten Village is highest with family dependents of 3–6 people with 51%. The development of sandalwood needs to involve the parties, namely the government, private sector, academics and community. The government is a policymaker to provide the regulators. Private sectors are financiers and provide capital and employment for the community around the sandalwood development area. Academics have a role as innovators through a reset, and the resulting technology can contribute to the development of sandalwood. At the same time, as an important partner in the development of sandalwood, the community was expected to grow sandalwood on its own land and labor in the development of sandalwood in Timor-Leste.

Public Knowledge of Sandalwood and its Economic Value in Local and International Markets

The importance of community knowledge about sandalwood and its commercial value is needed to develop sandalwood. Data on public knowledge of sandalwood and its economic value in national and international markets is stated in questions Q1 and Q2, presented in Figure 2. Figure 2 illustrates that the public knows sandalwood as an endemic plant of Timor-Leste which is 100% in both villages. While public knowledge about the economic value of Sandalwood in the national and international markets, namely in Maudemo village by 96% and in Aidabaleten village by 86%. This has a positive impact on the prospects for sandalwood development in Timor-Leste.

Sandalwood as a native plant of Timor-Leste that has high economic value in the local and global market. Sandalwood needs to be developed (see also Allcott and Keniston 2018; Ouko *et al.* 2018). Sandalwood development needs to involve the parties one of the parties involved in the community. Community is very important because they have a good knowledge of sandalwood. Every people of Timor-Leste knows about the original sandalwood trees, and it's important for the history of the nation (Burridge 2022), Figure 2 indicates the people in both villages have a good knowledge of sandalwood. In addition, people also know the high value of the economy and high prices in the local and global markets. The global sandalwood oil market will

reach USD 97 million, approximately 1.2 trillion in 2020 (Thomson 2020). Therefore, people's knowledge of sandalwood and its economic value becomes a strength and opportunity for the community to develop sandalwood. This shows that people are very familiar with sandalwood and its economic value. The aromatic essential oils produced from sandalwood have a great commercial value as well. (Zhang *et al.* 2020).

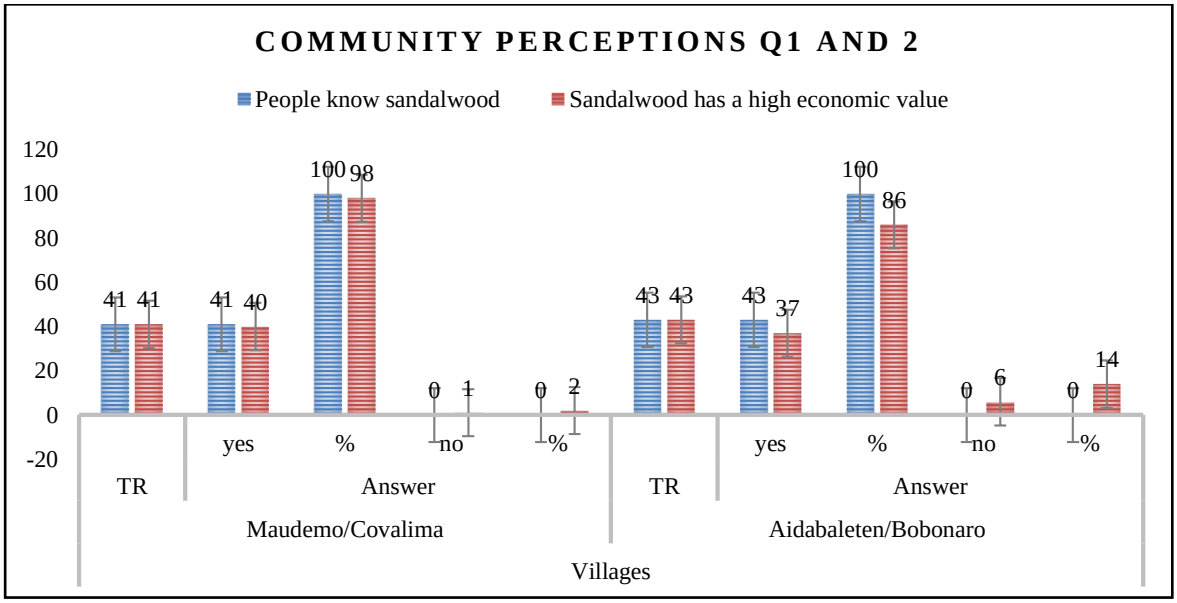

Figure 2 Public knowledge of sandalwood and its economic value in local and international markets (TR = Total Respondent)

Implementation and Resource Aspects

Aspects of sandalwood development and its implementation require resources. Therefore, the resources owned by the community and their implementation are very important to know. Aspects of resources and the implementation of sandalwood are stated in questions Q3, Q4, Q5, and Q6 can be seen in Figure 3.

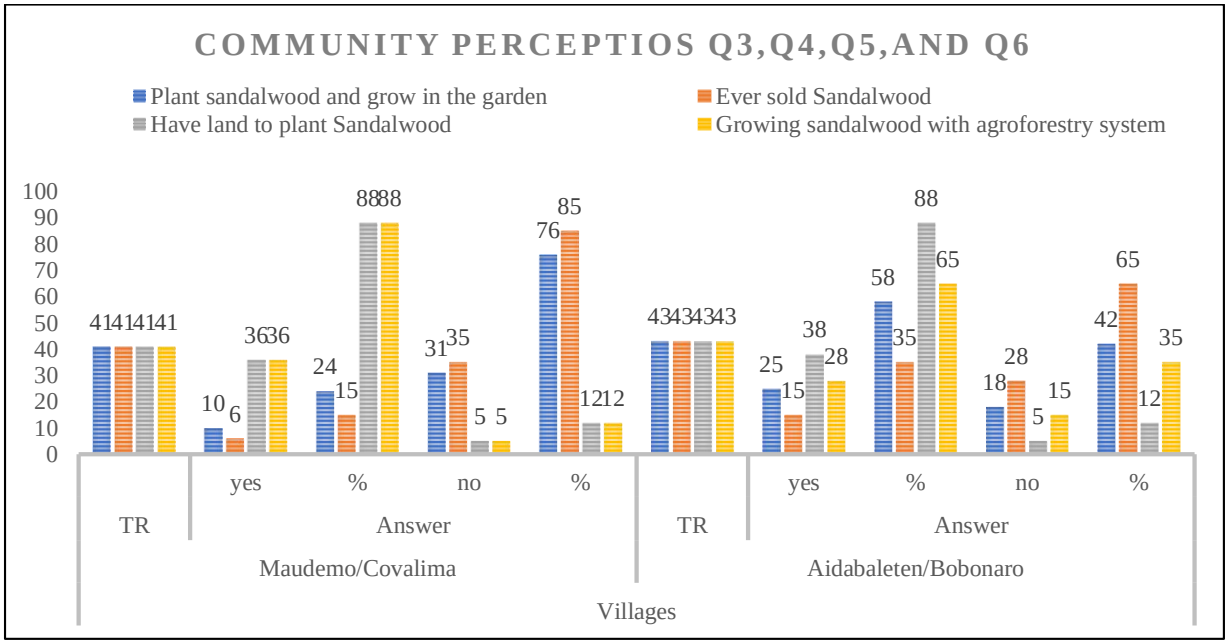

Figure 3 Implementations and resources aspect

Data analysis on Q3, Q4, Q5, and Q6, where the question of whether people grow sandalwood in their plants in Maudemo village which planted only 24% while those who did not plant 76%, while Aidabaleten Villages that plant sandalwood in their villages are 58% while those who do not plant 42%. The results of the data analysis for whether the community has ever harvested and sold sandalwood in Maudemo Village 15% have sold sandalwood while those who are not 85% never while in the village of Aidabaleten who once sold sandalwood 35% and who never sold 65%. For land ownership to plant sandalwood in Maudemo Village, 88% have land above 1 hektar, while in Aidabaleten Village, 88% of the community has land above 1 hectar. The community manages its gardens with an agroforestry system in Maudemo Village, 88%, while in Aidabaleten Village, 65%.

Sandalwood needs to be developed massively to improve the economy and society in the country. Sandalwood development requires the role of the community and the parties. People who know it is easier to do and follow the programs carried out by the government. Those who understand the existence of sandalwood and its economic value for them will spur the intention to plant sandalwood. If the public knows and is well aware of the importance of sandalwood for socio-economic life, then it makes it easier for people to develop it themselves.

The Community does not yet have an awareness of planting Sandalwood grow in their land. The number Q3 indicates it. Q4, Q5, and Q6, from communities in the Villages Maudemo (76%) and Village Aidabaleten (56%) are not growing sandalwood. Data shows that people in both villages have land above 1 hectare, with 88% of respondents, although the community has not planted sandalwood on their land. Therefore, the government must socialize the sandalwood planting program massively.

Communities in both villages also manage their land with agroforestry systems. This is because of 88% and 65%; thus, sandalwood is suitable for ordination with other types of crops. Furthermore, because of the nature of semi-parasitic sandalwood plants requiring a host to live, Sandalwood is very suitable for growing in agroforestry systems. Therefore, the available land area and agroforestry patterned planting system allow the community to develop sandalwood well. Farmers on the pacific islands grow sandalwood with an agroforestry system efficiently because the price of sandalwood is still commercially high (Thomson 2020). The community perception shows that agroforestry systems will have a positive impact on their livelihood when developing sandalwood.

Public Knowledge of Government Programs for Sandalwood Development and Their Participation

The government's sandalwood development programs will run well if the community participates. Community participation is maximum if the public is aware of the program. Knowledge and community participation in the development of sandalwood is stated in questions Q7, Q8, and Q9 can be seen in Figure 4.

The analysis results for Q7, Q8, and Q9 are as follows from the figure above. The results of Q7 showed that for general knowledge of the sandalwood development program in Maudemo village, the public 100% knew it. Similarly, the people of Aidabaleten Village, with 98% of the community, are aware of the sandalwood development program in their area. Whether the people who come to work on-site (Q8) in Maudemo Village, 59% participate in working at the sandalwood development site, while in Aidabaleten Village, only 35% work at the planting site. For the question (Q9) about whether the community adopts or exemplifies the program carried out by the Government in Maudemo Village, 22% adopt, while in Aidabaleten Village, 63% adopt.

Implementing the program in one area is very important to be known by the surrounding community. So that the public knows and follows the program held by the government, it needs socialization. One of the most important aspects of the continuity of program implementation is the participation and active participation of the community in the program implementation process as an instrument to build community and government cohesion so that they are responsible and have a sense of belonging to the programs carried out together (Irwani *et al.* 2022).

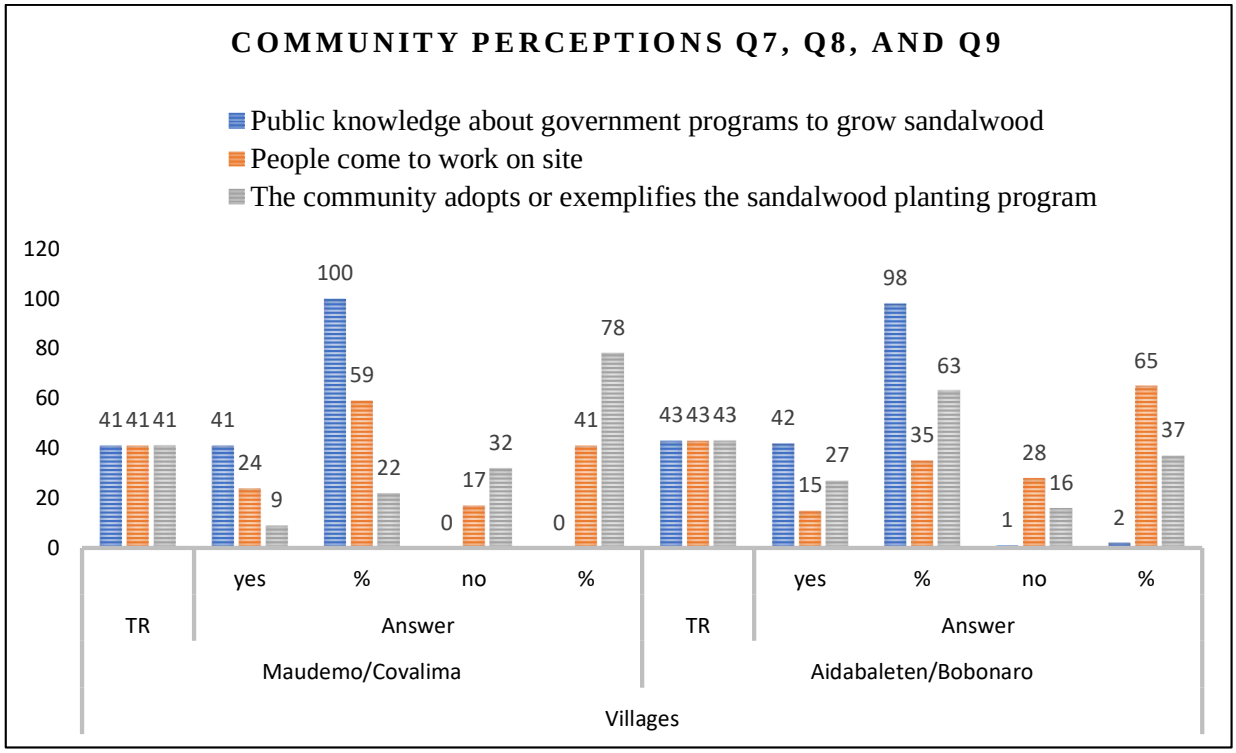

Figure 4 Public knowledge of government programs for sandalwood development and their participation

The socialization of the program will provide understanding and invite the public to participate. The importance of socializing the program to the parties is important so that its role in implementing the program runs well and efficiently (Thys *et al.* 2019). Furthermore, involving the community in implementation of the program is very important for adopting the program carried out. It can be seen in Figure 4, Q8 that the community has not adopted the sandalwood development program in Maudemo village, which only 22% can adopted, while in Aidabaleten Village, 63% have adopted sandalwood development programmed by the government and non-governmental organizations. Regarding the adoption of the community to the government program in Maudemo Village, only 22% are adopted and can grow sandalwood on their land, while in Aidabaleten Village, 63% plant sandalwood in their garden.

This is because the Aidabaleten Village community participates in the sandalwood planting program run by Instituição Portuguesa Apoio Desenvolvimento (IPAD) through a Rural Development Program (RDP) II project, which distributes sandalwood seeds for free so that people plant in their own land and gardens. In addition, Agriculture Integrated Community (AI-Com) is funded by Australian Center for International Agriculture Research (ACIAR), making a pilot involving several families growing sandalwood.In Maudemo Village, people are enthusiastic about growing sandalwood, but they can't make their nursery. However, the people of Maudemo Village and Aidabaleten Village both want seedlings to be planted in their own lands. Therefore, we need to engage the parties to expand sandalwood.

Long-term engagement with local communities is required to kickstart social learning processes that lead to better management practices (Ouko *et al.* 2018). One of the successes of sandalwood development is the participation of the parties. The parties will play their respective roles so that the expansion of sandalwood development goes well. The role of each party is very important, including the government as a policymaker and program, entrepreneurs as capital owners are expected to open jobs for the communities, academics as researchers, and innovation development. In addition, entrepreneurs can develop derivative products from sandalwood to answer local and international markets the academy of war to produce innovations and research results that can be used to develop sandalwood.

The Knowledge of the Community about Policy and Regulations

Knowledge of policies and regulations is needed by the community in the development of sandalwood. General knowledge of sandalwood development, policies, and laws and regulations is stated in questions Q11, Q12, and Q13 and shown in Figure 5.

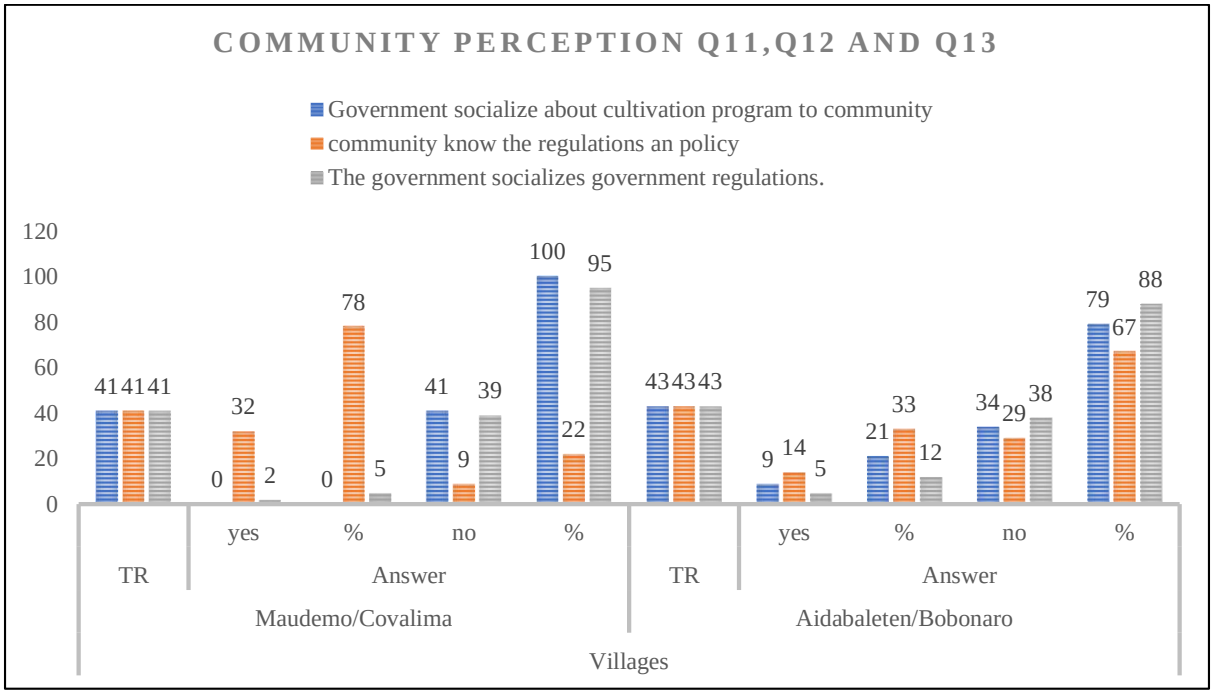

Figure 5 The knowledge of the community about policy and regulations

The analysis of the data shown in Figure 5 shows that the people in Maudemo Village 100% state that there is no socialization program from the Government on the development and cultivation of sandalwood. Even in the village of Aidabaleten, 79% of the people said they did not get socialization of sandalwood development programs from the government. Public knowledge of the rules and regulations of the quiet sandalwood 78% of the people in Maudemo Village, and 67% of the people of Aidabaleten Village are also unaware of the regulations on sandalwood development. This is due to the absence of socialization of programs, regulations, and legislation on sandalwood development carried out by the government.

Figure 3, Q4 shows communities with a land area of more than 1 hectare and above, indicating that opportunities to develop sandalwood on their own land are possible. It means policy to provide seedlings, incentives, and bank credit needed to support their programs. The large land and public knowledge of sandalwood became the basic capital for the development of sandalwood now and in the future. The need for strategies, government policies, and programs to develop sandalwood massively on government land and communities. As a policy manager, the government needs a strategic program to develop sandalwood.

Government resolution no. 11/2017 on sandalwood as a national economy allows the parties to develop sandalwood. The choice of January 13 as a national sandalwood planting day is an opportunity to develop sandalwood on a large scale. Government policies and programs must be on the side of the community by providing socialization of regulations and programs to the community. It is expected that the government will make special regulations to regulate the development of sandalwood, starting from the provision of seedlings, planting, maintenance, harvesting to production. The level of understanding of the community increases because it is caused by socialization (Fitria *et al.* 2021).

The massive development of sandalwood can improve the community's economy and the country's foreign exchange, given the high demand of the global market as an opportunity for Timor-Leste to develop sandalwood on a large scale so that it can respond to global demand. The prices of sandalwood in the global

market is very promising and it takes the courage of the government to invest in sandalwood. The economic value of sandalwood in the high international market is not due to the quality of the sotalol's content in Sandalwood. The quality of sandalwood (Santalum album) with high content of sotalol's following the International Standard Organization (ISO) is expected to still be the best in the next ten years in the global market. It is predicted that by 2026 the price of sandalwood oil in the international market will double to USD 197 Global Sandalwood Oil Markets Report 2020 (Thomson 2020).

Figures 5 Q11, Q12, and Q13 describe the role of the government in developing sandalwood related to the government regulations, socialization of programs, and government regulations. The results showed that 100% of the community stated that the government had never socialized about sandalwood planting programs to the community. While in Aidabaleten Village, 79% said the government did not socialize sandalwood planting programs to the community. Socialization must be done so that information can be conveyed widely to the community (Fitria *et al.* 2021). As for the socialization of government regulations regarding sandalwood, 95% of Maudemo village said never, and for Aidabaleten village, 88% said there was never socialization of government regulations on sandalwood.

One of the sandalwood development program strategies to run well needs public knowledge of government regulations and strategic programs regarding sandalwood development. For the public to know about the regulations and programs of sandalwood development strategies, the government needs to socialize about the laws and regulations and strategic programs for sandalwood development that have been programmed. Socialization of government regulations and programs that are carried out repeatedly can increase the level of high understanding of the socialized program or regulation (Fitria *et al.* 2021). Socialization of activities and training for farmers is an obligation for the government in forest and land management. Socialization must be done so that information can be conveyed widely to the community. Socialization of activities and training is an institutional way to motivate and transfer knowledge to farmers in the management of their forests and land.

Policies for Incentives and Subsidies from the Government

Figure 6 above Q10, Q14, and Q15 explains whether there is a government policy to subsidize sandalwood seeds for the people of Maudemo Village 93% state that there is not yet. In Aidabaleten Village, 69% of people say there is no subsidy for seedlings. Regarding the provision of incentives to the community in Maudemo Village, 100% stated that there was no incentive. Likewise, among the people of Aidabaleten Village, 88% admitted that they had never received incentives. For bank credit, community of Maudemo Village 100% want bank credit. Aidabaleten Village 95% of community are need of bank credit for sandalwood development.

Figure 6 shows that the people need seedling subsidies to plant because people do not yet have the expertise to make their seedlings. Sandalwood is a semi-parasitic plant that requires a host plant, and breeding requires special expertise. In addition, knowledge of host plants needs to be introduced to the community. With the area of land owned and the introduction of sandalwood both botanically and economically in the market, people, if they subsidized their seeds with a heart, will plant them in their plants and fields. Aniceto Batista Amaral, 26 years old, said that he has a desire to plant sandalwood, but there are no seeds.

Furthermore, it is said that if the government provides seedlings and is distributed for free to the community, then we are happy to plant in our garden "interview when taking data" need government policy to cooperate with banks both private banks and state banks give credit to the community as the capital of development business sandalwood. This is seen from the community's answer to the need for credit to develop 100% community sandalwood development business in Maudemo Village and Aidabaleten Village at 88%. So the picture shows that if the community is given vibrant community business capital to run a sandalwood development business. Sandalwood development is embraced by planting on customary land for commercial and economic purposes (Lee *et al.* 2019).

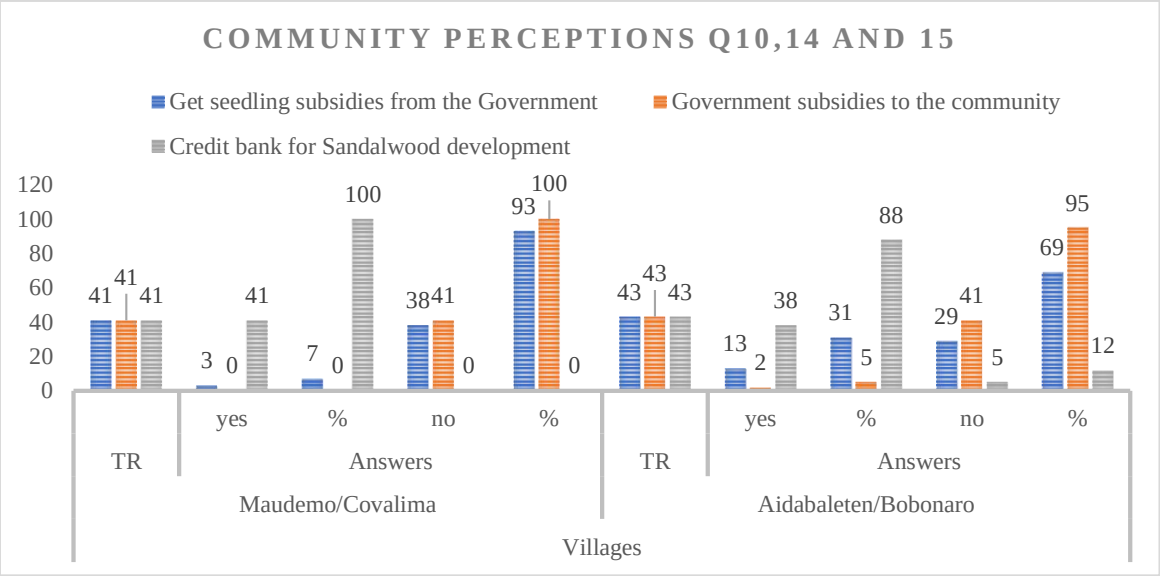

Figure 6 Subsidies seedling, incentive, and bank credit

The Maudemo and Aidabaleten Villages communities require 93% sandalwood seedlings subsidies, and 69% say there is no sandalwood seedling subsidy by the government. Umbelino Monis Cardoso suggested that if the government distributed sandalwood seedlings for free, we would grow them in our respective gardens. "The same thing Lourenco da Costa Amaral farmer felt said we want to adopt the government's sandalwood plants in our respective gardens. Still, there are no seedlings". Further Jose Angelino also noted that "if the government gives providing seedlings, they plant to replace oil and gas in the future". This is because one of the government's policies is to subsidize the community. Seedling subsidy program issued by the government for community empowerment (Aisyah and Puspitarini 2022).

The two villages' 100% and 95% need incentive assistance for sandalwood development. This shows that the government is obliged to provide incentive support for the community to develop sandalwood. Incentive support with, financial or non-financial, is a source of stimulants so that the community implements the programs well. (Sandi and Pandoyo 2020). Meanwhile, 100% and 88% of respondents need bank credit as capital to develop sandalwood, so government and banking policies are needed to provide it. Credit to the community as support to increase the will and capital of sandalwood development efforts. Improvements in the strategic economic development of the community, one of which is through a strategic credit program (Ashari 2009). One of the essential roles in improving and economic growth of a country is the banking sector (Mishfanny 2018). Therefore, communities need subsidies, seedlings, incentives, and bank credit to develop sandalwood on their land to contribute social economics of the country.

The Presence of Natural Sandalwood and its Causes

The natural presence of sandalwood in the forest and its causes can be expressed by question Q16. Response to the presence of natural sandalwood can be shown in Figure 7. For the existence of natural, and its causes, the figures above present that respondent in the Maudemo Village, 98% of respondents still find sandalwood in nature. In contrast, Aidabaleten Village states that it still finds sandalwood growing naturally in the forest, which is 98%. When asked more deeply whether sandalwood is found like large or small trees. Almost all respondents said the tree was small. Some respondents sometimes find large natural sandalwood trees, but the sandalwood tree is gone within 2-3 weeks of returning to the location. The results of this data show that the presence of sandalwood is naturally still many but small, although found a big tree but when you return to the place the tree was cut out, therefore, needs to be conserved. Illegal cutting on natural sandalwood still happened so need the government regulation to regulate the illegal cutting so far.

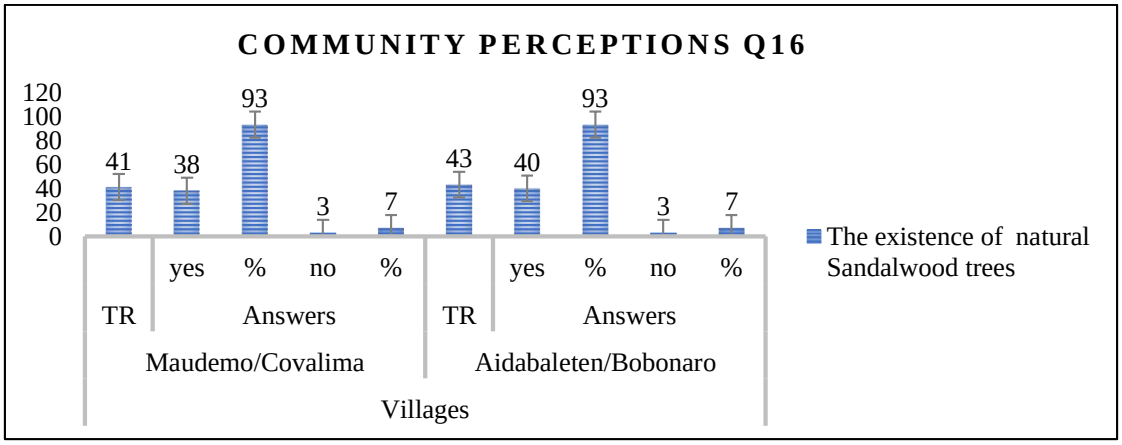

Figure 7 The presence of natural sandalwood trees

Based on the results of the inventory of sandalwood stands in 2003 by the Directorate of Forestry, Coffee and Industrial Plants have been naturally degraded. Sandalwood degradation was caused by overexploitation during Portuguese colonization and Indonesian occupation. Portuguese and Indonesian sandalwood was only snatched away during the colonial period but not planted. Degradation makes the International Union Conservation Nature Conservation (IUCN) categorize sandalwood as a near-extinct plant, so conservation policies are needed. The degradation of sandalwood in Timor-Leste is also described in Figure 7, where 98% of respondents from both Maudemo and Aidabaleten Villages stated that they found sandalwood growing naturally in the forest but still small.

The result shows that the presence of sandalwood in Timor-Leste should be in conservation, not intended for production. Respondents also said they found a large sandalwood tree in the forest but visited again when the sandalwood tree was gone. The loss of large natural sandalwood trees is also due to a lack of control on the part of the government. In addition, theft occurs because society is still dependent on nature. In addition, the community also knows the high economic value, but there is no policy to manage and produce sandalwood into products that are ready to be marketed. The policy that needs to be taken by the government is the empowerment of the community through socialization and training so that the community has an alternative source of income.

The government's ban on harvesting and selling sandalwood has also led to many illegals, according to the Secretary of State for Forestry and Nature Conservation number 27/SSFNC/X/2012 concerning the prohibition of harvesting, collecting, and buying and selling activities and conducting commercial transactions throughout Timor-Leste. The government needs to review the ban and provide business licenses to the parties, namely business licenses that include planting, harvesting, product manufacturing, and product marketing so that the community and business actors can develop sandalwood. To prevent illegal logging in the future, the government has the authority to set laws and regulations. The decline in natural sandalwood stands is caused by illegal logging and forest fires (Wawo *et al.* 2018).

The Regulation on Sandalwood Development in Timor-Leste

The government has issued various forms of regulations and laws on the existence and development of sandalwood in Timor-Leste. There is stated in various government regulations: United Nations Transition Administration in Timor-Leste (UNTAET) Regulation no. 17/2000 on the prohibition of harvesting and exporting timber forest products. This regulation aims to ban the community from harvesting and to export wood forest products, including sandalwood. Although this regulation is made, many people still violate this regulation. A violation of UNTAET regulation 17/2000 is the illegal logging of sandalwood, where the sandalwood products sold by the government to Korea and Japan in 2008 are illegal results collected by the forestry police and security services (Said Apolinario Freitas, Senior Forest Guard Staff).

The Secretary State of Forestry and Nature Conservation, decree law no:27/GSEFCN-MAP/XI/2012, that starting on November 6, 2012, all communities throughout Timor-Leste are prohibited from carrying out sandalwood-related activities consisting of harvesting, collecting, buying, and selling, carrying and conducting commercial transactions throughout Timor-Leste. The Secretary of state forestry and nature conservation decree was issued because of many illegal sandalwood activities. This decree refers to the decree of the Minister of Agriculture and Fisheries no: 16 /GM/MAF/2012 dated June 13 to solve the sandalwood problems. This Minister's regulation was issued because of the problem of illegal sandalwood collected by the Police and Forest Guard.

Timor-Leste needs specific regulations and institutions to develop sandalwood. Therefore, suggest that the government need to establish specific law and regulation for the development of sandalwood massively in the future. Basically, the regulations are made well-intentioned, but if the regulations are made poorly, they will cause huge losses. This is because the regulation that prohibit sandalwood buying and selling transactions actually cause illegal activities. An important tools to achieve a good public goal is the creation of regulations, but if the regulations are made poorly, it brings harm rather than good (Beales *et al.* 2017).

Implication Strategy for Sandalwood Development

Strategy is an important part of developing sandalwood massively. Strategy of development sandalwood needs stakeholder involvement. There are four important actors in the development of sandalwood to improve the economy of the society and the state of Timor-Leste. The relation of each actor shows in Figure 8.

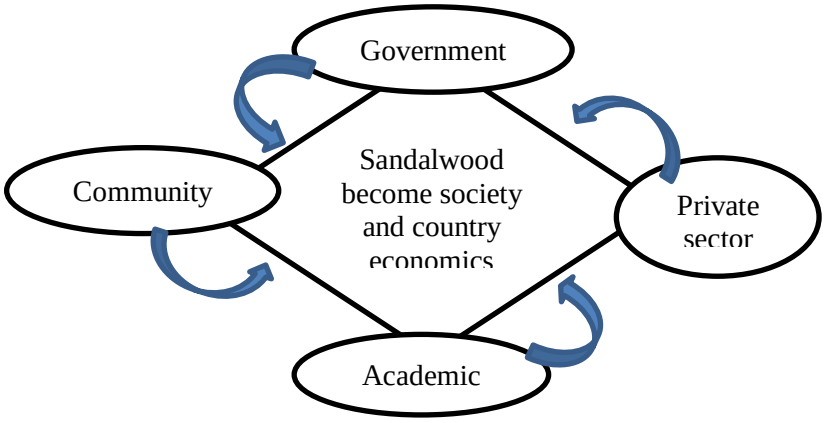

Figure 8 Important actor in sandalwood development

The picture above explains that there are 4 important actors in the development of sandalwood in Timor-Leste. The four actors are government, private sector, society, and academia. Each actor plays their own important role. The government as the main role holder that provides policies, regulations, and strategic plans to develop sandalwood.

Government is the first actor to play very important rule for sandalwood development to involve the parties. When the government makes a strategic policy, it needs to involve the parties (Elsye 2021). The government establishes regulations and policies regarding sandalwood management from seed, seedling planting, maintenance, harvesting, sales, and prices of sandalwood. The policy expected by the government is to provide funds for sandalwood development and subsidies for the community and entrepreneurs who want to develop sandalwood. government have a responsibility to develop community in the village to improve their economic. The process of mobilizing resources with the capacity building of local communities is community development aimed at improving the social and economic conditions of their groups through cooperation (Wahyuningtyas *et al.* 2022).

Private sector provide employment and market. Private sector can provide employment opportunities for the community so as to reduce unemployment and improve the community's economy through the development of sandalwood products. In the development of sandalwood, each actor needs a clear framework in the strategic plan that has been made. Strong partnerships between employers, governments, and other actors become difficult if no clarity of framework is created (Shah *et al.* 2019). The problem with sandalwood management in Timor-Leste is that the government has not involved the private sectors in sandalwood management. Currently the government is prohibiting entrepreneurs and the public from buying and selling sandalwood.

Regulations on this prohibition must be stopped in order to provide sandalwood business opportunities for entrepreneurs to manage and develop sandalwood more commercially. The decision implemented by the government currently does not support the development of sandalwood. Community involvement in sandalwood cultivation is important to improve their economy through the development sandalwood industry (Lee *et al.* 2019). The community is expected to become workers in sandalwood entrepreneurs and be able to grow sandalwood on their large land. In addition to planting sandalwood, the community also maintains the safety of sandalwood plants grown by the government and the private sector.

Academics act as researchers who produce innovations and new technologies in the field of sandalwood development. Important research conducted by academics includes seeds, seedlings, soil, and its environment, host plants, plant maintenance, agroforestry systems, and products produced from sandalwood. Innovative products and technologies can improve the development of sandalwood and products with high market value. Academics also be agent trainers for the private sector and community. Supporting and organizing farmers with new technology training and demonstrating the use of technology in the field from planting to harvesting with good communication between farmers so that they become actors of the technology itself (Balasubramanian *et al.* 2007). Academic also research in the area of germination and nursery management, seedbank preparation, and smallholder production to gained the quality and quantity of sandalwood seed and products.

The government needs to support other actors in the development of sandalwood. Some things that are very important and require government support as a benchmark are science and technology, management and development techniques, information, product development, finance, human resource development, and export supports (Wahyuningtyas *et al.* 2022). Community involvement in sandalwood development is very important. Although the community has land above 1 hectare, nevertheless, it has not planted sandalwood on its own land due to lack of technical knowledge, no seedlings to plant, lack of awareness of the sandalwood planting program from the government.

Community needs technical assistance from the government through education and training, mentoring, seedlings subsidies, incentives, bank credit to develop sandalwood. Involvement of parties important to develop sandalwood as part of Strategic Development Plan (SDP) of Timor-Leste 2011–2030 which is using sandalwood for reforestation will provide job opportunity to improve the economics of society. To achieve the successful implementation of SDP of Timor-Leste needs actively involvement and participation of Timorese society (Ferreira *et al.* 2019 in Lee *et al.* 2019).

CONCLUSION

The conclusions of the study include: (1) Community knows the sandalwood, and its economic value was 100%, indicating that sandalwood has promising prospects to be developed in Timor-Leste; (2) Around 88% of the community has more than 1 hectare of land, but has not planted sandalwood, so it needs government assistance to socialize the sandalwood planting program to the community; (3) The development of sandalwood in Timor-Leste requires knowledge, resources, laws and regulation, government subsidies, and the involvement of the parties to develop sandalwood for the economic improvement of the community and the state; (4) The existence of sandalwood that grows naturally is still found in the forest but is dominated by

seedlings and poles, although there are big trees but it's always stolen so that conservation is needed; (5) Law and regulations were made, and be a good opportunity to develop sandalwood in Timor-Leste; (6) There are 4 important actors in developing sandalwood in Timor-Leste government, private sectors, academic, and community.

ACKNOWLEDGMENT

We are grateful to the Government of Timor-Leste, the Ministry of Agriculture and Fisheries, GIZ, and IPB University for providing opportunities, cost, and facility support for our research. Thanks were also to the local leaders of Maudemo and Aidabaleten Villages and their communities, who have provided information for this research. We hope that this paper can be useful for the development of Sandalwood in Timor-Leste.

REFERENCES

[UNTAET] United Nations Transition Administration in Timor-Leste. 2000. Regulation no. 17/2000 on the Prohibition of Harvesting and Exporting Timber Forest Products. Dili: UNTAET.

Abukari H, Mwalyosi RB. 2020. Local communities' perceptions about the impact of protected areas on livelihoods and community development. *Global Ecology and Conservation*. 2(e00909):1–12. doi:doi.org/10.1016/j.gecco.2020.e00909.

Aisyah S, Puspitarini R. 2022. Peran pemerintah desa dalam meningkatkan usaha tani melalui subsidi bibit saat pandemi covid. *Jurnal Sosial Politik Integratif*. 2(1):55–61.

Allcott H, Keniston D. 2018. Dutch disease or agglomeration? The local economic effects of natural resource booms in modern America. *Review of Economic Studies*. 85(2):695–731. doi:doi.org/10.1093/restud/rdx042.

Ashari. 2009. Policy Optimization of Credit Program for Agricultural Sector in Indonesia. *Analis Kebijakan Pertanian.* 7(1):21–42.

Balasubramanian V, Sie M, Hijmans RJ, Otsuka K. 2007. Increasing rice production in sub-*Saharan* Africa: challenges and opportunities. *Advances in Agronomy*.94:55–133.

Beales H, Brito J, Davis Jr JK, DeMuth C, Devine D, Dudley S, Mannix B, McGinnis JO. 2017. *Government Regulation: The Good, The Bad, and The Ugly*. Washington DC (WA): Regulatory Transparency Project of the Federalist Society.

Burdock GA, Carabin IG. 2008. Safety assessment of sandalwood oil (*Santalum album* L.). *Food and Chemical Toxicology*. 46(2):421–432. doi:doi.org/10.1016/j.fct.2007.09.092.

Diaz-Chavez ML, Moniodis J, Madilao LL, Jancsik S, Keeling CI, Barbour EL, Ghisalbert EL, Plummer JA, Jones CG, Bohlmann J. 2013. Biosynthesis of sandalwood oil: *Santalum album* CYP76F cytochromes P450 produce santalols and bergamotol. *PLoS ONE*. 8(9):1–11. doi:doi.org/10.1371/journal.pone.0075053.

Elsye R. 2021. Kebijakan pemerintah bagi pelindungan dan keselamatan masyarakat dari penularan covid 19 di Indonesia. *Jurnal Kebijakan Pemerintahan*. 4(2):31–37.

Fatima T, Srivastava A, Somashekar PV, Hanur VS, Rao MS, Bisht SS. 2019. Assessment of morphological and genetic variability through genic microsatellite markers for essential oil in Sandalwood (*Santalum album* L.). *3 Biotech*. 9(7):1–16. doi:doi.org/10.1007/s13205-019-1758-9.

Fitria A, Lidyah R, Sumantri R. 2021. Sosialisasi peraturan pemerintah nomor 23 tahun 2018 terhadap kepatuhan wajib pajak pada UMKM di KPP Pratama Palembang Seberang Ulu. *Jurnal Intelektualita: Keislaman, Sosial Dan Sains*. 10(1):125–133. doi:doi.org/10.19109/intelektualita.v10i1.8499.

Halbe J, Holtz G, Ruutu S. 2020. Participatory modeling for transition governance: linking methods to process phases. *Environmental Innovation and Societal Transitions*. 35:60–76. doi:doi.org/10.1016/j.eist.2020.01.008.

Irwani S, Hariyadi, Kartodihadjo H. 2022. Analysis of policy implementation for peatland ecosystem degradation control on community land in the Ex-PLG area of Central Kalimantan Province. *JPSL*. 12(1):34–45. doi:doi.org/10.29244/jpsl.12.1.34-45.

Kucharska M, Frydrych B, Wesolowski W, Szymanska JA, Kilanowicz A. 2021. A comparison of the composition of selected commercial sandalwood oils with the international standard. *Molecules*. 26(8):1–12. doi:doi.org/10.3390/molecules26082249.

Lee DJ, Burridge AJ, Page T, Huth JR, Thompson N. 2019. Domestication of northern Sandalwood (*Santalum lanceolatum*, Santalaceae) for Indigenous forestry on the Cape York Peninsula. *Australian Forestry*. 82:14–22. doi:doi.org/10.1080/00049158.2018.1543567.

Li Y, Zhang X, Cheng Q, Teixeira da Silva JA, Fang L, Ma G. 2021. Elicitors modulate young sandalwood (*Santalum album* L.) growth, heartwood formation, and concrete oil synthesis. *Plants 2021*. 10:1–14. doi:doi.org/10.3390/ plants10020339.

Mishfanny M. 2018. Pengaruh kredit perbankan terhadap pertumbuhan ekonomi: studi komparatif negara yang menyerapkan dan tidak menyerapkan perbankan syariah [undergraduate thesis]. Bogor: Bogor Agricultural University.

Niu M, Xiong Y, Yan H, Zhang X, Li Y, da Silva JAT, Ma G. 2021. Cloning and expression analysis of mevalonate kinase and phosphomevalonate kinase genes associated with the MVA pathway in *Santalum album*. *Scientific Reports*. 11(1):1–13. doi:doi.org/10.1038/s41598-021-96511-4.

Niu M, Yan H, Xiong Y, Zhang Y, Zhang X, Li Y, da Silva JAT, Ma G. 2021. Cloning, characterization, and functional analysis of acetyl-CoA C-acetyltransferase and 3-hydroxy-3-methylglutaryl-CoA synthase genes in Santalum album. *Scientific Reports*. 11(1):1–13. doi:doi.org/10.1038/s41598-020-80268-3.

Ouko CA, Mulwa R, Kibugi R, Owuor MA, Zaehringer JG, Oguge NO. 2018. Community perceptions of ecosystem services and the management of Mt. Marsabit forest in Northern Kenya. *Environments–MDPI*. 5(11):1–14. doi:doi.org/10.3390/environments5110121.

Sandi ID, Pandoyo. 2020. Pengaruh insentif terhadap prestasi kerja karyawan pada PT. Aplikanusa Lintasarta Jakarta Selatan. *Jurnal Ilmu Administrasi Publik Dan Bisnis*. 1(2):32–38.

Schaaf M, Warthin C, Freedman L, Topp SM. 2020. The community health worker as service extender, cultural broker and social change agent: a critical interpretive synthesis of roles, intent and accountability. *BMJ Global Health*. 5(6):1–13. doi:doi.org/10.1136/bmjgh-2020-002296.

Shah, Kalim UN, Keron A, Saleem HS, Dinesh J, Doorgeshwaree. 2019. Plastics waste metabolism in a Petro-Island State: towards solving a "wicked problem" in trinidad and Tobago. *Sustainability*. 11(23):1–19. doi:doi.org/10.3390/su11236580.

Slovin E. 1960. *Slovin's Formula for Sampling Technique*. [Accessed 2022 May 1]. https://prudencexd.weebly.com/.

Thomson LAJ. 2020. Looking ahead–global sandalwood production and markets in 2040, and implications for Pacific Island producers. *Australian Forestry*. 83(4):245–254. doi:doi.org/10.1080/00049158.2020.1841441.

Thys S, Sahibi H, Gabriël S, Rahali T, Lefèvre P, Rhalem A, Marcotty T, Boelaert M, Dorny P. 2019. Community perception and knowledge of cystic echinococcosis in the High Atlas Mountains, Morocco. *BMC Public Health*. 19(1):1–15. doi:doi.org/10.1186/s12889-018-6372-y.

Wahyuningtyas R, Disastra G, Rismayani R. 2022. Toward cooperative competitiveness for community development in economic society 5.0. *Journal of Enterprising Communities*. doi:doi.org/10.1108/JEC-10-2021-0149.

Wawo AH, Abdulhadi R. 2018. Cendana (*Santalum album*) dan Keanekaragaman Inang Sekundernya Di Daerah Pesisir Kolbano, Nusa Tenggara Timur. *J. Biol. Indon*. III(3): 183–188.

Zhang X, Wu J, Liu J, Liu L. 2020. Coupling coordinative development model of the economy-society-environment system in some coastal cities of the east China Sea. *Polish Journal of Environmental Studies*. 30(1):943–954. doi:doi.org/10.15244/pjoes/122452.