Working Paper

Farmers' preferences for training topics and dissemination of agroforestry information in Indonesia

Riyandoko and Endri Martini

World Agroforestry Centre

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Working Paper 284

Correct citation:

Riyandoko and Martini E. 2018. *Farmers' preferences for training topics and dissemination of agroforestry information in Indonesia*. Working Paper 284. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. DOI: http://dx.doi.org/10.5716/WP18015.PDF

Titles in the Working Paper Series aim to disseminate interim results on agroforestry research and practices and stimulate feedback from the scientific community. Other publication series from the World Agroforestry Centre include: Agroforestry Perspectives, Technical Manuals and Occasional Papers.

Published by the World Agroforestry Centre
Southeast Asia Regional Program
JL. CIFOR, Situ Gede, Sindang Barang, Bogor 16680
PO Box 161, Bogor 16001, Indonesia

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ICRAF Southeast Asia website: http://www.worldagroforestry.org/region/southeast-asia/

Working paper no. 284

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About the authors

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Endri Martini is an agroforestry extension researcher with the World Agroforestry Centre (ICRAF) since 2011. She has been part of ICRAF since 2001, working on various agroforestry topics, such as biodiversity conservation and community-based natural resources management. She obtained her bachelor degree from the Silviculture Department of the Faculty of Forestry, Institut Pertanian Bogor, and her master degree in Natural Resource and Environmental Management from the University of Hawaii at Manoa, Hawaii, USA.

Abstract

Agroforestry has been implemented by farmers in Indonesia for a very long time. Various studies of agroforestry have been conducted either by local or foreign research institutions. One of these research projects, Development of Timber and Non-timber Forest Products' Production and Market Strategies for Improvement of Smallholders' Livelihoods in Indonesia, which was implemented by the World Agroforestry Centre (ICRAF) with funding from the Australian Centre for International Agricultural Research (ACIAR) (FST 2012-039), examined production and market strategies for timber and non-timber forest products, 2012 to 2017. The project produced research results that were then disseminated to farmers through training sessions, with the expectation that this would help improve the livelihoods of agroforestry farmers in various parts of Indonesia. Farmers will adopt the information or knowledge provided through training if they are interested in the topic. They tend to circulate such information to other farmers. This study was conducted to explore farmers' preferences for training or extension topics and information dissemination in Sumbawa District, West Nusa Tenggara Province; Gunung Kidul District, Special Region of Yogyakarta Province; and South Timor Tengah District, East Nusa Tenggara Province. Semi-structured interviews were carried out from March to June 2016 to collect information on farmers' preferences for training topics, acceptance of new agroforestry technologies, and expected training or extension services on agroforestry subjects. Evaluation of training and extension activities by participants was also conducted to acquire feedback for improvement of future agroforestry training or extension. Interviews were conducted with 110 respondents (farmers), 56 of whom were participants of training and extension activities carried out by the project team and the remaining 54 were non-participants of such training and extension activities; 29% of total respondents were female. Respondents were randomly chosen from among participants of agroforestry and forestry training or extension activities conducted in the previous year in each district and farmers who were not participants. Qualitative and quantitative data analyses were conducted. The results showed that farmers from the three districts preferred agroforestry extension focusing on silviculture, agroforestry farm management, and agroforestry product marketing. Farmers' preferences for extension topics varied depending on location and gender. In terms of information dissemination, extensionists played an important role as sources of information for farmers. Female farmers with less access to extensionists depended on family, farmers' associations and 'champion' or leading farmers as their sources of agroforestry information. In areas with limited road access and other infrastructure, such as Nusa Tenggara, sources of agroforestry information were limited compared to more developed areas, such as Gunung Kidul in the Special Region of Yogyakarta. Reliable sources of information, and technology with simple characteristics and appropriateness for specific areas, affected farmers' adoption of technology. For improvement purposes, delivery of agroforestry training or extension in the three districts should focus more on production and marketing of timber and non-timber forest products, taking into consideration participants' backgrounds, methods, materials, time and duration of the training or extension activity.

Keywords: Gunung Kidul, Sumbawa, South Timor Tengah, extension topics, information, farmer, agroforestry

Acknowledgements

This study was carried out with funding from the Australian Centre for International Agricultural Research to the Development of Timber and Non-timber Forest Products' Production and Market Strategies for Improvement of Smallholders' Livelihoods in Indonesia (FST/2012/039 [KANOPPI]).

The authors would like to express their gratitude to respondents from Sumbawa, Gunung Kidul and South Timor Tengah for their time and welcome to researchers for providing the necessary information for this study. The authors would also like to express their gratitude to KANOPPI partners at the study sites: Mr Junaidin of Batudulang Village, Sumbawa; Mr Suwardi of Pelat Village, Batudulang, Sumbawa; Extension Implementation Agency of Unter Iwes District, Sumbawa; Mr Sumardamto Purnomo; Gunung Kidul District Forestry and Plantation Department; Kelompok Kerja Hutan Rakyat Lestari of Gunung Kidul District; Extension and Food Security Agency of Gunung Kidul; and the Forestry Department and Extension and Food Security Agency of South Timor Tengah for their support in gathering data at each location. Our gratitude also goes to Mrs Subekti Rahayu and Mr Robert Finlayson for their assistance in editing this paper. We would also like to thank Pémad International Translations who provided service to translate this paper from Indonesian to English. Finally, we wish to express our gratitude to Mr Aulia Perdana, KANOPPI project leader, for his support and input at each stage of this study.

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1 Introduction

Agroforestry as a form of land management has been practised for many hundreds of years in Indonesia (Hairiah et al 2003). Modern agroforestry is a combination of forestry and agricultural techniques and systems developed to align agricultural intensification with forest conservation (de Foresta et al 2000). Put simply, agroforestry involves integration of trees, annual crops, and/or livestock on farms and in landscapes. In practice, agroforestry is classified into two: 1) simple agroforestry; and 2) complex agroforestry (Nair 1993). Simple agroforestry is a system involving intercropping one or more annual crop species between one species of tree. Complex agroforestry involves more than one tree species with annual crops and/or livestock on the same piece of land. The type of trees that can be integrated in agroforestry systems include both timber and non-timber species, such as fruit and exudates (for example, rubber latex).

Even though farmers have long been integrating various types of trees, optimum yields are often not achieved. This is often due to farmers' limited knowledge of tree cultivation (silviculture), measurement of timber volume, best practices in agroforestry management, marketing of timber and non-timber products, and policies on management of privately-owned tree products (Putro et al 2015). Weak extension services, owing to a limited number of government agricultural and forestry extensionists with a corresponding limited knowledge of agroforestry, has restricted farmers' ability to gain knowledge of agroforestry. Based on a baseline study conducted by KANOPPI, the percentages of farmers who were able to access agroforestry, or forestry, extension services were 41% in Gunung Kidul District, 30% in Sumbawa District, and 14% in South Timor Tengah District (Riyandoko et al 2016a).

To support the improvement of extension workers' capacity in Gunung Kidul, Sumbawa and South Timor Tengah Districts, the World Agroforestry Centre (ICRAF) and its partner provided training for voluntary extensionists and 'champion' or leading farmers in 2015. The topics presented during the four-day training were 1) introduction to timber and non-timber forest products; 2) policies regarding management of privately-owned tree products; 3) marketing of timber and non-timber forest products; 4) timber trees' cultivation; 5) timber and non-timber forest products' integrated into farm management (agroforestry); and 6) extension communication (Riyandoko et al 2016b). Training participants were expected to disseminate the information acquired to other farmers and voluntary extensionists. The participants' willingness to disseminate information was affected by their preferences for the training topics. If participants were interested in the topics, they were more likely to disseminate the information to others. This study aimed to 1) explore farmers' preferences for training topics; and 2) understand the process of agroforestry information dissemination acquired from training.

2 Methodology

2.1 Study sites

The study took place at research sites that had conducted training in the production and marketing of timber and non-timber forest products from agroforesty systems (Figure 1). Each site had different types of tree species and products as well as other distinctive characteristics, such as dominant ethnicity and daily language used by farmers (Table 1).

Figure 1. Map of KANOPPI project sites where training for voluntary extensionists and champion farmers were held in 2015

Source: Google maps 2016

Table 1. Characteristics of study sites in Gunung Kidul, Sumbawa and South Timor Tengah districts

District, province	Type of crop in agroforestry farm		Main ethnicity	Daily language of farmers
	Timber	Non-timber product		
Gunung Kidul, Special Region of Yogyakarta	Teak, mahogany, albizia, white albizia	White ginger, ginger, cassumunar ginger, turmeric	Javanese	Javanese, Indonesian
Sumbawa, West Nusa Tenggara	Teak	Candlenut, ginger, honey	Sumbawan	Indonesian, Sumbawan/ Samawan
South Timor Tengah	Gmelina, mahogany	Candlenut, ginger, bamboo	Molloan, Aloran	Molloan

2.2 Data collection

The study of farmers' preferences for training topics and information dissemination was conducted between March and June 2016, 6–12 months after the voluntary extensionists and champion farmers had completed their training. Data were collected in the three districts through semi-structured interviews with 110 respondents consisting of farmers and voluntary extensionists, 29% of whom were female. Respondents were classified into two groups: 1) training participant; and 2) non-participant. Respondents in Sumbawa and South Timor Tengah were farmers and champion farmers while respondents in Gunung Kidul were voluntary extensionists appointed by the local government through a decree of the Extension and Food Security Agency of Gunung Kidul District. The total number of respondents in Sumbawa District was 39, from Pelat and Batudulang villages; in South Timor Tengah District it was 41, from Netpala, Bosen and Ajobaki villages; in Gunung Kidul District it was 30, from Tepus, Girisubo, Semanu, Patuk, Nglipar, Ngawen, Paliyan, Semin, Panggang, Saptosari and Karangmojo sub-districts (Table 2). The total number of respondents who were training participants differed from the total number of training participants owing to some participants being no longer domiciled in at the sites or were unavailable for interview.

Table 2. Numbers of respondents in each district, disaggregated by gender

District	Participants		Non-participants		Total
	Male	Female	Male	Female	
Gunung Kidul	19	-	6	5	30
Sumbawa	11	8	15	5	39
South Timor Tengah	13	5	14	9	41

Information collected in this study were 1) sources of information for farmers on forestry and agroforestry; 2) farmers' acceptance of newly acquired knowledge or technology; 3) ranking of the most interesting training topics according to training participants; and 4) respondents' feedback for future training or extension to provide more benefit and impact. Some of the questions asked of participants were different than those asked of non-participants. For example, non-participants were not asked any questions regarding post-training follow up.

2.2 Data analysis

Collected data were then analyzed in both quantitative and qualitative manners. The Kruskal-Wallis Rank Sum statistical analysis was used to analyze farmers' preferences for training topics. Subsequently, a qualitative analysis of supporting factors affecting farmers' preferences was conducted. Social Network Analysis was used to analyse dissemination of information about agroforestry and forestry. The data analyses in this study used SYSTAT 11 software for Kruskal-Wallis and Node XL for social networks.

3 Results and discussion

3.1 Training for voluntary extensionists and champion farmers

Training for voluntary extensionists and champion farmers was conducted in 2015 in Sumbawa, South Timor Tengah and Gunung Kidul. The training was attended by 73 participants, 26% of whom were female farmers (Table 3). Participants attending the training in Sumbawa and South Timor Tengah were farmers and champion farmers recommended by farmers' groups, village administrators, and sub-district extension agencies. A champion farmer is one possessing more experience and knowledge than that of other farmers and who is prepared to be a voluntary extensionist under the local extension agency. In total, 49 farmers participated in the training, 32.7% of whom were female. Training participants in Gunung Kidul were 19 voluntary extensionists appointed under a decree of the head of the sub-district extension agency. Fifteen (15) government extensionists participated in the training, from forestry and agriculture agencies and forest management units at each site.

Table 3. Number of training participants on timber and non-timber forest products in Gunung Kidul, Sumbawa, and South Timor Tengah

District	Time (Duration)	Number of participants					
		Champion farmer		Voluntary extensionist		Government extensionist	
		M	F	M	F	M	F
Sumbawa	11–14 May 2015 (four days)	11	10	0	0	3	1
South Timor Tengah	20–22 October 2015 (three days)	12	6	0	0	4	2
Gunung Kidul	14–17 Dec 2015 (four days)	0	0	19	0	5	0

Note: M = male; F = female. Source: Training report data, 2015.

Topics studied in the training were 1) introduction to timber and non-timber forest products; 2) policies regarding private forest products' management; 3) timber and non-timber products' marketing; 4) timber trees' maintenance (silviculture); 5) timber and non-timber products' integrated into farm management (agroforestry); and 6) extension communication and information dissemination (the syllabus is provided in Appendix 1). According to the syllabus, all training topics were delivered in four days but the execution was based on initial agreements and learning contracts between participants and facilitators. In Sumbawa and Gunung Kidul, training was conducted in four days; in South Timor Tengah it took three days. The decision to hold three-day training, instead of four, in South Timor Tengah was based on mutual agreement between participants and the facilitator because one of the planned four days coincided with market day, which is when farmers usually engage in trading.

Training implementation at each site was successful, with strong support from governmental agencies as well as local non-governmental organization.

1) Training in Sumbawa was held in cooperation between KANOPPI and WWF Indonesia's Nusa Tenggara program, Institute of Non-Timber Forest Products' Research and Technology (Balai Penelitian dan Teknologi Hasil Hutan Bukan Kayu/BPTHHBK) Mataram, Universitas Mataram, and the Agriculture, Fishery, and Forestry Extension Implementation Agency (Badan Pelaksana Penyuluhan Pertanian, Perikanan dan Kehutanan/ BP4K) of Sumbawa District.
2) Training in South Timor Tengah was held in cooperation between KANOPPI and the Extension and Forestry agencies (Badan Penyuluhan and Dinas Kehutanan);
3) Training in Gunung Kidul was held in cooperation between KANOPPI, the Forestry and Plantation Agency of Gunung Kidul and the Extension Agency of Gunung Kidul District.

3.2 Farmers' preferences for agroforestry training topics

In this study, farmers' preferences for, or interest in, extension topics was observed by ranking the most interesting training material according to training participant. The Kruskal-Wallis analysis showed respondents' preference ranking of training material in all districts, in sequential order: 1) timber trees' maintenance (silviculture); 2) timber and non-timber forest products' integrated farm management; 3) timber and non-timber forest products' marketing; 4) management policies regarding private forest products; 5) extension communication; and 6) introduction to timber and non-timber forest products.

Respondents' preferences for training material were affected by their need for training and extension in basic farming practices. From those six topics, timber trees' maintenance (silviculture) and timber and non-timber forest products' integrated farm management (agroforestry) were practical topics on farming, meeting their basic need to cultivate their farms.

In addition to their need for practical and basic knowledge, advanced analysis showed farmers' preferences for training topics were also affected by regional factors and gender roles. Male farmers in the three districts tended to prefer similar training topics, that is, timber trees' maintenance (silviculture) followed by non-timber forest products' integrated farm management (agroforestry), and timber and non-timber forest products' marketing. Female farmers' preferences varied between locations.

Table 4. Farmer's preferences on topics for agroforestry training

Ranking*	Sumbawa		Gunung Kidul		South Timor Tengah	
	Male	Female	Male	Female	Male	Female
1	Silviculture	Timber and non-timber forest products' integrated farm management	Silviculture	-	Silviculture	Silviculture
2	Timber and non-timber forest products' integrated farm management	Silviculture	Timber and non-timber forest products' integrated farm management	-	Timber and non-timber forest products' integrated farm management	Marketing/policies on private forest products' administration
3	Marketing	Marketing	Marketing	-	Marketing	-
4	Introduction to timber and non-timber forest products	Policies on private forest products' administration	Policies on private forest products' administration	-	Policies on private forest products' administration	Timber and non-timber forest products' integrated farm management
5	Policies on private forest products' administration	Introduction to timber and non-timber forest products	Extension communication	-	Extension communication	Introduction to timber and non-timber forest products
6	Extension communication	Extension communication	Introduction to timber and non-timber forest products	-	Introduction to timber and non-timber forest products	Extension communication

Note: * the first rank is the most preferred. Source: Primary data.

Female participants tended to prefer training topics that suited their daily activities. Female farmers in South Timor Tengah who were less likely to work on the farm preferred topics on marketing or privately-owned forest products' management policy and timber trees' cultivation. Female farmers in Sumbawa who usually worked on the farm preferred topics on timber and non-timber forest products' integrated farm management (agroforestry), especially, cultivation of annual crops under stocked stands, such as ginger under teak. In Gunung Kidul, there were no female participants in the training because there were no female forestry extensionists or voluntary extensionists in the district. Furthermore, based on field observations and discussions with farmers, there was a perception that agroforestry and forestry were not the domain of female farmers.

3.3 Process of agroforestry information dissemination

3.3.1 Agroforestry and forestry information sources

The study showed farmers' sources of information on agroforestry and forestry were obtained from 1) outside the village; 2) inside the village; and 3) electronic and print media. Information sources from outside the village included extensionists, government agencies, NGOs and private agencies.

Information sources from inside the village included family, friends, neighbours, farmers' groups, and champion farmers. In this study, farmers' sources of information on agroforestry and forestry are shown in a social network diagram (Figure 2). This diagram contains symbols illustrating information sources and lines illustrating dissemination flows and connections among the information sources. Symbols used in the study are circle, triangle and square. The size of the symbol shows the role and influence of the information sources to farmers. The bigger the symbol, the greater the roles and influences.

The most important and influential sources of information on agroforestry and forestry for farmers in the three districts were sourced from outside their villages, that is, extensionists, district forestry agencies, NGOs and forestry projects. The most important and influential sources of information from inside their villages were family, farmers' groups and champion farmers.

From a gender perspective, there were differences in sources of information that served as a reference for each gender to obtain agroforestry and forestry information. The most influential sources of information for female farmers were family, farmers' groups and NGOs whereas the most influential sources of information for male farmers were extension workers, district forestry agencies and NGOs (Figure 2). Information sources for female farmers tended to come from inside the village whereas for male farmers they were from outside. This tendency was owing to male farmers being more likely to have opportunities to engage with outsiders than female farmers. For example, male farmers had a higher tendency to be assigned to attend training and extension events outside the village, for instance, at district, provincial and national levels. Female farmers had relatively fewer opportunities to attend training taking place outside the village. Thus, female farmers tended to depend on family, farmers' groups and champion farmers who attended the training. The tendency for female farmers to access information through electronic media was greater than male farmers since they tended to stay at home watching television.

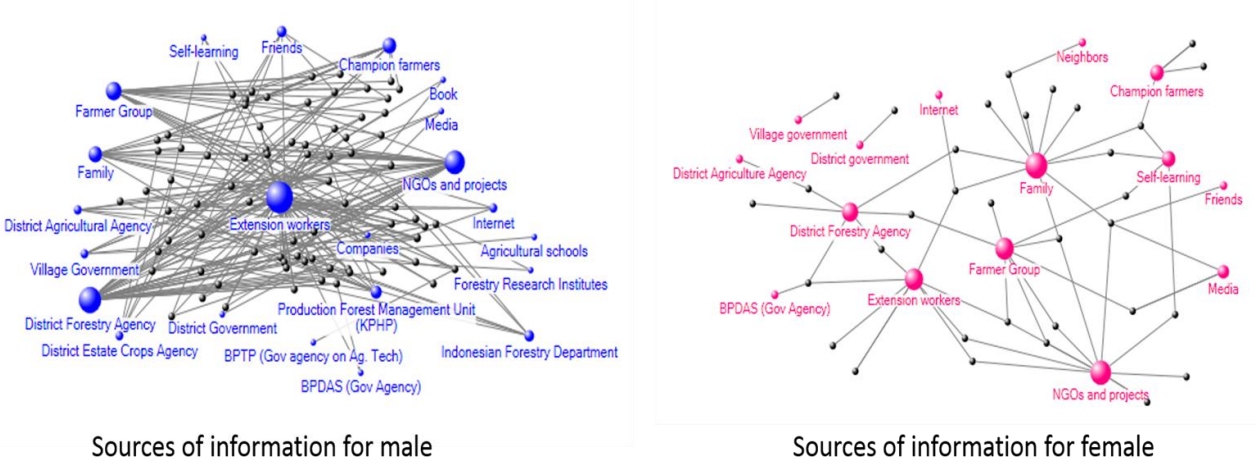

Figure 2. Networks of information sources in all studied districts, by gender

The differences in priorities of agroforestry and forestry sources of information were also found between districts (Figure 3). In Gunung Kidul, extension workers, district forestry agency and NGOs were the primary sources. In Sumbawa, champion farmers, NGOs, KPHP (Production Forest Management Unit), and extension workers were most frequently accessed by farmers. In South Timor Tengah, extension workers, farmers' groups and family were the primary sources. In South Timor Tengah, farmers' limited access to information from outside their villages led to dependency on information from inside villages, such as from farmers' groups and family. Both played important roles in the dissemination of agroforestry and forestry information. In Gunung Kidul, families were not considered as sources of information.

The number of sources of information in Gunung Kidul was higher than in Sumbawa and South Timor Tengah. It was also found that only in Gunung Kidul was the Ministry of Forestry a source. South Timor Tengah had the least number of sources of information because of the limited number of organizations focusing on agroforestry and forestry compared to Gunung Kidul and Sumbawa.

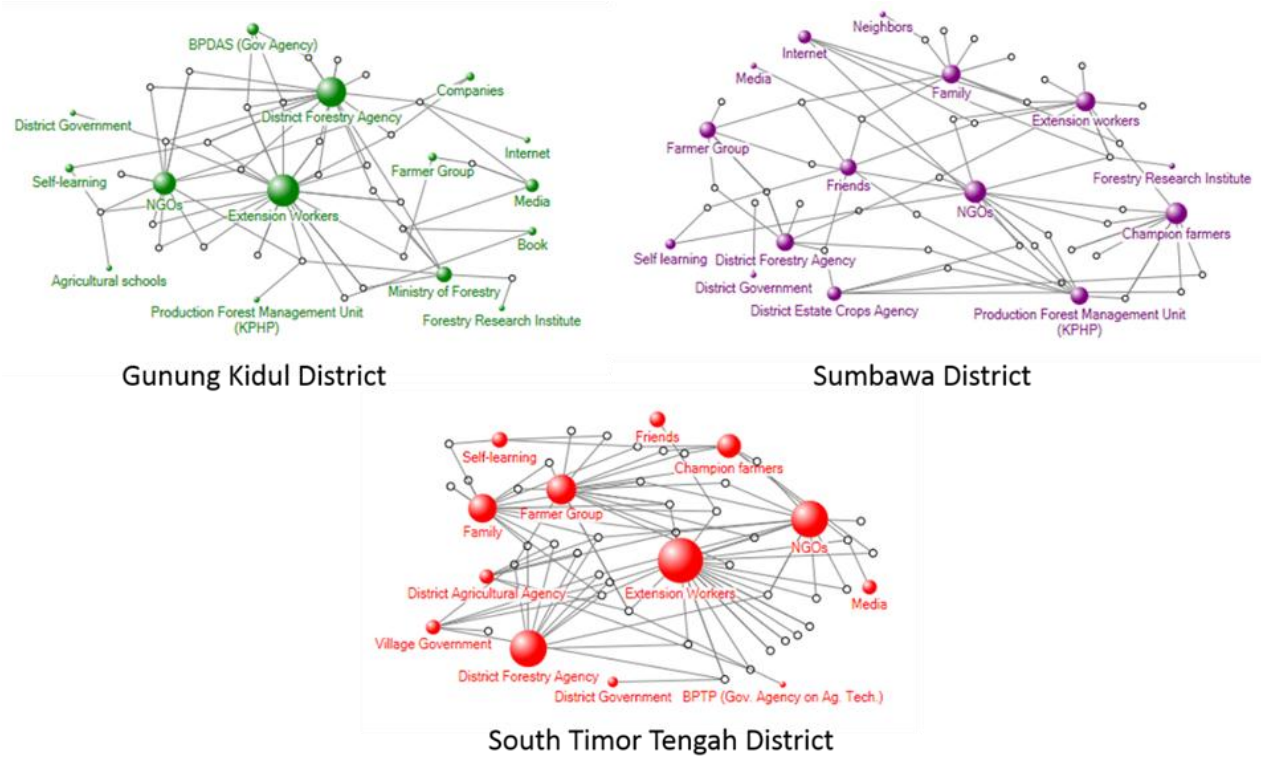

Figure 3. Variations in priorities of sources of information on agroforestry and forestry in Gunung Kidul, Sumbawa and South Timor Tengah Districts

3.3.1.1 Agroforestry and forestry information sources for farmers by gender in Gunung Kidul

In Gunung Kidul, agroforestry and forestry extension or training were more prioritized for men; only a handful of women with important roles in the community, such as the female leader of a farmers' group and a village head, were invited to participate in training. There was a perspective in the community that agroforestry and forestry activities were the domain of men, thus, women were less

active in searching for information related to the subjects. This led to less sources of information used by women.

Both for men and women, extension workers and NGOs were the primary sources of agroforestry and forestry information (Figure 4.). The differing priorities for sources of information between men and women in Gunung Kidul was owing to farmers' groups and media proving more attractive for women whereas programs from the Ministry of Forestry served as sources of agroforestry information for men. Male farmers in Gunung Kidul had greater access to sources of information at district and national levels compared to female farmers. Easy access to national sources of information was the privilege only of several farmers who acted as voluntary extensionists. As a form of capacity development, voluntary extensionists were assigned to attend training at national level.

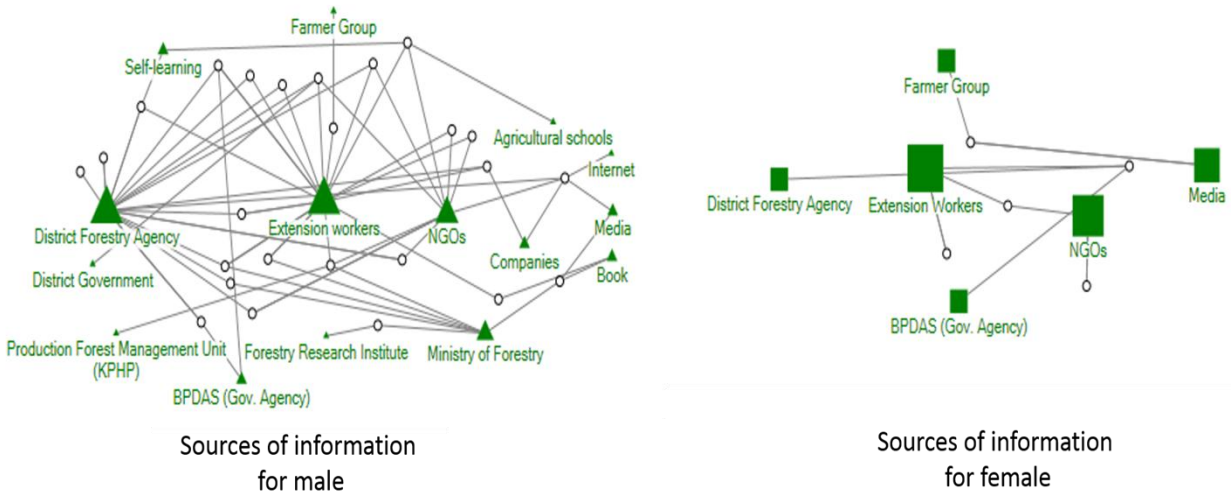

Figure 4. Networks of information sources for male and female farmers and voluntary extension workers in Gunung Kidul

3.3.1.2 Agroforestry and forestry information sources for farmers by gender in Sumbawa

Farmers in Sumbawa received agroforestry and forestry information from outside and inside their villages in balance. NGOs, extension workers, forestry agency officers and production forest management unit staff of Batulanteh were important sources of information from outside the villages while inside were champion farmers, family, farmers' groups and friends. Farmers in Sumbawa had limited access to information from electronic media and internet owing to poor facilities and infrastructure. The balanced nature of information sources was influenced by proximity of the villages to the district capital. Extension workers, forestry agency officers and NGOs could gain easy access. Interpersonal communication with family, farmers' groups and neighbours was an effective form of information dissemination.

Information sources of significance to female farmers in Sumbawa were inside the villages, that is, family, champion farmers, farmers' groups, neighbours and friends (Figure 5). Family was the most important source, followed by champion farmers and farmers' groups while the important and more

influential information sources from outside the village for female farmers were NGOs rather than extension workers or governmental agencies.

Information sources from outside and inside the village held equal weight for male farmers in Sumbawa. The most significant from outside the village were extension workers, NGOs and the production forest management unit of Batulanteh. Significant sources from inside the village were champion farmers, f'rmers' groups and friends. The study showed that female farmers tended to make more use of the internet and electronic media compared to male farmers.

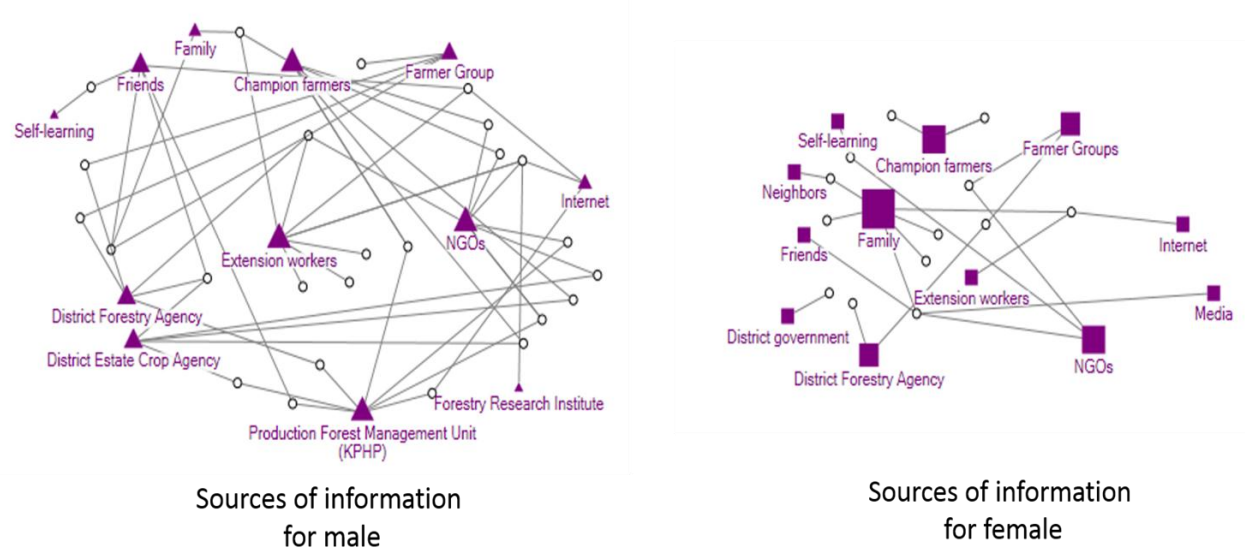

Figure 5. Networks of information sources for male and female farmers and voluntary extension workers in Sumbawa

3.3.1.3 Agroforestry and forestry information sources for farmers by gender in South Timor Tengah

In South Timor Tengah, extension workers played a significant role as sources of information for farmers, followed by family and farmers' groups especially when farmers had minimal interaction with extension workers. Bosen and Ajobaki villages shared the same issue owing to their remote locations, leading to limited visits by extension workers.

Sources of information acquired from inside the villages, that is, family and farmers' groups, had more significant influence on female farmers in South Timor Tengah compared to sources acquired from outside (Figure 6). Aside from those two sources, female farmers accessed information from their village governments and champion farmers while sources from outside the village for female farmers were extension workers, forestry agency and NGOs, all sharing equal weight. Opportunities for female farmers to take part in training and extension activities were unequal, particularly for those living in remote areas.

Male farmers in South Timor Tengah tended to receive agroforestry and forestry information from outside their villages although sources inside the villages — such as family and farmers' groups — also played significant roles. Extension workers were the most influential sources of information for

male farmers because male farmers often had more opportunities to take part in extension activity in their village or outside.

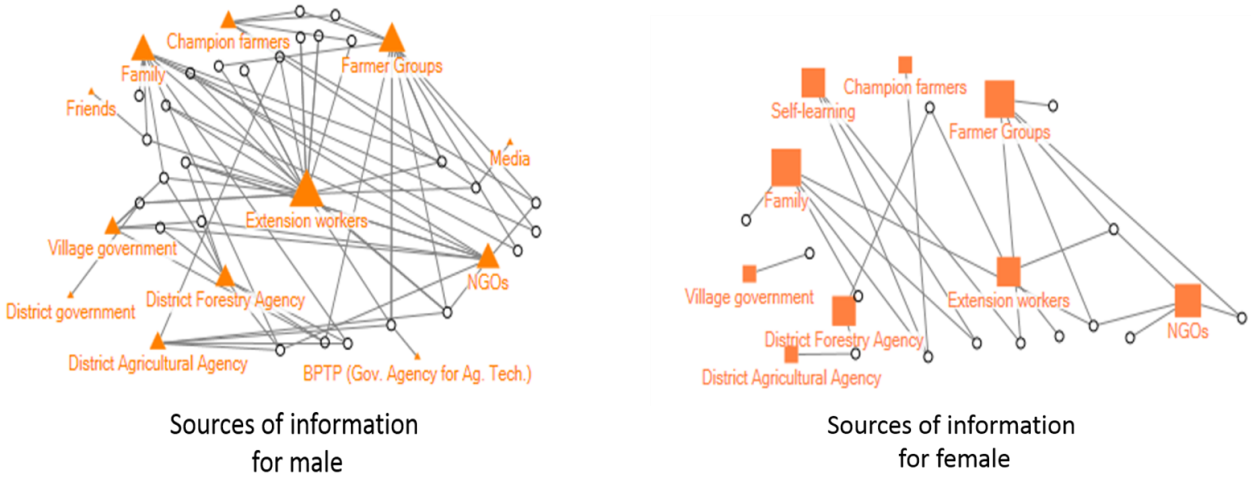

Figure 6. Networks of information sources on agroforestry and forestry for male and female farmers in South Timor Tengah

3.3.2 Agroforestry and forestry information dissemination as a result of training held by KANOPPI

The dissemination of information was analyzed based on agroforestry and forestry extension topics received by farmers, namely, 1) timber and non-timber forest products; 2) timber and non-timber forest products' marketing; 3) policies on administration of forest products on private land; 4) silviculture; and 5) agroforestry farm management. Analysis was also conducted of answers acquired from non-training-participant respondents, especially, regarding the information sources that they had accessed previously on the same topics.

3.3.2.1 Information dissemination about timber and non-timber forest products

The forestry agency was the most important disseminator compared to others regarding timber and non-timber forest products, especially, the definitions and types of products. Information disseminated from KANOPPI activities was mostly received by farmers through the forestry agency (Figure 7), thus, in future, extension or training activities disseminating information should formally involve district forestry agency staff as participants. This would support information dissemination through extension and training to farmers requiring such information.

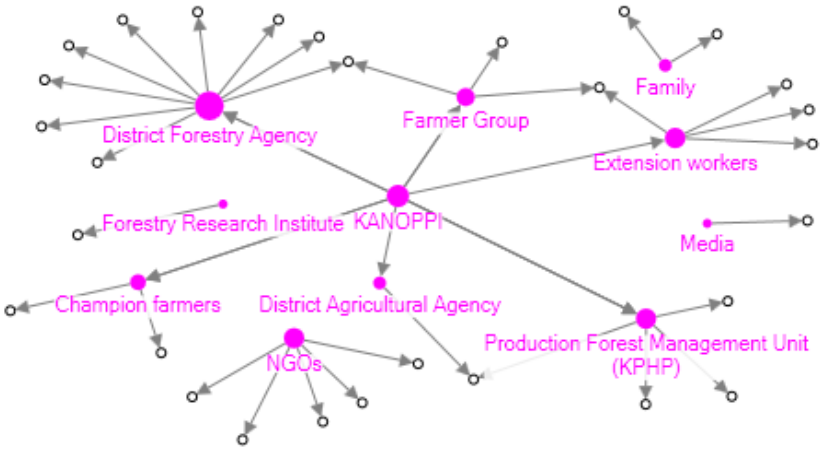

Figure 7. Network of farmers' information sources on timber and non-timber forest products

3.3.2.2 Information dissemination about marketing timber and non-timber forest products

For marketing timber and non-timber forest products, KANOPPI provided information on how to market timber, the desirable qualitites demanded by the markets, as well as prices for products of varying quality. Information delivered by KANOPPI was received by non-participating farmers, especially from timber and non-timber products' traders involved in the training. Figure 8 shows that extension or training aimed at improving farmers' knowledge of timber and non-timber products' marketing should involve traders because they have high potential as information disseminators. For traders, providing extension services to farmers could serve as a strategy to produce favourable quality timber and non-timber products.

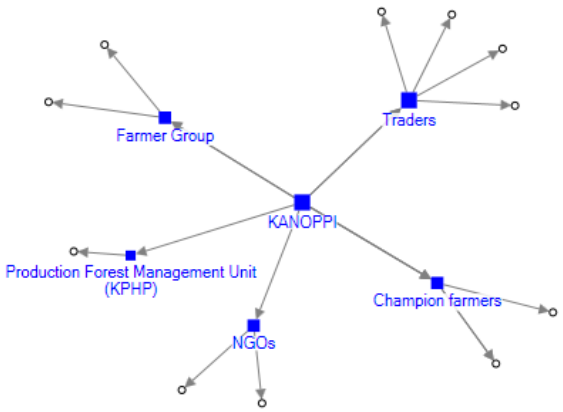

Figure 8. Network of farmers' information sources on marketing of timber and non-timber forest products

3.3.2.3 Information dissemination about policies regarding administration of forest products produced on private land

Information about policies related to administration (licensing) of forest products on private land was disseminated by KANOPPI through training and received by non-training-participant respondents

through the village governments, specifically, the village heads and staff (Figure 9). Village governments play a significant role in granting permits to harvest and trade timber from privately owned land. Thus, in the promotion of policies on forest product management on private land, village governments should be engaged as information disseminators.

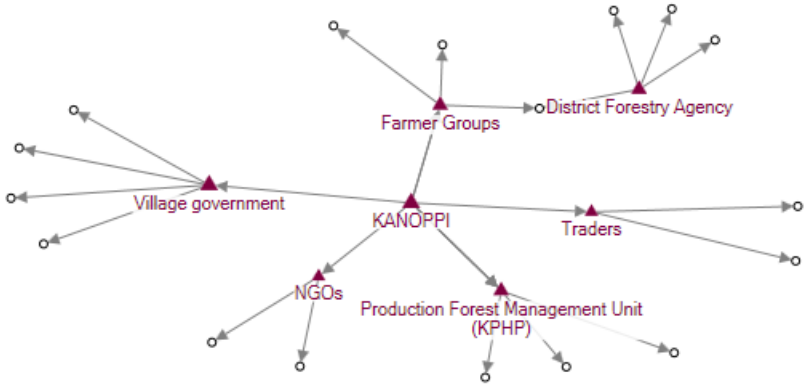

Figure 9. Farmers' information sources network on policy on the administration of forest products on private land

3.3.2.4 Dissemination of information about silviculture

Silvicultural topics discussed at the training organized by KANOPPI were thinning and pruning of tree crops, particularly, teak. Information dissemination through the KANOPPI training in timber and non-timber forest products was received by non-participant respondents mostly from the forestry agency and extension workers. Figure 10 shows that it is important to invite forestry agency officers and extension workers as training participants on topics related to silviculture because they disseminate useful information to farmers about improving timber quality.

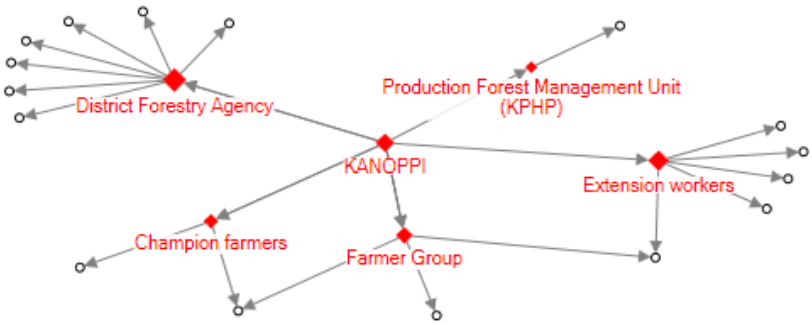

Figure 10. Sources of information about silviculture topics

3.3.2.5 Dissemination of information about agroforestry farm management

Information about agroforestry farm management delivered by KANOPPI focused on planting of annual crops with economic value under timber trees, for example, ginger beneath teak. Information such as appropriate spacing, required shade percentage, and annual crop varieties that could be grown beneath a teak canopy were delivered in the training. Non-participant respondents received the information delivered by KANOPPI from forestry agency officers and extension workers (Figure 11).

Therefore, similar to the strategy for disseminating silvicultural information, dissemination of information on agroforestry farm management should involve district forestry agency officers and extension workers.

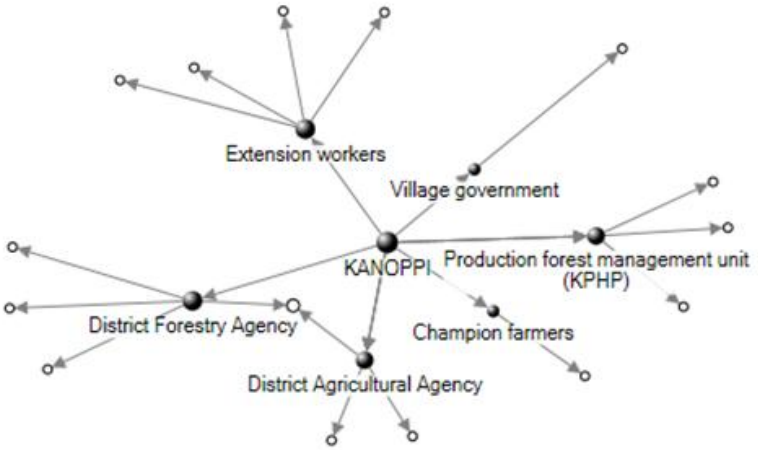

Figure 11. Network of sources of information about agroforestry farm management

3.4 Relation between sources of information, information topic and adoption process

A knowledge adoption process starts with successful dissemination to an audience, in this case, farmers. After understanding information about new technologies, farmers usually conduct trials. If the new technology is found to be beneficial, it will be applied on the farm. We found that farmers' responses to new technologies varied depending on the source of information and whether the information was relevant.

Stages of the adoption were strongly influenced by the reliability of the source of information (Figure 12). Both the first, assessing relative advantage, and the second, conducting trials, were influenced by the reliability of the source of information and the appropriateness of the technology. In the third, adoption, stage, the most influential factor was the simplicity of the technology. Thus, aside from the reliability of the source of information, attention should be paid to the type of information provided to ensure it meets the needs of the farmers.

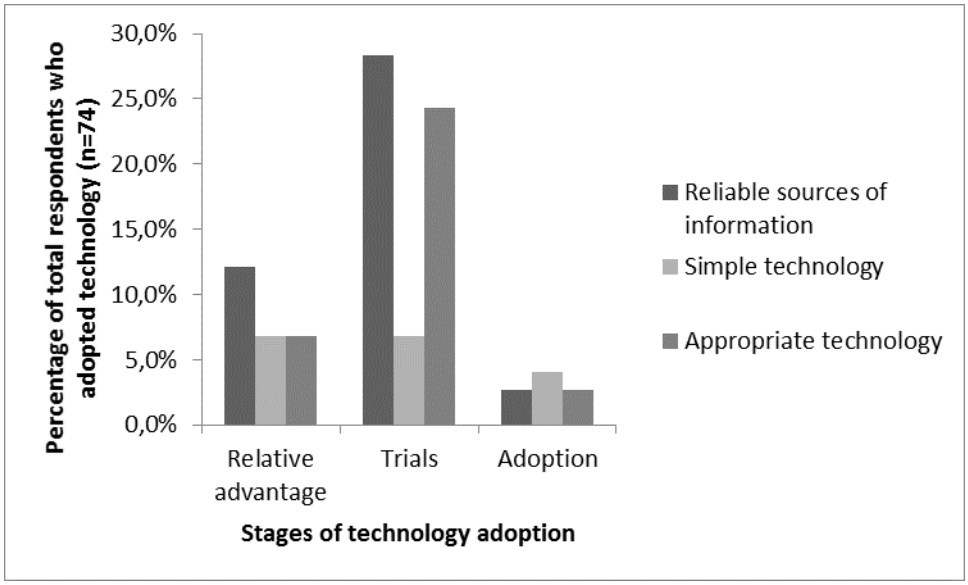

Figure 12. Farmers' perceptions of factors affecting the adoption of agroforestry technology

3.5 Developing agroforestry training or extension services based on farmers' needs

Information regarding farmers' preferences for extension topics and information dissemination can be used as the basis for developing agroforestry training or extension based on farmers' needs. In addition, evaluation by participants of the training can be used to design further training or extension services. In this study, training and extension evaluations were conducted based on the criteria of training participant, method of extension used, material presented, resource person, and duration of activity.

3.5.1 Participants in agroforestry training

Each participant's experience in training and extension was an important consideration when conducting training and extension. Participants were people who met criteria associated with the topic. The selection of participants involved people at the target sites providing a range of criteria, taking into consideration the local need for training and extension. Participants selected were champion or experienced farmers, members of farmers' groups, farmers with motivation and willingness to disseminate knowledge, public figures, women and literate younger farmers (Figure 13). Participants from farmers' groups are able to assist in monitoring and evaluation after training and wider dissemination of the acquired information to other members of the group was almost guaranteed. Participants were also selected from members of farmers' groups who had never received any training. Non-participating farmers were also selected as a control.

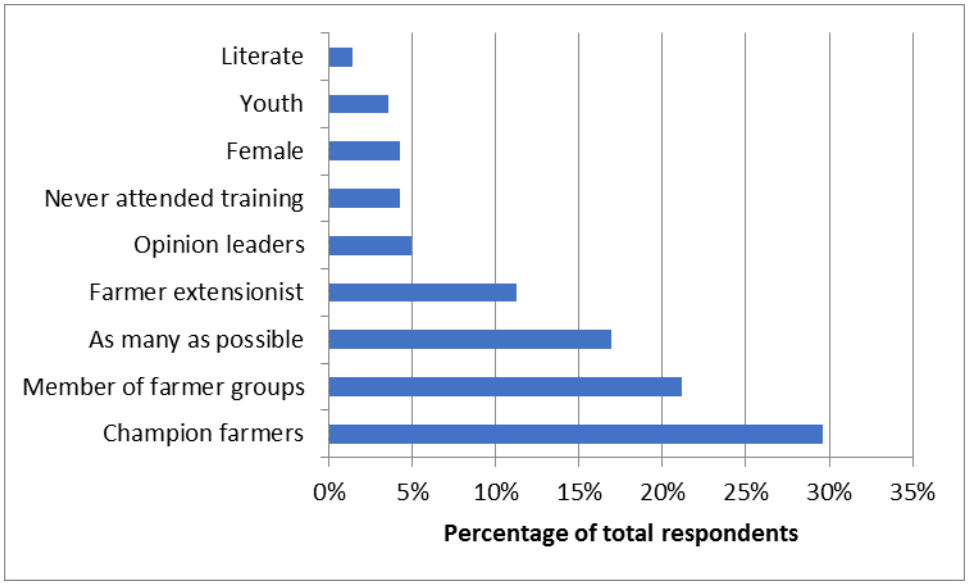

Figure 13. Criteria for selecting training and extension participants based on respondents' inputs

3.5.2 Methods used in agroforestry training

Methods of extension or training conducted by KANOPPI were a combination of discussions, practice and field visits. Based on all respondents' feedback, the most favourable method was a combination of discussion and practice, next was practice only, and third was a combination of discussion, practice and field visits (Figure 14). Respondents' least favoured method was discussion only, next a combination of practice and field visits, field visit only, and discussion and field visits.

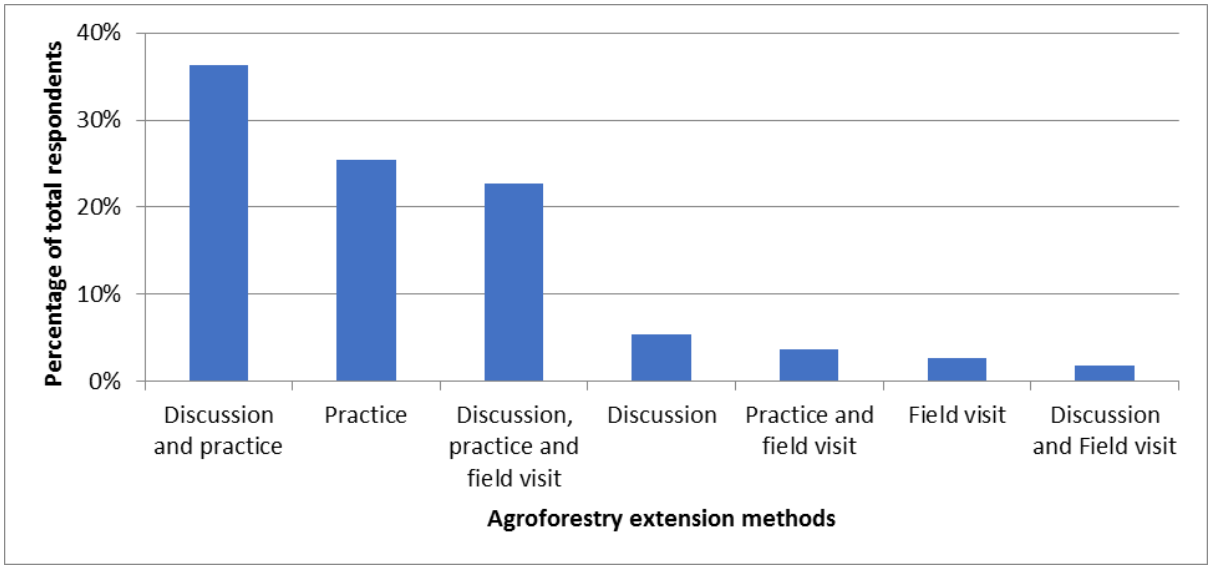

Figure 14. Respondents' preferred methods for agroforestry training or extension

Based on previous agroforestry training held by KANOPPI, the combination of discussion and practice eases participants into learning new knowledge and technologies. Discussions were held to introduce theory and were combined with farmers' daily experience and practice to improve participants' skills in newly learned techniques. Field visits were held to build participants'

motivation and insight into the topics. During field visits, participants were able to see successful practices conducted by farmers or others, which provided motivation to implement the practices themselves and disseminate the knowledge and technologies learned in the training.

3.5.3. Material presented in agroforestry training

Sixty-one per cent (61%) of participants stated that the material provide was sufficient to provide insight on timber and non-timber forest products. Five per cent (5%) of participants stated that there was too much material covered in a short amount of time. Some participants suggested that the material should have been focused on specific subjects, such as marketing, non-timber forest products, policies regarding forest product management on private land, silviculture, agroforestry management, extension, and forest conservation. Respondents suggested to deepen the marketing topic, including 1) providing market information about timber and non-timber forest products; and 2) increasing the value of non-timber forest products. Topics regarding non-timber forest products that needed to be revisited if there was to be further training were bee farms for honey production, white ginger, 'tarum' (*Indigofera* sp) and bamboo.

Respondents who never participated in training said that they needed information on silvicultural techniques (tree pruning and thinning), non-timber forest products, alternate crop and fruit-crop cultivation, agroforestry products' marketing, agroforestry farm management and forest conservation.

Generally, silviculture and non-timber forest products' marketing topics were the most demanded topics in all three districts.

3.5.4. Timing and duration of agroforestry training

Training and extension must consider timing and duration in order to not interrupt important events, such as cultivation, harvesting, and religious/cultural activities. Timing and duration affected the effectiveness of the training and the number of participants. The four-day duration of training held by KANOPPI was considered sufficient by 50.9% participants, however, 35% participants suggested to add another day, and 7% suggested to reduce the number of days.

The four-day duration was considered sufficient by both men and women. However, male farmers preferred to add a day whereas female farmers preferred to reduce the number of days (Figure 15). Female farmers tended to have little flexible time because of domestic and farming commitments, compared to male farmers. Female farmers had limited time for attending training outside their village if it was conducted over four days or more. Some respondents also suggested to hold regular meetings, for example, once a week, to provide agroforestry training to farmers.

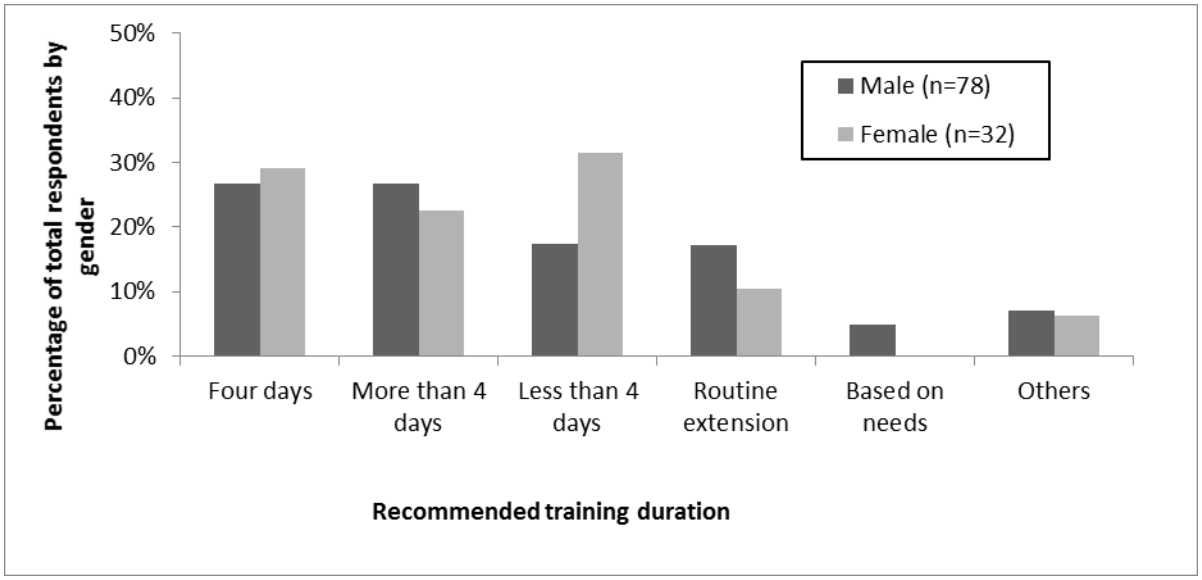

Figure 15. Recommended duration of training or extension for both male and female participants

4. Conclusion and recommendations

Conclusion

Farmers in Gunung Kidul, Sumbawa and South Timor Tengah preferred practical and basic extension topics, such as silviculture, agroforestry farm management, timber and non-timber products' marketing. Interest in a training topic usually depended on farmers' habits in specific locations and on gender.

Information dissemination by farmers who attended training to other farmers took different forms depending on location, gender and available sources of information. Generally, extensionists played important roles in agroforestry and forestry information dissemination to farmers. In addition, forestry agency and NGOs were also important actors in dissemination. The role of farmers' groups, family, champion farmers and NGOs were crucial in information dissemination, especially, for female farmers.

Recommendations

The form of agroforestry and forestry training or extension should be adjusted to farmers' requirements and local conditions. The form of training or extension should be conducted with regard to topic, participants, method, timing and duration. Silviculture, agroforestry farm management and marketing were the most proposed topics from farmers. The selection of participants for training should consider each farmer's background, such as: 1) member of a farmers' group, recommended by their peers; 2) farmers with motivation and willingness to disseminate information; and 3)

experienced farmers. Several groups might be involved in the training or extension, such as, 1) traders in the timber and non-timber products' marketing topic; 2) extensionists and officers of forestry agencies in the forestry and agroforestry topic; and 3) village government officials for permits related to timber trading management and utilization. Methods can take the form of a combination of discussion, practice and field visits to increase knowledge, skills and motivation.

In each location, farmers had particular preferences for topics as well as the information dissemination process. To support the dissemination of information about agroforestry and forestry to farmers most in need, it would be necessary to analyze the actors who play important roles in dissemination and their level of education, before undertaking any training or extension activities.

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Appendix 1. Syllabus training for voluntary extension and champion farmers on timber and non-timber forest product production and marketing strategies

No.	Topic	Subjects	Goals	Methods	Instrument	Time
1	Group dynamics	Introduction, ice breaking Identification of participants' expectations Building agreement Learning contract	Getting to know each other Recognition of participants' expectations of the training activity Agreement on the agenda and training rules	Games Discussion Brainstorming	Flipchart, marker, metaplan paper	60 minutes
2	Pretest for participants	Rapid self-assessment	Identification of the participants' knowledge and background of the training topic	Completing the rapid self-assessment form	A rapid self-assessment form copied on a plano paper.	30 minutes
3	Introduction to timber and non-timber forest products for farmers' livelihoods and the environment	Definition of forest products: timber, non-timber Categorization of non-timber products (refer to Regulations of the Minister of Forestry No. 35/2007) Local timber and non-timber products	Participants understand products: timber and non-timber Participants can identify and categorize local timber and non-timber products	Presentation Discussion Simulation/games	LCD projector, computer, marker, metaplan paper, whiteboard	60 minutes
4	Policies on timber and non-timber products	Policies related to timber Policies related to non-timber	Participants understand policies related to timber and non-timber products	Presentation Role play	LCD projector, computer, marker, metaplan paper, plano paper, whiteboard	120 minutes
5	Introduction to timber and non-timber products' marketing	Exploration of local timber and non-timber products' markets Visit to processor and/or buyer of timber and non-timber products	Participants can assess the featured local timber and non-timber products Participants can determine timber and non-timber products' markets Participants understand the timber marketing chain	Group discussion Visits to sawmill and non-timber products' processing facilities	Stationery, plano paper, marker	180 minutes
6	Tree measurement	Introduction to tree measurement using various methods	Participants understand tree measurement using various methods Participants understand the tools used in tree measurement	Presentation Brainstorming	LCD projector, computer, marker, metaplan paper, whiteboard	120 minutes

No.	Topic	Subjects	Goals	Methods	Instrument	Time
7	Tree measurement practice and simple timber volume calculation	Tree measurement using various methods, such as Master Tree Grower	Participants can carry out tree measurement to determine timber volume using various methods	Presentation Measurement practice/training on farm Result of presentation and discussion	Whiteboard/flipcard, marker, paper Measurement tape and timber measuring tools	180 minutes
8	Maintenance of plants or silviculture	Planting, thinning, pruning and harvesting procedures	Participants understand crop cultivation management (silviculture)	Lecture Brainstorming Games/simulations	LCD projector, computer, marker, metaplan paper, plano paper	60 minutes
9	Observation of silviculture on farm	Practice/simulation of pruning and thinning Observation of growth and crop cultivation management	Participants understand pruning and thinning teak Participants compare silvicultural treatments on farm	Practice/simulation Observation Presentation Discussion	Flipchart, marker, metaplan paper, plano paper, paper tape, hvs paper	180 minutes
10	Integrated management of various timber and non-timber products	Alternative timber and non-timber integrated farm management Agroforestry Silvopasture Agrosilvofishery	Participants understand different types of timber and non-timber integrated agroforestry management	Presentation Discussion Brainstorming	LCD projector, computer, marker, metaplan paper, plano paper, paper tape, hvs paper, whiteboard	60 minutes
11	Case study of demonstration plot for integration of teak, white ginger and galangal	Presentation of integrated timber and non-timber mixed garden concept Integrated teak and white ginger concept	Participants understand different types of timber and non-timber integrated agroforestry management	Presentation Discussion Brainstorming	LCD projector, computer, marker, metaplan paper, plano paper, paper tape, HVS paper, whiteboard	60 minutes
12	Observation of white ginger and galangal growth under teak stocked stands with branch pruning and thinning treatments	Observation of white ginger and galangal growth under teak stocked stands Benefits of mixed farm management at demonstration site	Participants understand timber and non-timber integrated agroforestry management Participants understand the differences in white ginger and galangal growth for each pruning and thinning treatment of teak crop	Observatio Discussion Presentation	Writing tools, plano paper	180 minutes

No.	Topic	Subjects	Goals	Methods	Instrument	Time
13	Follow-up plan and activity evaluation Post-test	Follow-up plan and activity evaluation Post-test for participants	Participants establish a post-training action plan Participants' post-training conditions identified	Discussion Rapid self-assessment	Plano paper Rapid self-assessment form	60 minutes

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