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# Final report

*project*

## Development of timber and non-timber forest products' production and market strategies for improvement of smallholders' livelihoods in Indonesia

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# 1 Acknowledgments

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## 2 Executive summary

The “Development of timber and non-timber forest products’ production and market strategies for improvement of smallholders’ livelihoods in Indonesia” (Kanoppi) was a four year project that commenced in 2013 and ended in 2017. ICRAF - The World Agroforestry Centre was the commissioned organization in-charge of overall project implementation. The project was implemented with 1) the Forest and Environment Research, Development and Innovation Agency, Ministry of Environment and Forestry (FOERDIA), through the Forest Research Centre; 2) the Center for International Forestry Research (CIFOR); 3) the University of Western Australia (UWA); 4) the World Wildlife Fund (WWF) Indonesia; 5) Universitas Mataram; 6) Threads of Life; and 7) the Farm Forestry Consortium (FFC). The project’s aim was to identify, enhance and expand smallholders’ involvement in the management of commercial, forestry-based products at different spatial scales in eastern Indonesia. It sought to 1) develop and implement integrated timber and non-timber forest products (NTFP) production systems to enhance local livelihoods; 2) identify and implement enhanced marketing strategies and value chains to improve timber and NTFP market links for smallholders; 3) analyse and improve policy frameworks to facilitate smallholders’ production and integrated marketing of timber and NTFPs; and 4) enhance expansion of smallholder-managed integrated timber and NTFP production systems.

Together with key farmers in seven villages in three districts, eleven on-farm silviculture trials were designed and established with input from farmers and ICRAF-FOERDIA researchers. These trials were established in farmers’ existing agroforestry systems in Gunungkidul, Sumbawa and Timor Tengah Selatan. In Gunungkidul, trials from a previous ACIAR project were retained and maintained with teak as the focus species for testing new intercropping species and new management techniques (thinning, pruning, singling, and fertilizing). In Sumbawa, Lombok, and Timor Tengah Selatan, new trials were established to conduct experiments on management techniques. Timber and non-timber products include teak (*Tectona grandis*), mahogany (*Swietenia mahogany*), jahe emprit (*Zingiber officinale* var. *amarum*), kencur (*Kaempferia galangal*), rumput ketak (*Lygodium circinatum* (Burm.f.) Sw), tarum or indigo (*Indigofera tinctoria*), kayu ules (*Helicteres isora*), bamboo (*Gigantochloa apus*), forest honey from wild bees (*Apis dorsata*), and honey from stingless bees (*Apis trigona*).

Farmers’ lack of market access, processing capacity, appropriate business models to realise value from their products, and dependency on traders hinders their ability to diversify and increase profit. Through trainings, workshops, and facilitations, farmers obtain knowledge and eventually self-esteem to improve their production and sales. Smallholder business models has been developed with farmers at Gunungkidul, Sumbawa, and Timor Tengah Selatan. The project observed that in most project areas farmer groups develop un-binding business practices, formed only during sales of products, in this case, teak, candlenut, coconut oil, forest honey, and naturally dyed woven fabric. Through business-related workshops and further participatory assessments, a collective business model was preferred. The business model is composed of farmer group members with a simple organisational structure, which pools resources, shares information and provides benefits for their members. A value-added reseller model was also preferred. It is a model embedded in the collective model, where the group adds value to the original products gathered by the group members. These value additions are essential for distribution to intermediaries further down the market chain.

Private sector engagement began in Year 3. Project partners linked farmers with the private sector to increase market access and enhance alternate livelihoods option, which eventually increases household income. Threads of Life, as the project’s private sector partner, together with UWA linked farmer groups with a network of private sector businesses in Bali and Australia, such as Wooden Ships, a knitware manufacturer; PT Sido Muncul, a herbal drink manufacturer; and Blue Stones Botanicals, Jamusara, and Pacific Provender for essential oils. Universitas Mataram collaborated with CV. Makassar

Utama, a local teak processor in Sumbawa, and PT. Jawa Furni Lestari, a Yogyakarta-based teak furniture manufacturing company, to assist farmer groups in business capacity development. CIFOR and FFC formed a bamboo growers association in Gunungkidul under the name 'Deling Handayani' to serve as a communication forum among growers to discuss cultivation and marketing issues.

To address policy bottlenecks at district and provincial levels, aspects of the policy and regulatory framework that hinders timber and NTFP production and marketing was reviewed and analysed by CIFOR, WWF, and FFC in consultation with key stakeholders. Improved regulations and government support, focussing on effective and practical implementation were proposed through the establishment of policy working groups at each of the three districts and a trial application of the policy framework was implemented. Three grand strategy documents were produced: 1) Sumbawa: Grand Strategy for integrated timber and NTFP management at the landscape level; 2) Timor Tengah Selatan: Grand Strategy for integrated NTFP management at the landscape level; and 3) Gunungkidul: Improve the cost effectiveness of the policy on timber verification and certification and promote NTFP as part of the local government development strategy.

The rate of adoption of appropriate silvicultural practices by smallholder farmers is expected to increase through improved technical capacity learned in extension training programs, strengthened institution of farmer groups, and increased knowledge on management and marketing regulations. Champion farmers in Gunungkidul and Sumbawa changed their negotiation strategy to increase the price of teak stands owing to their increased knowledge on teak silviculture and of timber-stand valuation. Although the involvement is only 24%, female farmers proved to be more interested to test new technologies or knowledge. Female farmers in Gunungkidul and Sumbawa, in particular, have higher adoption preferences than male farmers.

Strong collaboration among policy makers, researchers and extension providers will be required to accelerate the processes of adoption of silvicultural practices by smallholder farmers. The approaches should be centred on livelihood strategies of farmers linked to their household conditions and farm characteristics in selecting the intensities of pruning, thinning, and intercropping and levels of germplasm quality. Government and research centre investments in research and development of extension services and farmer group facilitation are ways to generate participatory learning process methods for raising awareness and changing perceptions of farmers on silvicultural innovations. The Forestry Research Centre needs to develop various on-farm trial of the silvicultural techniques to enhance knowledge and demonstration of the recommended innovations and enhance impacts on profits related to timber and NTFP productivity in both the short- and long-term. In other words, such trials focus on how easily farmers can learn about trials' performance and optimal management. Furthermore, government policies provide the advantages of sustainable biodiversity intensification of farming in intercropping practice and thus increase the adoption of silvicultural practices.

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## 3 Background

Understanding how to implement complementary management of timber and NTFPs is particularly important for poor households in Indonesia. First, landscape heterogeneity from plot level upwards offers resilience and diverse livelihood options in the face of climate variability. Second, the diverse range of forestry and agroforestry practices at different scales, along with crops and livestock, is an important feature of many smallholders' production systems, as is the production of timber and NTFPs in smallholders' systems in Java, West Nusa Tenggara, and East Nusa Tenggara.

Average cash income of rural households in the provinces of East Nusa Tenggara and West Nusa Tenggara are less than AUD 300 per year, well below that in other parts of Indonesia, while Yogyakarta is one of the most densely-populated parts of the country with a higher-than-average proportion of the rural population classified as poor. Regarding Government of Indonesia priorities, Nusa Tenggara is a selected Ministry of Forestry pilot area for NTFP development. Ministry of Forestry Decree No. 21/2009 identified NTFPs as important across Indonesia. Previous ACIAR projects (including SMAR/2006/011) have also identified the importance of a wide range of other priority forest products relevant to local biophysical, socioeconomic, and market conditions.

Developing timber and non-timber forest product (NTFP) value chains, so that farmers capture more value from their products is a key strategy to improve livelihood opportunities, but is constrained by silvicultural management practices that result in low productivity and profitability from integrated timber and NTFP production systems. This is compounded by smallholders and communities lacking market access, processing capacity and appropriate business models to realise value from their products. There is need to develop effective extension strategies to spread successful management options widely amongst households for which they are appropriate, and to align policies so that barriers to developing timber and NTFPs value chains are removed and agricultural and forest land uses are reconciled to deliver a range of provisioning, regulating and cultural ecosystem services.

In response to efforts both from government and ACIAR to support forest product development and increase household income in the area, the World Agroforestry Centre joined forces with partners to enhance and expand smallholders' involvement in the management of commercial, forestry-based products at different spatial scales.

## 4 Objectives

The overall aim of the project was to identify, enhance and expand smallholders' involvement in the management of commercial, forestry-based products at different spatial scales in eastern Indonesia. The specific objectives were to:

- Develop and implement integrated timber and NTFP production systems to enhance local livelihoods
- Identify and implement enhanced marketing strategies and value chains to improve timber and NTFP market links for smallholders
- Analyse and improve policy frameworks to facilitate smallholders' production and integrated marketing of timber and NTFPs
- Enhance expansion of smallholder-managed integrated timber and NTFP production systems

The project builds on recommendations from three ACIAR projects that addressed ACIAR priorities: 'Improving economic outcomes for smallholders growing teak in agroforestry systems in Indonesia (FST/2005/177)'; 'Community forestry partnerships in Indonesia' (FST/2003/025); 'Enterprise development, value chains and evaluation of non-timber forest products for agroforestry systems in West Timor, Flores, Sumba and Savu in NTT (SMAR/2006/011).



## 5 Methodology

The project addressed the following key research questions:

- How can forestry and agroforestry management practices be improved to enhance integrated timber and non-timber forest product (NTFP) management and production?
- What are suitable strategies for effective integrated marketing of timber and NTFPs for smallholders?
- What policy factors significantly hinder smallholders' production and competitiveness in timber and NTFPs and how can those factors be addressed?
- What are the key characteristics of an extension program that can deliver information on best practices for timber and NTFP management, production and value-added marketing?

A baseline survey was conducted in November 2013 involving a sample of 500 farmer respondents in three districts (Gunungkidul, Sumbawa, and Timor Tengah Selatan) to identify 1) demography and specific socio-economic indicators; 2) farmers' current management practices at farm level; 3) current marketing and small-scale enterprise practices; 4) level of understanding about policy and regulations being applied; and 5) forestry extension practices and needs. A purposive sampling method was used and sampling frames were developed to make sure selected villages, hamlets and respondents represented as much as possible the variation of livelihoods and land-use management characteristics in relation to timber and/or NTFPs management. The baseline survey served as basis to respond to the key research questions.

Specific methodologies are explained in these interrelated objectives, specified as to:

### **1. Develop and implement integrated timber and NTFP production systems to enhance local livelihoods**

To complement the baseline survey, an inventory study was conducted on 198 farms across three districts to assess species composition in various agroforestry practices, and the relationships between tree species and stand basal area (BA), farm area and elevation, and the richness of non-tree species, and to evaluate the current uses of non-tree species for local livelihoods. Together with key farmers in seven villages in three districts, eleven on-farm demonstration trials were designed and established with input from farmers and ICRAF-FOERDIA researchers. These trials were established in farmers' existing agroforestry practices in Gunungkidul, Sumbawa and Timor Tengah Selatan (see Figures 1, 2, and 3).

In Gunungkidul, trials from a previous project (FST/2005/177) were retained and maintained with teak as the focus species for establishing experiments by including new intercropping species, and new management techniques (thinning, pruning, singling, and fertilizing). In Sumbawa, Lombok, and Timor Tengah Selatan, new trials were established to conduct experiments on management techniques. Timber and non-timber products included teak (*Tectona grandis*), mahogany (*Swietenia mahogany*), jahe emprit (*Zingiber officinale var. amarum*), kencur (*Kaempferia galangal*), rumput ketak (*Lygodium circinatum (Burm.f.) Sw*), tarum (*Indigofera tinctoria*), kayu ules (*Helicteres isora*), bamboo (*Gigantochloa apus*), forest honey from wild bees (*Apis dorsata*), and honey from stingless bees (*Apis trigona*).

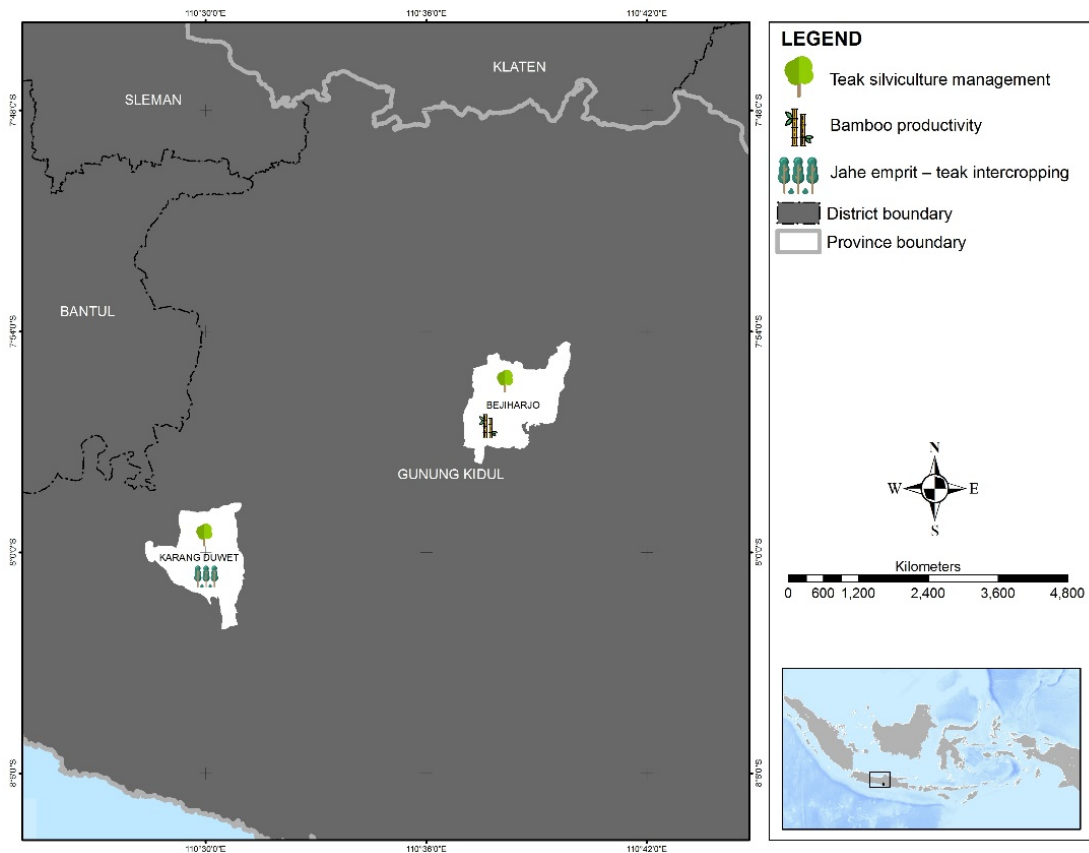


Figure 1. Distribution of trials in Gunungkidul

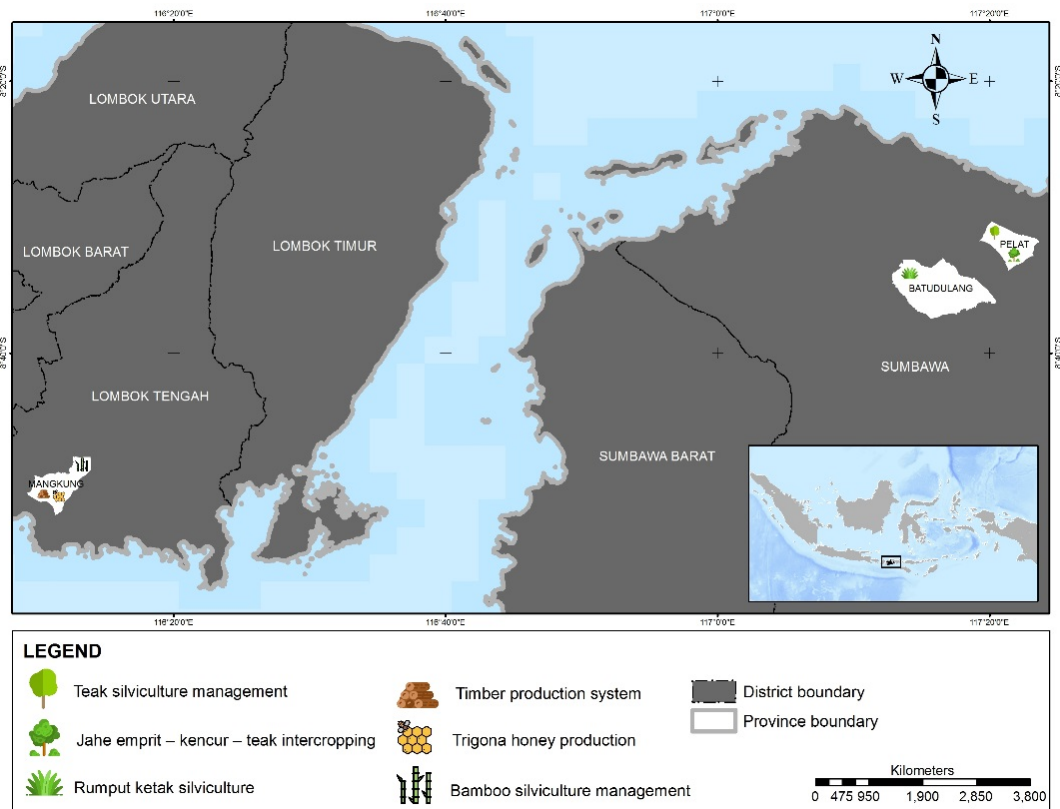


Figure 2. Distribution of trials in Lombok Tengah and Sumbawa

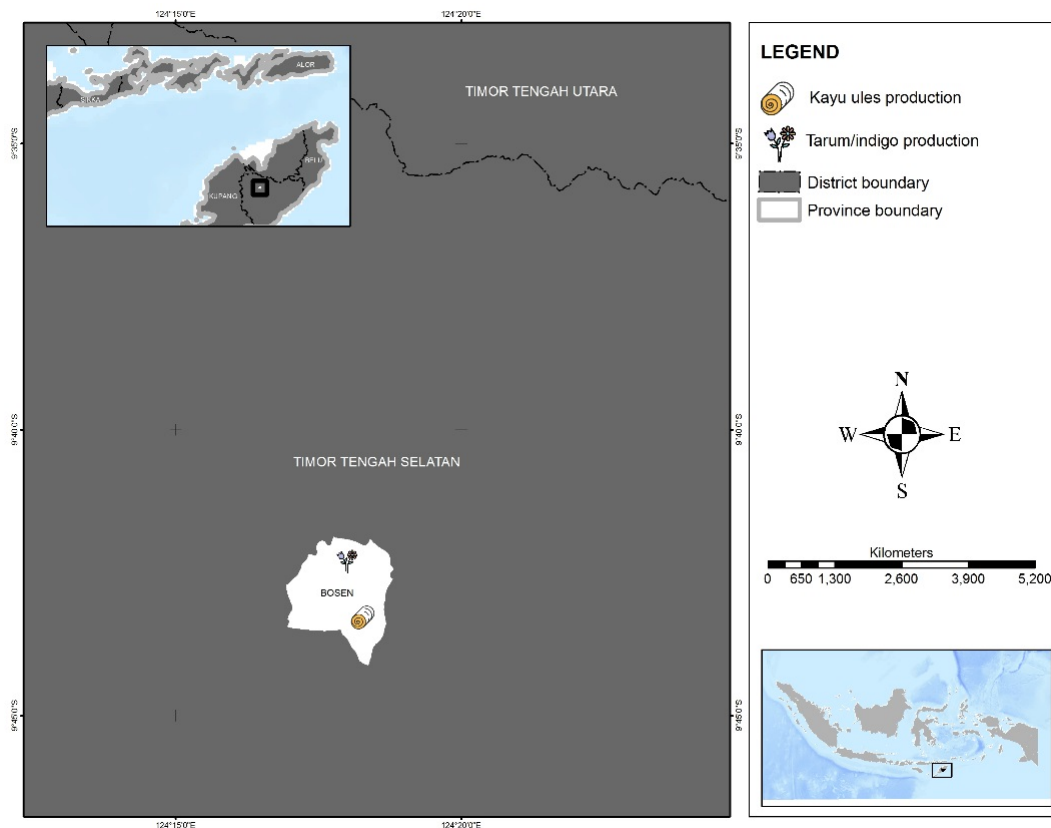


Figure 3. Distribution of trials in Timor Tengah Selatan

Participatory management and monitoring was employed to collect data from these trials. Researchers, in consultation with farmers, designed standard experimental treatments, and management schemes, but farmers managed all farming activities, including improved practices such as planting, fertilizing, and watering. In several trials researchers led sampling and analysis and farmers, who were hired as enumerators, conducted the measurements and recording of indicators such as crop and tree growth.

Starting at the end of 2014, champion farmers hired as enumerators together with ICRAF and FOERDIA researchers conducted silviculture management and growth measurement. Pruning for teak was conducted every November in Gunungkidul and every December in Sumbawa. Jahe emprit and kencur management (planting, fertilizing, etc) was conducted between November and July. Rumput ketak thinning and fertilizing was conducted every March. Bamboo coppicing and fertilizing was done every May. Growth measurement was conducted every six months for teak stands, every three months for rumput ketak, tarum and kayu ules, and monthly for bambu apus, jahe emprit and kencur.

In Timor Tengah Selatan, FOERDIA research centres organized a focus group discussion with key farmers in September 2015 and collected information regarding the perception of farmers on timber species planted and their preferences. With regards to timber species preferences and silvicultural practices, farmers linked those issues to slow and fast growing timber species such as teak, mahogany, candlenut, tamarind, and gmelina. Smallholder timber production only focuses on subsistence needs, the potential of unproductive land, income generation and livelihood improvement. The discussion was followed up with a community nursery development activity by propagating sengon (*Falcataria moluccana*), acasia (*Acacia mangium*), gmelina (*Gmelina arborea*), teak (*Tectona grandis*), and candlenut (*Aleurites moluccana*).

Procurement of rumput ketak (*Lygodium circinnatum*) seedlings using spora originated from Batudulang village in Sumbawa was conducted at the Cibodas Botanic Garden and the Forest Research Centre Nursery in Bogor.

Cross-visits and informal trainings were conducted to enhance farmers' exposure to, and awareness of, most appropriate management practices for timber and NTFPs. In collaboration with teams from Objectives 2, 3 and 4 (lead), Farmer Field Schools were conducted focusing on silvicultural practices, sustainable land management using intercropping, policy awareness, and smallholder business development.

Models are widely used in assessing options for management of agroforestry and forestry systems. The modelling of agroforestry systems had also to contend with the interaction between trees and the other elements of the system. Van Noordwijk et al. (2004) described the key features of the WaNuLCAS (Water, Nutrient and Light Capture in Agroforestry Systems) model, formulated in the STELLA research modelling environment. The model is structured to represent a four-layer soil profile with four spatial zones, a water, nitrogen, phosphorus balance and uptake by a crop (or weed) and up to three types of tree(s). The WaNuLCAS model was used in this project to incorporate silvicultural management options, with two primary objectives: 1) to evaluate the effect of initial spacing on ginger yield and 2) to evaluate the effects of various silvicultural regimes on tree growth and volume production.

A manual on integrated management of timber and NTFP has been developed by ICRAF and FOERDIA researchers to provide a step by step guidelines for farmers on silviculture and intercropping in an agroforestry setting. The manual outline was consulted to key farmers and stakeholders during its development to obtain practicability and user-friendliness. The manual uses a simplified Bahasa Indonesia and many images for easy understanding.

## **2. Identify and implement enhanced marketing strategies and value chains to improve timber and NTFP market links for smallholders**

To analyze the overall smallholder market, rapid market appraisal (RMA) was used to identify and assess the problems and opportunities related to the smallholder market system and to understand how the commodity system is organized, operates and performs. Farmers, traders, processors, and policy makers participated in the commodity selection process and market and value chain assessments through focus group discussions and interviews. This particular activity in conducted in collaboration with Objectives 1, 3 & 4. In Gunungkidul and Sumbawa, scoping studies applying in-depth interviews, group meetings, and observations were also conducted, and preferred timber and NTFP species were confirmed, such as smallholder teak (*Tectona grandis*) and kencur (*Kaemferia galanga*) which were in line with the baseline survey results.

In Timor Tengah Selatan, the quantitative data and qualitative information came from five methods and approaches. Firstly, in this particular district, this project followed up on systematic surveys of local marketplaces conducted during an earlier ACIAR project (SMAR/2006/011). These are widely acknowledged as an effective method for gaining insights into which plant species have commercial value in local livelihoods and to understand the characteristics of traders. During SMAR/2006/011, primary data were collected on the informal-sector trade in local marketplaces on Flores, Savu, Sumba and in West Timor (Cunningham et al., 2011a). Systematic classification of these marketplaces, their schedules and the types of traders within them was an important step in understanding the network of harvesting and trade in products such as pinang (*Areca catechu*) and sirih (*Piper betle*). Secondly, the knowledge regarding which NTFP species occurred within East Nusa Tenggara, including species harvested for timber, was combined with information on which natural products were traded in local, national or international markets and had further market potential.

Thirdly, the “hidden” supply chains that are separate from the trade in local marketplaces were assessed using field observation and interviews with people along the supply chain, from harvesters and middlemen to major traders. Specifically, this involves trade in some medicinal plants, such as *Helicteres isora* (locally known as usakneo or kayu ules), usnea (Spanish moss, known as tai angin or kayu angin), kemiri (*Aleurites moluccana*/candlenuts), asem (*Tamarindus indica*) pulp and seeds and to a lesser extent in kayu kuning dyes (*Maclura cochinchinensis*). These are often sold through kinship networks of traders who consolidate products bought from smallholder producers by “papalele” (buyers of these products at the “farm-gate”), where Indonesian entrepreneurs of Chinese descent usually play a leading role in the consolidation process.

Fourthly, analyses of global trade data for selected NTFPs exported from East Nusa Tenggara – specifically usnea, kayu ules and rumput ketak (*Lygodium circinnatum*) – were combined with field assessments of value chains and an understanding of the biological factors influencing production in eastern Indonesia. The discussions with harvesters and traders included questions on prices, processing methods, what quantities of a product harvesters generally collected in a day or, where relevant, whether resource shortages were becoming a constraint or not. International trade data were obtained from published literature and from websites that record international trade (such as [www.zauba.com](http://www.zauba.com)). In the case of baskets woven from rumput ketak fern stems in Indonesia that are exported globally, prices were recorded from websites of wholesalers in Japan ([www.rakuten.co.jp](http://www.rakuten.co.jp)) the USA (for example <http://www.alaskafurexchange.com> and <http://www.alaskaantler.com>) and at the final point in the rumput ketak value chain in the Alaska, USA. This was supplemented through interviews with local traders and for usnea and kayu ules, with jamu and cosmetic manufacturers in Java to gain insights into the supply and demand factors faced by large manufacturers. Productive meetings were held, for example, with staff of two jamu (herbal drink) companies, Nyonya Meneer and Sidomuncul, and with the cosmetic company, Martha Tilaar.

The fifth approach was through “action research” where, with Threads of Life (ToL) as the principal partner, UWA and with additional technical support from Pacific Provinder (PP), supported the start-up of a village-based business in Timor Tengah Selatan. Having a seed oil press made in Bali (rather than importing it from Australia) was an important step in this process, with the press then shipped to Timor Tengah Selatan. With ToL and PP, discussions followed by oil workshops and small scale business training courses were held at a village level. This included a realistic assessment of which markets would (or would not) be viable for which seed oils. Virgin coconut oil (VCO) production for example, was only cost-effective in West Timor for the local domestic market.

### **3: Analyse and improve policy frameworks to facilitate smallholders' production and integrated marketing of timber and NTFPs**

Policy assessment was conducted along the supply and value chains, both for timber and NTFPs whether managed in the same plots or in different plots as part of the same landscape area. Assessments on policy and regulations from national to local level were also conducted (see Figure 4). The results of the policy assessment had provided clear guidance and direction for policy intervention implemented in the following years. Based on the findings of the baseline study, policy research methodology was developed and is explained below:

- Identifying the production, marketing and processing systems for timber and NTFPs that are commonly practiced by local community, traders and industries.
- Assessing and reviewing of policy and regulatory frameworks that hinder timber and NTFP production, marketing and processing included identifying disincentives on land and tree tenure under different practices involving local communities.

- Conducting participatory assessment, and institutional and stakeholders analysis, in the policy decision making processes concerning timber and NTFPs management in the chain from production, marketing to processing.
- Forming policy working groups (PWGs) and identifying focal points representing different stakeholder groups to be part of PWG at district and provincial levels in improving the existing policy and regulatory framework on timber and NTFPs production, marketing and processing.
- Highlighting recommendations that are relevant to improve the effectiveness of policy and regulatory framework for enhancing the livelihoods of rural communities depending on timber and NTFPs.

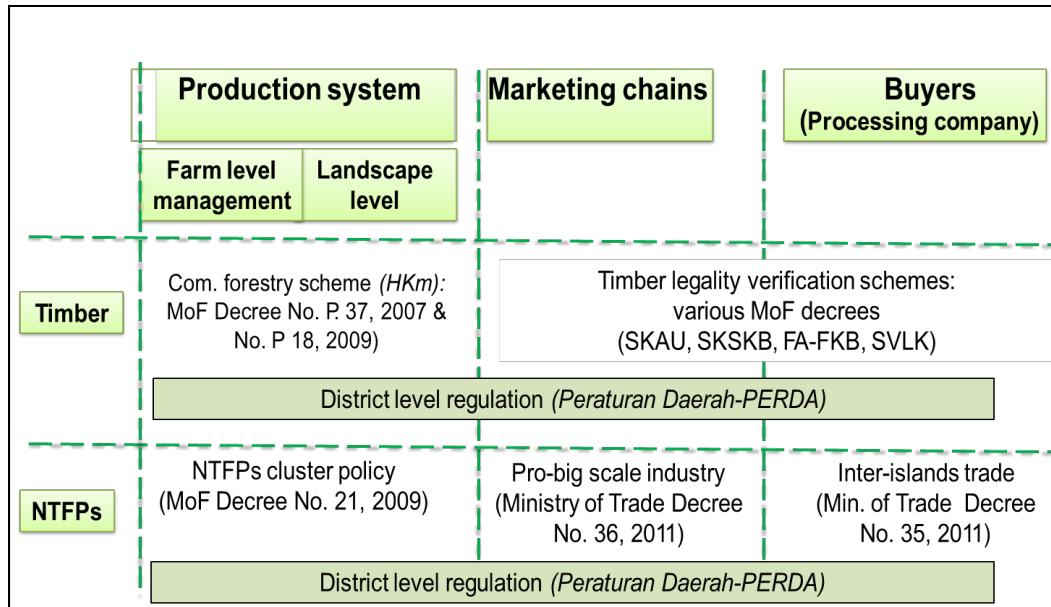


Figure 4. Matrix used in identifying policies and regulations for timber and NTFPs

To increase awareness of the identified policies and regulations, PWGs were formed in Gunungkidul, Sumbawa, and Timor Tengah Selatan to provide input in the development of improved regulations and policy framework, participate in project intervention, connecting stakeholders and government agencies at different levels, from district to village, and district to province, and deliver recommendations to the national government. The intervention focused on developing strategic planning in conjunction with the district strategic planning document for integrated management of timber and NTFPs in Sumbawa and Timor Tengah Selatan, and improving cost effectiveness of policy on timber verification and certification, and promoting NTFPs as part of the local government development strategy (i.e. honey, bamboo, and herbal plants) in Gunungkidul.

Results of the policy assessment was used to formulate project interventions to support integrated management of timber and NTFPs. To provide further recommendations, several complementary studies were implemented: 1) assessment of the impacts of overly regulated policies on farm forestry practices in Gunungkidul; 2) mapping and assessment of timber marketing and regulations in Java; 3) impacts of multiple harvest and marketing regulatory regimes on the competitiveness of timber from smallholding tree farming; and 4) critical review of the impact of Law No. 23/ 2014 on community-based management regimes.

Project support to the trial of the improved regulations and monitoring the impact of recommendations was implemented. Initially, this was planned to be conducted intensively at the district level. Due to the enactment of the Law 23/2014, the policy framework, including policy advocacies, had to be redesigned. However, this came out to

be an opportunity to scale-up the adoption of the framework up to the provincial level, under the new law the provincial government has wider authorities. Approaches used at this stage included to collaboratively develop follow up recommendations for applying the improved policy and regulations with key government agencies and conduct participatory impact analysis, including Cost and Benefit Analysis (CBA), of scenarios for implementing improved policies. Particular focus was on the potential impact on livelihoods of local communities, production systems, and marketing chains in all three provinces. Thus, strategy documents as support to the district and provincial strategic planning were developed using participatory approaches. Consultations on the strategy documents for improved policy and regulations with government agencies, communities and other key stakeholders were implemented.

#### **4: Enhance expansion of smallholder-managed integrated timber and NTFP production systems**

A series of surveys on extension practices was conducted, starting in 2014, in Sumbawa, Gunungkidul and Timor Tengah Selatan to understand the effective forestry extension practices supporting the development of timber and NTFPs as source of income for farmers. The surveys identified the existing conditions, challenges and needs in the implementation of forestry and agroforestry extension. Interviews were conducted with 500 farmers and six focus group discussions (FGDs) were held to obtain information regarding the forestry extension approaches, implemented both by the government and private sector. In addition, field observations on forestry extension practices were conducted in order to collect qualitative and quantitative data.

To follow up the survey results and recommendations, a series of trainings related with timber and NTFPs production, marketing and regulations to increase the livelihoods of farmers were conducted in the three districts, throughout 2015-2016, aiming at farmer champions and voluntary and government extension agents. The objective of these trainings was to improve knowledge and skills on production, marketing and regulations, and on the design and delivery of rural advisory services related to timber and NTFPs. A farmer field school approach was used in these trainings in order to provide the farmers with experiential learning activities that helped them better understand the context of the materials. An adult learning method was also applied as it was in accordance with the characteristics of farmers: 1) prefer to learn from experience; 2) prefer to learn things that are practical, easy to apply, and useful in life; 3) learning by sharing opinions with others; 4) learning by solving problems that is not subject-oriented; 5) require longer learning time where new information is acquired; and 6) will continue the learning process if the experience is satisfactory. To complement the training activities, farmer cross visits to commodity clusters in other districts within the province were conducted to increase farmers' understanding on product market specifications and demand.

From the process and results obtained from trial experiments and implementation of activities, a series of extension materials, such as information sheets, booklets, bulletins, and manuals, were developed, printed, and distributed to stakeholders, including farmers and extension agents. The process applied participatory methods where a series of consultation with partners, farmers and relevant stakeholder were conducted in order to provide input and improvement. All information sheets and manuals were tested in the field during its development.

#### **Project management and coordination**

The main activities of this component were 1) project planning of both technical and financial activities in accordance with the contract with ACIAR and in consensus with all partners; 2) technical and financial coordination and ensuring the implementation of the plan at all project sites, including solving practical problems; and 3) reporting to ACIAR, ICRAF and others as appropriate. Joint workshops and activities, joint logistical arrangements, and annual coordination meetings were conducted collaboratively.

### **Overall monitoring and evaluation**

Regular monitoring and evaluation was carried out throughout the project duration and as part of project workshops and annual meetings. The monitoring of activities, deliverables, achievements, and challenges was also conducted in through regular communications between project members via emails and social media groups. Outcome assessment using Theory of Change (ToC) method was implemented at the end of the project cycle (see Appendix 3). It is a specific type of methodology for planning, participation, and evaluation, which is essentially a comprehensive description and illustration of how and why a desired change is expected to happen in a particular context. In relation to the project activities, the assessment was to identify 1) research activities implemented; 2) knowledge and tailored knowledge produced; 3) engagement with partners for knowledge outreach, and channelling the knowledge to outcomes; and 4) policy and practice change in achieving impacts.



## 6 Achievements against activities and outputs/milestones

### Objective 1: Develop and implement integrated timber and NTFP production systems to enhance local livelihoods

No.	Planned activity	Outputs/milestones	Completion date	Comments
1.1	Reassess and analyse current timber and NTFP production practices, including those identified by the previous three projects, and recommend improvements	<ul style="list-style-type: none"> <li>• Recommendations confirmed for priority species and management of timber and NTFP production</li> <li>• Inventories conducted to identify farmers' current species' composition, tree density and tree size of representative agroforestry systems</li> <li>• Participatory surveys conducted to identify farmers' current management practices when information is lacking</li> <li>• Literature review conducted</li> <li>• Report outlining the baseline situation for each of agroforestry and NTFP models with recommendations for improvement</li> </ul>	2014	<p>Accomplished (The baseline report output was not achieved but will be produced in Kanoppi2)</p> <p>An inventory study to complement the baseline survey findings conducted with four main tasks:</p> <ol style="list-style-type: none"> <li>1. Assess species composition in a various agroforestry systems</li> <li>2. Assess the relationships between tree species and Stand Basal Area, farm area and elevation, and the richness of non-tree species</li> <li>3. Develop allometric models: the relationships between branch cutting frequencies and tree performances including DBH, total height, main branch height, and canopy width</li> <li>4. Evaluate the current uses of non-tree species for local livelihoods.</li> </ol> <p>The survey of 198 farms showed that most farmers still use traditional management and have limited access to high quality germplasm and silvicultural practices for their timber and NTFP species in agroforestry systems.</p> <ul style="list-style-type: none"> <li>• Journal article: Khasanah N, Perdana A, Rahmanullah A, Manurung G, Roshetko JM, van Noordwijk M, 2015. Intercropping teak (<i>Tectona grandis</i>) and maize (<i>Zea mays</i>): bioeconomic trade-off analysis of agroforestry management practices in Gunungkidul. <i>Agroforestry Systems</i>, 89: 1019-1033</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
				<ul style="list-style-type: none"> <li>• Journal article: Adoption of silvicultural practices in smallholder timber and NTFPs production systems in Indonesia (this peer-review article is under review for Agricultural Systems Journal)</li> <li>• Book chapter: Roshetko, JM and A Perdana. 2017. The Significance of Planted Teak for Smallholder Farmers. 66-70. In: Kolbert W and Kleine M (eds), The Global Teak Study, Analysis, Evaluation and Future Potential of Teak Resources. IUFRO World Series Volume 36. Vienna. 108 p.</li> <li>• Newsletter article: Roshetko JM, A Perdana, G Sabastian, D Rohadi, AA Pramono, N Widyani, N Nuryartono, P Manalu, MA Fauzi, P Sumardamto, N Kusumowardhani. 2016. Smallholder teak production in Indonesia. <i>Teaknet Bulletin</i> 9 (3): 2-8</li> <li>• The features and allometric relationships characterizing tree species on farmland at project sites. Data has been collected. Intended as a peer-reviewed article, the draft has not yet been produced</li> <li>• The contribution of household and farm attributes to on-farm income generation for smallholder timber-NTFPs production systems in Indonesia Data has been collected. Intended as a peer-reviewed article, the draft has not yet been produced.</li> <li>• Two additional papers are proposed to be completed under Kanoppi2: - allometric relationships characterizing tree species on farmland in Indonesia; and contribution of household and farm attributes to on-farm income generation of smallholder timber-NTFPs production systems</li> </ul>

1.2	Conduct demonstration trials of priority timber and NTFP systems	<ul style="list-style-type: none"> <li>• Trials designed with input from farmers and researchers</li> <li>• At least eight trials designed and established</li> <li>• Trials existing in Gunungkidul maintained (in accordance with farmers' management plans) to document longer term impacts of thinning, singling and pruning</li> <li>• Participatory trials established in both existing systems and on fallowed land and timber and NTFP species incorporated</li> <li>• Trials managed, monitored and evaluated</li> </ul>	2014 – 2015	<p>Accomplished</p> <p>11 demonstration trials were designed with input from farmers and ICRAF-FORDA researchers, and established in farmers' existing agroforestry systems in Gunungkidul, Sumbawa, Lombok, and Timor Tengah Selatan.</p> <p>The list of trials are as follows:</p> <ol style="list-style-type: none"> <li>1. Silvicultural practices to improve teak production in Gunungkidul.</li> <li>2. Cultivating ginger (jahe emprit - <i>Zingiber officinale</i> var. <i>amarum</i>) in the understorey of teak systems in Gunungkidul.</li> <li>3. Improving productivity of unmanaged bamboo apus (<i>Gigantochloa apus</i>) in Gunungkidul.</li> <li>4. Silvicultural management and intercropping with jahe emprit (<i>Zingiber officinale</i> var. <i>amarum</i>) and kencur (<i>Kaempferia galanga</i>) to improve growth of teak in Sumbawa.</li> <li>5. Identifying silvicultural practices to improve teak production on sloping land in Sumbawa.</li> <li>6. Fertilization and coppicing to increase the productivity of rumput ketak (<i>Lygodium circinatum</i> Burm.f. Sw) in Sumbawa.</li> <li>7. Fertilization and coppicing effects on fruit production of kayu ules (<i>Helicteres isora</i>) in Timor Tengah Selatan.</li> <li>8. Effects of fertilizer application on the leave production of two varieties of tarum (<i>Indigofera tinctoria</i>) in Timor Tengah Selatan.</li> <li>9. <i>Trigona</i> sp. management to increase production of bee bread, honey and bee propolis in Lombok.</li> <li>10. Silvicultural management to increase production of smallholder mahogany (<i>Swietenia macrophylla</i>) stands in Lombok.</li> <li>11. Silvicultural management of bamboo galah (<i>Gigantochloa atter</i>) and bamboo petung (<i>Dendrocalamus asper</i>) in Lombok.</li> </ol>
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No.	Planned activity	Outputs/milestones	Completion date	Comments
				<p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• Presentation: Silviculture technique to improve teak productivity in community forest in Sumbawa</li> <li>• Presentation: <i>Trigona</i> sp beekeeping in Mangkung, Central Lombok</li> <li>• Presentation: Silvicultural practices for unmanaged clumps of bambu apus</li> <li>• Presentation: Increasing stand quality of community plantation forests at Mangkung village, Central Lombok</li> <li>• Presentation: Establishment of trial plots of local bamboo and introduced tissue cultured bamboo</li> <li>• Presentation: Establishment of natural rumput ketak plot in Sumbawa</li> <li>• Report: Prameswari D, Manurung G, Sudomo A, Widiana IW, Novandra A, Apriliani A, Krisnawati, Siswadi, and Surata IK, 2017. Improvement in production and quality of timber and NTFP on community land.</li> </ul>
		<ul style="list-style-type: none"> <li>• Sources of quality germplasm for timber and NTFPs identified and made available to farmers</li> </ul>	2015 to 2016	<p>Sources of quality germplasm for timber and NTFPs identified and made available for farmers in Timor Tengah Selatan in 2015 and in Sumbawa in 2016.</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>• Guidebook: Effendi R. 2016. Rumput Ketak (<i>Lygodium circinnatum</i>) Nursery Manual (in Bahasa Indonesia)</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
		<ul style="list-style-type: none"> <li>Report describing nature of systems trialled and farmers' attitudes to these systems</li> </ul>	2016	<p>Data collection conducted in parallel with monitoring and farmer training activities.</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>Working paper: Riyandoko, Martini E. 2016. Farmers' preference towards extension topics and agroforestry information dissemination (in Bahasa Indonesia) – to be finalised as a report under Kanoppi2</li> </ul>
1.3	Develop computer simulations of priority timber and NTFP systems	<ul style="list-style-type: none"> <li>Growth and yield data collected and compared</li> <li>Computer simulations of priority systems conducted for each site</li> <li>Results of simulations reviewed and evaluated with farmers, extension staff and researchers</li> <li>Report documenting results of simulation, including economic benefits, and providing recommendations for each site</li> </ul>	2017	<p>Accomplished</p> <p>Data for all trials collected and preliminary (2 year data) compared.</p> <p>Site study and simulation options between possible scenarios has been determined. Data collection commenced in April 2015. The simulation management models was developed for intercropping-silvicultural teak with jahe emprit in Sumbawa. The model has been developed using teak and jahe emprit growth data from the research trials. A simulation of teak – maize intercropping systems was also conducted. The article was published in 2015 (joint output with FST/2005/177).</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>Report: Sabastian GE, Anggrayani S. 2017. Modelling silvicultural management options for intercropping Teak (<i>Tectona grandis</i>) with Ginger (<i>Zingiber officinale</i>) in Sumbawa, Indonesia. (Report to be updated with economic benefits information under Kanoppi2.</li> <li>Journal article: Khasanah N, Perdana A, Rahmanullah A, Manurung G, Roshetko JM, van Noordwijk M. 2015. Intercropping teak (<i>Tectona grandis</i>) and maize (<i>Zea mays</i>): bioeconomic trade-off analysis of agroforestry management practices in Gunungkidul, West Java. Agroforestry Systems DOI: 10.1007/s10457-015-9832-8</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
1.4	Develop and evaluate guidelines for integrated management of smallholders' timber and NTFP systems relevant for each site	<ul style="list-style-type: none"> <li>Literature review conducted (linked to 1.1)</li> </ul>		Presented during 2014 Annual Meeting
<ul style="list-style-type: none"> <li>Farmers' days, cross-visits and informal trainings conducted to enhance farmers' exposure to, and awareness of, most appropriate management practices for timber and NTFPs</li> </ul>		May 2015	Accomplished	
<ul style="list-style-type: none"> <li>Outline of guidelines reviewed with key stakeholders, including farmers' feedback</li> <li>Guidelines drafted</li> </ul>		2015	Accomplished	
<ul style="list-style-type: none"> <li>Guidelines field tested, with farmers' feedback</li> <li>Guidelines for each site published</li> </ul>		2016 to 2017	Accomplished  <u>Publication:</u> <ul style="list-style-type: none"> <li>Manual for Integrated Management of Timber and NTFP (in Bahasa Indonesia)</li> </ul>	

**Objective 2: To identify and implement marketing strategies and value chains to improve timber and NTFP market links for smallholders**

No.	Planned activity	Outputs/milestones	Completion date	Comments
2.1	Identify the timber and NTFP species that are most important for local livelihoods through analysis of value-chain governance, socioeconomics and silvicultural conditions and practices	<ul style="list-style-type: none"> <li>• 4–6 species each for timber and NTFPs identified using commodity selection methods and criteria aligned with the livelihoods' assessment</li> <li>• Report on current practices in smallholders' marketing and enterprise development</li> <li>• Participatory market and value chain analysis completed</li> <li>• Report on current situation with NTFP marketing by smallholders with recommendations developed to improve current marketing practices and strategies</li> </ul>	Most priority products were identified in Yr 1 as scheduled. Additional products were identified in Yr 2 during fieldwork.	<p>Accomplished</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• Paper: Cunningham A. 2013. Species profile, synthesis and recommendation for <i>Lygodium circinnatum</i></li> <li>• Report: Ingram W, Cunningham A. 2014. Marketing NTFPs from the Gunung Mutis area</li> <li>• Report: Ingram W. 2014. Value chain analysis for <i>Apis dorsata</i> honey from Gunung Mutis, Timor</li> <li>• Report: Ingram W, Cunningham A. 2014. NTFP Value Chains for <i>Aleurites moluccana</i> and <i>Tamarindus indica</i> from the Gunung Mutis area, West Timor</li> <li>• Report: Ingram W. 2014. Paths to sustainability: the marketing of <i>Apis dorsata</i> honey from Gunung Mutis</li> <li>• Report: Muktasam. 2013. Marketing of timber and NTFP in Sumbawa (in Bahasa Indonesia)</li> <li>• Report: Ingram W. 2015. Value chain analysis for indigo blue dye paste made from <i>Indigofera tinctoria</i> in Java, Bali, Nusa Tenggara Timur</li> </ul>

2.2	Establish 4–5 models of smallholders' enterprises for the identified timber and NTFPs	<ul style="list-style-type: none"> <li>Interested farmers and intermediaries identified in three provinces</li> <li>Report on current opportunities and impediments for identified NTFP smallholders' businesses with preliminary business feasibility and socioeconomic analyses</li> </ul>	2014 – 2015	<p>On the basis of market survey and value chain investigation at the community, private business and policy maker levels, interested farmers and processing actors were identified. Most farmers are willing to adopt improve practices for their agroforestry system, especially for NTFPs, even though there are associated risk. For Sumbawa, a report on value chain and business model analysis for timber and NTFPs was completed and presented to the Policy Working Group. Alternative interventions for value-chain improvement and small scale business for timber and NTFPs were discussed. This also provides ideas for the future direction of policies on timber and NTFPs. A capacity building action-plan was designed to support value chain improvement and the implementation of business models. In addition, Farmer Groups have been identified, such as "KUB Sumber Alam" in Batudulang, who are willing to improve their honey marketing system as well as become involved in small scale creative businesses for timber processing. For TTS, business-to-market chain models were documented and analysed for: 1) <i>Apis dorsata</i> honey, 2) candlenuts, and 3) potential natural dye plants. For Gunungkidul, community enterprise models and value chains existed for timber products and were acknowledged by the local government.</p> <p>Publications: (joint topics with publications under Activity 2.1)</p> <ul style="list-style-type: none"> <li>Info Brief: Business model developed in collaboration with private sector to assist smallholders to improve marketing and returns from selected non timber forest products.</li> <li>Report: Ingram W, Cunningham A. 2014. NTFP Value Chains for <i>Aleurites moluccana</i> and <i>Tamarindus indica</i> from the Gunung Mutis area, West Timor</li> <li>Report: Ingram W. 2014. Paths to sustainability: the marketing of <i>Apis dorsata</i> honey from Gunung Mutis</li> <li>Report: Muktasam. 2013. Marketing of timber and NTFP in Sumbawa (in Bahasa Indonesia)</li> <li>Journal article: Cunningham et al 2017. Opportunities, barriers and support needs: micro-enterprise and small enterprise development based on non-timber products in eastern Indonesia, Australian Forestry, 1-17, published online 12 June 2017. <a href="http://dx.doi.org/10.1080/00049158.2017.1329614">http://dx.doi.org/10.1080/00049158.2017.1329614</a></li> </ul>
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No.	Planned activity	Outputs/milestones	Completion date	Comments
2.3	Enhance quality, quantity and timing of NTFP products marketed by smallholders' enterprises	<ul style="list-style-type: none"> <li>• Small-scale business capacity building (technical and financial) of interested groups conducted, reported by gender</li> </ul>	March – June 2015	<p>Accomplished</p> <p>Small-scale business capacity building (technical and financial) of interested groups conducted between March – April 2015 for Timor Tengah Selatan, Sumbawa and in June 2015 for Gunungkidul. In Bosen, the only identified business unit for all NTFP marketing is the village BUMDes (village-owned business unit). The development and initiation of the BUMDes has been held up in district and regency level bureaucracy. The BUMDes is the organisation through which to perform capacity building, but the BUMDes currently has no structure or activities. In Fatumnasi, community business units associated with WWF activities were identified as targets for the project. Threads of Life's capacity building skills have been offered to WWF for their community business groups. Details regarding gender disaggregation are provided in Section 8.2 and Table 4.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• Report: Ingram W, 2015. Can BUMDes control the candlenut market in Bosen village? (in Bahasa Indonesia)</li> <li>• Report: Riyandoko, 2015. Training for volunteer extension agents and farmer champions on timber and NTFP for livelihood enhancement in Gunungkidul (in Bahasa Indonesia).</li> <li>• Report: Riyandoko, 2015. Farmer field school in production, marketing, and regulations: timber and NTFP for farmers in Sumbawa (in Bahasa Indonesia).</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
		<ul style="list-style-type: none"> <li>Farmers' cross-visits to markets, industries and production areas conducted to enhance farmers' exposure to, and awareness of, most appropriate small enterprise models and marketing practices for timber and NTFPs</li> </ul>	<p>May 2015</p> <p>February 23-24, 2016</p> <p>August 2016</p>	<p>Accomplished</p> <p>Farmer cross visit to wood processing company in Sumbawa conducted in conjunction with Activities 1.4 and 4.2. Farmers from Pelat, Sumbawa and Mangkung, Lombok Tengah visited a community-based <i>Trigona sp</i> honey production facility in North Lombok District, in conjunction with Activity 4.2. Bamboo farmers, traders, and crafters from Gunungkidul visited bamboo villages in West Java to experience first-hand a bamboo-based community development.</p> <p>Publications:</p> <ul style="list-style-type: none"> <li>Report: Riyandoko, 2015. Farmer field school in production, marketing, and regulations: timber and NTFPs for farmers in Sumbawa (in Bahasa Indonesia).</li> <li>Report: Riyandoko, 2016. Cross visit on <i>Trigona sp.</i> management in North and Central Lombok districts (in Bahasa Indonesia).</li> <li>Report: Riyandoko, 2016. Bamboo nursery, clump management, and preservation workshop in Gunungkidul (in Bahasa Indonesia)</li> </ul>
		<ul style="list-style-type: none"> <li>Links with financial services institutions and smallholders' enterprises developed</li> </ul>	<p>2015</p>	<p>Accomplished</p> <p>Discussions with banks and other financial institution representatives in building a mutual commitment for community access to financing and credit in Gunungkidul and Sumbawa. Initial discussions were conducted in 2015.</p>

		<ul style="list-style-type: none"> <li>• Report on better value chains (2.1) for selected timber and NTFPs (for example, linking teak producers directly to furniture manufacturers) put into practice</li> </ul>	<p>April 2015</p>	<p>Workshop on business model potentials and value chain improvement plan held by Threads of Life in Bosen village, Timor Tengah Selatan. Universitas Mataram conducted FGDs in Sumbawa between to start putting market access linkages into practice.</p> <p>Threads of Life offered another model based on credit union practices where farmers are all familiar with. The BUMDes would give up the idea of setting up a monopoly and recognize itself as one of many market players. It would then have to compete to give the best service to the producers. As a cooperative, it should buy from its members at the lowest price possible and then share out the profit when a profit is made. Membership would start small and grow with success. Based on productivity estimates, seasonality, and sales in local market, the assessment showed that the BUMDes will need more support for capital and it needs to understand functions in small business development. The assessment concluded that the BUMDes will not be a feasible option if capital is insufficient and management is lacking skills.</p> <p>During the farmer field school event in early May 2015 in Sumbawa, targeted farmers were linked with UD Makassar Utama, a local wood processor (teak and other hardwood species) with provincial-wide coverage, and exports mostly to furniture manufacturers in Java. This is one option introduced to strengthen linkages between value chain actors. The farmers were then assessed on their business approach. The key farmers were then brought to Java end of 2016 to learn teak furniture processing at PT Jawa Furni, a legally-sourced teak furniture manufacturing company. In Gunungkidul, links between teak farmers and PT Jawa Furni has also been made.</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>• Report: Ingram W. 2015. Recent advances towards the indigo paste production in Timor</li> <li>• Journal article: Perdana A, Roshetko JM. 2015. Survival strategy: traders of smallholder teak in Gunungkidul Indonesia. <i>International Forestry Review</i>, 17 (4), 461-468.</li> </ul>
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No.	Planned activity	Outputs/milestones	Completion date	Comments
				<ul style="list-style-type: none"> <li>Journal article: Maryudi A, Nawir AA, Sekartaji DA, Sumardamto P, Purwanto RH, Sadono R, Soeprijadi D, Affianto A, Rohman R, Riyanto S. 2016. Smallholder farmers' knowledge of regulations governing the sale of timber and supply chains in Gunungkidul district. Small-scale Forestry.</li> </ul>
		<ul style="list-style-type: none"> <li>Pilot and full reports on action research of production, processing and quality standards of oil production from priority NTFPs produced in smallholders' integrated systems</li> </ul>	September 2015	<p>Accomplished</p> <p>With Threads of Life (ToL) as the principal partner, UWA and with additional technical support from Pacific Provinder (PP), supported the start-up of a village-based business in Timor Tengah Selatan. Having a seed oil press made in Bali (rather than importing it from Australia) was an important step in this process, with the press then shipped to Timor Tengah Selatan. With ToL and PP, discussions followed by oil workshops and small scale business training courses were held at a village level. This included a realistic assessment of which markets would (or would not) be viable for which seed oils. Virgin coconut oil (VCO) production for example, was only cost-effective in West Timor for the local domestic market.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>Report: Cunningham A, Ingram W. 2015. Oel Ekam oil workshop</li> <li>Guidebook: Threads of Life, 2015. Guide for VCO and candlenut oil workshop (in Bahasa Indonesia)</li> <li>Guidebook: Manual on virgin coconut oil and candlenut oil production</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
		<ul style="list-style-type: none"> <li>Annual capacity building of smallholders' enterprises with smallholders' feedback</li> </ul>	April – May 2015	<p>Smallholder enterprise development capacity building held in Bosen village, Timor Tengah Selatan. Capacity building in smallholder product value chain held in Pelat village, Sumbawa.</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>Report: Ingram W, 2015. Can BUMDes control the candlenut market in Bosen village? (in Bahasa Indonesia)</li> <li>Report: Muktasam A. 2016. Marketing of timber and NTFP in Sumbawa (updated version in Bahasa Indonesia)</li> </ul>
		<ul style="list-style-type: none"> <li>Report on the analysis of economic benefits from enhanced smallholders' NTFP enterprises in three provinces</li> </ul>	2016	<p>This report is partially completed. This process of collecting the economic data will be conducted within the first year of Kanoppi2.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>Report: Ingram W. 2015. Can BUMDes control the candlenut market in Bosen village? (in Bahasa Indonesia)</li> <li>Report: Muktasam A. 2016. Marketing of timber and NTFP in Sumbawa (updated version in Bahasa Indonesia)</li> </ul>
2.4	Develop integrated marketing strategies for timber and NTFPs, an approach to product marketing where different modes work together to create improved value, and assess the possibility of establishing partnerships with key traders and corporations	<ul style="list-style-type: none"> <li>Integrated marketing scenarios implemented and assessed for each timber and NTFP species using action research methods involving farmers and other chain actors</li> </ul>	2016	<p>Accomplished</p> <p>Private sector engagement began in Y3. Smallholder business models has been developed in three locations, Gunungkidul, Sumbawa, and Timor Tengah Selatan. Assessments of current business models were conducted between 2014 and 2015. The project observed that in most project areas farmer groups develop an un-binding business practice, formed only during sales of products, in this case, teak, candlenut, avocado, and coconut oil, forest honey, and naturally dyed woven fabric. Through business-related workshops and further participative assessments, a collective business model was preferred. The business model is composed of farmer group members with simple organisational structure, which pools resources, shares information and provides benefits for their members. A value-added reseller model was also preferred. It is a model embedded in the collective model</p>

No.	Planned activity	Outputs/milestones	Completion date	Comments
		<ul style="list-style-type: none"> <li>Smallholders' business model (involving market agents and the private sector) developed</li> </ul>		<p>where the group adds value to the original products gathered by the group members. These value addition is essential for distribution to intermediaries further down the market chain.</p> <p>Threads of Life as the private sector partner together with UWA linked farmer groups with a network of private sectors in Bali and Australia, such as Wooden Ships, a knitware manufacturer, PT Sido Muncul, a herbal drink manufacturer, Blue Stones Botanicals, Jamusara, and Pacific Provender for essential oils. Universitas Mataram collaborates with CV. Makassar Utama, a local teak processor in Sumbawa, to assist teak farmer groups in business capacity development.</p>
		<ul style="list-style-type: none"> <li>Report on costs and benefits from integrated marketing activities</li> </ul>	2017	<p>This report is partially completed. More time is required to gather information on benefits received by farmers. This report will be completed within the first year of Kanoppi2.</p> <p>Developing workable business plans based on strategies included in the grand strategy document by applying cost benefit analysis on a range of prioritised timber and NTFPs commodities was one of the contributing factors to the body of scientific knowledge in operationalising a landscape approach. One of the notable activities implemented in Sumbawa was the collaboration with Objective 2 on the development of business plan document as a business implementation guideline in the strategy document. Methods included cost benefit analysis at farm level for a range of prioritised commodities.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>Muktasam, Nawir, A., Yumn, A., &amp; Perdana, A. 2016. Business Plan: Development production, processing and marketing timber and non-timber forest product of priority commodity in Sumbawa based on watershed. Mataram, NTB.</li> <li>Kusumawardhani, W., Kautsari, N., Martadinata, A. P. and Syafii, S., 2016. Grand strategy for integrated timber and NTFPs management based on landscape in Sumbawa District.</li> </ul>

**Objective 3: Analyse and improve policy frameworks to facilitate smallholders' production and integrated marketing of timber and NTFPs**

No.	Activity	Outputs/ Milestones	Completion date	Comments
3.1	Review policy and regulatory frameworks that hinder timber and NTFP production and marketing, in consultation with key stakeholders, including policy-makers at local and national levels, community producers, traders along value chains and company buyers	<ul style="list-style-type: none"> <li>Participatory assessment and stakeholders' analysis designed</li> </ul>	2013	<p>Accomplished</p> <p>During the inception meeting, plans for the overall activity for four years of the project duration were collaboratively identified with the main partners. CIFOR compiled and circulated the scoping reports on the three objectives in collaboration with partners involved. Detailed first year-plan was developed for specific sites. The CIFOR-ICRAF team produced a questionnaire and field guidelines for a baseline study. CIFOR finalised sampling frames for the three sites. CIFOR also coordinated the process of developing a framework for data analysis. Detailed working plan and design for participatory assessment and stakeholders' analysis was developed and finalized prior to the assessment through FGDs at the district and village levels in collaboration with WWF and Gadjah Mada University.</p>
		<ul style="list-style-type: none"> <li>Policy working group (PWG) established</li> </ul>	2014	Accomplished, information under 3.2.
		<ul style="list-style-type: none"> <li>Report on disincentives in policy and regulatory frameworks (including land and tree tenure) produced</li> </ul>	2014	For Sumbawa and Timor Tengah Selatan, studies were led by WWF. Studies in Gunungkidul was led by Gadjah Mada University.
3.2	Propose improved regulations and government support, focussing on effective and practical implementation, in consultation with key stakeholders identified in 3.1, and	<ul style="list-style-type: none"> <li>Consultations on improved policy and regulations with government agencies, communities and other key stakeholders implemented</li> </ul>	2014 - 2015	<p>In Gunungkidul, the current working group, i.e. Farm Forestry Consortium (<i>Pokja Hutan Rakyat Lestari</i>), which is one of the project partners, is revitalizing its group. In Sumbawa it was formalised through the Head of the District Decree No. 70/2015 (<i>Surat Keputusan Bupati Sumbawa No.70, 2015</i>); in Timor Tengah Selatan, through the Head of the District Decree No. 416/2014 (<i>Keputusan Bupati Timor Tengah Selatan Nomor 416/Kep/HK/2014 tanggal 12 Desember 2014</i>). CIFOR and WWF co-organised and facilitated the FGDs at the district level in Timor Tengah Selatan and Sumbawa. In coordination with CIFOR, WWF led the FGDs at both village and provincial levels. CIFOR and FFC led FGD at the village and district levels in</p>

No.	Activity	Outputs/ Milestones	Completion date	Comments
	collaboratively analyse the impacts of the various scenarios			<p>Gunungkidul. Follow up study conducted by CIFOR and UGM to assess the impacts of overly regulated policies on farm forestry practices in Gunungkidul. Intensive consultation through PWG in defining proposed recommendations, and consultation with stakeholders at the district and provincial levels: forestry NGOs based in Yogyakarta, and Forestry Agency of Yogyakarta Province. Most of the consultation was conducted in conjunction with the dissemination process of the data analysis results of the baseline household data in three sites.</p> <p>Intensive consultation on the processes of facilitating the improvements through:</p> <ul style="list-style-type: none"> <li>• Developing strategic planning (<i>Rencana strategis terpadu</i>) for timber &amp; NTFP management at the district level</li> <li>• Working plans that include training for the local community to improve their policy knowledge and stakeholders at the district level.</li> </ul>
		<ul style="list-style-type: none"> <li>• Report on improvements to regulations and policies published for more effective policy frameworks finalised</li> </ul>	2014 - 2015	<p>Three reports have been completed. Reports on assessment of policy constraints in Sumbawa and Timor Tengah Selatan was led by WWF and CIFOR. Report on the assessment of policy constraints in Gunungkidul was led by Gadjah Mada University and CIFOR. A journal paper has been submitted to Forest Policy and Economics, collaboratively led by UGM and CIFOR. Initial consultation with focal points at the ministerial level in Jakarta (i.e. FORDA DG and Director of Social Forestry) has been conducted. An analytical framework for analysing impacts of the various scenarios has been developed as first step to implement Activities 3.3. The scenario analysis is focused on the Sumbawa case study, as it has been managed under one forest management unit of KPH. The methodology can be shared for other research sites.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• Report: Maryudi, A., Nawir, A. A., Permadi, D. B., Pratiwi, D. and Sumardamto, P., 2014. Smallholding Forestry in Gunungkidul District, Yogyakarta Province: The current regulatory frameworks on production, processing and marketing systems, CIFOR (Center for International Forestry Research), Bogor.</li> </ul>



No.	Activity	Outputs/ Milestones	Completion date	Comments
				<ul style="list-style-type: none"> <li>• Report: Putro, W. D., Nawir, A. A., Hakim, M. R., Syafii, S. and Julmansyah, 2014. Policy analysis in support of the production, marketing and processing of timber and non-timber forest products in Sumbawa District - West Nusa Tenggara (in Bahasa Indonesia).</li> <li>• Report: Kian, D. A., Nawir, A. A., Hakim, M. R., Nomeni, Y. F. and Syafii, S., 2014. Policy analysis in support of the production, marketing and processing of timber and non-timber forest products in Timor Tengah Selatan District - East Nusa Tenggara (in Bahasa Indonesia).</li> </ul>
3.3.	Designing trial applications of the new policy/regulations and analysing the impact of these changes.	<ul style="list-style-type: none"> <li>• Participatory processes for designing the trial application of the new policy/regulations</li> <li>• Series of consultations with key stakeholders, including communities and government</li> </ul>	2015 - 2017	<p>Accomplished</p> <p>Three strategies developed (see Appendix 2):</p> <ol style="list-style-type: none"> <li>1) Sumbawa: Grand Strategy for integrated timber and NTFP management at the landscape level</li> <li>2) Timor Tengah Selatan: Grand Dstrategy for integrated NTFP management at the landscape level</li> <li>3) Gunungkidul: Improve the cost effectiveness of the policy on timber verification and certification and promote NTFP as part of the local government development strategy</li> </ol> <p>Consultation activities include:</p> <ul style="list-style-type: none"> <li>• Workshop on the debriefing session for PWG members, followed-up with participatory planning processes to formulate and develop the grand strategy</li> <li>• Initiation workshop to discuss the conceptual framework for formulating and developing the grand strategy</li> </ul>

No.	Activity	Outputs/ Milestones	Completion date	Comments
				<ul style="list-style-type: none"> <li>• Training workshop for PWG members on: policy and law advocacy in the related sectors for developing integrated timber and NTFP management</li> <li>• Coordination meeting between PWG Sumbawa and technical government agencies at the provincial level</li> <li>• Mapping potential timber production and developing the coding system for timber from community members' privately owned land in Pelat Village as part of the requirements for establishing a partnership with the Forest Management Unit (KPHP) and industries</li> <li>• Advocacy for obtaining a decree from the head of the district to legitimately support the grand strategy document</li> <li>• Coordination meeting between PWG and the stakeholders at the district level to build similar understanding, and distributing responsibilities among stakeholders for operationalising GSD of integrated timber and NTFP</li> <li>• Coordination meeting between PWG and the stakeholders at the district level to build similar understanding, and distributing responsibilities among stakeholders for operationalising GSD of integrated timber and NTFP</li> <li>• Coordination meeting between PWG and the stakeholders at the district level to build similar understanding, and distributing responsibilities among stakeholders for operationalising GSD of integrated timber and NTFP</li> <li>• Provincial level meeting to facilitate a multi-stakeholder discussion with regards to the direction of forestry management in Yogyakarta Province after the implementation of Law 23/2014</li> <li>• Regular multi-stakeholder discussion on finding solutions to problems for community-based forest management that may arise after the implementation of Law No. 23/2014</li> </ul>

No.	Activity	Outputs/ Milestones	Completion date	Comments
		<ul style="list-style-type: none"> <li>Impact analysis of proposed improved regulation and policies reported</li> </ul>	2016 - 2017	<p>Accomplished</p> <p>National dissemination of Grand Strategy for integrated timber and NTFP management at the landscape level. Talk show on “Grand strategy for integrated management of timber and NTFP at the landscape level, lessons learnt from Sumbawa, Timor Tengah Selatan and Gunungkidul District, as part of the national festival for community on social forestry across Indonesia Archipelago (PeSoNa 2016) organised by the Directorate General of Social Forestry and Partnership on Environment to share information, testimony and success story on social forestry.</p> <p>National consolidation meeting for mapping the partners in implementing social forestry. Important results: this meeting aimed to facilitate more synergy and effectiveness by understanding the roles of different partners to support the national social forestry program. Facilitating the participatory processes to develop the village government medium-term plans (RPJMDes) and annual working plan (RKPDes) in Pelat Village, as one of Kanoppi case studied villages. Batulanteh, Sumbawa District of West Nusa Tenggara. Landscape-based operationalising GSD was implemented by Samawa Center (NGO based in Sumbawa District).</p> <p>Participatory outcome assessment based using Theory of Change (ToC) has been conducted as part of the impact analysis of proposed improved regulation and policies. Potential impacts from other objectives were also assessed. The assessment covered the period from April 2013 to March 2017.</p>
				<p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>Report: Maryudi, A., Nawir, A. A., Sekartaji, D. A. and Sumardamto, P., 2015. The impacts of multiple harvest and marketing regulatory frameworks on the competitiveness of timber from private smallholder plantation of Gunungkidul District in the commercial markets, Research part of Kanoppi Project, implemented under a collaboration between CIFOR and the Faculty of Forestry, Gadjah Mada University.</li> </ul>

No.	Activity	Outputs/ Milestones	Completion date	Comments
				<ul style="list-style-type: none"> <li>• Report: Kusumawardhani, W., Kautsari, N., Martadinata, A. P. and Syafii, S., 2016. Grand strategy for integrated timber and NTFPs management based on landscape in Sumbawa District.</li> <li>• Report: Policy Working Group NTFPs, 2016. Grand strategy for integrated NTFPs priorities based on landscape in Timor Tengah Selatan district.</li> <li>• Report: WWF and CIFOR Team, 2016. Managing a participatory training workshop on policy and regulations in forestry sector.</li> <li>• CIFOR. 2016. Operationalising the landscape approach: Grand strategy for integrated timber and non-timber forest products at the landscape level (lessons from Sumbawa, Timor Tengah Selatan and Gunungkidul). In Proceeding of National Social Forestry Event - Ministry of Environment and Forestry.</li> <li>• Book: Putro, W.D. and Nawir, A. A., 2017. Review on the impact of Act no. 23 (UU 23/2014) on community based management regimes in facilitating the integrated management of timber and non-timber forest products at farm and landscape level (in Bahasa Indonesia), CIFOR and Mataram University, Yogyakarta. Forthcoming.</li> <li>• Journal article: Maryudi, A., Nawir, A. A., Permadi, D. B., Purwanto, R. H., Pratiwi, D., Syafi'i, A. and Sumardamto, P.,2015. Complex regulatory frameworks governing private smallholder tree plantations in Gunungkidul District, Indonesia, Forest Policy and Economics, 59: 1-6.</li> <li>• Journal article: Afianto, A., Maryudi, A., Nawir, A. A., Sekartaji, D. A., Sumardamto, P., Purwanto, H., Sadono, R., Suryanto, P., Soraya, E. and Riyanto, S., 2015. Smallholder farmers' knowledge of regulations governing the sale of timber and supply chains in Gunungkidul District, Indonesia., Small-Scale Forestry,1-13.</li> <li>• Journal article: Maryudi, A., Nawir, A. A., Sekartaji, D. A., Sumardamto, P., Purwanto, R. H., Sadono, R., Suryanto, P., Soraya, E. and Riyanto, S., 2015. Farmers' knowledge on multiple regulatory regimes governing supply chains of timber from privately-grown smallholder plantations in Indonesia, Small-Scale Forestry.</li> </ul>

No.	Activity	Outputs/ Milestones	Completion date	Comments
				<ul style="list-style-type: none"> <li>Journal article: Maryudi, A., Mulyana, B., Nawir, A. A., Sekartaji, D. A., Siswoko, B.D., Sumardamto, P., Supriyatno, N., Soraya, E. and Yuwono, T., 2017. Beyond good wood: Exploring strategies for small-scale forest growers and enterprises to benefit from legal and sustainable certification in Indonesia, <i>Journal of Agriculture and Rural Development in the Tropics and Subtropics</i>. Vol. 118 No. 1 (2017): 17-29.</li> <li>Book: Maryudi, A. and Nawir, A. A. (Eds.), 2017. 'Hutan Rakyat Di Simpang Jalan' ('Which Way Forward? Smallholder Tree Planting and Artisanal Timber Processing and Marketing'). UGM Press, Yogyakarta.</li> </ul>

**Objective 4: Enhance expansion of smallholder-managed integrated timber and NTFP production systems**

No.	Planned activity	Outputs/milestones	Completion date	Comments
4.1.	Assessment of current extension methods and practices, in consultation with key stakeholders, including community producers and government technical and extension agencies	<ul style="list-style-type: none"> <li>Current extension characteristics identified</li> <li>Needs, challenges and problems for developing effective extension methods and practices identified</li> </ul>	2014 - 2015	<p>Accomplished</p> <p>Survey on current extension activities has been conducted in Gunungkidul, Timor Tengah Selatan, and Sumbawa. The reports on needs, challenges, and problems for extension method development in the three districts has been completed and used as reference for Activities 1.4, 2.3, 3.3., and developed into a working paper, published in Bahasa Indonesia and English.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>Report: Riyandoko, 2015. Extension methods and practice in Gunungkidul district, Yogyakarta Special Region (in Bahasa Indonesia)</li> <li>Report: Riyandoko, 2015. Extensions methods and practice in Timor Tengah Selatan district, East Nusa Tenggara (in Bahasa Indonesia)</li> <li>Report: Riyandoko, 2015. Extension methods and practice in Sumbawa district, West Nusa Tenggara (in Bahasa Indonesia)</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
		<ul style="list-style-type: none"> <li>• Report on effectiveness of current extension practices published</li> </ul>	June 2015	<ul style="list-style-type: none"> <li>• Working paper: Riyandoko, Martini E, Perdana A, Yumn A, Roshetko JM. 2016 Existing conditions, challenges and needs in the implementation of forestry and agroforestry extension in Indonesia (in Bahasa Indonesia)</li> <li>• Working paper: Riyandoko, Martini E, Perdana A, Yumn A, Roshetko JM. 2016 Existing conditions, challenges and needs in the implementation of forestry and agroforestry extension in Indonesia (Appendix 4)</li> <li>• Proceedings: Riyandoko, Martini E, Perdana A, Roshetko JM. 2015. Position, challenges and potential of agroforestry extension in Indonesia: Case studies in Gunungkidul, Sumbawa, and Timor Tengah Selatan (in Bahasa Indonesia)</li> </ul>
4.2.	Develop locally oriented extension programs using a participatory approach to deliver information on most appropriate practices for integrated management, production and value-added marketing, and contribute to an effective dissemination of related policy and regulations	<ul style="list-style-type: none"> <li>• Preparation of communications strategy</li> <li>• Action plans for wider dissemination and extension capacity building produced</li> <li>• Extension capacity building conducted</li> </ul>	April 2015	<p>Accomplished</p> <p>A communications strategy and action plan document has been developed and shared with objective members, and serve as reference for project activities.</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>• Guidebook: SPEAK Indonesia, 2015. Capacity strengthening in communications for farmer behavioural change on integrated timber and non-timber forest production (in Bahasa Indonesia)</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
		<ul style="list-style-type: none"> <li>• Farmers' days, cross-visits and informal training will be conducted to enhance farmers' and existing extensionists' exposure to, and awareness of, most appropriate management practices for timber and NTFPs, including awareness of, and access to, quality germplasm</li> </ul>	2015 - 2016	<p>Accomplished</p> <p>Extension capacity building were conducted in a form of farmer field schools, trainings, and cross-visits in conjunction with Activities 1.4, 2.3, and 3.3. A total of 1,971 partners (24% women) were reached and had their capacity built through various activities. A table by site is provided Section 8.2.</p> <p>Workshops and farmer field schools were conducted between May 2015 – Feb 2016 with topics on timber and NTFP production, extension information dissemination, indigo paste production, bamboo nursery, clump management, and preservation, attended by government and voluntary extension agents, men and women farmers, and interested stakeholders. Cross visit were conducted in Lombok. Materials of cross visit include: <i>Trigona sp</i> beekeeping, honey processing, <i>Trigona sp</i> product marketing strengthening of farmers group, and local regulations which support to <i>Trigona sp</i> managements. Trainings, farmer field schools, and cross visit conducted collaboratively by ICRAF, Mataram University, NTFP research center (NTFP research centre in Mataram) and WWF Indonesia.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• Report: Riyandoko, 2015. Farmer field school in production, marketing, and regulations: timber and NTFP for farmers in Sumbawa (in Bahasa Indonesia)</li> <li>• Report: Riyandoko, 2015. Training for volunteer extension agents and farmer champions on timber and NTFP for livelihood enhancement in Timor Tengah Selatan (in Bahasa Indonesia)</li> <li>• Proceedings: Riyandoko, Martini E, Roshetko J. 2015. Female farmers participation in agroforestry extension activities in Indonesia</li> <li>• Report: Riyandoko, 2015. Training for volunteer extension agents and farmer champions on timber and NTFP for livelihood enhancement in Gunungkidul (in Bahasa Indonesia)</li> <li>• Report: Riyandoko, 2016. Cross visit on <i>Trigona sp.</i> management in North and Central Lombok districts (in Bahasa Indonesia)</li> </ul>

No.	Planned activity	Outputs/milestones	Completion date	Comments
				<ul style="list-style-type: none"> <li>• Guidebook: Riyandoko, Ingram W, Sukadana IW, Sujata IK, Maduarta IM, 2016. Guide on indigo paste production for weaving thread natural colouring at household level in Timor Tengah Selatan (in Bahasa Indonesia)</li> <li>• Report: Riyandoko, 2016. Bamboo nursery, clump management, and preservation workshop in Gunungkidul (in Bahasa Indonesia)</li> </ul> <p>Kanoppi project partners contributed articles in Kiprah Agroforestri, ICRAF periodicals, on project site profiles, activity development and lessons learnt. Approximately 1000 copies has been printed and distributed to ICRAF partners, including local government agencies in Indonesia.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• Periodical: Rahayu S, Perdana A, Juita R (eds), 2015. Kiprah Agroforestri, 7 (1). World Agroforestry Centre, Bogor (in Bahasa Indonesia).</li> <li>• Periodical: Rahayu S, Riyandoko, Atikah A (eds), 2016. Kiprah Agroforestri, 9 (1). World Agroforestry Centre, Bogor (in Bahasa Indonesia).</li> </ul> <p>Kanoppi project produced three information sheets for farmers, policy working group members, project partners, local government officers, and extension agents on: 1) teak silviculture, marketing and regulations; 2) teak and ginger intercropping; and 3) <i>Trigona</i> sp. Over 2000 copies were printed and distributed.</p> <p><u>Publications:</u></p> <ul style="list-style-type: none"> <li>• (O4.16) Information sheet: Riyandoko, Sabastian GE, Anggrayani S. 2015. Teak as source of livelihoods enhancement for smallholder farmers (in Bahasa Indonesia)</li> <li>• (O4.17) Information sheet: Sabastian GE, Anggrayani S, Riyandoko. 2016. Benefits of teak with ginger and galangal intercropping management in community teak gardens in Sumbawa and Gunungkidul (in Bahasa Indonesia)</li> <li>• (O4.18) Information sheet: Riendriasari SD, Riyandoko. 2016. Trigona bee maintenance (in Bahasa Indonesia)</li> </ul>



No.	Planned activity	Outputs/milestones	Completion date	Comments
4.3	Develop collaborative manual of most appropriate extension practices and disseminate to numerous sites and users	Manual of most appropriate extension practices published	2016	<p>Accomplished</p> <p>A manual has been developed for extension agents and lead farmer capacity building. Manual field testing conducted in conjunction with activity 4.2. Field tests were conducted involving a total of 109 respondents (25 women): May 2015 for Sumbawa, October 2015 for Timor Tengah Selatan, and December 2015 for Gunungkidul.</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>(O4.19) Guidebook: Riyandoko. 2016. Agroforestry advisory service for farmers in Indonesia: guide for extension agents and farmer champions (in Bahasa Indonesia).</li> </ul>
		Final workshop organised	<p>March, 2016 in Sumbawa</p> <p>May, 2016 in Gunungkidul</p> <p>June, 2016 in Timor Tengah Selatan</p>	<p>Accomplished</p> <p>The workshops have been conducted in Sumbawa, Gunungkidul and Timor Tengah Selatan to evaluate the prevalence of farmers towards extension materials and information dissemination trainings conducted in 2015.</p>
		Final report published		<p>Accomplished</p> <p>Final report has been completed and developed into a working paper. This working paper will be published in English by end of 2017 under Kanoppi2.</p> <p><u>Publication:</u></p> <ul style="list-style-type: none"> <li>Working paper: Riyandoko, Martini E. 2016. Farmers' preference towards extension topics and agroforestry information dissemination (in Bahasa Indonesia)</li> </ul>

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## 7 Key results and discussion

### **Objective 1: Develop and implement integrated timber and NTFP production systems to enhance local livelihoods**

The project conducted a household study in 2013-14. Not restricted to families producing timber or NTFPs, the study surveyed 30% of all farm families in 15 hamlets. For the previous three-year period, the average contribution of timber and NTFPs to on-farm income in Gunungkidul, Sumbawa and Timor Tengah Selatan districts were 4.5%<sup>1</sup>, 33.3% and 40.2%, respectively. Across all three sites, timber contributed only 1.3% of on-farm income compared 24.7% for NTFPs and 73.0% for agriculture crops. The average age of household heads was 48 years and most considered themselves primarily farmers. They allocated up to two household members for agricultural management. Most household heads (80%) were literate with formal education through primary school; however, only 40% have received timber or NTFP management training or participated in the farmer group activities. Also, only 30% of respondents had knowledge of national regulations regarding timber and NTFPs management or marketing; and only half of them had knowledge on product-market specifications. On-farm incomes averaged 17.9 million IDR/year (1,753 AUD/year) and off-farm activities, such as running small kiosks, industrialized labour, carpentry, and government employment contributed to an annual income of about 9.29 million IDR/year (910 AUD/year). The average land area managed by each household was approximately 0.5 ha, comprising an average of three parcels where farmers cultivated with four to five priority timber and NTFPs species.

The adoption of improved silvicultural practices can enhance timber and NTFPs production. However, many factors influence farmers' adoption of those practices. A project study confirmed that farm and household characteristics affect the adoption of timber and non-timber forest product management practices by farmers in Gunungkidul, Sumbawa and Timor Tengah Selatan districts. Farmers who have accesses to extension services, farmer groups, and knowledge of government policies were more likely to adopt improved timber and NTFPs production practices. The probability of adoption increased with the area of land managed per farm families, due to the increase in available space for growing more timber and NTFPs species. Also, the adoption of timber and NTFPs management practices increased as farmers' on- and off-farm incomes increase. These findings suggest that farm and household characteristics must be considered by policy makers, researchers and extension providers when designing extension programs specific for local conditions.

The factors affecting farmers' ability to adopt improved timber and NTFPs management practices vary moderately between districts. In Gunungkidul, farmers who have adopted silvicultural management practices cultivate up to 40% more species than non-adopting farmers. Adopting farmers tend to have more land and higher incomes. However, adoption of silvicultural management practices by farmers depends on the availability of family labour, as farmers will not hire labour to conduct silvicultural management. In Sumbawa and Timor Tengah Selatan adoption is limited by other factors. Farmers there are 2 to 4 times more likely to adopt silvicultural practices when they have access to extension training opportunities. In Timor Tengah Selatan farmers are more likely to adopt if they participate in farmer group activities. In Sumbawa and Timor Tengah Selatan farmer access to markets is lower than in Gunungkidul. In those locations, farmers who feel they have market information and access are twice as likely to adopt silvicultural management practices. The closer the farmer lives to the forest, the more likely they are

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<sup>1</sup> A previous study by the project team (Roshetko et al 2013) reports that timber production accounts for 15% of total income for timber farming families.

to adopt sustainable management practices for the extraction of NTFPs, particularly wild-honey in Sumbawa.

To increase the likelihood of adoption, eleven on-farm trials were designed through a participatory process including farmers and ICRAF-FORDA researchers. The trials were established in farmers' existing agroforestry systems in Gunungkidul, Sumbawa, Lombok, and Timor Tengah Selatan. The silvicultural trials established are listed here, results reported represent second year data:

1. Silvicultural practices to improve teak production in Gunungkidul.
  - a. Pruning regimes (50% and 60%) and thinning treatment (reduce stocking to 950 trees/ha) yielded higher timber growth compared to no-silvicultural treatment ranging from DBH increment of 0.73 cm/year to 1.01 cm/year.
  - b. The combination of 60% pruning and thinning increased DBH incremental growth by 0.01 cm/year.
2. Cultivating ginger (jahe emprit - *Zingiber officinale* var. *amarum*) in the understory of teak systems in Gunungkidul.
  - a. Singling and fertilizing (manure 5 ton/ha + NPK 525 kg/ha) treatments significantly increased teak DBH increment growth by 14.6 and 20.6 cm, respectively; thinning increased total height by 7.0 cm.
  - b. Combined treatment of 60% pruning, singling, and fertilizing increased DBH increment by 2.2 cm compared to each individual treatment.
  - c. Combined treatment of 60% pruning and singling increased ginger yields 4.8 gram/rhizome, while fertilizing significantly increased ginger yields by 44.9 gram/rhizome.
3. Improving productivity of unmanaged bamboo apus (*Gigantochloa apus*) in Gunungkidul.
  - a. Interaction between fertilizing (manure 50 kg/clump and manure 50 kg + Urea 1 kg + SP36 0.2 kg/clump) and thinning (reduced to 10 culms/year and reduced to 5 culms/year) increased the DBH increment and height growth by 5.9 and 40.7 cm, respectively, with total culm height of 11.7 m.
4. Silvicultural management and intercropping with jahe emprit (*Zingiber officinale* var. *amarum*) and kencur (*Kaempferia galanga*) to improve growth of teak in Sumbawa.
  - a. The combination of 50% pruning and 25% thinning increased DBH incremental growth by 2.42 cm.
  - b. The combination of 50% pruning and 25% thinning did not increase the production of ginger and kencur.
5. Identifying silvicultural practices to improve teak production on sloping land in Sumbawa.
  - a. Treatments included 50% and 60% pruning and 25% thinning.
  - b. Thinning 25% significantly increased DBH incremental growth 1.4 cm.
6. Fertilization and coppicing to increase the productivity of rumput ketak (*Lygodium circinatum* (Burm.f.) Sw in Sumbawa.
  - a. Coppice treatments (no coppicing, reduced to 5 stems/clump, reduced to 10 stems/clump) and fertilizer treatments (no fertilizer, manure 5 kg/clump, manure 5 kg/clump + urea 50 gram/clump) did not increase the production of rumput ketak.

7. Fertilization and coppicing effects on fruit production of kayu ules (*Helicteres isora* L.) in Timor Tengah Selatan.
  - a. Treatments included fertilization (NPK 60 gram/clump) and coppicing (heavy coppicing: reduced to 3 culms/clump; and moderate coppicing: reduced to 6 culms/clump).
  - b. Heavy coppicing treatment yielded the greatest fruit production (86.3 gram/clump).
  - c. The combination of fertilizer and coppicing significantly reduced fruit yields by 45.1 gram/clump and 18.8 gram/clump.
8. Effects of fertilizer application on the leave production of two varieties of tarum (*Indigofera tinctoria* L.) in Timor Tengah Selatan.
  - a. Fertilizer treatment (NPK 60 gram/plant) had no effect on leaves production (the lack of effect may be the result of drought conditions experienced during the trial).
  - b. The straight variety of indigo appears to be more vulnerable to drought, as 100% of the straight plants died compared to 60% of the bent variety.
9. *Trigona* sp. management to increase production of bee bread, honey and bee propolis in Lombok.
  - a. Treatments included placements of stups in vertical or horizontal positions, and in homegardens or near forests.
  - b. Drought conditions during the trial limited the production of bee forage (nectar and pollen). No statistically significant treatment effects occurred.
  - c. However, vertical stups placed near the forest showed a trend to higher yields of bee bread (14.8 gram), honey (8.9 gram) and bee propolis (6.9 gram) compared to other treatments.
10. Silvicultural management to increase production of smallholder mahogany (*Swietenia macrophylla*) stands in Lombok.
  - a. Treatments include 40% pruning and 28% thinning.
  - b. The combination of 40% pruning and 28% thinning increased DBH and height incremental growth by 0.8 cm/year and 1.3 m/year, respectively.
  - c. Pruning 40% increased incremental growth of DBH and height by 0.7 cm/year and 1.2 m/year; while 28% thinning increased DBH and height incremental growth by 1.2 cm/year and 1.5 m/year, respectively.
11. Silvicultural management of bamboo galah (*Gigantochloa atter*) and bamboo petung (*Dendrocalamus asper*) in Lombok.
  - a. The combination of intense thinning over a 3 year period (Year-1: 35.3%, Year-2: 26.0%, Year-3: 17.6%) and fertilizer application (cow manure 50 kg/clump, NPK 10 kg/clump, goat manure 50 kg/clump) increased the number of culms of bamboo galah by 56.8 culms/clump (Year-1), 65.1 culms/clump (Year-2), 68.0 culms/clump (Year-3). Incremental growth of DBH and height increased by 0.68 cm and 0.13 m, respectively.
  - b. Drip irrigation (using plastic 600 ml bottles, soil pot 600 ml, bamboo pot 600 ml) and fertilizer application (cow manure 2 kg/culm, NPK 60 gram/culm, goat manure 2 kg/culm) increased the seedling survival of local and tissue culture bamboo petung by 67.7% and 82.1%, respectively.

The adoption of improved silvicultural management practices holds potential to enhance smallholder timber and NTFP production and marketing systems. Training and information

should be provided to farmers to facilitate and accelerate the adoption of silvicultural practices. However, ability of individual farmers to adopt improved silvicultural practices is greatly influenced by their farm and household characteristics, such as: level of education, access to extension services, membership in farmer groups, landholdings, on-farm and off-farm income, awareness of government policies, and market knowledge and access. Thus silvicultural extension activities and information should be designed and implemented with consideration of farmers' capabilities and characteristics. The design approach, which should include policy makers, researchers and extension providers, should be centred on supporting farmers' livelihood strategies.

## **Objective 2: Identify and implement enhanced marketing strategies and value chains to improve timber and NTFP market links for smallholders**

Teak, candlenut, bamboo, indigo, ginger, galangal, coconut, and honey were amongst the selected commodities for this project for several reasons: 1) farmers recognised these commodities as contributors to their household income, 2) value-adding processing is possible with these commodities, and 3) demand is high for these products and markets are accessible. The project members also considered three other commodities with high demand but were relatively unknown to farmers: 1) kayu ules (*Helicteres isora*), 2) tai angin (*Usnea* spp), and 3) rumput ketak (*Lygodium circinnatum*).

The project's initial rapid market appraisals and value chain analysis of these commodities, conducted between 2013-2014, show that smallholder teak has its own niche in the wooden furniture industry in Central Java, with a sale price of up to 1.8 million IDR/m<sup>3</sup> in Gunungkidul. Round candlenuts can be sold in markets at around 25,000 IDR/kg in eastern Indonesia. Indigo, precipitated from the dye vat and dried into cakes for storage and transportation, sold at 200,000 IDR/kg to dyers in Bali. Kayu ules and tai angin were found to have an increasing demand for medicinal/herbal drinks in Indonesia.

Throughout 2014-2016, workshops on product value adding were conducted to increase farmers', and other stakeholders', knowledge and capacity. Strategies were proposed to the participants for the development of their businesses. As an example, after following a range of training activities, farmers in Timor Tengah Selatan were able to produce virgin coconut oil (VCO) and candlenut oil. With total cost of goods per litre of around 70,000 IDR, in 2015 these farmer producers were linked to Bluestone Botanicals, an essential oil company in Bali, who bought VCO for 130,000 IDR per litre and candlenut oil for 160,000 IDR per litre. The company was willing to commit a monthly purchase of 50 litres of VCO and 10 litres of candlenut oil.

Processing candlenut is very labour intensive. Villagers in Sumbawa and Timor Tengah Selatan process and sell candlenut to a low value market, where local buyers then bulk and resell the product for good profit. For this reason, a Macadamia nut cracker was brought from Australia to test as a labour saving device. There was an average of 113 candlenut per kilograms. Using the nutcracker, villagers could process one kg of cleaned nuts in 54.3 person-minutes. The test involved a five person team processing 16 kilograms of whole candlenuts. On average three kilograms of whole candlenuts yields one kilogram of unshelled candlenuts and two kilograms of shell requiring 25 minutes for a three-person team. Additional time was required to extract the nuts from the shells. In Oel Ekam, 87 kilograms of candlenut produced 3.75 litres of oil from the first pressing and two litres from the second pressing. Collaboration with the candlenut oil buyer in Bali showed the cold press process produced a high quality oil with very little odour. In Batudulang, Sumbawa, farmers who were facilitated by the project also used the nutcracker and produced candlenut oils. Three kilograms of candlenuts (12,000 IDR per kilogram) can produce four 85ml bottles of oil, sold at 20,000 IDR each. One farmer was reported to sell 50 bottles at a total price of 1,000,000 IDR.

The project identified a potential for the underutilised species kayu ules. The main global exporter of kayu ules is India, which exports to 19 countries, far beyond the natural

geographical distribution of this species. Over the 27-month period (January 2013 – March 2015), India exported 351 tonnes of kayu ules. Most of the exports (85.3%) were to Indonesia (299 tonnes or 133.1 tonnes/year). Indonesia demand for kayu ules is supplemented by an intra-island trade in Java and an inter-island trade from East Nusa Tenggara. West Timor, for example, exports around 31-37 tonnes of air-dried kayu ules per year to Java. At the farm gate, local harvesters in Timor Tengah Selatan obtain 4,000 IDR per kilogram, with businesses in Java paying 25,000 IDR per kilogram for kayu ules. This is similar to the price paid for kayu ules imported from India to Java. Improved local benefits to local villagers are likely to come from improving kayu ules quality through better drying techniques. There is opportunity to cultivate kayu ules in smallholder teak plantations in Indonesia, with multiple-use of both kayu ules fruits and its fibrous bark which has medicinal uses. Kayu ules re-sprouts vigorously making it easy to retain. This species has strong potential to remain a supplementary source of income to farmers in West Timor.

Project partners in Timor Tengah Selatan made considerable efforts to link indigo farmers with the end users of indigo paste. One international knitware manufacturer, the Wooden Ships, was involved in improving indigo paste production in the district. The company requires 400 kg of indigo-dyed yarn per month. One hectare of indigo will produce 250 kg of paste that can dye 150 kg of yarn, thus farmers need to harvest 2.7 hectares per month to service the Wooden Ships demand. With the price indigo paste of about 85,000 IDR per kilogram and the company taking 15% as profit, the farm gate price would be 44,000 IDR per kilogram. This farm gate price represents a gross income of 22,000,000 IDR per hectare per year for the farmer, the great attraction of this crop is that it requires very little labour or physical inputs. An additional productive link has been with a Textile Technology University in Bandung, Indonesia who now works closely with Threads of Life.

Stems of the climbing fern rumput ketak are widely used in the Asia-Pacific region for basketry, but rumput ketak trade has been little studied. Due to commercial depletion of large rumput ketak stems in Bali, wild harvested rumput ketak from montane forests of Flores, Sumbawa and Central Kalimantan is shipped in bundles to a village market in east Bali. Under current non-selective harvesting of rumput ketak stems, a harvester is able to collect ten bundles (each of 70-100 stems) per day, selling these for 5000 IDR per bundle (an income of 5 AUD per day), which is above the average daily income for the area. These are sold to traders who re-sell the bundles in Lombok and at markets in East Bali, where they are bought by local farmers who supplement their income by weaving fine quality baskets. Trials in Sumbawa indicate that pruning and fertilizing rumput ketak yields a benefit-cost ratio that is greater than one, suggesting that farmers can obtain profit by cultivating rumput ketak. Recommendations have been made regarding how to benefit local communities at each end of the value-chain.

A study on smallholder business shows that at most project sites farmer groups develop an un-binding business practice, formed only during sales of products. Examples include, teak and bamboo in Gunungkidul; teak and candlenut in Sumbawa; and candlenut, avocado, coconut oil, forest honey, and naturally dyed woven fabric in Timor Tengah Selatan. Although marketing principles are not adequately implemented in all three sites, farmer groups do properly organised sales through intermediaries.

Through business-related workshops and further participative assessments, collective business models were found to be most preferred by farmer groups at each site. The business models are composed of farmer group members with a simple organisational structure, which pools resources, shares information and provides benefits for their members. A value-added reseller model was also developed. It is a model embedded in the collective model where the group adds value to the original products gathered by the group members. This value addition (product processing) is essential for distribution of products to intermediaries further down the market chain.

Small-scale business capacity building (technical and financial) for interested groups was conducted between March – April 2015 for Timor Tengah Selatan, Sumbawa and in June

2015 for Gunungkidul. In Bosen, Timor Tengah Selatan, the only identified business unit for all NTFP marketing is the village BUMDes (village-owned business unit). The development and initiation of the BUMDes has been held up by district and regency level bureaucracy. The BUMDes currently has no structure or activities, and is not a viable organisation through which to conduct capacity building. In Fatumnasi, community business units associated with WWF activities were identified as targets for the project. Threads of Life's capacity building skills have been offered to WWF for their community business groups. In Sumbawa, smallholder collective business groups exist and are preferred by its members. During the no-cost extension period, project members met with the Sumbawa Policy Working Group to develop a village regulation supporting the operation of a BUMDes in Pelat village and to redesign the BUMDes as a smallholder timber business unit and a learning centre.

To increase market access, Threads of Life and University of Western Australia linked farmer groups in Timor Tengah Selatan with a network of companies in Bali, Central Java, and Australia, such as Wooden Ships, PT Sido Muncul, a herbal drink manufacturer, Blue Stones Botanicals, Jamusara, and Pacific Provender for essential oils. ICRAF and FFC in Gunungkidul linked bamboo farmer groups with local manufacturers to increase farmers' capacity in understanding and meeting market specifications. To optimise teak marketing, Universitas Mataram, ICRAF, and WWF Indonesia collaborates with CV. Makassar Utama, a local teak processor, and PT Jawa Furni Lestari, a Yogyakarta-based teak furniture manufacturing company, to assist farmer groups in business capacity development. CIFOR and FFC formed a bamboo growers association in Gunungkidul under the name 'Deling Handayani' to serve as a communication forum for growers to discuss cultivation and marketing issues.

### **Objective 3: Analyse and improve policy frameworks to facilitate smallholders' production and integrated marketing of timber and NTFPs**

#### *Analysis of policy constraints*

Using the matrix (see Figure 5) as the framework in mapping various regulations governing timber and NTFPs along the supply and market chains, the researchers, involved in each case study district conducted in-depth research. The research also conducted to understand the translation of the national level regulations into practice at the village and district levels. Under the implementation of regional autonomy, there were incidences of overlapping of policy and regulation frameworks produced by the district governments in addition to those produced by central government. The policy constraints identified when trying to facilitate cost-effective smallholders' production, and integrated marketing of timber and NTFPs include: 1) an overly regulated system, and 2) overlapping policy and regulation frameworks. There are several implications from ineffective current policies and regulation frameworks that have initially been observed, such as 1) disincentives in production systems; 2) low cost-effective value added processing industries; 3) high transaction costs; and 4) opportunities for middle-men and brokers to gain large shares of the profit margins that suppress the farm gate prices. However, in several cases, we need to recognise that traders often play an important role in bringing together farmers and processing companies, and this helps support local livelihoods.

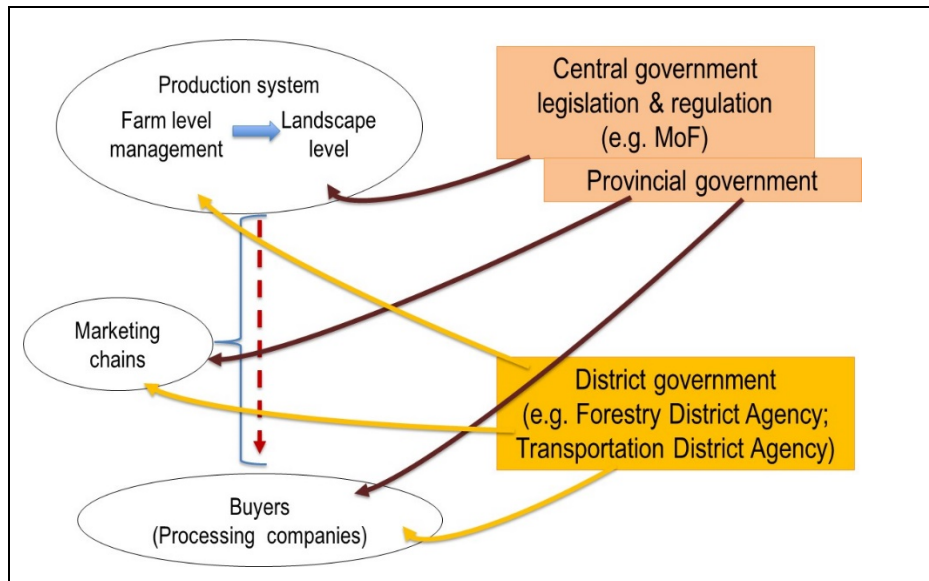


Figure 5. Overlapping processes in producing policy and regulation framework by central government and district government under the Law No. 32/2004

There are relationships between complementary management characteristics of timber and NTFPs as reflected in the household income portfolio, forest land status managed by households, and the landscape type of surrounding forests close to the village. The extent of the relationship of these aspects is driven by the legislation and regulations applied in an area. These can be observed from the three case study sites in Gunungkidul, Sumbawa, and Timor Tengah Selatan.

Firstly, households in Gunungkidul district privately own and manage most of the land. This is shown in the results of the baseline data analysis where 66% of the total respondents manage privately-owned lands, with and without land papers. In this case, there is more freedom among these households to explore various economic opportunities based on timber and NTFPs. Regulations applied are in response to an active free-market in the area, such as those related to permits for harvesting and transporting timber accepted by all actors along the supply and market chains. It has been observed that there are more regulations applied to timber than NTFPs.

Secondly, in Sumbawa district, NTFP management, marketing and processing are more advanced than timber commodities. There are three main reasons for this: 1) the areas managed are mostly privately-owned by rural villagers (95%), but these are next to the boundary of protection forests (some 37% are less than 3 km); 2) most of the community members that manage timber trees on their privately-owned land do not have any knowledge of timber harvesting and transporting permits; and 3) there are more agencies working on the marketing and processing of NTFPs such as the Sumbawa Forest Honey Network (*Jaringan Madu Hutan Sumbawa– JMHS*), which has intensively facilitated the local community in improving their practices in honey extraction from natural forests, as well as in its packaging and marketing the products outside of Sumbawa (e.g. in Jakarta).

Due to less controversial potential impacts of harvesting NTFPs, few regulations have been produced at the district level on NTFP management, harvesting and transporting. The national policies are the main references used in regulating the supply chain of various NTFPs harvested from natural forests and local community farmlands. Nevertheless, NTFP and timber products from the same plot owned by the same household are the target of different regulations and could result in costly compliances of management, harvesting, processing and marketing.



Thirdly, in Timor Tengah Selatan, similar to the situation in Sumbawa, most of the land managed by households in Fatumnasi village is close to the boundary of a nature reserve. About 71% of household surveyed own land less than 2 km from the nature reserve. Therefore, the villagers are not allowed to harvest the trees and they have limited access to NTFPs such as honey in these forests. While in another village, Bosen, about 45% of households surveyed who also own land less than 2 km from the nature reserve have more freedom to harvest timber, but limited knowledge on how to harvest and transport the timber. Informal customary norms and rules are found to be more effective in regulating day-to-day community forestry management, including maintaining the conservation area free from encroachment.

With the existing timber and NTFP potential and issues, an integrated timber and NTFP management strategy is required, since these two commodity categories had been treated separately. Therefore, both timber and NTFPs can support communities economically, ecologically and socially. Integrated timber and NTFP management was expected to overcome the limitations of uncomplimentary timber and NTFP management strategies, and to provide the synergy between these sectors, which had been lacking.

### *Preparation of Grand Strategies*

In Sumbawa, sectors providing capital to district programs operated in silos. A grand strategy document was prepared to overcome this by utilising a landscape based approach to promote integration of all aspects, from economic to environmental. Kanoppi studies determined 6 (six) priority watersheds based on the following criteria: 1) cover an area in excess of 10,000 ha; 2) have high utility and populations; and 3) have forest ecology characteristics. These priority watersheds are the Utan, Sumbawa, Moyo Hulu, Panas, Nangagali, and Boal watersheds. Preparation of the grand strategy for integrated timber and NTFP development was planned for a 10-year timeframe from 2016-2025 (See Appendix 2).

The preparation of this grand strategy document constitutes an effort in designing steps and strategies for integrated timber product and NTFP management in Sumbawa. The objectives of preparing this strategy are: 1) to support national policies in developing and enhancing community economic, ecological and social values from sustainable integration of timber and NTFPs; 2) to provide reference for the Sumbawa district government and West Nusa Tenggara provincial government in preparing policies on integrated landscape-based timber and NTFP management and environmental services management (eg. ecotourism).

The management strategies formulated for each specific component were based on the zonation of the watershed: upstream, midstream and downstream. Agroforestry development should aid the enforcement of the conservation function by taking into account priority species such as avocado (*Persea americana*), candlenut and coffee. Shade trees should include timber species with a closed canopy and high conservation value as a priority such as rimas (*Duabanga molucana*), suren (*Toona sureni*), dadap (*Erythrina sp.*) and udu (*Litsea accedentoides*). Matrix summarizing the main strategy and direction for developing integrated timber and NTFPs management at the landscape level is included in Table 1.

There were two decrees produced at the district level and two decrees are in progress at the village level. At the provincial level, there has been no progress despite the commitment that had been expressed by the provincial government as represented by the Regional Planning Agency of West Nusa Tenggara Province. Major challenges included the dynamics of the staff rotation in the government agencies, including the four time turnover of the Head of Forestry Agency, whom would be the important technical agency dealing with forestry management, including the management of timber and NTFPs.

Table 1. Sumbawa: government's commitments and decrees produced under Kanoppi Project

Government levels	Government decrees and commitments	Contents
Sumbawa District	District Head Decree No. 70/2015	The formation of Policy Working Group (PWG) on developing timber and NTFPs integrated management
	District Head Decree No. 144/2016	Grand strategy for integrated landscape-based timber and non-timber forest product management in Sumbawa District (2016-2020)
West Nusa Tenggara Province	Commitment from the Regional Planning Agency representing the Government of West Nusa Tenggara Province, in facilitating local regulations at the provincial level to integrated timber and NTFP management.	Coordination meeting between PWG Sumbawa and the Regional Planning Agency of West Nusa Tenggara Province at the provincial level was held on 1 March 2016. Important results: (1) Support was received for the development of strategy for integrated timber and NTFP management at the provincial level. (2) The District of Sumbawa is ready to be 'a place to go to' to provide lessons learnt for developing integrated timber and NTFP management policy framework.
Pelat Village	Village level regulations on BumDes and Hutan Rakyat	Still on-going (beyond project timeframe) and led by <i>KPH Puncak Ngegas Batulanteh</i> in collaboration with Bappeda Sumbawa and Pelat Village Government.

For Timor Tengah Selatan, since the local communities have limited access to the nature reserve and forest for livelihood activities such as harvesting forest honey, it is vital to ensure that they can obtain permits, in line with the norms and rules under traditional community forest management (*suf*) as well as the formal administrative management authority, to legally produce and collect NTFPs. However, business model should not be implemented in this forest. This restriction would help prevent over-harvesting and the possible counter-productive impacts on conservation efforts. The main strategy for managing the area outside the state forest includes developing the buffer zone in the boundary area of the forests (production and protection forests and nature reserve) by cultivating multipurpose tree species and low economic value timber with the role of enhancing the ecological function. It is also important to enforce appropriate timber management in accordance with Law No. 32/2012 on environmental management.

The grand strategy document (See Appendix 2) is intended to provide reference for strategic direction to improve coordination, synergy and connectivity among multi-stakeholders along supply and value chains, primarily among relevant government agencies. It was based on national, provincial and district government strategic documents, including the regional spatial planning document (*Rencana Tata Ruang Wilayah-RTRW*). The landscape approach is based on watershed ecosystems and zonation (i.e. upstream, midstream and downstream). In Timor Tengah Selatan, the Grand strategy for integrated management of NTFPs at the landscape level, focused on forest classification categories and three zones in the watersheds. In the grand strategy document, management directions are specified based on three components: 1) area management (*kelola wilayah*): enforce the conservation function of the area as a buffer zone and/or rehabilitate degraded areas, while enhancing local livelihoods, 2) business management (*kelola usaha*): promote the establishment of small to medium scale enterprises (*Usaha Mikro Kecil dan Menengah-UMKM*) for value added processing activities both for timber and NTFPs; and 3) institutional arrangement and management

(*kelola kelembagaan*): improve the coordination, synergy and interconnectivity of various government agencies at the district level, as well as between these agencies and private market industries.

The grand strategy provides a strategic approach with which to facilitate the forestry programme, as part of the natural resource management plan, based on a landscape approach at the district level. In particular, to ensure access is granted to community groups in line with regional development priorities, and to receive support and funding from the local government. The provincial government has adopted this approach and the lessons learned, in developing the grand strategy for developing NTFP management regulations, for the whole province. The recommendations of this grand strategy imply that business of NTFPs in Timor Tengah Selatan district can generate higher profits than current ones, by processing most all of NTFPs into more valuable products suitable to consumer needs. A matrix summarizing the main strategy and direction for developing integrated Non-timber Forest Product (NTFPs) management at the landscape level is included in Table 2.

For the policy recommendations to be adopted, government decrees being advocated by the Kanoppi Policy Team in Timor Tengah Selatan included three decrees that were produced at the district level on the formation of a PWG, deciding on ten priority commodities, and the adoption of grand strategy document.

Table 2. Timor Tengah Selatan: government’s commitments and decrees produced under Kanoppi Project

Government levels	Government decrees and commitments	Contents
Timor Tengah Selatan district	District Head Decree No. 416/KEP/HK/2014	The formation of Policy Working Group (PWG) on developing NTFPs integrated management
	District Head Decree No. 122/KEP/HK/2016	Ten priority commodities of NTFPs in Timor Tengah Selatan district
	District Head Decree No. 123/KEP/HK/2016	Grand strategy for integrated NTFPs management in Timor Tengah Selatan district (2016-2020)
East Nusa Tenggara Province	Governor of East Nusa Tenggara Decree No. 70/KEP/HK/2017	Appointment of <b>drafting team</b> to develop the provincial government regulation on NTFPs management for East Nusa Tenggara Province
	Governor of East Nusa Tenggara Decree No. 71/KEP/HK/2017	Appointment of <b>technical team</b> to develop the provincial government regulation on NTFPs management for East Nusa Tenggara Province
	Draft of East Nusa Tenggara Province Regulation (2017)	On harvesting and managing NTFPs in East Nusa Tenggara Province ( <i>Perda Peraturan Daerah tentang Pengelolaan dan Pemanfaatan Hasil Hutan Bukan Kayu di Provinsi NTT</i> ). After the public consultation, the process to get the legitimation of this regulation is now taking over by the provincial government (Economics Bureau).

Smallholder tree plantations in the Gunungkidul are considered one of the most commercialized timber marketing hubs for domestic and export markets. The baseline study found that tree species planted include *Tectona grandis*, *Swietenia mahagony*, *Acacia auriculiformis*, *Albizia saman*, and *Dalbergia latifolia*. Community members pointed out that those species are the most preferred tree species among stakeholders, due to three reasons: 1) their adaptability to the limestone soils, 2) the availability of wild

seedlings, and 3) the timber demand from local traders as well as from the processing industry. Second priority species have also become important. They include *Mangifera indica*, *Artocarpus heterophyllus*, *Gnetum gnemon*, *Ceiba pentandra*, and *Parkia speciosa*. The shift to these second priority species has been stimulated by the fact that mature teak was rapidly decreasing and the timber industries prefer to use mature second priority species rather than young teak trees.

As one of the main timber supplier to Indonesia's prominent wooden furniture industry in Jepara, Central Java, timber smallholders in Gunungkidul showed dependency towards intermediaries due to 1) lacking access to market information (product demand, specifications and prices); (2) lacking understanding of market channels; (3) producing products of unreliable quality and quantity; and (4) rarely engaging in grading or processing to improve product quality. Smallholders also rely on intermediaries in dealing with the legality documentation, i.e. certificate of (timber) origins. Advocates of smallholder plantations observe market-based policy instruments regarding certification and legality verification as opportunities for smallholders to obtain more benefits. In fact, both instruments promised improved market-access and even improved prices for timber that originated from certified or legally-verified sources.

However, numerous regulatory barriers restrict smallholding forestry. That the existing community forestry programs in Gunungkidul fall short of the initial target to a large extent is explained by the regulatory barriers of tenurial uncertainties and the complex licensing procedures. Those coupled by the limited capacity of government institutions to provide technical assistance appear to impede local people to secure the community forestry licenses. More importantly, communities that have secured forestry licenses have yet to obtain meaningful benefit from the forests, particularly timber.

The existing regulations have the potential to affect smallholders, in both positive and negative ways. Farmers should improve their knowledge of the rules and regulations applied in the supply chains of the timber industries. A study conducted by project partners pointed out that smallholders are most concerned with improved market access and better prices for their timber. Adequate knowledge of regulations may allow smallholders to exercise coping strategies and priorities with regard to the sale of their timber. For example, whether the tree growers need to adopt certification and which schemes provide the best opportunities for them.

The study concludes that the desire to improve market access is not sufficient for smallholders to engage in certification of sustainable forestry despite the fact that they practice good (certifiable) forest management. The benefits captured by smallholders that engage in legality verification and certification are short-term. In the long-run, smallholders remain constrained by the existing regulatory frameworks due to the artisanal nature of the practice. The substantial, prohibitive costs of mandatory legality verification are seen by smallholders in the study villages as the principal constraint for them to engage in commercial markets. Similar challenges also exist in the form of certification of sustainable forestry. Despite its voluntary nature, the market-based approach hinders smallholders' engagement in commercial and export-orientated markets.

Although constrained by Law No. 23/2014, the project promoted improvements of the effectiveness of timber certification and proposed a strategy and direction for developing integrated timber and NTFPs management at the landscape level (see Table 3). NTFPs have been increasingly promoted by the district government to complement timber-oriented smallholder management. Led by the Farm Forest Consortium (FFC), a district government decree has been produced focusing on the approval of bamboo as one of the NTFPs to be supported using government budget.

Table 3. Gunungkidul: government's decree and commitments facilitated by Kanoppi Project

Government level	Government decrees and commitments	Contents
Gunungkidul District	Coordination meeting on the formation of the bamboo growers association in Gunungkidul District (27 April 2016)	The Bamboo Growers Association in Gunungkidul District was formed under the name ' <i>Deling Handayani</i> '. The objective of the association is to serve as a communication forum among growers to discuss cultivation and marketing issues.
	District Head Decree No. 297/KPTS/2014	Bamboo as a priority commodity of NTFP in Gunungkidul.

However, the strategy which integrates timber and NTFP in the case of Gunungkidul requires more work. Similar with the strategies for Sumbawa and Timor Tengah Selatan, three main components of management will be included: 1) area, 2) business, and 3) institutional arrangement. This is planned to be conducted in the following phase of the project. The watershed: 1) upstream at the north zone, which is Batur Agung, and 2) Ledok Wonosari covering midstream and downstream, will be used as unit of analysis (see Appendix 2).

#### **Objective 4: Enhance expansion of smallholder-managed integrated timber and NTFP production systems**

Timber and NTFPs are forest and agroforestry products and potential livelihood sources for farmers. If managed in a sustainable manner, these products can increase the income of farmers. To achieve sustainable management, farmers require access to appropriate information. However, in remote areas, farmers have limited access to such information. Therefore, this study was conducted in order to understand the effective forestry extension practices that support the development of timber and NTFPs as a source of income for farmers in Indonesia. Interviews were conducted with 500 farmers, and six FGDs were held to discuss the forestry extension approaches implemented both by the government and the private sector. In addition, field observations on forestry extension practices were conducted in order to collect supported qualitative and quantitative data. This study was conducted in three districts Gunungkidul; Sumbawa; and Timor Tengah Selatan. The result shows that current forestry extension practices are not optimum, mainly because of: 1) the inadequate number of government field extension agents specialized in forestry issues; 2) inadequate learning material given to farmers; and 3) inadequate budget allocation for forestry extension activities at the district level. In several remote study areas, private extension agents play a major role in helping the dissemination of forestry information. Implementation of forestry extension programs cannot depend solely on government extension agents. Collaboration between government and private extension agents is necessary to support the effectiveness of information dissemination and the capacity building of farmers for a sustainable forest management.

Currently, the average number of extension worker in a subdistrict is one person. Most of these workers are over 50 years old (Gunungkidul 100%; Sumbawa 77.2%; Timor Tengah Selatan 37.5%), and in the next five years, they will reach their retirement age. In 2014, 5,056 forestry extension agents were working in 5,340 subdistricts of Indonesia. In order to provide a sufficient forestry extension service in Indonesia, there needs to be an

average of four persons in each subdistrict, or approximately 20,241 forestry extension agents for the whole of Indonesia.

Insufficient forestry extension material is available to farmers. The current material is limited on cultivation techniques, nurseries and conservation. Material about potential plantation and forest products is still very limited. Material about forestry product marketing (timber and non-timber forest products) and supporting policies does not even exist in the three districts. Limited budget and lack of knowledge on effective timber and NTFP management practices also affect the quality and effectiveness of extension activities. This can also affect the implementation of planned extension programs, such as the intensity, media procurement, method establishment, facility and infrastructure and the continuity of the extension. There is some potential that can be developed in order to improve the extension work, such as:

- Private and voluntary extension institutions (companies and NGOs) have provided extension and facilitation to farmers. Cooperation with private and voluntary institutions would increase the quantity and quality of forestry extension so that it reaches more communities and remote areas
- Increasing collaboration between forestry, agricultural and fishery extension agents in the context of agroforestry extension
- Increasing the number and role of community voluntary forestry extension agents to cover more areas
- Using research results made available by the Forestry Research and Development Office of the Ministry of Environment and Forestry and other research institutions as extension material for farmers. Research results have not been optimally utilized by the district extension agency and tend to be distributed only to the district/municipal forestry and plantation agency.

An initial survey on extension activities in Gunungkidul, Sumbawa, and Timor Tengah Selatan involving 500 respondents indicates that agroforestry extension activities are still low, i.e. only around 50% of total respondents in Gunungkidul received it, 33% in Sumbawa and 19% in Timor Tengah Selatan (see Figure 6). Participation rate of female farmers tends to be lower relative to male farmers in all three study sites. The highest number of female farmers who had received agroforestry extension service was in Gunungkidul (11%) while the least in Timor Tengah Selatan (0.8%).

The dissemination of agroforestry technology information is more common to male farmers. However in agroforestry, the roles of women and men are fairly balanced, thus increasing women participation in agroforestry extension activities holds high potential to strengthen women's role but also increase agroforestry productivity. A study was conducted to determine the role and involvement of women in extension activities of timber-based agroforestry systems in the three districts in March-June 2016. Interviews were conducted with 110 farmers (30% female) randomly selected from areas where agroforestry extension programs were held in each district. The study shows that female farmers were less involved in agroforestry extension activities, thus they tend to get information on agroforestry from farmer groups, families and friends. Participation of women in agroforestry extension activities can be improved by considering the needs for extension materials they have prioritized. Female farmers prefer agroforestry technologies on crop planting in the understory, silviculture techniques (pruning and thinning) and information about marketing. Preferences of female farmers for agroforestry extension topics vary depending on the culture and customs in their respective regions. Compared to male farmers, female farmers are more willing to try new agroforestry technology learned from extension activities. Therefore, to enhance agroforestry productivity via increasing adoption rate of agroforestry technologies, it is necessary to enhance women involvement in agroforestry extension activities by inviting more women in agroforestry extension events.

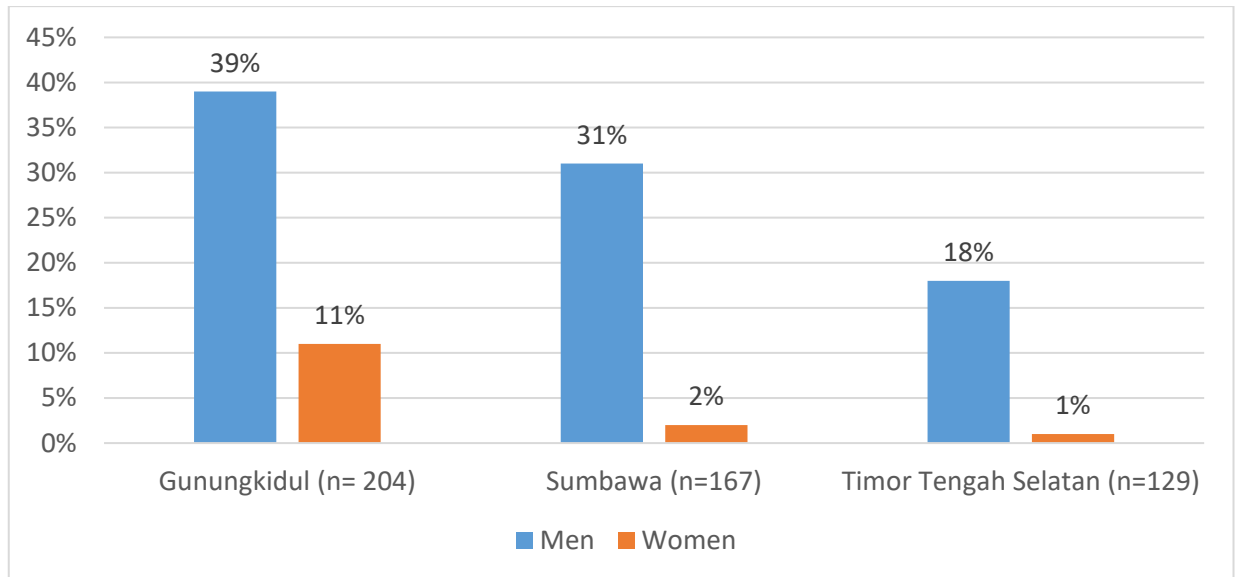


Figure 6. Farmers who had received counselling in agroforestry in Gunungkidul, Sumbawa and Timor Tengah Selatan.

Another study, involving 74 respondents who had interactions with project activities, shows that farmers' sources of information and knowledge on agroforestry are derived from external sources (outside the village) and internal sources (inside the village), where external source are government agents and non-governmental agents (see Figure 7). In all location male farmers received more information from government agents, while female farmers received information from internal sources of information. In areas with limited road accessibility as in Sumbawa and Timor Tengah Selatan, internal information sources are very important for female farmers for acquiring information on agroforestry.

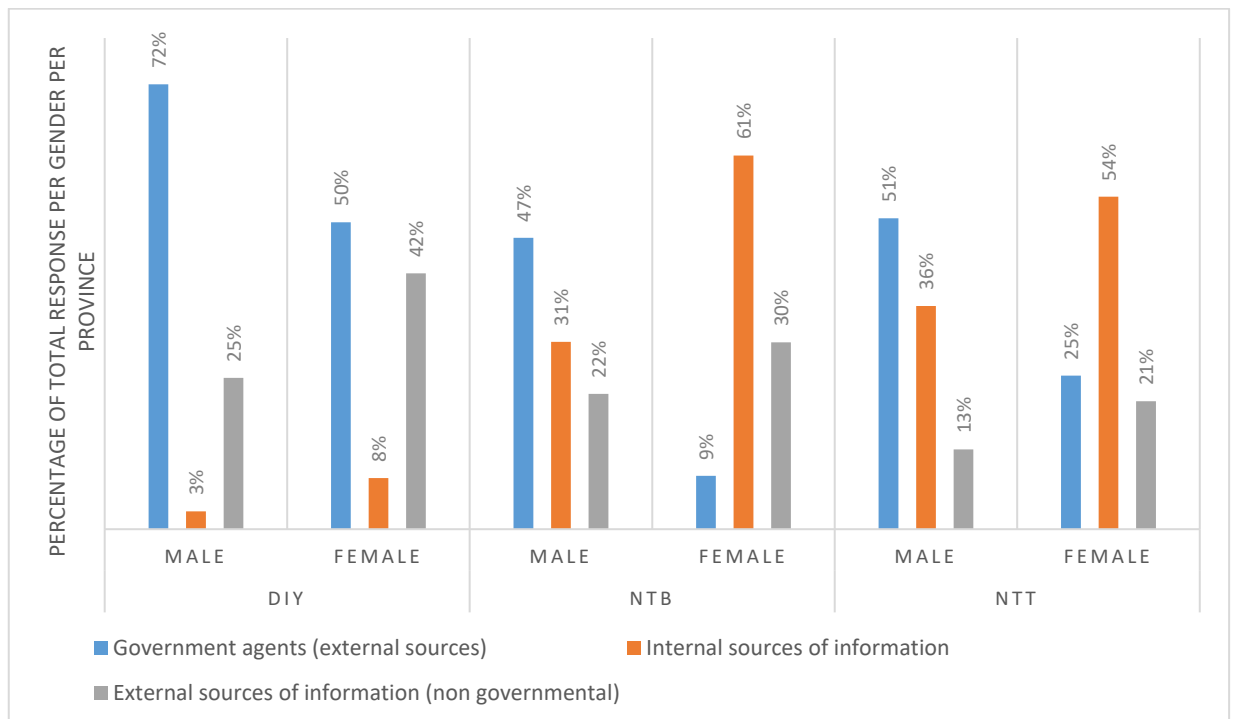


Figure 7. Sources of agroforestry information between provinces and genders.

Note: DIY is represented by Gunungkidul; NTB by Sumbawa; and NTT by Timor Tengah Selatan

Sources of information from government are training and extension activities at the district and village level that usually attended by farmer groups' representatives or farmer champions. While internal sources of information in the village are farmer groups, neighbours, friends, parents, and family. Information on agroforestry in the village is

usually accessed informally through farmers' groups meetings, discussions and conversations from farmer-to-farmer. Female farmers in Sumbawa received information from families, parents, and neighbours who have obtained information through training or extension programs from government and non-government agencies. In Timor Tengah Selatan, in addition to receiving information from parents and family, female farmers also received information from regular farmer group meeting. Female farmers have access to trainings and other extension activities offered by external sources when such events are held inside the village, with balanced proportion of male and female participants. In Sumbawa and Timor Tengah Selatan, both men and women have equal access on forestry and agroforestry project as external source of information. While in Gunungkidul better access to electricity and phone signal have made the media (television, radio, magazines and internet) a more important source of information for both men and women.

Surveys regarding agroforestry extension topics indicated that silviculture (pruning and thinning) is the main topic preferred by farmers. Other topics identified by farmers in order of preference are: 1) integrated farm management of timber and non-timber forest products or agroforestry; 2) marketing of timber and NTFP; 3) regulations on marketing forest products; 4) communication of agroforestry extension; and 5) introduction of timber and non-timber forest products. Preferences on topic of agroforestry extension were influenced by farmers' needs for extension materials.

Farmer' preferences for agroforestry extension topics in this study did not significantly vary by region or gender. In all study sites, male farmers tended to have same preference for topics. Preferences of female farmers for extension topic showed slight differences depending on the daily habits and culture in each location. For example, female farmers in Timor Tengah Selatan do not work in tree gardens as frequently as female farmers in Sumbawa, thus in Timor Tengah Selatan topic on marketing and policy aspects of forest products are the second most preferred topics by women. While in Sumbawa, female farmers chose topics regarding integrated management of timber and NTFPs as the most preferred topic, particularly topic on planting spices such as ginger under teak stands.

A supporting study on networking showed that information on silviculture disseminated by Kanoppi project activities was received by farmers more from the forestry agency (Dinas Kehutanan) and extension agents (penyuluh) compared to Forest Management Unit (KPHP), champion farmers (petani unggul), and farmer groups (kelompok tani). Information on integrated timber-NTFP management was received by farmers more from the forestry agency (Dinas Kehutanan), Forest Management Unit (KPHP), and extension agents (penyuluh), compared to the agriculture agency (Dinas Pertanian), champion farmers (petani unggul), and village government (pemerintah desa). See Figures 8 and 9.

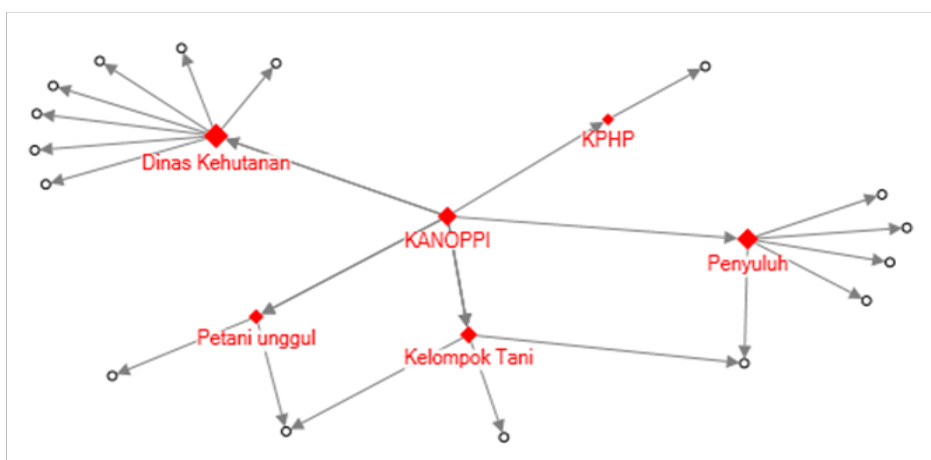


Figure 8. Social network diagram on source of information on silviculture.



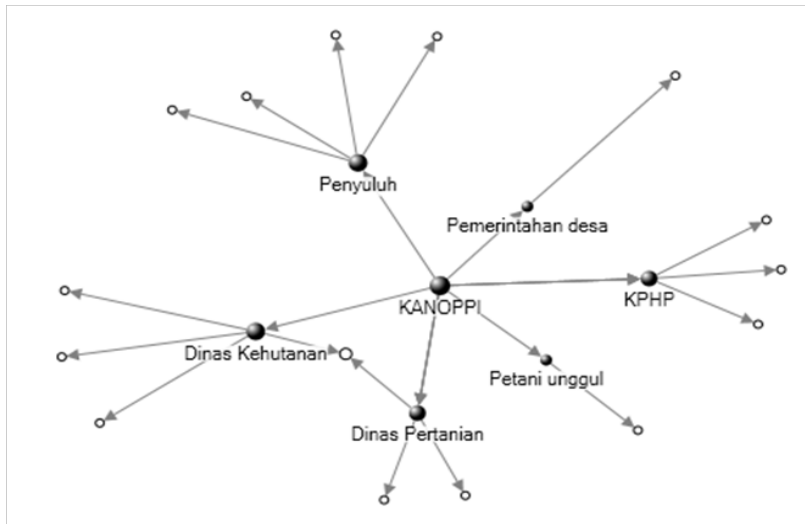


Figure 9. Social network diagram on source of information on integrated timber-NTFP management

Adoption preferences in this study were analyzed by observing farmers preference when they receive new knowledge and technology on agroforestry management. Four stages were used to assess the level of adoption preferences: 1) farmers assessed the benefits of knowledge/technology; 2) farmers tested knowledge/technology on a small scale; 3) farmers applied knowledge/technology; and 4) farmers disseminated knowledge / technology. Results of the study shows that compared to males, female farmers show a greater tendency to test a new technology or knowledge more frequently (see Figure 10). Besides testing the knowledge, female farmers in Gunungkidul and Sumbawa have higher adoption preferences than male farmers. Between study sites, farmers in Gunungkidul have higher adoption preferences if compared to the other two sites, this is likely due to more intensive agroforestry extension activities in Gunungkidul than in other two sites.

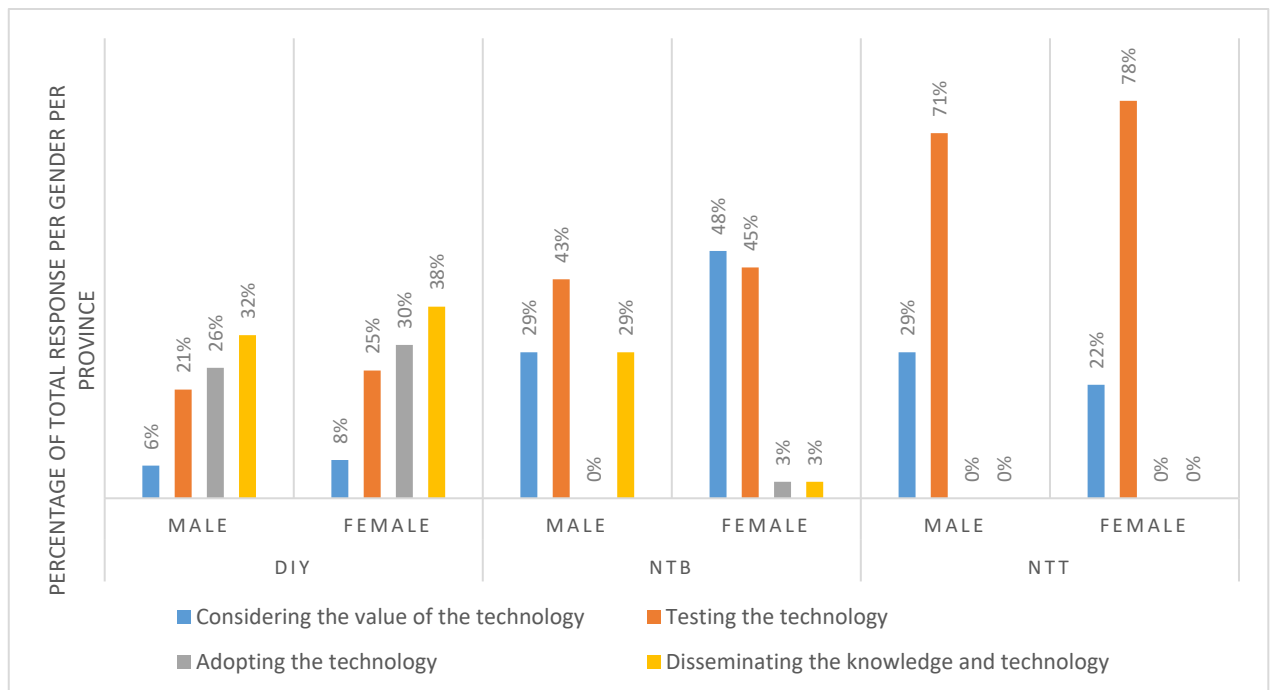


Figure 10. Male and female farmers acquiring new technology or knowledge

Note: DIY is represented by Gunungkidul; NTB by Sumbawa; and NTT by Timor Tengah Selatan

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## 8 Impacts

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### 8.1 Scientific impacts – now and in 5 years

The scientific understanding of smallholder agroforestry (biophysics, markets, and policy) increased through the production of scientific manuscripts based on the project findings. The project also contributed to the growing body of literature on agroforestry adoption, dissemination, and scaling up. As found in the literature, scaling up agricultural innovations has remained a central aim over many decades of international investments in agricultural research and natural resources management.

During the course of the project ten peer-reviewed articles or book chapters have been published. Additionally, 15 working papers and extension documents, including manuals, guidebooks, and information sheets, were published. Data from the project website indicate that those documents have been downloaded more than 600 times, additional to the 4,150 hardcopies distributed to project partners and other stakeholders.

Scientific impacts have not been limited to the Kanoppi project area. The silviculture findings have been used in Sulawesi, through the Agroforestry and Forestry in Sulawesi (AgFor) Project. Specifically, the smallholder silviculture and intercropping recommendations developed by Kanoppi project were shared through extension publications, project reports and training activities. The silviculture and marketing teams were requested by FAO, IUFRO and Teak Net to share Kanoppi scientific findings in the following publications: 1) Technical Report: Global evaluation of teak management (FAO report); 2) The future of teak: What policy makers and managers need to consider (IUFRO report); and 3) Teaknet Bulletin 9 (3): 2-8. The FAO and IUFRO manuscripts are in press. Additionally, at least three members of the Kanoppi project team shared teak findings with colleagues from three ACIAR projects (Laos, PNG, and Vanuatu) involved with the improvement of smallholder teak management and production.

The scientific impacts of the NTFP research range from a better understanding of resource uses and value chain to accurate analyses of fatty acid content of candlenut oils. Over the next four-year phase, we will build on these results to partner with businesses in Indonesia and Australia to scale-out a value-added trade in a range of products. Ideally, scientific impacts can also be leveraged through partnerships. Researchers in the Advanced Technology Development section of the Indonesian company PT DEXA Medica have recently published a study (Subroto et al., 2017) that parallels the oil analyses conducted by project partners Professor Michael Clarke and Dorothy Hahne (Centre for Microscopy, Characterization and Analysis (CMCA), Metabolomics Australia, UWA). While the study by researchers at PT DEXA Medica assessed the optimum conditions for supercritical carbon dioxide extraction of candlenut oil, our goal is to take our research results one step further. Our study showed that candlenut oil contains 24-26% gamma linoleic acid, the main component of evening primrose oil, which is used in the high value cosmetic market. Extraction of gamma linoleic acid requires supercritical carbon dioxide extraction from candlenut oil. In the next phase we intend to achieve this with commercial partners, either in Australia (with a botanical extracts company in Sydney) and with commercial partners in Java. Supercritical carbon dioxide extraction is also used to extract active ingredients from dye plants (such as bioactive flavonoids from *Strobilanthes*).

Collaborative research with the Indonesian Textile Technology Polytechnic (Sekolah Tinggi Teknologi Tekstil) in Bandung has produced and calibrated a field test for the quality of indigo paste. Such a test has been necessary for the development of market chains where product adulteration is a problem. Research of indigo value chains, both domestically and internationally, will lead to publication of research with the Indonesian Textile Technology Polytechnic on indigo value chains and indigo product quality control. Research into NTFP market chains in NTT province resulted in an article being published in a special issue of *Australian Forestry* journal covering ACIAR forestry research projects.

This project is also contributing to the body of scientific knowledge in operationalising the landscape approach, by designing a followed-up activities based on different methodologies and conceptual framework as described below:

- Integrated Watershed Management Approach (IWMA) in for timber and NTFP management throughout the supply and value chains (from production to marketing and processing) under the activity coordinated and implemented in the field by Samawa Center on “Strengthening community-based institution and its capacity at the upstream of Batulanteh Watershed to ensure a mutually beneficial management and utilisation schemes between upstream communities and downstream users”.
- Commodity-case: embedding enhancement of knowledge on policy for bamboo growers in “Developing bamboo farmer field school with pictogram guideline for the six steps of resilient bamboo forestry”, which will include: information on policy and regulations framework for smallholders to be included in this pictogram guideline.
- Integrated-analysis of the data (spatial and non-spatial) to find several optimisation scenarios at the landscape level from Sumbawa Project Site. This study was conducted to determine the optimum allocation value of comprehensive land use based on the scenario that takes into account the economic, ecological, and a comprehensive economic-ecological, describes the land use allocation by considering some applications, such as business plan, documents grand strategy and the preservation of ecology (land critical).
- In an activity coordinated and implemented in the field by FMU/KPH, the team had been testing the suitable field methodology for conducting inventory for timber potential managed on community-privately owned lands.
- The development of workable business plans based on strategies included in the strategy documents by conducting the Cost Benefit Analysis (CBA) on a range of prioritised timber and NTFPs commodities.

## 8.2 Capacity impacts – now and in 5 years

The capacities of men and women farmers, project members, and other stakeholders were enriched through various activities (see Table 4). The total number of partners reached was 1,971 (24% women). Through farmer field schools and workshops, farmers in Sumbawa and Gunungkidul improved their ability to understand timber market information, including price, market specifications, and tree and timber measurement through the Master Tree Grower method. A woodcraft group and a Trigona honey learning centre was initiated in Sumbawa as a result of the project’s capacity-building activities. The learning centre was officially launched by the Director-General of Production Forest Sustainable Management, Ministry of Environment and Forestry in April 2016. Bamboo growers in Gunungkidul gained more knowledge on bamboo market specification and demand, and have been eager to practice techniques for preserving bamboo as taught in Kanoppi project trainings. A communication forum for bamboo growers was established as platform to discuss cultivation and marketing issues.

Table 4. Number of farmers and stakeholders directly involved in project activities

Activities	Gunungkidul		Lombok & Sumbawa		Timor Tengah Selatan	
	Men	Women	Men	Women	Men	Women
Farm surveys	511	161	248	78	255	81
Demonstration trials	27	9	59	19	18	6
Capacity building and cross visits	131	20	140	58	106	44
Total	669	190	447	155	379	131

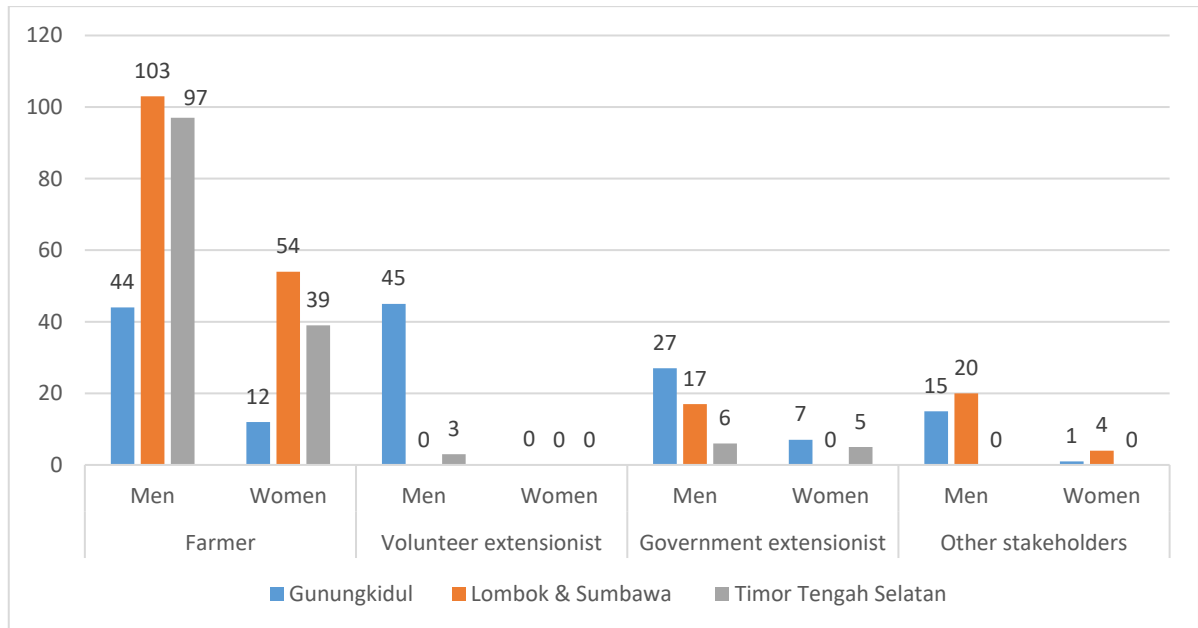


Figure 11. Number of men and women involved in capacity building and cross visits

The numbers in Table 4 and Figure 11 represents farmers, voluntary extensionists or farmer champions, government extensionists, government officials, and other stakeholders who were directly involved. In the capacity building activities, including cross visits, percentage of participants were 70% farmers, 10% voluntary extensionist, 12% government extensionist, and 8% other stakeholders. Other stakeholders include government officials from the forestry and district planning offices. Many more people were reached by the project interventions and knowledge through these directly involved stakeholders.

As a result of project capacity building activities, farmer groups' institutional and business capacity were also increased. Farmers are now able to understand the difference between selling and marketing, as individuals and in groups, which changed their marketing behaviour. Farmers in Timor Tengah Selatan are now able to operate and maintain a cold-pressed nut oil production system and have established the foundations of a community business with marketing activities in the town of Soe. Community business groups were formed to produce and market virgin coconut oil, and candlenut oil.

The increase in capacity was also experienced by project partners. Threads of Life's dyers (project staff) have improved their capacities to cultivate *Indigofera tinctoria* and *Strobilanthes cusia* at large scales and work with indigo dye paste at larger scales of dye production. The Indonesian Textile Technology Polytechnic has improved institutional understanding of natural dye processes, the opportunities for applying its resources to community development rather than only industry, and the option of raising funds through research partnerships rather than relying solely on government support. The project partners and key stakeholders in the districts now have a better understanding of the systematic methodologies and conceptual frameworks in formulating and designing integrated timber and NTFP management. This include a better understanding of the possible impacts of the implementation of Law No. 23/2014 on planned advocacy strategies to promote integrated timber and NTFP.

To further increase individual capacity of partners, the project supported a bachelor student from Bogor Agriculture Institute with a thesis on social factors in the context of regulations on forest product marketing, a case study in Sumbawa. Three Masters postgraduate students from: 1) Universitas Gadjah Mada with a thesis on the impacts of multiple regulatory frameworks on the management of smallholder tree plantations in Gunungkidul; 2) Universitas Mataram (Kanoppi project member from WWF Indonesia) with a thesis on the application of agroforestry systems and their contribution to farmer

households in the Forest Management Unit of Batulanteh, Sumbawa, using data from the project's baseline survey; 3) Fenner School, Australian National University (FOERDIA researcher from the Agroforestry Research Centre, Ciamis), with a thesis on bamboo value chains and the impact on regional policy in Gunungkidul. A PWG member from Sumbawa received an Australian-funded scholarship to pursue her PhD at the University of Queensland. Her proposal closely links with the policy work implemented in this project, titled, "Scenario analysis of the management of timber and non-timber forest products as an implication of Law No. 23/ 2014 on local government: case study in Sumbawa District".

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## 8.3 Community impacts – now and in 5 years

### 8.3.1 Economic impacts

The results based on post-ante analysis on the estimated economic impacts, in comparison to the ex-ante analysis included in the full proposal of this project are presented in Table 5. Table 6 explains the scenarios used on improved complementary management of timber and NTFPs in three districts. Overall, the results from post-ante analysis provided more realistic results, since these were supported by good baseline data in all three districts collected at the beginning of the project.

#### Short-term impacts

Based on findings of the project, improvements in silvicultural practices of timber and NTFP management are expected to result in higher productivity and quality for at least 10% of tree growers and improvements in marketing strategies by establishing the foundation to ensure the better price is achievable. Extrapolating findings such as these to other areas, such as widely adopted by forestry households at the conservative estimated numbers based on Central Bureau of Statistics and the Ministry of Forestry, and complementing them with further research could possibly double the impact. With further project interventions as planned in the Kanoppi Project Phase 2, these impacts are expected to sustain for years.

#### Long-term impacts<sup>2</sup>

Based on the estimation that at least 10% of forestry households will adopt improved practices, and applying an 8% discount rate, per hectare net present values are estimated at AUD 8,250 (improved productivity for both timber and NTFPs, and the application of intercropping techniques under Kanoppi project). These impacts are possible because the project aims to improve management and production in existing systems implemented under all objectives. The first benefits to participants (indicated by positive net cash flow) are likely to occur by the sixth year. Adoption is expected to continue over a 20-year period following an S-shaped logistic diffusion curve.

Using the total numbers of rural households at the three sites under Kanoppi, the benefit–cost ratio (BCR) showed a promising return per hectare for every dollar invested for improvement of combined timber with NTFP, and also with intercropping technique, at AUD 3 and AUD 6, respectively. The analysis indicates that timber alone does not provide significant return, compared to NTFP-based household income obtained from NTFP. This proportion is consistent with study by CIFOR PEN (Poverty and Environment Network) in 2012. The proportion was quite significant among forestry households in Gunungkidul

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<sup>2</sup> Different set of data were used in the ex-ante and ex-post. In the ex-ante, the analysis was based on field data from Sumbawa Project Site only which were collected in the previous project. The data were adjusted to the year of the analysis using CPI (Consumer Price Index).

District (about 65%), where timber-based income is used for savings and emergencies, with other income sources allocated for day-to-day consumption.

Using the total numbers of estimated forestry households in Indonesia, the analysis provided higher BCR, at AUD 17 for timber and NTFP productivity improvement, and at AUD 34 when it combines with intercropping. One of the important factors in the calculation is that at the research sites, significant areas of land managed by villagers is out of production as a result of degradation. Forestry development is therefore not competing with other land uses and the opportunity cost is low. These impacts are likely to accrue when we take into account the estimated area of critical and degraded lands in all project sites which reaches 1.03 million hectare (KLHK, 2011). Adoption of timber-NTFP systems represent significant increases in income in the project areas where annual cash income is currently only AUD 650/family (see Appendix 1 for explanation of the methodology and scenarios used to estimate the economic impacts).

Table 5. Discounted project revenues from research on improved complementary management of timber and NTFPs in three project sites under Kanoppi 1

Description	Ex-Ante <sup>a</sup>		Ex-Post <sup>b</sup>	
	Total net revenues (AUD million)	BCR	Total net revenues (AUD million)	BCR
a. Estimated direct outreach by forestry households totalling at households in three project sites	Adopted by 30% of the total 402,280 households		Adopted by 10% of the total 451,123 households <sup>c</sup>	
a.1. By increasing timber productivity	26	19	-1.4	1
a.2. By increasing productivity of timber & NTFPs	58	41	4	3
a.3. By increasing productivity of timber, NTFPs & intercropping <sup>d</sup>	-	-	15	6
b. Secondary adoption based on 3.4 million of forestry households in Indonesia <sup>e</sup>	Rate of adoption by households			
	30%		10%	
	Total net revenues (AUD million)	BCR	Total net revenues (AUD million)	BCR
b.1. By increasing timber productivity	228	161	5.5	3
b.2. By increasing productivity of timber & NTFPs	495	349	41	17
b.3. By increasing productivity of timber, NTFPs & intercropping	-	-	87	34
c. Net benefits per hectare (NPV/ha)	IDR (million)	AUD	IDR (million)	AUD
c.1. Current practices (no project intervention)	2	178	-	-
c.2. Practices with improved timber productivity	24	2,524	8	752
c.3. Practices with improved NTFPs productivity	-	-	33	3,244
c.4. Practices with improved timber and NTFPs productivity	51	5,462	40	3,996
c.5. Practices with improved intercropping	-	-	56	5,548
c.6. Practices with improved timber, NTFPs & intercropping	-	-	83	8,250

File: Comparison Post Ante Kanoppi 1 04042017

Notes:

- a. Based on the calculation included in the proposal of this project.
- b. Based on the baseline data and information collected from the research implemented.
- c. The rate of adoption is 10% as resulted from the assessment by Objective 4 in Kanoppi; the total number of households were based on the latest statistical figures from the Ministry of Internal Affairs (2015).
- d. Intercropping: teak and ginger, as implemented by Objective 1 in the field trials.
- e. Forestry households that presumably are relying on both timber and NTFOs (MoF and CBS, 2004).  
Forestry households are a subset group of total households involved in agricultural practices.



Table 6. Scenarios on improved complementary management of timber and NTFPs in three districts

Objective	Comparisons	Baseline data	Kanoppi project
Objective 1	Timber harvesting	Varied in three locations: 25-36 years	At the end of rotation (20 years)
	NTFP harvesting	With current productivity, every year	With current productivity since no project intervention under Kanoppi 1 has been conducted
	Timber trees per ha	Varied 400–800 trees	Mixed ages, varied in three locations
	Pruning to timber trees	No	Experiments were conducted under Objective 1
	Thinning to timber tress	No	
	Fertilisers to timber and NTFPs	No	
	Volumes per tree	Normal volume based on standard table volumes	Established the foundation to ensure the increment is achievable
Objective 2	Timber & NTFP prices	Varies with volume, based on farmer surveys	Established the foundation to ensure the premium price is achievable
Objective 3	Grand strategy document legalised & adopted	Problems identified, and needs for a clear strategy document for integrated timber and NTFPs management were identified,	Document legalised & adopted: Grand strategy for integrated timber and NTFPs management at the landscape level
	Ten prioritised NTFPs identified		Identified and adopted as development guidance, and budgeted
	Operationalising the grand strategy document		Supporting regulations produced and adopted
Objective 4	Adoption rates of research results	Problems identified, and improvement strategies defined	Adoption by the 10% of those villagers involved in the project activities

### 8.3.2 Social impacts

Social impacts in this project are closely linked to the capacity and economic impacts. The project enhanced the scaling up of project outcomes where project partners took various approaches to engage farmers and other beneficiaries, such as training and capacity development, farm surveys, and demonstration trials (see Table 4).

This project has been implementing activities in at least eight villages in Gunungkidul, Sumbawa, Lombok, and Timor Tengah Selatan districts since 2013. Approximately 1,971 farmers, extension agents (voluntary and government), government officials, and other stakeholders are currently benefitting from project interventions, of whom 24% are women.

Women farmers in Sumbawa increased their role to provide alternative income from sales of candlenut shells, which has value in Java as a charcoal substitute. Female farmers in Timor Tengah Selatan also added value to their role in the nut oil production. Champion



farmers in Gunungkidul and Sumbawa changed their negotiation strategy to increase the price of teak stands owing to their increased knowledge of timber-stand valuation.

The project also facilitated partnership building with the private sector which created economic opportunities and social capital enhancement. The project linked farmer groups with a network of private sectors in Java, Bali and Australia, such as Wooden Ships, a knitware manufacturer, PT Sido Muncul, a herbal drink manufacturer, Blue Stones Botanicals, Jamusara, Pacific Provender for essential oils, and CV. Makassar Utama, a local teak processor.

Related to policy support, the project has successfully influenced some district and provincial policy decisions, which is expected to facilitate a wider adoption. In Gunungkidul, a decree was issued by the head of district to promote the bamboo as a priority species. In Sumbawa, the head of district issued a decree to promote the adoption of the strategies developed by the project. The provincial government of West Nusa Tenggara through its Development Planning Agency is committed to facilitate regulations at the provincial level to integrate timber and NTFP management. In Timor Tengah Selatan, the head of district government issued a decree on prioritising ten non-timber commodities and promoting the strategy facilitated by the project. The Governor of East Nusa Tenggara issued a decree to assign a technical team to develop a provincial government regulation on NTFPs management.

### **8.3.3 Environmental impacts**

The Kanoppi project improved the sustainable management of natural resource in the project areas through the grand strategy documents developed by the policy team. The grand strategies and activities improved community and local government understanding of, and capacity to contribute to, land governance and spatial planning processes. To forecast changes and improvements of the environment, Grey Linear Programming was implemented, using Batulanteh watershed in Sumbawa as unit of analysis, to determine the optimum allocation value of land use and planning based on the scenario that takes into account aspects such as social, economic, ecological, and the combination of economic-ecological. It also describes the land use allocation by considering the application of the business plan, grand strategy document, and the preservation of the ecosystem. Two scenarios were applied: 1) economic benefits optimisation; and 2) land use optimisation. Under Scenario 1, the economic benefits increase from 36.8 million IDR/ha to 38.4 million IDR/ha, (1.5% increase per ha). Under Scenario 2, there is approximately 8.7% improvement in land use, increasing land under cultivation from 75,566 ha to 78,077 ha.

The Sumbawa district planning agency incorporated the study findings into the strategic district planning for 2017 onwards, which serves as basis to allocate budget in relation with land use planning for environmental improvement, covering an area of 75,566 ha. These projections led to a focus on incorporating the landscape approach into the recently initiated Kanoppi2 project, which will expand improved sustainable management to other watersheds and landscapes in Gunungkidul, Sumbawa, Flores, Timor Tengah Selatan, Timor Tengah Utara, and Kupang.

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## **8.4 Communication and dissemination activities**

Communication and dissemination through various means, such as videos, information sheets, manuals, guidebooks, periodicals, policy dialogues, and trainings have increased the project's visibility. The project produced ten videos, gaining more than 1,000 online views. It also produced ten international journal articles and book chapters, two working papers, 28 technical reports, five books and chapters, ten guidebooks, information sheets, periodicals, and manuals as extension materials. Approximately 4,750 copies of guidebooks, information sheets, periodicals, and manuals have been distributed through project activities, including 600 online views.

The project team also presented research findings in major conferences, such as World Agroforestry Congress 2014, Forest Restoration at Landscape Level in Asia Pacific, IUFRO Research Group 3.08 Small-scale Forestry, and Forest Asia Summit. Several project members were also involved in a cross-project knowledge sharing workshop on teak coordinated with three other ACIAR funded projects.

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## 9 Conclusions and recommendations

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### 9.1 Conclusions

Understanding how to implement complementary management of timber and NTFPs is particularly important for poorer households in Java and West and East Nusa Tenggara. However, ways for farmers to capture more value from their efforts and products are constrained by their traditional silvicultural management practices that result in low productivity, limited market access and product processing capacity, inappropriate business models, ineffective extension strategies, and unaligned policies. This project was designed and implemented to address this situation.

The project presented a range of experiments on silviculture management practices and identified strategies to improve marketing, policy framework, and extension programs. The eleven on-farm silvicultural trials were established to increase the likelihood of adoption of silviculture management practices to improve the productivity and quality of various commercial timber and NTFPs. The results so far have been encouraging and showed that champion farmers in Gunungkidul and Sumbawa changed their negotiation strategy to increase the price of teak stands owing to their increased knowledge on teak silviculture and of timber-stand valuation. Although their involvement is only 24%, female farmers demonstrate a greater interest to test new technologies or knowledge than male farmers. Female farmers in Gunungkidul and Sumbawa, in particular, have higher adoption preferences. The involvement of more women farmers will be emphasized in the next phase of this project to achieve higher impact.

Increased awareness and early signs of adoption has been observed, and strategies for improved information dissemination has been developed through the participation of voluntary and government extension agents. Supported by the private sector, a focus on improving product quality and optimising sales of teak, VCO, and candlenut oil, for example, through collective marketing as the best-bet smallholder marketing strategy have been introduced to farmers and relevant stakeholders in order to improve access to market.

Considering policy as socioeconomic safeguard for smallholders, the process of improving policy frameworks and the development of policy implementation strategies has been acknowledged and supported by the relevant district and provincial government agencies. Grand strategy documents were developed to support improvements in policy frameworks and implementation of regulations related to management and marketing of timber and NTFP at district level and have been recognised by provincial governments.

The project contributed to the theory of change for the development of integrated timber and NTFP production and marketing by facilitating district and provincial governments, researchers, farmers, and stakeholders to build capacity to improve and implement better silviculture management, processing and marketing systems. The project's participatory action research approach has been challenging but very useful in generating active participation and cooperation amongst its partners and other stakeholders. By the end of the project, retrospect to the long production cycle for many timber and NTFP crops, the silvicultural trials and the strategies related to marketing, policy implementation, and information dissemination indicated a great potential for expanding smallholders' involvement in the management of commercial, forestry-based products in eastern Indonesia. Further research is required to fine-tune, promote and scale out the findings and to observe the longer-term benefits to smallholder farmers and the environment.

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## 9.2 Recommendations

The project recommends that future project interventions related to smallholder timber and NTFP management, processing, marketing, extension and policies would consider the following:

- Increase and quantify the productivity of integrated timber and NTFP production systems through developing improved and sustainable management practices appropriate for local contexts, which includes developing and promoting commercially viable bamboo agroforestry options;
- Increase smallholder household income through improving marketing of timber and NTFPs through private sector engagement and market development, providing sufficient support to sustain scaling out, and dealing with policy bottlenecks;
- Promote improved timber and NTFP production and marketing options through developing effective extension strategies that lead to widespread adoption; and
- Encourage the establishment of resilient institutional arrangements, supported by relevant policy frameworks that foster landscape-scale forest management for the benefit of smallholders.

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## 11 Appendixes

### 11.1 Appendix 1: Data, methods and assumptions for the long-term potential returns to research investment

#### Sources of data

Primary data collection for these commodities management were collected through household baseline survey and focus group discussion in three districts of Sumbawa, Timor Tengah Selatan and Gunungkidul, in which two villages were selected in each district. The community forestry management in these districts mainly refers to area outside state forest.

#### Type of products and assumptions on improved management

Both timber and NTFPs used are highly commercially traded in the local market to supply the regional market. Type of products and assumptions on improved management are developed for the following commodities:

Project sites	Timber	NTFP (farming)	NTFP extraction	Intercropping
Gunungkidul	Teak	Bamboo	-	Teak and ginger
Sumbawa	Teak	Candle nuts	Forest honey	Teak and ginger
Timor Tengah Selatan	-	Candle nuts	Forest honey	-

#### Adoption by villagers

The rate of adoption of 10% is used for current practices after Kanoppi 1, which was based on the assessment implemented by Objective 4. Estimated direct outreach by forestry household for post-ante analysis used the recent figures at the total 451,123 household that presumably are relying on both timber and NTFP. Recent households data source were from *Kemendagri* (Ministry of Home Affairs), 2015.

#### Discount rates and inflation rates

Real discount rate of 8% is used in the analysis based on the average interest rate for commercial loans at bank at regional level for 2015. Data was also adjusted to the current values taking into account the inflation rate using CPI (Consumer Price Index).

#### Opportunity costs of land use

In Indonesia, state forests managed by community are often areas deforested or degraded due to illegal logging and forest encroachment. Forestry development is therefore not competing with other land uses and the opportunity cost is low. At the proposed project sites, preliminary assessment will define the opportunity costs of land use to differentiate between a truly deforested area and a degraded area that may recover through natural regeneration. The timber and NTFP potential for each scenario will be estimated.

### Shape analysis and assessment indicators (NPV and BCR)

Adoption was projected based on an S-shaped logistic diffusion curve (Raitzer et al. 2006), with the maximum adoption of 10% achieved after 20 years, in which timber species can be harvested at the shorter rotation owing to improved silvicultural practices, as well as productivity per hectare, compared to the current system of 25-year rotation in Gunungkidul and 36-year in Sumbawa.

Calculations of annual research benefits have been made and compared to costs to determine the BCR for the research investment. The net benefit of the ACIAR-funded project over the assessment period is equal to the discounted stream of returns from timber and NTFP under improved management, less the discounted stream of returns under current management. Consecutively, the discounted net benefits are compared with research investment to determine the project's benefit-cost ratio based on the equation below.

$$BCR = \frac{\sum_t A_t (NPV_{It} - NPV_{Ct}) / (1+r)^t}{\sum_t R_t / (1+r)^t}$$

Where: BCR: benefit-cost ratio  
t: year  
A<sub>t</sub>: per hectare additional adopting area in year t  
NPV<sub>It</sub>: per hectare net present value of improved management for a rotation starting in year t  
NPV<sub>Ct</sub>: per hectare net present value of current management for a rotation starting in year t  
r: discount rate  
R<sub>t</sub>: research cost in year t

## 11.2 Appendix 2: Grand Strategy Documents

Sumbawa Grand Strategy Document: strategy and direction for developing integrated timber and Non-timber Forest Product (NTFPs) management at the landscape level

Components in the integrated management at the landscape level	Management strategies based on zonation according to watershed area		
	Upstream	Midstream	Downstream
<b>A. Area management, Objective: Enforcing the conservation function of the area as the buffer zone and/or rehabilitating the degraded areas, while enhancing local livelihoods</b>			
Enforcing the conservation function of the area as the buffer zone and/or rehabilitating the degraded areas	Agroforestry development with priority commodity selection of: avocado ( <i>Persea americana</i> ), candlenut ( <i>Aleurites moluccana</i> ) and coffee. Shading trees include timber species with good canopy function and high conservation values, such as: rimas ( <i>Duabanga moluccana</i> ), suren ( <i>Toona sureni</i> ), dadap ( <i>Erythrina sp.</i> ), and udu ( <i>Litsea accedentoides</i> ).	Agroforestry development under inter-cropping technique with priority commodity combination of: teak ( <i>Tectona grandis</i> ) and small ginger ( <i>Zingiber officinale</i> ), ginger and rumpuk ketak ( <i>Lygodium circinatum</i> ), trigona honey bee cultivation and calliandra ( <i>Calliandra sp.</i> ), sengan and small ginger. Shading trees include timber species with good canopy function and high conservation values: sengan ( <i>Paraserianthes falcataria</i> ), calliandra and jabon ( <i>Neolamarckia cadamba</i> ). Calliandra has also the function as the sources of nectar for bees producing trigona honey ( <i>Trigona sp.</i> ).	Land rehabilitation and enhancing local livelihoods through the development of agroforestry and intercropping by using a combination of: teak and cash crops (maize, local variety peanut, <i>lebug</i> (pigeon pea or <i>Cajanus cajan</i> ); eucalyptus ( <i>Eucalyptus alba</i> ) and cash crops (paddy, maize, peanut); and teak, trigona honey cultivation and turmeric ( <i>Curcuma sp.</i> ).
Enhancing local livelihoods	Enhancing the conservation of forest at the upstream area will ensure the continuity of forest honey production, through the planting of host trees (e.g. Binong (latin name)). There should be limited expansion of planting by using the existing highly commercial values of timber species, such as: agarwood ( <i>Aquilaria sp.</i> ), rosewood ( <i>Dalbergia latifolia</i> ), and jabon ( <i>Neolamarckia cadamba</i> ). Recommended NTFPs: small ginger or <i>jahe empit</i> , turmeric, coffee and avocado ( <i>Persea americana</i> ).	Recommended commercial timber species: teak, agarwood, and rosewood Recommended NTFPs: trigona honey, tamarind ( <i>Tamarindus indica</i> ), turmeric, bee bread from bees producing trigona honey. Also bee bread in producing trigona has important market values. Recommended planting the forage fooder (HMT- Hijau Makanan Ternak): lamtoro ( <i>Leucanea glauca</i> ), and a combination of calliandra and other cash crops to support agrosilvopastoral development.	Recommended commercial timber species: teak and mahogany. Recommended timber species as shading trees with high conservation values: mahogany and tamarind. Recommended NTFPs: trigona honey bee, turmeric, ginger and tamarind. Recommended planting the forage fooder (HMT- Hijau Makanan Ternak): lamtoro, and a combination of calliandra and other cash crops to support agrosilvopastoral.
Integrating environmental services for economic values	Village and community-based ecotourism: ecotourism development based on local potential and context surrounding the protected and production forest. This should be in line with the regional tourism development master plan ( <i>RIPDA-Rencana Induk Pengembangan Pariwisata Daerah</i> ).		

Components in the integrated management at the landscape level	Management strategies based on zonation according to watershed area		
	Upstream	Midstream	Downstream
<b>B. Business management, Objective: Promoting the establishment of small-medium scale enterprises (<i>UMKM-Usaha Mikro Kecil dan Menengah</i>) for value added processing activities both for timber and NTFPs</b>			
Business model development: NTFPs	Recommended processing industry for medicinal plants. Medicinal plants are commonly processed as instant drink as part of the cottage industries (e.g. ginger and turmeric). For candlenuts, it is focussed on enhancing the involvement of local households (usually managed by women) in <i>ose</i> (candlenut de-shelling processing) enterprises.	Strategically developed medicinal plants processing cottage industry connecting the production of the plants between upstream and downstream as the intended market for the medicinal plants produced. It is expected that this will stimulate more effective the interconnectivity between the local small-scale processing industries and much larger and established medicinal production industries (e.g. in Java).	Agroforestry products-based small scale marketing and processing industries (e.g. on ginger, turmeric, and tamarind).
Business model development: timber	Wood-based processing small-scale industries are not recommended in the upstream area.	Wood-based processing small-scale industries are not recommended in the midstream area.	The development of furniture cottage industry (e.g. using teak), and for producing flooring and parquet. Wood product is used for the development of creative industries.
Opening opportunities for market and business expansion	Local communities are empowered through the business cooperative of local small-scale producers ( <i>KUB-Koperasi Usaha Bersama</i> ) facilitated by the extension officers of the implementing extension agency for agriculture, fisheries and forestry ( <i>BP4K-Badan Pelaksana Penyuluhan Pertanian Perikanan dan Kehutanan</i> ).  Whenever it is relevant to the business plan of the local Forest Management Unit-FMU ( <i>KPHP-Kesatuan Pengelolaan Hutan</i> ), the marketing processes are facilitated by FMU that will establish the partnership with large-scale processing industry (in coordination with the District Agency for Industry and Commerce and the Forestry and Estate District Agency).	Local communities are empowered through the business cooperative of local small-scale producers ( <i>KUB</i> ). Based on the existing model, trigona honey production and marketing is developed through a partnership between the <i>KUB</i> and <i>KPHP</i> .	Facilitating the development of creative industries for a range of wood and NTFPs produced from the upstream to downstream area.
	Ensuring the continuity of supply of NTFPs and timber by facilitating the development of community nurseries ( <i>KBR-Kebun Bibit Rakyat</i> ) in each village, focussing on recommended species (as described above) with good business-prospect.		
	Creating access to financial capital for establishing small-medium scale enterprises ( <i>UMKM-Usaha Mikro Kecil dan Menengah</i> ) by establishing a partnership between <i>KUB</i> and the financing and banking institution for micro-credit (softloans).		
	Market and business network expansion: establishing partnership with external businessmen for processed product packing that is in line with modern green-based retail market or supermarket networking.		
	Facilitating the process in getting certified-label for NTFPs processed product for <i>UMKM</i> , such as: clearance from National Agency of Drug and Food Control ( <i>BPOM-Badan Pengawas Obat dan Makanan</i> ), permit for household food industry ( <i>PIRT-Pangan Industri Rumah Tangga</i> ), and passing the criteria of Indonesia National Standard ( <i>SNI-Standar Nasional Indonesia</i> ).		

Components in the integrated management at the landscape level	Management strategies based on zonation according to watershed area		
	Upstream	Midstream	Downstream
<b>C. Institutional arrangement and management, Objective: improving the coordination, synergy, and inter-connectivity of various government agencies at the district level, as well as between these agencies and private market industries.</b>			
Improving the coordination, synergy, and inter-connectivity of various government agencies	The Grand Strategy Document provides a strong-basis as the entry point to improve the coordination, synergy, and inter-connectivity of various government agencies ( <i>SKPD-Satuan Kerja Perangkat Daerah</i> ) . However, training programs in strengthening the related SKPDs' capacities are needed.		
	Expanding the coordination and synergy between government agencies at the district level with other agencies under the authority of provincial and central government is required, such as with <i>BKSDA-Balai Konservasi Sumber Daya Alam</i> managing the Ecotourism Park ( <i>TWA-Taman Wisata Alam</i> ) Semongkat.		
Facilitating partnership arrangement along the supply and value chains	The development of business plan integration based on partnership arrangement between KUB, and FMU, and/or with potential processing industries along the supply and value chains.		
	Improve capacity of extension worker and extension organisation (government and self-help) in supporting the development of timber and NTFPs production and business that have high potential economic values, taking into account the recommended species to be developed as well as added-value cottage industries based on needs and priorities in each zone along the watersheds.		
Empowering institutional legal status, and entrepreneurship and business skills of small-scale producers at the village level	Establishment and strengthening of community institutional status and legality (such as: farmer group, the association of farmer groups ( <i>GAPOKTAN-Gabungan Kelompok Tani</i> ) , and trigona honey small-scale producers).		
	Enhancing the institutional management and entrepreneurship skills, relevant to the needs and priorities of area management based on zonation along the watershed (upstream, midstream, and downstream). Methods include: training (in class and on-field) and cross-visit for learning from other areas/groups.		

Components in the integrated management at the landscape level	Management strategies based on forest classification and zonation according to watershed area						Outside state forest		
	Production forest		Protection forest			Nature Reserve			
	Midstream	Downstream	Upstream	Midstream	Downstream	Upstream	Downstream	Midstream	Upstream
<b>A. Area management, Objective: Enforcing the conservation function of the area as the buffer zone and/or rehabilitating the degraded areas, while enhancing local livelihoods</b>									
Management strategy in enhancing the conservation function of the area as the buffer zone and improving the production system (through recommended NTFPs)	Developing the buffer zone of the production forest by cultivating and developing NTFPs with a significant roles in enhancing the ecological function and in accordance with community livelihoods' needs.	Managing critical lands, while enhancing the livelihoods of local community by intensifying the planting of MPTS (Multipurpose Tree Species); and community members can do intercropping underneath.	Land rehabilitation by using MPTS and recommended timber species with low economic value but has significant roles for restoring the conservation function. The selection of MPTS and timber species should consider the function in providing nectar for forest honey bees.	Developing the buffer zone of the production forest by cultivating and developing NTFPs and timber with a significant roles in enhancing the ecological function.	Management with intercropping practices as the income opportunity for local community members.	Ensuring the legality of NTFPs production by issuing the harvesting permit (i.e. for forest honey) in accordance to norms and rules under traditional communal forest management ( <i>Suf</i> ), as well as formal administrative management authority.	Developing the buffer zone of the forests (production and protection forests, and nature reserve) by cultivating and developing MPTS and low economic values of timber with a significant roles in enhancing the ecological function. As well as enforcing the proper timber management in accordance to Act No. 32/2012 on environmental management.		

Components in the integrated management at the landscape level	Management strategies based on forest classification and zonation according to watershed area						Outside state forest		
	Production forest		Protection forest			Nature Reserve	Downstream	Midstream	Upstream
	Midstream	Downstream	Upstream	Midstream	Downstream	Upstream			
<b>B. Business management, Objective: Promoting the establishment of small-medium scale enterprises (UMKM-Usaha Mikro Kecil dan Menengah) for value added processing activities both for timber and NTFPs</b>									
Business and modelling sector	Developing commercially-based agroforestry management taking into account of different aspects (e.g. business feasibility; potentially develop under partnership arrangement with industries along the supply chains) . Developing small-scale post-harvesting processing enterprises with the main focus for adding value of commodities that have adequately been produced in the area (e.g. cashew nut, tarum, betel; forest honey).	Developing small-scale post-harvesting processing enterprises with the main focus for adding value of commodities that have adequately been produced in the area. Area management is designed taking into account business feasibility aspect; potentially develop under partnership arrangement with industries along the supply and value chains) .	Developing and managing NTFPs through small-scale enterprises under partnership arrangement with the business unit of <i>Mutis Timau</i> Protected Forest Management Unit (KPHL-Kesatuan Pengelolaan Hutan Lindung).	Developing and managing NTFPs through small-scale enterprises under partnership arrangement with the 12 newly-established KPHL (former Forestry District Agency)	Developing and managing NTFPs through small-scale enterprises under partnership arrangement with the 12 newly-established KPHL (former Forestry District Agency)	No business model should be implemented here.	Developing commercially-based agroforestry management taking into account of different aspects (e.g. business feasibility; potentially develop under partnership arrangement with industries along the supply chains) . Developing small-scale post-harvesting processing enterprises with the main focus for adding value of commodities that have adequately been produced in the area (e.g. cashew nut, tarum, betel; forest honey). Developing farm forestry ( <i>Hutan Rakyat</i> ).		
Access to finance capital	Establishing partnership with micro-financing institution and/or banks providing loans from UMKM (e.g. <i>BRI-Bank Rakyat Indonesia</i> , <i>Bank Nusa Tenggara Timur</i> . Revitalising village government fund. Developing proposal for accessing Corporate Social Responsibility-CSR funds of state-owned company. Empowering local community group by conducting training on entrepreneurship to improve their business skills, for example, so they have capacity to write the proposal.								
<b>C. Institutional arrangement and management, Objective: improving the coordination, synergy, and inter-connectivity of various government agencies at the district level, as well as between these agencies and private market industries.</b>									
Strategy of the development of social forestry (PS): HKm, HTR, HD, Partnership etc.	Through Community Forestry Scheme ( <i>HKm-Hutan Kemasyarakatan</i> ), which is a nationally-wide initiative as part of social forestry program supported by the Ministry of Environment and Forest (MoEF).	Through various PS, partnership, village forests are directed to utilize village fund in cooperation with Dishut.	Partnership to maintain protection function to generate a range of benefits (economic, social and institutional aspects)				Serving as the supporting production centres of timber and NTFPs.		



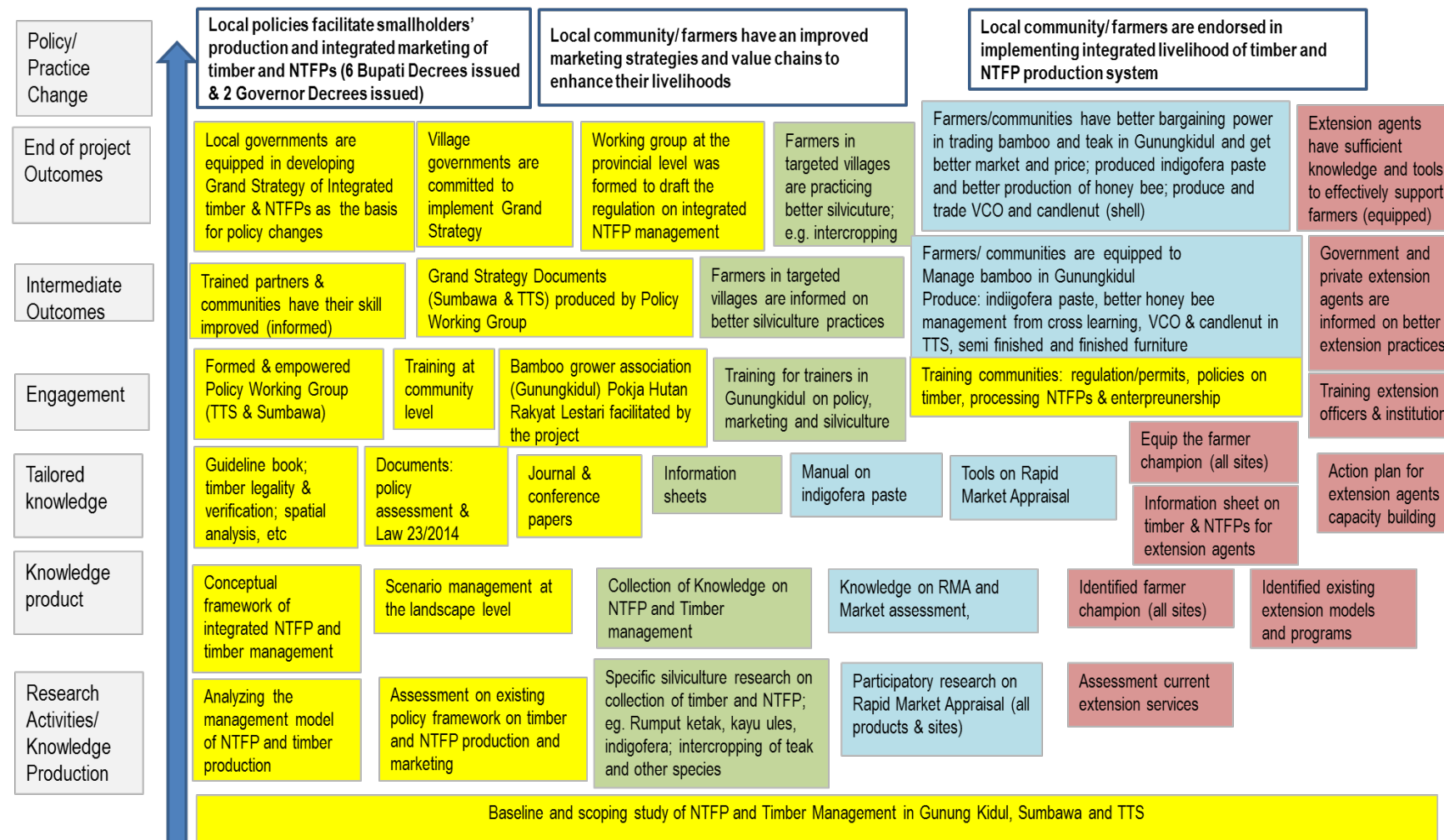
Gunungkidul Grand Strategy Document: proposed strategy and direction for developing integrated timber and Non-timber Forest Product (NTFPs) management at the landscape level

Components in the integrated management at the landscape level	Management strategies based on zonation according to watershed area		
	Upstream: North Zone (Batur Agung)	Midstream: Middle Zone (Ledok Wonosari)	Downstream: South Zone (Ledok Wonosari)
<b>A. Area management, Objective: Enforcing the conservation function of the area as the buffer zone and/or rehabilitating the degraded areas, while enhancing local livelihoods</b>			
Enforcing the conservation function of the area as the buffer zone and/or rehabilitating the degraded areas	Agroforestry development with priority timber species having high conservation values of: sengon ( <i>Paraserianthes falcataria</i> ) as the main trees and rosewood ( <i>Dalbergia latifolia</i> ) with intercropping of plants underneath as the sources of nectar for bees in cultivated honey production. Bamboo ( <i>Bambusa sp.</i> ) planting by community at the river bank or community land by using <i>bambu wuluh</i> ( <i>Schizotachyum blunei</i> Ness.), and <i>bambu apus</i> ( <i>Gigantochloa apus</i> Kurz.) in accordance with the industry needs in the North Zone.	Agroforestry development with priority commodity selection of: teak ( <i>Tectona grandis</i> ) and bushes ( <i>jahe emprit</i> or small ginger ( <i>Zingiber sp.</i> )) as combination, and then agroforestry development with priority commodity selection of cash crops is also conducted (maize, casava, peanut, and soybean). In critical lands, timber species used should consider the high conservation values.	Agroforestry development with priority commodity selection of: teak and bushes ( <i>jahe emprit</i> ) as combination, and then agroforestry development with priority commodity selection of cash crops is also conducted (maize, casava, peanut, and soybean). In critical lands, timber species used should consider the high conservation values.
Enhancing local livelihoods	Commercial timber species: sengon, rosewood, jabon ( <i>Neolamarckia cadamba</i> )  NTFPs: medicinal plant ( <i>jahe emprit</i> ), bamboo, cultivated honey production ( <i>Apis florea</i> ), and candlenuts ( <i>Aleurites moluccana</i> )	Commercial timber species: teak and sengon NTFPs : <i>jahe emprit</i> , bamboo, and candlenuts	Commercial timber species: teak and acacia ( <i>Acacia sp.</i> ). NTFPs : Candlenut, bamboo, turmeric ( <i>Curcuma longa</i> ), ginger, tamarind ( <i>Tamarindus indica</i> L.), and sandalwood ( <i>Santalum album</i> ) that potentially can be developed in Rongkop and Girisubo Sub-Districts
Integrating environmental services for economic values	Honey village (kampung madu) development in Nglipar Sub-District and fruits garden development in Embung Sriten region integrated with Wonosadi TAHURA plan Development of whether it can be integrated by model of Micro Watersheds of Watu Gede in Nglipar, Patuk, and Gedangsari Sub-Districts	There is potential cacao ( <i>Theobroma cacao</i> L.) village tourism in Patuk region and integrated with fruits garden of Nglanggeran. There is bamboo industry center in Semanu and Paliyan that can be developed into tourism region	

Components in the integrated management at the landscape level	Management strategies based on zonation according to watershed area		
	Upstream: North Zone (Batur Agung)	Midstream: Middle Zone (Ledok Wonosari)	Downstream: South Zone (Ledok Wonosari)
<b>B. Business management, Objective: Promoting the establishment of small-medium scale enterprises (<i>UMKM-Usaha Mikro Kecil dan Menengah</i>) for value added processing activities both for timber and NTFPs</b>			
Business model development	Developing honey production-village, a village that focuses on cultivating bees for honey production and other potential eco-tourism. Education tourism based on: (1) local communities' experiences in managing farm forestry ( <i>hutan rakyat</i> ) and (2) Center of bamboo wuluh handicraft that is already there with an established marketing network. For candlenuts: it is focussed on enhancing the involvement of local households (usually managed by women) in ose (candlenut de-shelling processing) enterprises.	Strategically developed medicinal plants processing cottage industry connecting the production of the plants between upstream and downstream as the intended market for the medicinal plants produced. It is expected that this will stimulate more effective the interconnectivity between the local small-scale processing industries and much larger and established medicinal production industries (e.g. in Java).	The development of furniture cottage industry (e.g. using teak), and for producing flooring and parquet. Wood product is used for the development of creative industries.
Opening opportunities for market and business expansion	Ensuring the continuity of supply of NTFPs and timber by facilitating the development of community nurseries ( <i>KBR-Kebun Bibit Rakyat</i> ) in each village, focussing on recommended species (as described above) with good business-prospect.		
	Creating access to financial capital for establishing small-medium scale enterprises ( <i>UMKM-Usaha Mikro Kecil dan Menengah</i> ) by establishing a partnership between KUB and the financing and banking institution for micro-credit (softloans).		
	Market and business network expansion: establishing partnership with external businessmen for processed product packing that is in line with modern green-based retail market or supermarket networking.		
	Facilitating the process in getting certified-label for NTFPs processed product for UMKM, such as: clearance from National Agency of Drug and Food Control ( <i>BPOM-Badan Pengawas Obat dan Makanan</i> ), permit for household food industry ( <i>PIRT-Pangan Industri Rumah Tangga</i> ), and passing the criteria of Indonesia National Standard ( <i>SNI-Standar Nasional Indonesia</i> ).		

Components in the integrated management at the landscape level	Management strategies based on zonation according to watershed area		
	Upstream: North Zone (Batur Agung)	Midstream: Middle Zone (Ledok Wonosari)	Downstream: South Zone (Ledok Wonosari)
<b>C. Institutional arrangement and management, Objective: improving the coordination, synergy, and inter-connectivity of various government agencies at the district level, as well as between these agencies and private market industries.</b>			
Improving the coordination, synergy, and inter-connectivity of various government agencies	The Grand Strategy Document provides a strong basis as the entry point to improve the coordination, synergy, and inter-connectivity of various government agencies ( <i>SKPD-Satuan Kerja Perangkat Daerah</i> ) at district level. However, training programs in strengthening the related SKPDs' capacities are needed.		
	Expanding the coordination and synergy between government agencies at the district level with other agencies under the authority of provincial and central government is required, such as the forestry district agency at the provincial level and Production FMU ( <i>KPHP-Kesatuan Pengelolaan Hutan Produksi</i> ).		
Facilitating partnership arrangement along the supply and value chains	The development of business plan integration based on partnership arrangement between KUB, and FMU, and/or with potential processing industries along the supply and value chains.		
	Improve capacity of extension worker and extension organisation (government and self-help) in supporting the development of timber and NTFPs production and business that have high potential economic values, taking into account the recommended species to be developed as well as added-value cottage industries based on needs and priorities in each zone along the watersheds.		
Empowering institutional legal status, and entrepreneurship and business skills of small-scale producers at the village level	Establishment and strengthening of community-based institutions (farmer group, bamboo growers, and cultivated honey producers) in terms of institutional and entrepreneurship management. As well as specific While for matters that are specific in region will be adjusted with its needs and priorities.		
	Enhancing the institutional management and entrepreneurship skills, relevant to the needs and priorities of area management based on zonation along the watershed (upstream, midstream, and downstream). Methods include: training (in class and on-field) and cross-visit for learning from other areas/groups.		

### 11.3 Appendix 3: Theory of Change (ToC) reflecting the outcomes of the four objectives in Kanoppi Project



Notes: Objective 1 (green), Objective 2 (blue), Objective 3 (yellow), and Objective 4 (red).

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## **11.4 Appendix 4: Existing Conditions, Challenges and Needs in the Implementation of Forestry and Agroforestry Extension in Indonesia**

### **Abstract:**

Timber and non-timber forest products (NTFPs) are forest and agroforestry products and potential sources of livelihood for farmers. If managed in a sustainable manner, these products can increase the income of farmers. To achieve sustainable management, farmers require access to appropriate information. However, in remote areas, farmers have limited access to such information. Therefore, this study was conducted in order to understand the effective forestry extension practices that support the development of timber and NTFPs as source of income for farmers in Indonesia. Interviews were conducted with 500 farmers and six FGDs were held to discuss the approach of forestry extension, implemented both by the government and private sector. In addition, field observations on forestry extension practices were conducted in order to collect supported qualitative and quantitative data. This study was conducted in three districts of three provinces in Indonesia, i.e. Gunungkidul, Daerah Istimewa Yogyakarta; Sumbawa, West Nusa Tenggara; and Timor Tengah Selatan, East Nusa Tenggara. The result shows that current forestry extension practices are not optimum, mainly because of a) inadequate number of field government extension agents specialize on forestry issue; b) inadequate learning material given to farmers; and c) inadequate budget allocations for forestry extension activities at the district level. In several remote study areas, private extension agents play a major role in helping the dissemination of forestry information. Implementation of forestry extension program cannot depend solely on government extension agents. Collaboration between government and private extension agents is necessary to support the effectiveness of information dissemination and the capacity building of farmers for a sustainable forest management.