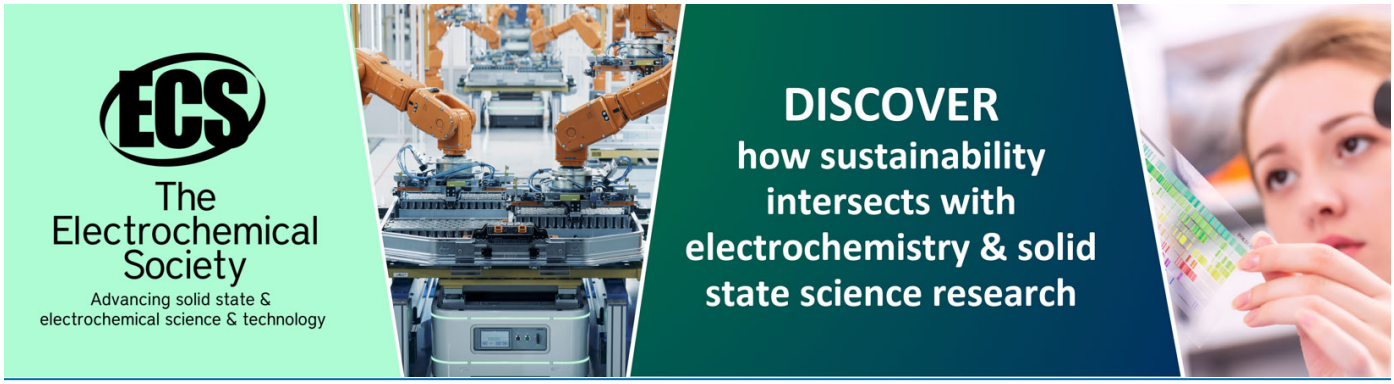
Farming competence of farmer in peatland management: Case in Rasau Jaya Dua Village, West Kalimantan Province



Farming competence of farmer in peatland management: Case in Rasau Jaya Dua Village, West Kalimantan Province

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Abstract. The local community has managed peatlands for a long time with various commodities and levels of management. The success of farming in peatland requires the seriousness of farmers and proper land management to produce peatland's high productivity and sustainability, including farmer's competence. The research aims to analyze farmers' competence in peatland farming and identify factors that influence farmers' competence in peatland management. The research was conducted from August to October 2017 in Rasau Jaya Dua Village, Kubu Raya District, West Kalimantan. The selection of 48 respondents was made by a simple random sampling method. Primary data, including characteristics of respondents and farmer's competence in peatland management, were collected through interviews using questionnaires and field observations. Data were analyzed qualitatively and quantitatively using the correlation test of Rank Spearman. The results showed that the farmers' competence level in peatland farming in Rasau Jaya Dua Village was moderate. Factors that must be considered to develop the farming competence in peatland are age, motivation, and interaction with extension workers. Increasing the farming competence of farmers in peatland management can be achieved through improving the interaction between farmers and extension workers.

1. Introduction

The community has managed peatland for a long time with various commodities and levels of management. Land destruction, pesticide and chemical contamination of flora and fauna, deforestation, water pollution, and loss of functional biodiversity are common consequences of agricultural production [1]. Farmers' daily tasks are complicated because they require awareness and consideration of various biological, technical, functional, political, legal, economic, ethical, and social factors and circumstances [2].

[3] stated that the level of competence of farmers determines the right decisions and actions and their performance to tackle the problems and demands of the farming needs. Peatland management efforts in Indonesia refer to the Republic of Indonesia Government Regulation Number 57 of 2016 concerning the Protection and Management of Peat Ecosystems which mandates the need to formulate a Peat Ecosystem Protection and Management Plan (RPPEG). RPPEG is a written plan document containing the peat ecosystem's potential problems and efforts to protect and manage it within a certain period [4]. RPPEG needs to be disseminated to all stakeholders related to peatland management, including farmers as peatland managers at the site level.

The research objectives are to analyze the level of farming competence of farmer in peatland and to identify factors influence farmer's competence in peatland management.

2. Materials and Methods

2.1. Time and research location

The research was conducted from August to Oktober 2017 in Rasau Jaya Dua Village, Rasau Jaya Sub District, Kubu Raya District, West Kalimantan Province. Rasau Jaya Dua Village is selected as a research location because most of the village area is peatland, which the community has managed for farming activities. This village has an area of 38.57 km^2, the largest village in the Rasau Jaya sub-district with an area of 111.03 km^2 [5]. In Rasau Jaya Dua, there is a farmer group with members who cultivate peatland for farming. In Rasau Jaya Dua, there is also a facilitator team for Protection and Management of Peat Ecosystems (PPEG), a collaboration between the Ministry of Environment and Forestry (KLHK), Kubu Raya Government, and Tanjung Pura University.

2.2. Methodology for data collection and analysis

The selection of 48 respondents was made by a simple random sampling method. Primary data, including characteristics of respondents, farmer's competence in peatland farming, were collected through interviews using questionnaires and field observations (Figure 1). The characteristics of respondents consist of age, education level, number of family members, farming experience, motivation, land ownership, interaction with extension workers, availability of production facilities, involvement in farmer groups. In contrast, farmers' competence in peatland management includes knowledge attitudes and skills.

A specific questionnaire was developed for this research. The questionnaire was used to assess the level of knowledge/understanding regarding peatland management (consist of 20 questions), the level of attitude regarding peatland management (consist of 25 questions), and the level of skill regarding peatland management (consist of 24 questions). Each question was rated on a four-point scale with weight and score as presented in Table 1. Data were analyzed qualitatively and quantitatively using the correlation test of Rank Spearman.

Figure 1. Respondents' interview.

Table 1. Model of weighting and score.

Scale	Element of Competence			Score
	Knowledge	Attitude	Skill	
4	Very good	Strongly agree	Very skilled	3.25-4.00
3	Good	Agree	Skilled	2.50-3.24
2	Moderate	Disagree	Unskilled	1.75-2.49
1	Low	Strongly disagree	Very unskilled	1.00-1.74

3. Results and Discussions

3.1 Respondent characteristics

Respondent characteristics consist of internal and external characteristics. Internal characteristics include age, education level, number of family members, self-managed peatland, other people's land managed, farming experience and motivation. Meanwhile, external characteristics include interaction with extension workers, availability of production facilities, and involvement in farmer groups. Internal and external characteristics are presented in Table 2 and Table 3.

Table 2. Internal characteristics of respondents.

Characteristics	n = 40 Number	Percentage (%)
Gender		
Male	16	33.33
Female	32	66.67
Age (years)		
15-64	44	91.67
>64	4	8.33
Educational level		
Elemenatry school	34	70.83
Junior high school	10	20.83
Senior high school	3	6.25
Diploma/Bachelor	1	2.08
Number of family (person)		
1-2	29	60.42
3-4	18	37.50
>4	1	2.08
Self-managed peatland (hectares)		
0-0.5	22	45.83
>0.5-1	18	37.50
>1-1.5	2	4.17
>1.5-2	4	8.33
>2	2	4.17
Other people's peatland managed (hectares)		
0-0.5	35	72.92
>0.5-1	10	20.83
>1-1.5	0	0.00
>1.5-2	2	4.17
>2	1	2.08

Characteristics	n = 40 Number	Percentage (%)
Farming experience (years)		
1-5	13	27.08
>5-10	7	14.58
>10-15	6	12.50
>15-20	5	10.42
>20	17	35.42

Table 2 shows that, on average, respondents are in productive age, ranging from 15-64 years old according to BPS [6]. Respondents had an average of 6.65 years of education, classified as the junior high school education level with the lowest formal education being two years and the highest education is 18 years. Education has a significant relationship with competence [7].

The number of the family refers to all dependent family members living in the same house and unemployed [8]. Most of the respondents are women (66.67%) who cultivate their peatlands without the help of their husbands (head of household) as their husbands work outside the village in the oil palm or the forest plantation and usually return to the village every four months. On the other hand, most children are of unproductive age (school age) and cannot help their mothers work in the peatlands. Therefore, the number of family members and the ability of farmers to manage their peatlands are not correlated in this study.

Average peatland holding is 0.88 ha, most of which is land allocated by the government for transmigrants. Some respondents also manage other people's peatland with an average area of 0.47 ha, using both profit sharing and rent systems

On average, total dependent family members are only 2.13 people, classified as a small family, ranging from 1-3 people [6]. Therefore, farming experience plays an important role in one's competence. Furthermore, through experience, a person will be more mature in dealing with various problems in farming [9]. Furthermore, [9] classified farming experiences into three groups, namely new experience (less than ten years), moderate experience (10-20 years), and old experience with farming experiences more than 20 years. Based on this classification, the respondents of this research were classified into a moderate experience with 18.23 years of farming experience.

Table 3. External characteristics of respondents.

Characteristics	Number
Interaction with extension workers	
Minimum	5.00
Maximum	13.00
Average	9.21
Availability of production facilities	
Minimum	7.00
Maximum	12.00
Average	8.90
Involvement in farmer groups	
Minimum	4.00
Maximum	8.00
Average	5.92

Farmers in managing peatlands need information support from many stakeholders, including extension workers. The agricultural extension aims to increase knowledge and skills and change farmers' attitudes and behavior from traditional to dynamic rational [10]. Respondents obtained

information about agricultural techniques from extension activities carried out by Field Agricultural Extension (PPL). An extension is carried out routinely every two months, and extension workers are also persistent in monitoring planting locations such as gardens and rice fields, especially on farmers facing agricultural problems. However, extension material is still limited to technical aspects, and it has not touched non-technical matters, such as facilitating farmers closer to access to capital, which so far became a classic problem for farmers to increase production and productivity of their peatlands farming. Extension material is also limited to only one particular commodity, namely corn. Hence most farmers do not get capacity building according to their needs or problems. Apart from extension workers, farmers also often share their opinions and experiences in farming with other farmer groups member, including their leaders, who are relatively easy to find if there are problems related to farming on peatlands.

Almost all respondents know the extension workers who work in Rasau Jaya Dua Village. However, they admit that they are not so familiar since the intensity of the extension was relatively rare (6 times a year). As a result, close interaction only occurs between extension workers and the farmer group leaders.

Most of the seeds/ seedlings of crops were obtained by purchasing or preparing themselves. Most organic fertilizers (chicken and cow manure) are from their livestock. Most farmers have a relatively large number of chickens (>10) aiming for their own consumption, for sale, and for providing fertilizer (manure). Chemical fertilizers are bought from local markets, but their stock is not always available and sometimes farmers have to wait to get it. Therefore, farmer groups become a medium for farmers to interact, learn and share experiences. Most of the farmer group members are involved in the regular monthly meeting held on the 13th night of each month. The monthly meeting also discusses the development of savings and loan facilities to meet farming business needs and the arrangement of farm activities in rotation, cleaning existing secondary canals or ditches, etc.

3.2. Peatland management by community

Rasau Jaya Dua Village has become a transmigration village since 1974, with transmigrants were mosrly from central java (Blora, Grobogan, Kudus, Banyumas, Wonogiri, Kebumen, Pati, Solo) and Yogyakarta (Gunungkidul). Most of the land in this village is dominated by peatlands. Therefore, the peatland condition becomes a challenge for transmigrant communities working on dry land on Java Island. As a result, a small proportion of people return to Java because they cannot stand peatland conditions.

In the beginning, the community was provided land allotment to build a house of 40x100 m and agricultural land of 2 hectares. The transmigrant community carried out land clearing activities (initially in the form of forests) by cutting down typical peatlands trees such as *jelutong* (*Dyera polyphylla*), *pulai* (*Alstonia pneumatophora*), *nyatoh* (*Palaquium* spp.), etc. Remnants of logging during land clearing can still be seen from tree stumps that are still left on community land and some are used for building houses such as walls or floors.

In managing peatlands, respondents usually do it themselves, but several stages of land management involve family members and hired laborers. Before cultivating peatland, most respondents conducted peatland preparation by slashing, burning and planting.

3.2.1. Land management. Peatlands are characterized by very high organic content, poor mineral content, and high acidity saturated with water or even inundated. Giving ameliorate in the form of liming or giving ash can reduce soil acidity. Usually, people use dolomite (lime) and or ash from burning peat.

Burning activities are usually carried out during land clearing or when pioneering peatlands clearing by controlled burning of the remains of shrubs and stumps. Large wooden stumps are left to rot and land cultivation is carried out by removing grass/shrubs through chopping with machetes/sickles. The grass/ shrub is then composted around vegetable or horticultural crops. The main risk of farming on peatlands during the rainy season is that the plants can rot easily due to pest attacks, and in the dry season, there is a concern that the peatlands will become too dry. Some efforts

applied by the farmers to control water both in the rainy season and in the dry season are as follows: 1) Most farmers prepare wells/reservoirs of at least (1x1x2) m in size, made in the middle of peatland area. This wheel is prepared for watering/fertilizing plants when needed (dry season), washing agricultural equipment/hands, etc.; during the rainy season, farmers use a ditch or worm drain system.

3.2.2. Types of plants cultivated. At the beginning of farming, farmers planted the staple food-producing type, namely cassava, but this is rarely done because the results are not optimal and tend to fail. The types of plants planted on peatlands are determined by several aspects such as land suitability, farming patterns, cropping patterns, availability of manure, ash, lime, etc.

The principle used by farmers is selecting fiber-rooted plants that can grow on peatlands. Currently, almost all commodities are cultivated, both horticultural crops such as vegetables (mustard greens, chilies, green beans, cucumbers), corn, pineapples (started cultivation in 2009), oil palm, and rubber (started cultivation in 2011) and watermelon (started cultivation in 2013). However, corn (*Zea mays* L.) is one of the crops widely developed by the community due to several considerations such as ease of cultivation, marketing, and short harvest time.

3.2.3. Plantation. Planting various types of plants is carried out without considering the influence of the season. The community generally apply polyculture cropping pattern to diversify their income. The number of species planted in one stretch is highly dependent on the extent of land ownership and capital availability. Farmers with more than 1 ha land usually plant various types of plants and/or change crops in one planting season, but farmers with less than 0.5 ha usually only plant one crop and do not change crop types [11].

The size of land ownership also affects farmers' decisions in using spacing. For farmers having less than 1 ha of land, do not use spacing for practical reasons and speed up the processing time. However, planting certain types of plants such as vegetables (chilies) that require intensive care is carried out using certain techniques such as shipyard and spacing. Replanting is carried out if damaged seeds or seeds do not grow about a week after planting.

3.2.4. Maintenance. Low fertility of peatland is due to the minimum content of macronutrients (N, P, K, Ca and Mg) and micronutrients (especially Cu and B), thus requiring additional nutrients to increase its fertility. Like plant types' selection, maintenance and fertilization activities are also influenced by the land and capital owned size. Types of fertilizers commonly used are ash from peat burning, manure (chicken manure) and chemical fertilizers (TS, NPK, Urea). Organic fertilizers (chicken manure or peat burning ash) are usually given one week before planting. In contrast, chemical fertilizers (TS, NPK, Urea) are applied at the planting time by perforating the rows of plants. Based on farmers' experience, the use of ash and manure can guarantee plant growth in peatlands. However, land used for growing vegetables can still be replanted by adding only a tiny amount of nutrients, such as N for vegetable crops and NPK fertilizer for fruit crops.

3.2.5. Weeding. Weeding is done manually to reduce competition (nutrients and sunlight) between plants and weeds by removing and removing grass and weeds in the planting area or using herbicides.

3.2.6. Pest and disease control. The productivity of the species planted is also determined by the success in controlling pests and diseases attack. Therefore, protecting crops by carrying out pest management has always been an essential part of the agricultural system [12]. Pests commonly attack plants include leaf caterpillar (*Prodenia litura* F), stem borer (*Sesamia inferens* Walker), and cob borer (*Heliothis armigera*), while the diseases are leaf spot (*Cercospora nicotianae*) and leaf rust (*Hemileia vastatrix*). Some of the efforts made by farmers to control plant pests and diseases are cultivating the land before planting, carrying out simultaneous planting, and applying pesticides.

3.2.7. Harvest and post-harvest. The harvest period of plants in peatlands varies depending on the type, such as chili that takes four months and corn 3-4 months. Especially for corn, harvest is done when stems and leaves have begun to dry out. Manual identification can be made by pressing the corn kernels with thumbnails. Post-harvest handling of corn includes stripping, drying, sorting, threshing

and storage. Stripping reduces cob water to prevent fungus growth, speed up drying to have a long shelf life, and facilitate further processing. Sorting activities are carried out to separate large and small corn cobs, damaged seeds, color uniformity, and unripe corn.

Corn threshing is an activity to release seeds from the cobs, separate the cobs, and separates dirt from the peeled corn. This activity is carried out to avoid damage and facilitate transportation and should be done at the right time when the moisture content of corn is between 17 to 20 percent. To maintain this water content can be done by re-drying at any time.

3.2.8. Marketing. The existence of traders from one village or outside the village facilitates the marketing of various agricultural/plantation products on peatlands. The sale is usually made in the farmland. Farmers mainly determine prices due to their high bargaining position (access to information and number of buyers).

3.3. Farmers' competence in peatland management

Farmers' competence in peatland management is the ability that farmers have in knowledge, attitudes and skills regarding farming planning, peatland processing, planting, maintenance and fertilization, plant pests and diseases control, harvesting, post-harvest and marketing. The farmer competence describes farmers' ability to manage the farm based on effective and efficient planning following plant cultivation techniques. The competent farmer owns technical abilities and managerial abilities in carrying out farming [13].

3.3.1 Knowledge. The main goal of transitioning to more sustainable agricultural practices is to understand better farmers' knowledge(s) and learning processes [14, 15]. Farmers' awareness is shaped by a dynamic and multi-faceted mechanism that is partially related to location [16]. Knowledge of farmers in peatland management is presented in Table 4.

Table 4. Knowledge of farmers in peatland management.

Description	Score
Farming planning	2.88
Peatland processing	2.38
Planting	2.69
Maintenance	2.59
Plant pests and diseases control	2.95
Harvesting	2.99
Post-harvest	1.00
Marketing	2.59
Average	2.51

The average score of farmers' knowledge in peat management is in a good category, namely, 2.51 (2.50-3.24) and almost all points are in a good category (score more than 2.50), presumably due to the long-standing interaction of farmers with peatland. On the other hand, peatland processing (2.38) was categorized as moderate and post-harvest (1.00) was low. This is presumably due to the lack of intervention from the extension agents regarding peatland processing, such as ways to restore peatland fertility, which are still not following the principles of peatland management. Subsequently, post-harvest product processing still requires intervention from various parties because people mostly sell their products in raw form. Therefore it has not provided significant additional income to the community.

3.3.2 Attitude. The attitude of the farmer in peatland management is presented in Table 5.

Table 5. The attitude of the farmer in peatland management.

Description	Score
Farming planning	2.75
Peatland processing	2.44
Planting	2.17
Maintenance	2.82
Plant pests and diseases control	2.34
Harvesting	2.84
Post-harvest	2.63
Marketing	1.70
Average	2.46

The attitude of farmers in peat management has an average score of 2.46. However, this score is in the disagree category (1.75-2.49). This might be due to farmers paying less attention to managing peatlands according to the principles of proper peatland management, which consider the production aspect and the conservation or protection of peatland. Therefore, intervention from various parties is needed from extension workers and other relevant agencies such as the Agriculture Service, Environment and Forestry Service, the Office of Cooperatives and Micro Small Enterprise.

3.3.3. Skill. The skill of farmers in peatland management is presented in Table 6.

Table 6. The skill of farmers in peatland management.

Description	Score
Farming planning	2.46
Peatland processing	2.18
Planting	2.18
Maintenance	2.36
Plant pests and diseases control	2.56
Harvesting	3.16
Post-harvest	2.44
Marketing	2.64
Average	2.50

The average score of farmers' skills in peat management is in the skilled category, which is 2.50 (2.50-3.24). This indicates that the interaction between farmers and peatlands has been very long; hence, just like knowledge, farmers are also skilled in peatland management. Therefore, experienced farmers will tend to have the ability and skills of less experienced farmers [17].

3.4. Correlation of respondents with farmer competence

The correlation of respondent competence with internal characteristics is presented in Table 7.

Table 7. Correlation of respondent competence with internal characteristics.

Internal factors	Competence					
	Knowledge		Attitude		Skill	
	Correlation coefficient	Sig.	Correlation coefficient	Sig.	Correlation coefficient	Sig.
Age	**0.352**	0.140	**0.492**	0.000	0.240	0.869
Education level	0.930	0.529	0.119	0.420	0.700	0.639
Number of family members	0.178	0.226	-0.255	0.810	0.234	0.110
Self-managed peatland	0.195	0.184	0.378	0.008	0.310	0.032
Other people's peatland managed	-0.005	0.971	-0.142	0.334	-0.013	0.933
Farming experience	0.690	0.643	-0.162	0.271	0.420	0.774
Motivation	0.163	0.268	0.232	0.113	**0.313**	0.030

Age has a very significant positive relationship with the knowledge and attitudes of farmers in peatland management. The oldest respondent, 72 years old, is the first generation transmigrants from Central Java in Rasau Jaya Dua Village in 1975. The youngest respondent, 19 years old, is of mixed f Javanese and Melayu descent who lives in Rasau Jaya Dua Village because of marriage with local residents, the second generation of transmigrant families. A person's age is related to their competence in peatland management because age can be an indicator to determine a person's productivity [18]. Motivation has a very significant positive relationship with the skill of farmers in peatland management. This is because peat management is challenging to manage concerning its biophysical conditions if compared with mineral soils. This has motivated the farmers to improve their skills to obtain high production and productivity of the peatlands they manage.

The correlation of respondent competence with external characteristics is presented in Table 8.

Table 8. Correlation of respondent competence with external characteristics.

External factors	Competence					
	Knowledge		Attitude		Skill	
	Correlation coefficient	Sig.	Correlation coefficient	Sig.	Correlation coefficient	Sig.
Interaction with extension workers	**0.464**	0.001	**0.257**	0.032	**0.358**	0.12 0.00
Availability of production facilities	0.214	0.143	0.251	0.085	0.204	0.16 4.00
Involvement in farmer groups	0.046	0.755	0.209	0.154	0.230	0.11 5.00

Interaction with extension workers has a significant positive relationship with farmers' knowledge and skill in peatland management. This shows that the role of extension workers is vital in increasing farmers' knowledge and skills in peatland management. This is in line with the research results of [19], who reveal that agricultural extension has a very significant relationship with the ability of farmers to do farming. In addition, agricultural extension agents have a major contribution to increasing the capacity and performance of farmers. The results complement another study's results [20], which states that there is a relationship between the characteristics of farmers and their competence in farming. However, the three aspects of knowledge, skills and attitudes are independent of each other in assessing the various field agribusiness.

4. Conclusion

The level of farming competence of farmers in peatland management in Rasau Jaya Dua Village was in the moderate category. Factors that must be considered to develop the farming competence of

farmers in peatland are age, motivation, and interaction with extension workers. Therefore, increasing the farming competence of farmers in peatland management can be achieved through improving the interaction between farmers and extension workers.

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