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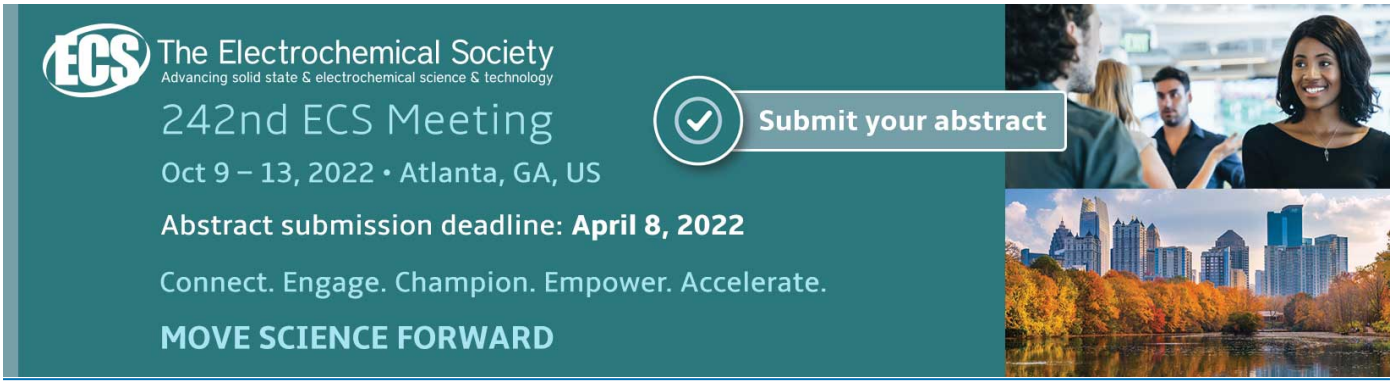

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Preface

Ladies and Gentlemen,

It is my great pleasure to welcome you all to The 2nd International Joint Conference on Science and technology –IJCST 20176 in Nusa Dua Bali-Indonesia 27-28 September 2017. This conference is multidisciplinary including engineering and social science and hope can dedicate a positive contribution to science and technology development. Hosted by Bali State Polytechnic (PNB) and other established university partner including UPNV Jatim, FMIPA-UNISA, FISH-UNESA, and UTM, this conference are attended by more than four hundreds participants who present their best research results.

Papers have been reviewed by peer reviewers and already presented orally in the conference and already selected to be published in **Journal of Physics: Conference Series** (http://jpcs.iop.org) These were then been reviewed again and final submission by IJCST 2017 Committee to the journal due date on 24 November 2017. With high confidence, depend on the paper topic and quality will can reach aim and topic of the conference "**As an international platform for scholars, researchers, practitioners, and government to discuss interdisciplinary research and practices that focuses in the theme of "Science, Technology, Innovation, and Culture for Sustainable Development: Challenge for Green Industry**".

We would like to extend our warm and sincere thanks to authors for great contribution in this conference. Hopefully all participants and authors can extend to build a networking each other in order to improve the research quality in future.

Sincerely yours,

IJCCST 2017 Committee

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Development of Farming Diversification with Implementation Plant Patterns as a Strategy of Economic Strengthening

by Budi Hariono

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Development of Farming Diversification with Implementation Plant Patterns as a Strategy of Economic Strengthening

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Abstract. Bojonegoro, Tulungagung, and Ponorogo districts are an agrarian area and become one of the leading food crops producers in East Java Province. Diversification of farming in this region is done by applying season-based cropping pattern, which is cultivating various commodities in rotation. Farmers need diversification programs wetland cannot provide an optimal contribution to the income of farmers caused because farmers are not able to cultivate high value-added commodities due to limited capital. This research is to identify the characteristics of farming and to analyse the farming system to know the pattern of planting suggestion and prospect. The research used descriptive method, profit farming analysis, and SWOT. The results showed that each region has a specific planting pattern with rice as the main commodity grown in the rainy season followed by crops and horticultural crops and a suggested planting pattern that needs to be implemented by farmers to increase their income. The prospect of diversification of farming development through the implementation of the proposed planting pattern is very suitable with the character of the region and the market demand.
Keywords: diversification of farming, cropping pattern, micro finance institutions, strategies.

1. Introduction

Farm diversification programs especially for paddy fields have been proclaimed by the government since Pelita I (1974 - 1978) aimed at increasing farmer income, expanding employment opportunities, and tackling poverty [1]. This program has a very high urgency to overcome various obstacles and problems faced by farmers, such as relatively small land area and simple farming management, lack of knowledge and skills, and low ability to apply agricultural technology in farming [2]; [3]. Farmers' access to institutional counselling and food institutions is still low, in addition to the knowledge and participation of farmers in institutional management is also not good [4]. Diversification of farms is also intended to prevent the adverse effects of monoculture cultivation systems that in the long run can lead to degradation of soil quality and fertility, increased pest and plant disease resistance, low land productivity, and prevent the risk of drought and crop failure.

Development of farming diversification should not be interpreted as an effort to convert rice cultivation to the cultivation of horticultural crops that have added value higher than rice. However, farming diversification should be interpreted as a practical model to optimize the utilization of agricultural land resources in order to provide more profitable results for farmers. Therefore, diversification of farming requires appropriate strategies to avoid conflict with self-sufficiency in rice, corn, and other food commodities. This can be done by developing the cultivation pattern by continuing to cultivate rice in paddy fields and cultivate palawija / horticulture / plantation crops priorities in rotation [5].

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The research is located in Bojonegoro, Ponorogo and Tulungagung districts. The location is an agricultural area and a contributor to rice production in East Java Province. The area of agricultural land in Bojonegoro Regency is 77,390.76 hectares [6], Ponorogo regency is 33,816.43 hectares [7], and Tulungagung Regency is 27,516 hectares [8]. Commonly used farming models in the area are rice field farming with rice as its main commodity, and palawija and horticulture commodities which are cultivated in rotation according to seasons. As a result, local governments are always working to increase the amount of paddy fields through increased irrigation capacity, such as building dams / reservoirs and primary irrigation channels. The limited amount of rice fields require effective management of farming systems so that they can be more productive and profitable. Optimizing the utilization of paddy fields through proper diversification of farms is believed to have a major impact on the increase in farmers' income at the research sites.

This research is expected to give direction and serve as one of recommendation material of policy of development of agriculture development in Bojonegoro, Ponorogo and Tulungagung. The purpose of this research activity are: a) knowing the characteristics of farm diversification (including commodities, means of production and cultivation techniques) at the study site; b) conduct an analysis of farm diversification in the research area; c) know the farm diversification development prospects in the research area; d) develop a farm diversification development strategy in the research area.

2. LITERATURE REVIEW

2.1. Farming

Farming is the study of ways of determining, organizing and co-ordinating the use of production factors as effectively and efficiently as possible so that agricultural production generates greater farmer income. According to [9], the science of farming is usually interpreted as the study of how one allocates existing resources effectively and efficiently for the purpose of obtaining high profits at a certain time. It is said to be effective if the farmer or producer can allocate the resources they have (controlled) as well as possible; and is said to be efficient when the utilization of these resources produces output (output) that exceeds the input (input).

2.2. Diversification of Farming

Diversified agriculture means planting more than one crop, one species of livestock, or one species of fish. Diversification by broad branch of farming is divided into diversification in the narrow sense and diversification in a broad sense. Diversification in the narrow sense of cultivating inter-plant species or between types of livestock while diversification in the broad sense of cultivating between species of plants, livestock, and fisheries. According to the resulting product diversification can be divided into horizontal and vertical diversification.

3. RESEARCH METHODOLOGY

3.1. Location / Time Research

The location of research activities in three areas includes: Bojonegoro, Ponorogo, and Tulungagung. The activity is carried out for 6 (six) months starting from April to October 2016.

3.2. Research Approach

This research includes the type of descriptive research using several qualitative and quantitative techniques. Meanwhile, quantitative techniques are used in the analysis of farm income of food crops and horticultural commodities in paddy fields so as to obtain a favourable farming priority. This study consists of eight stages. Details of the research stages are as follows:

a. Identification of existing characteristics of farm diversification in the research area
   This phase aims to obtain information about the characteristics of farm, the availability of water for irrigation, cropping patterns, types of commodities, availability of seeds / seedlings, production facilities, way of cultivation, volume of production, marketing chain, as well as the problems and obstacles encountered. At this stage used descriptive method through survey and interviews in some districts that have different diversification characteristics of farming.
b. Analysis of farming on the pattern of *the existing* farm diversification in the research area.

This stage is aimed to know farm profit from various farming diversification pattern in the research location, including analysis of farm cost structure, farm income, and income margin. At this stage used the method of profit analysis of farming

c. Analysis of the priority commodities for the development of farm diversification in the research area, This stage aims to determine the commodities of food crops or horticulture that can be a priority for the development of cropping or horizontal diversification pattern in the study sites. At this stage the expert survey method was used and FGD (Focus Group Discussion).
d. Analysis of the development prospects of commodity farm diversification a priority in the research area [10]. This stage aims to determine the commodities of food crops or horticulture that can be a priority for the development of cropping or horizontal diversification pattern in the study sites. At this stage the *expert survey* method was used and FGD *(Focus Group Discussion)*.

4. RESULTS AND DISCUSSION

4.1. Characteristics of Farm Diversification in Research Sites

The scope of farm diversification that is described in this study is associated with the horizontal diversification of cropping rotation between seasons *(sequential cropping)* in paddy fields. This is because the main activity of farmers is still focused on cultivation of commodities in paddy fields. Rice fields are widely used for the cultivation of various food crops and crops, such as rice, corn, soybeans, green beans, chillies, melons, watermelons and other seasonal horticultural crops.

4.1.1. Characteristics of Farm Diversification in Bojonegoro District. Diversification of wetland farming in Bojonegoro Regency is illustrated by the type of commodity cultivated Of the total 215,23 thousand hectares of paddy fields and rice crops, rice commodities have the largest crop area (70.13%), followed by maize (17.54%), soybean (9.01%), peanuts (1.11%), green beans (0.54%), cassava (1.54%), and sweet potato (0.11%). Table 1 is a partial description of the priority commodity cropping pattern contained in several districts in Bojonegoro District.

Table 1. Planting Pattern of Rice / Palawija / Horticultural Commodities Priority in Bojonegoro

	Planting Pattern (MH - MK I - MK II)	District Area
1.	Rice - rice - rice	Kalitidu, Dander, Kedungadem, Kanor, Sukosewu.Sumberejo, Balen, Baureno, Kapas, Kepoh Baru, Ngraho
2.	Rice - rice - corn	Sekar, Bubulan, Margomulyo, Dander, Purwosari
3.	Rice - rice - soybeans	Ngraho - Margomulyo - Sumberejo
4.	Rice - rice - green beans	Padangan - Kasiman
5.	Rice - rice - chili	Tambakrejo - Baureno - Kanor - Balen
6.	Rice - tobacco	New Story
7.	Rice - bw. Red - bw. red	Kedungadem - Gondang - sekar - Sukosewu

Characteristics of Farm Diversification in Tulungagung District. In Tulungagung there are 174 rivers, consisting of a river within the authority of the central government, the Lodoyo Tulungagung (Lodagung), six rivers are within the authority of the provincial government, and 167 local rivers are the responsibility of the local government.

Table 2 shows the pattern of planting rice / rice crops on paddy fields.

	Cropping pattern (MH - MK I - MK II)	District Area
A	Technical irrigation rice fields:	
	Rice - rice - rice	Tulungagung, Gondang, Kauman, Kedungwaru

	Rice - rice - palawija	Besuki, Bandung, Campurdarat, Pakel, Boyolangu, Tulungagung, Sumbergempol, Ngunut, Rejotangan, Kalidawir, Gondang, Kauman, Kedungwaru, Ngantru, Karangrejo, Pagerwojo, Sendang
B	Semi-irrigated rice fields:	
	Rice - rice - palawija	Besuki, Bandung, Campurdarat, Pakel, Boyolangu, Tulungagung, Sumbergempol, Ngunut, Rejotangan, Kalidawir, Gondang, Kauman, Kedungwaru, Ngantru, Karangrejo, Pagerwojo
	Padi - palawija - palawija	Kedungwaru, Nagantru
C	Rainfed rice fields:	
	Padi - palawija - bera	Besuki, Bandung, Campurdarat, Tanggunggunung, Rejotangan, Pucanglabon, Kalidawir, Gondang, Kauman, Pagerwojo, Sendang
	Palawija - palawija - bera	Besuki, Bandung, Campurdarat, Tanggunggunung, Rejotangan, Paranglabon, Kalidawir, Gondang, Kauman, Pagerwojo, Sendang

4.1.2. Characteristics of Farm Diversification in Ponorogo Regency. Diversification of wetland farming in Ponorogo Regency can be seen through the area of rice harvest and palawija. In Table 3 it is shown that there are several cropping patterns carried out by farmers in Ponorogo regency. In general, the reason for the farmers to cultivate the crops especially in the Constitutional Court I and II is (1) the irrigation water shortage, (2) break the cycle of pests, and (3) optimize the land use. Meanwhile, the reasons for farmers seeking horticultural crops and tobacco are (1) farmers have their own capital or access to capital institutions, (2) including advanced farmers and have high entrepreneurial spirit.

Table 3 Planting Pattern of Rice / Palawija / Horticulture Commodity Priority in Ponorogo Regency.

	Planting Pattern (MH - MK I - MK II)	District Area
1.	Rice - rice - rice	Pulung, Balong, Sukorejo, Babadan, Jenangan
2.	Rice - rice - corn	Sawo, Jambon, Sukorejo, Ngebel, Sambit
3.	Rice - corn - corn	Sawo, Sampung, Jambon, Slahung, Sambit, Pulung
4.	Rice - rice - peanuts	Balong, Jenangan, Slahung, Sawo
5.	Rice - rice - green beans	Balong, Bungkal
6.	Rice - rice - soybeans	Bump, Sawo, Siman, Jetis, Jenang, Mlarak
7.	Rice - rice - tobacco	Balong
8.	Rice - melon - melon	Sawo, Babadan, Sukorejo
9.	Rice - chili - chili	Sawo, Sooko, Pudak
10.	Rice - rice - bw. red	Sawo, Pulung, Sukorejo
11.	Bw. Leaves - cabbage	Pudak

5. CONCLUSION

1. Farm diversification developed in Bojonegoro, Ponorogo, and Tulungagung is horizontal diversification through planting rotation between seasons (*sequential cropping*) in paddy fields. Characteristics of farm diversification in the study site as follows:
   a. Bojonegoro: dominant cropping pattern is i) rice - rice - rice; ii) rice - rice - corn / soybean / green beans; iii) rice - rice - tobacco; iv) rice - onion - onion. The problems faced are flooding around the Bengawan Solo river basin often leading to failed crops, improved seed limitation, unbalanced fertilization and plant care less intensive.
   b. Tulungagung: dominant cropping pattern is i) rice - rice - rice; ii) rice - rice - corn / soybean / peanut; iii) rice - rice - chili / mustard / cabbage / watermelon / melon / tomato. The problem faced is the frequent droughts due to a long drought, causing crop failures, irrigation, fertilization unbalanced and less intensive treatment plants.
   c. Ponorogo: dominant cropping pattern is i) rice - rice - rice; ii) rice - rice - corn / soybean / peanut / green beans; iii) rice - rice - chilli / onion / cabbage / melon; iv) rice - rice -

tobacco. The problem faced is the limited-yielding seeds, fertilizer unbalanced and less intensive treatment plants.

2. Analysis of farming produce the recommended cropping patterns in an effort to diversify farming in the study site as follows:
   a. Bojonegoro: farm diversification which has the largest farm income is seeking paddy cropping pattern followed by priority or tobacco horticultural commodities, namely i) rice - onion - onion with an income of Rp. 227 504 400 / year / ha; ii) rice - rice - chili with revenue of Rp. 111 888 800 / year / ha; and iii) rice - rice - tobacco with an income of Rp. 53.6888 million / year / ha .
   b. Tulungagung: diversification of farming that have the greatest revenue is cropping i) rice - chili - chili with revenue of Rp. 167 508 000 / year / ha; 2) rice - rice - melon with an income of Rp. 116 498 000 / year / ha; and iii) rice - corn - tomato with an income of Rp. 75.12235 million / year / ha.
   c. Ponorogo: farm diversification which has the largest farm income is i) rice - melon - melon with an income of Rp. 185 756 000 / year / ha ; ii) rice - chili - chili with revenue of Rp. 173 240 000 / year / ha ; iii) onion - leeks - cabbage with an income of Rp. 132 171 559 / year / ha ; and iv) rice - rice - red onion with an income of Rp. 119 680 000 / year / ha .
3. Prospects for the development of farm diversification in the research area are as follows:
   a. Bojonegoro: The profit margin ratio for rice 65.65%, 60.76% onion, chilli 62.96%, and 62.12% tobacco with B / C ratio of 2.91 rice, red onion 2,55, 2,70 chili, and tobacco 2.64.
   b. Tulungagung: Cropping pattern of rice - chili - chili can be made to the paddy field which can only be planted with rice once a year due to water availability, that is rainfed. The profit margin ratio 63.35% for rice, chili 59.40%, 45.08% corn, 49.49% tomatoes, and melons 57.40% with B / C ratio of 2.89 rice, chili 2,46, corn 1 , 82, 1.98 tomato and melon 2.35.
   c. Ponorogo: Cropping pattern of rice - chili - chili and rice - melons - melons can be developed almost in all districts for pepper and melon have high adaptability. The profit margin ratio for rice 64.29%, 62.96% chilli, melons 57.40%, 55.87% red onion, scallion 65.51%, and 57.47% cabbage with a B / C ratio of 2.80 rice , chili 2,70, 2,35 melon, red onion 2.27, scallion 2,90, 2,35 and cabbage.

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