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Project Report

The Role of the Indigenous People in Agricultural Development in Papua, Indonesia

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Abstract: This research project was funded by the Masterplan for Acceleration and Expansion of Indonesia's Economic Development (MP3EI). The objective of this study was to examine the role of indigenous people of Marind in the agricultural development of rice cultivation in Merauke. A survey was conducted in three villages in Merauke using stratified random sampling. The finding suggest that indigenous people of Marind have a crucial role in the agricultural development of rice cultivation in Papua.

Keywords: Indigenous people of Marind; agricultural development; Papua

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1. Introduction

The global food crisis has been widely described as the worsening conditions of food security facing many poor people. Food security is becoming a major issue for less developed countries (LDCs). According to Weis (2013) the food security issue is being exacerbated by the fast-rising food consumption in industrializing countries, such as in China and parts of Asia. Furthermore, the uncertainty of the climate and the poor commitment by LDCs to boosting the agricultural sector contribute to the food crisis in many developing countries. These factors also apply in Papua, where the regions of Yahukimo and Puncak experienced food shortage resulting in many indigenous people suffering from hunger.

Indonesia has long been known as an agricultural country. Under the Suharto regime the Indonesian government introduced a transmigration program which aimed at redistributing people from highly populated areas to low populated areas such as Papua as well as promoting the agricultural sector. In reality, there is still debate regarding the benefit of the transmigration program in Papua. According to Manning and Rumbiak (1994) the transmigration program in Papua introduced new technique for mechanization of agriculture for local communities. However, Dagur (2014) reported that transmigration in Papua would threaten indigenous culture and further destabilize an already troubled area.

Under the Dutch colonization, Merauke was a buffer for food security for Papua as well Papua New Guinea (PNG). When Indonesia took over Papua in 1962, agriculture was the leading sector for Merauke. Under the transmigration program paddy become a major commodity for Merauke and it has been further developed in the regency because use of the suitable climate and topography. Paddy cultivation in Merauke is not only carried out by migrants but also by the indigenous people of the Marind tribes.

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This paper addresses the agricultural development in Papua, focusing on indigenous farmers of the Marind tribes in rice cultivation in Merauke. The nature of the agriculture system, land arrangement for rice cultivation, sources of irrigation, input for rice production and cost and benefit analysis are examined.

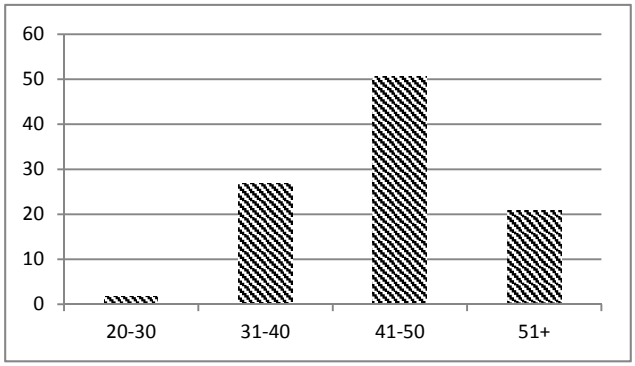
2. Method

This study was carried out from January to November 2015 in three villages of the three districts namely: Tanah Miring (Kampung Tambat), Semangga (Kampung Urum) and Kurik (Kampung Salor Wapeku). All Marind tribe farmers from the three villages were approached. The total number of the households in the three villages was 1,120, consisting of 296 households from Kampung Tambat, Tanah Miring district, 369 households from Kampung Urum, Semangga district, and 455 households from Kampung Salor Wapeku, Kurik district. The total number of the respondents in this study was 15% of the total number of the households in the three villages, amounting to 168 households. Simple random sampling method (based on percentages) was used primarily because the respondents had the same characteristics and the data was relatively homogeneous.

3. The Respondents

Rice cultivation was developed in Merauke when the Indonesian government introduced the transmigration program in the 1980s, which also involved the indigenous people of Marind. According to the head of districts from Kurik, *"the Marind communities are experienced in rice cultivation because they learned form migrant farmers particularly from Java"* (interview on 11 June 2015). Rice has become a significant commodity in Merauke and in Papuan rice production. According to a Bureau of Logistic staff member, in June 2015 Merauke surplus rice production amounted 70 tons which was distributed among the regencies in Papua.

Figure 1. Percentage of Respondents Classified by Age (N=168)



Source: Author's calculation from survey data, 2015.

The ages of the respondents to survey varied. As shown in Figure 1, the majority of respondents were aged between 41-50 years (about 50 percent) , followed by the respondents aged 31-40 years (28 percent); 21 percent were over 50 years of age, while, only a small percentage of respondents were aged 20-30 years.

The analysis of the characteristics of the Marind tribes in this study was based on their clan names. Marind tribes consist of clans such as Mehuze, Gebze, Kaize, Basik-Basik, Balagaize and Ndiken. As shown in Figure 2, Mehuze is the dominant clan, constituting about 33 percent of the total respondents, followed by Gebze, (25 percent), and Kaize

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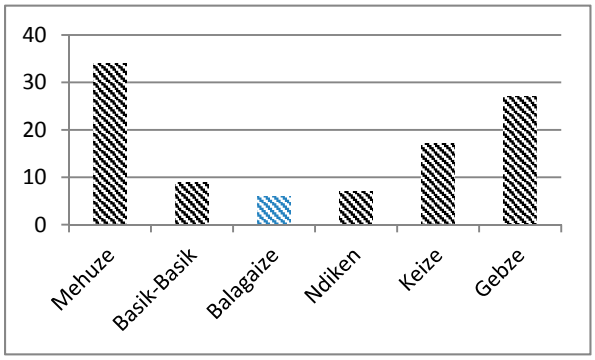
16 percent, with smaller percentages from other clans such as Basik-basik, Balagaize and Ndiken.

Figure 2 Respondent Classified by Clans (N=168)



Source: Author's calculation from survey data, 2015

4. Finding and Discussion

This section investigates the participation of indigenous Marind farmers in rice cultivation. The land arrangement, input for rice production is discussed and a cost and revenue analysis of the rice production by the indigenous people is provided.

4.1 Land Arrangement

As indigenous Marind farmers have various sizes of land for paddy cultivation, it is convenient for analysis to classify the farmers by the size of paddy cultivation into four operating farm size groups: (1) marginal farmers (operating less than 0.5 acre of land); (2) small farmers (operating 0.5 to 1.49 acres of land); (3) medium farmers (operating 1.5 to 2.49 acres of land); and large farmers (operating 2.5 acres or more land).

Table 1. Distribution of Operating Farms by Land Size Groups (Percent of all Farmers)

Land size	Mehuze	Basik-Basik	Balagaize	Ndiken	Keize	Gebze
Marginal farmers	32.82	33.15	45.87	36.35	29.60	37.17
Small farmers	43.82	42.54	42.2	47.29	46.26	42.51
Medium farmers	15.61	12.71	7.95	11.46	16.09	11.5
Large farmers	7.75	11.60	3.98	4.90	8.05	8.82
Total	100	100	100	100	100	100

Source: Author's calculation from survey data, 2015

Table 1 presents the distribution of operating farms by indigenous farmers of Marind tribes. The general features of the size of land operated by indigenous farmers; show that the majority of the indigenous farmers had small farms of 0.5 to 1.49 acres of land for rice cultivation. However, 46 percent of the indigenous farmers of the Balagaize clan had marginal farms. Paddy cultivation by indigenous Marind tribe farmers is organized by 3-5 households where each household is in charge of managing their land and the distribution of the land is negotiated with the head of the tribe.

An interesting finding about the Marind tribes is that their traditional way of life is nomadic. This implies that the Marind tribes used to practice traditional subsistence agriculture whit the farmers not settling in the one area. Under the transmigration program, many indigenous farmers also received land from the government and managed their own land for rice cultivation or planting other crops. Among indigenous farmers, only a small percentage had a large size of land to farm. For example, indigenous farmers from the Balagaize, Gebze, Mehuze clans operated less that approximately 8 percent of the total land paddy cultivation.

In Merauke, land arrangement was organized by indigenous farmers with the clan having of the land. Rumbiak (2015) argued that "*the ethnic leader of the Marind called Bob Marind, has a central role in the distribution of the land"* (interview on 11 June 2015). Land rights are becoming sensitive issues in Papua, and conflict often arises among indigenous people due to the lack of clarity of ownership. Bob Marind has the power and responsibility to kept peace and harmony among the indigenous communities.

Table 2 Land Tenure Arrangement across Indigenous Marind Farmer (percent of all farmers)

Tenurial	Mehuze	Basik-Basik	Balagaize	Ndiken	Keize	Gebze
Pure tenant	24.1	37.1	33.5	30.3	34.1	36.1
Sharecropping (A)	66.1	60.3	72.0	53.9	68.2	72.8
Cash lease (B)	25.4	27.6	16.5	22.2	20.5	13.2
Both (A+B)	8.5	12.2	11.5	23.9	11.4	14.0
Own land only	44.1	39.9	40.1	33.9	29.7	39.2

Source: Author's calculation from survey data, 2015

Table 2 shows, the percentages of indigenous Marind tribes who have land tenure arrangements in paddy cultivation. A significant number of indigenous Marind tribes sharecrop their land for paddy, with the highest percentage of sharecropping clans being the Balagaize and Gebze clans at about 72 percent of total farmers compared to other Marind clans. A substantial percentage of indigenous farmers own the land for paddy cultivation, particularly in the clans of Mehuze and Balagaize. Furthermore, a small proportion of farmers (about 8.5 percent) of farmers have mixed-tenancy arrangements

(operating sharecropped plus cash-leased land, either as pure tenants or landowners), particularly in the Mehuze clan.

4.2 Source of Irrigation

Modern rice farmers, use irrigation to produce rice. Irrigation enables farmers to control the flow and amount of water needed to produce the rice and eliminates the necessity rely on weather that might not always produce sufficient water. Water is drawn from nearby rivers or wells to flood the fields. Rice fields, where water is controlled by the farmer, produce about forty percent of the world's rice production.

Table 3 Sources of Irrigation of Indigenous Farms (percent of all farmers)

Source Irrigation	Mehuze	Basik-Basik	Balagaize	Ndiken	Keize	Gebze
Rainfed	64.6	37.8	67.4	58.9	71.8	50.8
Groundwater	0.5	17.4	5.1	10.7	1.0	16.8
Surface water	34.9	34.7	9.1	8.1	2.4	14.7
Groundwater & surface water	0	10.1	18.4	22.4	24.8	17.7

Source: Author's calculation from survey data, 2015

Irrigation plays crucial roles in increasing rice production, as pointed out by Ahmed and Sampath (1992), (1) irrigation enables farmers to grow an additional rice or wheat crop during the dry winter season, and thus increases cropping intensity and eases the land constraint; (2) irrigation complemented with fertilizers and modern high-yielding rice varieties significantly raises rice yields in comparison to rain-fed rice cultivation; and (3) supplemental irrigation can take much of the risk out of the two predominantly rain-fed rice seasons, dry and rain.

There were great differences among the indigenous famers in terms of the use of sources of irrigation, as shown in Table 3. The study found that, the vast majority of indigenous farmers use rainfed as source for irrigation. Poor irrigation systems contributed to many indigenous farmers preferring to use rainfed sources. Although, rainfed irrigation has become favoured for paddy cultivation, a serious problem faced by the farmers is flooding which often occurs in the wet season. In addition, surface water is a significant source of irrigation at around 34 percent of all indigenous farmers in the Mehuze and Basik-Basik clans. Meanwhile, only a small percentage of indigenous farmers use ground water as their irrigation source because during the dry season there is no stock water available from underground as occurred in 2015.

4.3 Input for Production

Several inputs for production are needed for rice production by indigenous farmers. The inputs such as seed, irrigation, fertilizer, manure, pesticide, and equipment and labour hire vary among indigenous famer.

Table 4 presents the percentages of cost input for paddy cultivation. In general, farmers use domestically produced seed but the percentage of cash costs for seed varies among indigenous farmers. The Balagaize clan spends about 18.7 percent for input cost for

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seed followed by the Gebze. Meanwhile the Mehuze spend about 11.7 percent of their. The costs of inputs for irrigation among indigenous farmers are about 7 percent for the Keize, Ndiken and Mehuze clans, while the Balagaize, Basik-Basik and Gebze spend 3 percent or less.

Table 4. Costs of Inputs as Percentages of Cash Costs per hectare for Paddy Cultivation

Ethnic Group	Seed	Irrigation	Ferilizer	Manure	Pestcide	Equip ment	Hired Labour	Total
Mehuze	11.7	7.3	25.6	1.6	5.2	14.7	33.9	100
Basik-Basik	13.1	1.2	16.9	1.1	4.0	14.3	49.3	100
Balagaize	18.7	3.7	16.7	1.1	2.1	14.5	43.2	100
Ndiken	10.6	7.8	28.6	1.2	4.7	14.4	32.7	100
Keize	12.3	7.9	22.8	3.8	5.8	14.9	32.5	100
Gebze	14.3	1.0	16.4	2.5	2.9	20.3	42.6	100

Source: Author's calculation from survey data, 2015

Fertilizer for rice cultivation is a substantial cost for indigenous farmers. The Ndiken, Mehuze and Keize clans spend about 28.6 percent, 22.8 percent and 22.8 percent respectively on fertilizer but all the indigenous farmers spend around 5 percent or less for manure and pesticide. In term of the use of equipment, Gebze spend 20 percent of the total input cost while the other tribes spend around 14 percent.

Paddy cultivation needs more labour input than other crops. Machinery is less widely used in rice cultivation than for other crops in Merauke where labour is employed throughout the production cycle from soil preparation to harvest. Family labour is used for planting and fertilizer and herbicide application in all rice growing regions. The Basik-Basik used labour the most extensively at about 49 percent of total cost and the Ndiken and Keize use the least labour.

Fertilizer is important for improving rice production. Obviously, indigenous Marind farmers plant local varieties of rice such as IR, Pandan Wangi and Mambramo. Table 5 presents the use of fertilizer by indigenous farmers classified by type of rice and the size of indigenous farmers.

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Table 5. Fertilizer used by Farmers (kilogram/hectare)

Type of rice	Fertilizer	Marginal	Small	Medium	Large
IR	Urea	103	93	97	87
	TSP	50	39	31	15
	KCL	6	13	0	3
Pandan Wangi	Urea	196	175	176	141
	TSP	100	92	72	79
	MP	19	24	19	16
Mamberamo	Urea	252	260	247	227
	TSP	137	122	114	126
	KCL	23	25	24	22

Source: Author's calculation from survey data, 2015

Note: Marginal farmers are with landholding below 0.5 areas; small farmers, between 0.5 and 1.49 acres; medium farmers, between 1.50 and 2.49 acres; and large farmers, 2.5 acres and more.

The actual use of fertilizers can be compared to the recommended dosage to determine whether farmers use adequate amounts of fertilizers. According to Triadiati et al (2011), generally the dose of fertilizer in paddy cultivation for Urea is 250 kg, for TSP 100 kg and for KCL 75 kg per hectare. As presented in Table 5, only the marginal and small farms cultivating Mamberamo rice are ideally fertilized with Urea at 252 kg/hectare and 260 kg/hectare respectively. Meanwhile for all the IR and Pandan Wangi paddies the doses of Urea are less than 250 kg/hectare. The correct dosage of TSP fertilizer is used only in the Mamberamo paddies at above 100 kg/hectare for all farm sizes, while for the Pandan Wangi paddies the ideal dosage of TSP fertilizer occurs only on the marginal sized farms. Finally, the average dosage for KCL fertilizer is much less than recommended (75 kg/hectare) on all the indigenous farms.

Table 6. Average Labor Use for Rice Cultivation by Activity (hour per hectares).

Ethnic Group	Land preparation	Planting	Fertilizer application	Pesticide application	Weeding	Irrigation	Harvest
Mehuze	39.2	130.0	15.0	11.4	205.5	11.4	161.1
Basik-Basik	44.0	190.7	14.1	10.6	194.9	16.1	204.7
Balagaize	89.4	215.3	28.6	16.6	226.1	50.1	232.3
Ndiken	72.0	256.6	19.5	13.4	203.7	29.2	226.7
Keize	119.9	241.8	31.3	19.7	272.2	89.6	250.7
Gebze	81.8	277.5	25.8	15.2	263.3	86.9	300.8

Source: Author's calculation from survey data, 2015

Labour is an important part for input for rice production. As mentioned previously, indigenous farmers used intensive labour for rice cultivation in Merauke. Table 6 shows the wide difference in work hours among indigenous Marind farmers classified by activities.

Table 6 provides the results of labour use for rice cultivation by activities from land preparation to harvest. The data reveal that the majority of indigenous Marind farmers spend most of their time preparing the land for paddy cultivation, weeding and harvesting. The indigenous farmers of the Gebze clan spend 300 hours per week harvest paddy but spend much fewer hours for pesticide application. For weeding activity, the

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indigenous farmers of the Keize, Gebze, Balagaize, Ndiken clans spend over 200 hours per week. Basik-Basik indigenous farmers spend 194 hour per week.

Table 7 Percentage of Farmers Using Machines for Land Preparation

Machinery / Ethnic	Two-wheeler power tiller	Four-wheeler tractor
Mehuze	76.1	12.4
Basik-Basik	56.7	12.2
Balagaize	74.1	18.2
Ndiken	83.4	6.5
Keize	76.5	2.2
Gebze	71.8	16.2

Source: Author's calculation from survey data, 2015

The application of new technology, for instance, the use of mechanical power, particularly the two-wheeler power tiller for farmland preparation is quite high. However, almost one-third of the farmers still use draft animals for land preparation, mainly for land leveling after machine plowing.

The distribution of power tiller usage by farmers is quite skewed. However, the majority of indigenous Marind farmers use a two-wheeler power tiller. Above 70 percent of the Ndiken, Mehuze, Balagaize, Keize and Gebze clans regularly use two-wheeler power tillers. According to the indigenous farmers, the two-wheeler power tiller is more convenient because it is easier to maintain than the four-wheeler tractor which is expensive to maintain. Another reason for using the two-wheeler power tiller is that the hire cost is much lower than the cost of hiring a tractor. Although, using four wheeler tractors is expensive, the study found that the Balagaize and Gebze clans used the four-wheeler at 18.2 and 16.2 percent

Table 8. Percentage of Farmers Visited by Extension Agents who found the Advice Useful

Land size / Ethnic	Marginal (>0.5)	Small (0.5-1.49)	Medium (1.50-2.49)	Large (>2.5)
Mehuze	78	89	90	88
Basik-Basik	86	94	92	92
Balagaize	80	93	89	89
Ndiken	85	92	91	90
Keize	64	91	93	91
Gebze	83	95	94	93

Source: Author's calculation from survey data, 2015

The role of the local government of Papua to provide consultation for indigenous farmers is critical for the introduction of modern paddy cultivation for indigenous people. As shown in Table 8, although the extension service is significantly skewed toward the medium and large farmers, most farmers report that the advice they receive from extension agents is very useful for their agricultural production practices. This signifies the importance of the extension service.

The role of local government Papua to provide consultation for indigenous famer is critical for upgrade the famers to introduce paddy for indigenous people. As shown in Table 8,

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4.4 Cost and Revenue for Rice Production

Revenue and cost analysis is essential for indigenous farmers in order to examine whether or not the farmers profit from planting paddy. Table 9 presents the costs and profitability of paddy cultivating for indigenous Marind per unit of land (hectare). The total cost per hectare is obtained by adding input costs, for example, costs of irrigation, seedling raising, pesticide use, and mechanical power; hired and family labor costs; and imputed land rent for both farmer-owned and rented-in land.

Table 9. Total Cost and Profitability of Paddy Cultivation for Indigenous Farmers in Merauke (in 000 rupiah)

Ethnic group	Cash cost per hectare	Total cost per hectare	Value of crop per hectare	Net profit per hectare	Gross profit per hectare
	(a)	(b)	(c)	(c)-(b)	(c)-(a)
Mehuze	33,613	61,206	66,701	5,495	33,088
Basik-Basik	26,008	50,328	64,577	14,249	38,569
Balagaize	42,948	70,909	81,357	10,448	38,409
Ndiken	32,629	61,660	67,207	5,547	34,578
Keize	35,135	62,154	65,344	3,190	30,209
Gebze	34,635	64,020	68,034	4,014	33,399

Source: Author's calculation from survey data, 2015

On the revenue side, total paddy production per hectare is multiplied by farmers' selling price of paddy to calculate gross revenue or return per hectare. Costs and profitability are reported on full cost and cash cost bases. Net profit is calculated by subtracting the full cost (including imputed costs of family labour and land rent) from the value of paddy (paddy output multiplied by farmers' selling price of paddy). Gross profit equals the value of paddy minus the cash cost (excluding imputed costs of family labour and land rent).

Table 9 shows that the net profits per hectare among indigenous farmers vary. Basik-Basik achieved the highest net profit (14 million rupiah) followed by Balagaize which reached 10 million rupiah per hectare. Meanwhile, Mehuze and Ndiken reached the same net profit (5 million rupiah), while, Keize achieved a small net profit of 3 million rupiah. It can be seen that in general, rice production has potential profitability for the indigenous famers of the Marind tribe in Merauke where the indigenous famers get profit from rice cultivation.

5. Conclusion

The Papuan economy depends on the extractive exploitation of natural resources. In order to increase the role of the agriculture sector in the Papuan economy, the local government designed a policy for promoting agricultural development. The indigenous farmers of the Marind tribe have a crucial role in the agricultural development of Papua. This study shows that the majority land distributed among the indigenous farmers was small (0.5-1.49 acres), and the sharecropping was used for operating the land for rice cultivation. The vast majority of indigenous farmers used rainfed as the source for

irrigation. In terms of the percentage cash costs, this study shows that indigenous farmers spent most of their budget on hired labour. Urea was the fertilizer favoured by indigenous farmers for planting types of paddy such as IR, Pandan Wangi and Mambramo. Indigenous farmers spent most working hours on planting and harvesting paddy. The two-wheeler power tiller was predominantly used by indigenous farmers for rice cultivation. The indigenous farmers perceived that the extension agents (supervisions) give useful advice for cultivation of paddy. Finally, rice cultivation is generally profitable for the indigenous farmer of Merauke.

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