Assessing Socio-Economic Productivities of Staple Crops: An Evidence from Oransbari Settlement Unit, West Papua

Penilaian Produktivitas Sosial Ekonomi Tanaman Pangan: Sebuah Bukti dari Unit Pemukiman Oransbari, Papua Barat

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ABSTRACT

Agricultural crops are vital for local food security and rural livelihoods but face challenges such as limited access to modern agricultural inputs, soil fertility issues, and climate variability. The study objective is to assess the productivity of staple crops—rice, corn, and soybean—in Oransbari Settlement Unit, South Manokwari, West Papua. Using a mixed-methods approach, this research combines farmer surveys and official document analysis to evaluate productivity levels, economic benefit, and identify factors influencing yields. The findings reveal that farmers consider agriculture as their primary livelihood (100% for paddy, 87% for corn, 75% for soybeans). Paddy farming is traditional and labour-intensive, corn and beans are emerging as modern, flexible alternatives. Paddy farmers are active in agribusiness (100%), while corn (87%) and soybeans (75%) show some inactive participants. Most farmers have 0-10 years of experience in corn (73%) and soybeans (75%), while paddy farmers are more experienced (47% with 11-20 years, and 15% with 21-30 years). Productivity of paddy is 4.19 tons/ha while on-site productivity shown 5.87 tons/ha, corn is 5 tons/ha, and soybeans productivity is 2.43 tons/ha. Net Income of paddy is IDR 34,322,343, corn is IDR 56,019,996, and soybeans is IDR 40,282,925. Corn generates the highest income. Sustainability, inclusivity, and productivity in the farming sector dan be supported by tailored interventions. Targeted interventions to address costs, land use, and productivity gaps could improve overall sustainability and profitability across all crops.

Keywords: *staple crops, Oransbari Settlement Unit, West Papua, sustainable agriculture, rural livelihoods*

ABSTRAK

Tanaman pertanian sangat penting untuk ketahanan pangan lokal dan mata pencaharian pedesaan, namun menghadapi tantangan seperti keterbatasan akses terhadap input pertanian modern, masalah kesuburan tanah, dan variabilitas iklim. Tujuan penelitian ini adalah untuk menilai produktivitas tanaman pokok—beras, jagung, dan kedelai—di Unit Pemukiman Oransbari, Manokwari Selatan, Papua Barat. Menggunakan pendekatan metode campuran, penelitian ini menggabungkan survei petani dan analisis dokumen resmi untuk mengevaluasi tingkat produktivitas, manfaat ekonomi, dan mengidentifikasi faktor-faktor yang mempengaruhi hasil panen. Temuan penelitian menunjukkan bahwa petani menganggap pertanian sebagai mata pencaharian utama mereka (100% untuk padi, 87% untuk jagung, 75% untuk kedelai). Pertanian padi bersifat tradisional dan padat tenaga kerja, sementara jagung dan kedelai mulai muncul sebagai alternatif modern yang lebih fleksibel. Petani padi aktif dalam agribisnis (100%), sementara petani jagung (87%) dan kedelai (75%) menunjukkan beberapa peserta yang tidak aktif. Sebagian besar petani memiliki pengalaman 0-10 tahun dalam menanam jagung (73%) dan kedelai (75%), sementara petani padi lebih berpengalaman (47% dengan pengalaman 11-20 tahun, dan 15% dengan pengalaman 21-30 tahun). Produktivitas padi adalah 4,19 ton/ha, sementara produktivitas di lapangan menunjukkan 5,87 ton/ha, jagung 5 ton/ha, dan kedelai 2,43 ton/ha. Pendapatan bersih dari padi adalah IDR 34.322.343, jagung IDR 56.019.996, dan kedelai IDR 40.282.925. Jagung menghasilkan pendapatan tertinggi. Keberlanjutan, inklusivitas, dan produktivitas di sektor pertanian dapat didukung oleh intervensi yang disesuaikan. Intervensi yang terarah untuk menangani biaya, penggunaan lahan, dan kesenjangan produktivitas dapat meningkatkan keberlanjutan dan profitabilitas secara keseluruhan pada ketiga komoditi tanaman.

Kata kunci: tanaman pokok, Satuan Pemukiman Oransbari, Papua Barat, pertanian berkelanjutan, mata pencaharian pedesaan.

INTRODUCTION

Staple crops such as rice, corn, and soybean (collectively known as Pajale in Indonesia) shape the backbone of agricultural systems and food security in rural regions. Indonesia is among the top rice producers globally, producing over 54 million tons annually. Corn production contributes significantly to livestock feed and human consumption (Suryana et al. 2020; Ervianti et al. 2024), with an annual output of approximately 18 million tons. Soybean production, however, remains below national demand, with import dependency exceeding 60%. In Indonesia, the government has prioritized the development of these crops to reduce dependency on imports and ensure a stable food supply (Rhofita 2022; Aldillah 2017).

Oransbari district in South Manokwari, West Papua, is an agricultural hub where crops play a vital role in supporting local livelihoods and regional food production. Oransbari has approximately 2,000 hectares of agricultural land dedicated to crops. The average productivity per hectare in Oransbari is rice, i.e. 4.5 tons/ha (national average: 5.2 tons/ha), corn is 3.2 tons/ha (national average: 5.6 tons/ha), and soybean is 1.2 tons/ha (national average: 1.5 tons/ha). Farmers primarily use traditional farming methods, with minimal mechanization (Silitonga et al. 2016; Ayu et al. 2023). Economic Importance of crops contribute to 60% of household income for smallholder farmers in Oransbari. Local markets depend on these crops for food supply and livestock feed. Despite their importance, there is limited research on the productivity of these crops in Oransbari Settlement Unit (OSU). Understanding the factors influencing their productivity is crucial for devising strategies to optimize yields and ensure sustainable farming practices. This study aims to assess the productivity of rice, corn, and soybean in Oransbari, exploring the challenges and potential opportunities for improvement.

Rice, corn, and soybean are essential staples in Indonesia, contributing significantly to the country's food security and rural economy (Budiman and Santu 2024). These crops are integral to the agricultural sector in West Papua, where farming is a primary source of livelihood. Oransbari district, with its fertile soils and favourable climatic conditions, has long been a centre for cultivating these crops. However, several factors, including limited access to modern farming technologies (Samuel et al. 2022), climate variability (Dutta et al. 2020), and soil degradation (Hufnagel et al. 2020), have constrained productivity in the region. Average annual rainfall in Oransbari exceeds 2,500 mm, which supports rice and corn cultivation but poses challenges for soybean farming. Soil quality varies across the district, with some areas experiencing nutrient depletion.

The Indonesian government has implemented programs to boost crop production, including seed distribution, agricultural extension services, and irrigation projects. Nevertheless, the effectiveness of these interventions remains understudied in areas like Oransbari Settlement Unit. This research seeks to fill this gap by providing a detailed analysis of the productivity of rice, corn, and soybean and identifying the factors that influence their yields.

The primary objectives of this study are to assess productivity, i.e. measure the current productivity and socio-economic levels of crops, i.e. rice, corn, and soybean in Oransbari Settlement Unit. This research aims to provide a comprehensive understanding of Pajale-crop productivity in Oransbari, West Papua. By addressing the challenges faced by local farmers and proposing actionable solutions, the study seeks to enhance agricultural outputs, improve farmer incomes, and contribute to regional food security.

MATERIALS AND METHODS

This research was conducted in Oransbari district, Manokwari Selatan Regency, West Papua province Indonesia. The research activities took place from April to June 2023. The method used is descriptive approach with a field survey. This research aims to describe the condition of paddy, corn, and soybeans farming based on the predetermined variables. As a case study, the focus of this research is on farmers cultivating primary crops.

Data were collected through direct interviews using a structured questionnaire and field observations. Interviews were conducted with crop farmers to obtain information related to the research variables. The population of farmers derived from all households in Oransbari district, totalling 160 households. From that total population, 69 households were selected as key respondents using the cluster random sampling technique. The cluster random sampling formula was used to determine the sample size, considering a certain margin of error. In doing this field research, we employed research flowchart consisted of determining the research location (i.e. Oransbari Settlement Unit), followed by

identifying the population and determining the households' sample sizes using the clustering random sampling technique, subsequently collecting data through face-to-face interviews using a structured questionnaire. Lastly processing and analysing the data descriptively to address the research objectives.

The variables examined in this study include socio-demographic of the farmers which refers to the personal and household characteristics of the farmers that determine their farming activities. This includes factors such as age, gender, education level, household size, and primary/secondary livelihoods. Production of paddy, corn, and soybeans, i.e. the total amount of paddy, corn, and soybeans harvested by farmers during a given year (ton/year). Productivity, i.e. the output of crops (paddy, corn, or soybeans) per unit of land area cultivated. It measures the efficiency of land use (ton/ha). Land, i.e. the total area of farmland used for cultivating paddy, corn, and soybeans by a farmer (ha). Capital, i.e. the financial resources invested in farming activities, including both fixed costs (e.g., equipment, infrastructure) and variable costs (e.g., seeds, fertilizers, labour, and transportation) (IDR). Labour, i.e. the human effort, measured in terms of time, involved in the cultivation of crops, including land preparation, planting, maintenance, and harvesting. Income, i.e. the net financial gain from farming activities after deducting the total costs from the total earnings. It reflects the profitability of farming operations (IDR).

RESULTS AND DISCUSSIONS

Farmers' Characteristics of Socio-Demographic

Table 1. provides a glamp of demographic, socioeconomic, and agribusiness-related information for farmers engaged in three types of crop cultivation, i.e. paddy, corn, and soybeans. The parameters discussed include age, sex, livelihood, side livelihoods, household size, education, agribusiness activity, and farming experience. Farmers aged 15-55 years represent a significant proportion for corn (70%) and soybeans (55%), while paddy farming is dominated by older farmers (>55 years, 74%). No farmers are below 14 years in any crop. Paddy farming appears to rely on an older demographic, potentially due to traditional or labour-intensive methods and requiring experience (Nurpita et al. 2018; Budiman and Santu 2024). Corn and beans attract more younger and middle-aged farmers, possibly due to lower labour requirements or higher profitability. Interventions to modernize paddy farming could encourage younger farmers to participate. The aging workforce in paddy farming raises concerns about sustainability unless younger farmers are engaged.

Men dominate all three crops: paddy (84%), corn (83%), and soybeans (75%). Women's participation is highest in soybeans (25%) and lowest in paddy (16%). The gender imbalance suggests that farming is predominantly male-driven, with women playing a supportive role, particularly in beans. This may reflect cultural or labour-related constraints. Programs targeting gender inclusivity in agriculture could encourage more women to participate, particularly in paddy and corn farming. Promoting labour-saving technologies could ease women's involvement in more labour-intensive crops.

Most farmers consider agriculture their primary livelihood (100% for paddy, 87% for corn, 75% for soybeans). Non-agricultural occupations (state officer and private jobs) are more common among corn (13%) and beans (25%) farmers. Paddy farming appears to be the primary livelihood, while corn and soybeans are often secondary income sources (Budiman and Santu 2024; Wihardjaka 2018). Diversification of income among corn and soybeans farmers reflects economic strategies to mitigate risks (Budiman and Santu 2024; Wihardjaka 2018; Rahman et al. 2020; Putra et al. 2022; Mamat and Husen 2021). Support for paddy farmers could include diversification opportunities to reduce reliance on a single crop. For corn and beans, policies should focus on improving productivity and profitability to make farming a primary livelihood.

Many farmers report no side livelihoods on farmers of paddy (68%), farmers of corn (60%), and farmers of soybeans (55%). Common side activities include farming (corn and soybeans), porter, smithing (notable for paddy farmers), and livestock farming. Paddy farmers are more likely to engage in smithing (21%), possibly reflecting traditional skills in the community. Livestock farming and fishing are less common but present potential for diversification.

Table 1. Socio-demographic of crops' farmers in Oransbari District

Parameters		Farmers					
		Paddy		Corn		Soybeans	
		Sum	Proportion	Sum	Proportion	Sum	Proportion
Ages (yr)							
	0-14	0	0	0	0	0	0
	15-55	5	26	21	70	11	55
	>55	14	74	9	30	9	45
Sex							
	Man	16	84	25	83	15	75
	Women	3	16	5	17	5	25
Livelihood							
	Farmer	19	100	26	87	15	75
	State officer	0	0	3	10	5	25
	Private	0	0	1	3	0	0
Side Livelihood							
	None	13	68	18	60	11	55
	Farmer	0	0	4	13,3	5	25
	Porter	2	10	3	10	2	10
	Skilled/Smiths	4	21	3	10	0	0
	Livestock Farmer	0	0	1	3,3	2	10
	Fisherman	0	0	1	3,3	0	0
Household size (head/hh)							
	1-3	14	74	20	67	16	80
	4-6	5	26	10	33	4	20
	>6	0	0	0	0	0	0
Activation in Agribusiness							
	Active	19	100	26	87	15	75
	Non-Active	0	0	4	13	5	25
Education							
	Non-Educated	0	0	6	5	4	6
	Non-Grad.Basic School	9	14	3	3	3	4
	Grad.Basic School	10	15	25	22	9	13
	Grad. Junior School	27	42	33	28	18	25
	Grad. Senior School	15	23	35	30	19	26
	Grad.University	4	6	14	12	19	26
Experiences (yr)							
	0-10	7	36,8	22	73	15	75
	11-20	9	47,3	6	20	5	25
	21-30	3	15,8	0	0	0	0
	>30	0	0	2	7	0	0

Encouraging complementary activities like livestock farming and fishing could enhance income and food security. Side livelihoods should be aligned with available resources and skills in the community. The majority of farmers have small households (1-3 members), i.e. paddy (74%), corn (67%), beans (80%). Larger households (4-6 members) are more common among corn farmers (33%) than paddy (26%) and soybeans (20%). Smaller household sizes may limit available family labour, influencing crop selection or productivity. Larger households could provide labour advantages, particularly in labour-intensive corn farming.

Policies to support smaller households could focus on labour-saving technologies or access to hired labour. Larger households could benefit from support to diversify crops or scale up production. All paddy farmers are active in agribusiness (100%), while corn (87%) and soybeans (75%) show some inactive participants. Paddy farming is integral to the livelihood of its participants, while corn and beans farming may be secondary activities for some. Efforts to engage inactive participants in corn and beans farming could involve training, subsidies, or better market access.

Higher education levels (university graduates) are most common among soybeans farmers (26%), followed by corn (12%) and paddy (6%). Paddy farming has a relatively higher proportion of farmers with only basic school education (15%). Beans farming appears to attract more educated individuals, potentially due to higher market potential or complexity. Paddy farming relies more on traditional knowledge, with fewer higher-educated participants. Education programs should target paddy farmers to introduce modern techniques. Supporting beans farming with advanced training could leverage its appeal among educated individuals.

Most farmers have 0-10 years of experience in corn (73%) and soybeans (75%), while paddy farmers are more experienced (47% with 11-20 years, and 15% with 21-30 years). Paddy farming benefits from experienced farmers, but the lack of new entrants could threaten its long-term viability. Corn and beans farming attract less experienced farmers, possibly due to lower barriers to entry. Programs targeting skill development for corn and beans farmers could improve productivity. Efforts to encourage younger, less experienced farmers into paddy farming could ensure sustainability.

Corn and soybeans attract younger farmers, suggesting opportunities for modernization and scaling up. Paddy farming needs youth-focused incentives to ensure generational continuity. Women's involvement, particularly in beans farming, should be supported through targeted programs such as credit access, training, and childcare support. Side livelihoods like livestock farming and fishing should be promoted to enhance income stability. Education levels vary across crops, suggesting the need for tailored training programs to introduce modern techniques for paddy farming and advanced skills for beans and corn farming. Paddy farming's reliance on older, experienced farmers highlights a need for succession planning and support for younger entrants.

Performances of Productivity and Land

Table 2 presents data on productivity, land utilization, capital investment, and income for three crops—paddy, corn, and soybeans. The data highlights differences in crop performance, resource use, and economic returns. Statistical Office of Southern Manokwari shown productivity of paddy is 4.19 tons/ha while on-site productivity shown 5.87 tons/ha (higher than statistical estimates by 40%). Statistical office shown corn productivity is 3.06 tons/ha, while on-site productivity is 5 tons/ha (higher by 63%). Statistical office presents soybeans productivity, i.e. 1.05 tons/ha, likewise on-site soybeans productivity is 2.43 tons/ha (higher by 131%). On-site productivity for all crops exceeds statistical estimates, indicating better-than-expected field performance or underestimation by statistical records. The significant gap in beans suggests either improvements in farming practices or a lack of reliable data for beans.

Table 2. Productivity and income performances of crop farmers in Oransbari District.

Parameters		Paddy Sum	Paddy Proportion	Corn Sum	Corn Proportion	Soybeans Sum	Soybeans Proportion
Statistical Office_Productivity	(ton/ha)	4,19		3,06		1,05	
On Site_Productivity	(ton/ha)	5,87		5		2,43	
Land	<0,5	0	0	16	53	13	65
	0,5-1,00	16	84	14	47	7	35
	>1,00	3	16	0	0	0	0
Capital	(IDR)	6198974		445203		9234508	
	Fixed	1646447		4		8	
				177800		136785	
	Variable	74		0		0	
		226634		623003		106023	
	Total	48		5		58	
Income	(IDR)						
	Earnings (IDR)	56985789		62250000		24030000	
	Cost (IDR)	22663448		6230035		10602358	
	Income (IDR)	34322343		56019996		40282925	

Land size of paddy >1.00 ha: 16%, while land size paddy of 0.5-1.00 ha is 84%. Likewise, no land holding is <0.5 ha. Majority (53%) of corn farmed on small plots (<0.5 ha), while 47% on medium plots (0.5-1.00 ha), no large plots. Majority (65%) on small plots (<0.5 ha) for corn and 35% on medium plots (0.5-1.00 ha). No large plots found. Paddy farming utilizes larger plots, which supports higher productivity and income potential. Corn and beans are predominantly grown on small plots, which may limit economies of scale and profitability. Encouraging land consolidation or improving efficiency on smaller plots for corn and beans could enhance productivity (Mamat and Husen 2021; Winara et al. 2022). Paddy farmers can leverage their larger land sizes for crop diversification.

Performances of Earning Cash

Fixed cost on paddy is IDR 6,198,974, while variable costs is IDR 16,464,474. Total capital is IDR 22,663,448 (highest among crops). Fixed cost for corn is IDR 4,452,034, and variable Costs is IDR 1,778,000. Total capital of corn is IDR 6,230,035 (lowest among crops). Fixed costs for soybeans is IDR 9,234,508, when variable cost is IDR 1,367,850. Total capital of soybeans is IDR 10,602,358. Paddy farming demands the highest total capital, reflecting intensive resource use. Corn has the lowest variable costs, likely due to fewer input requirements or smaller-scale farming. Beans have a high fixed cost relative to variable costs, indicating infrastructure or equipment investments. Policies to reduce input costs or subsidize capital investment for paddy farming could improve profitability. Beans farmers may benefit from strategies to balance fixed and variable costs, such as shared equipment.

Earnings of paddy is IDR 56,985,789, while the costs spent is IDR 22,663,448. Net Income of paddy is IDR 34,322,343. Corn earnings is IDR 62,250,000, while corn cost is IDR 6,230,035. Net income of corn is IDR 56,019,996 (highest among crops). Soybeans earnings is IDR 24,030,000, spent costs is IDR 10,602,358. Net Income of soybeans is IDR 40,282,925. Corn generates the highest income, primarily due to low production costs and moderate earnings. Paddy has high earnings but also high costs, resulting in a lower net income compared to corn. Soybeans generate the lowest earnings but achieve significant profitability due to moderate costs. Corn is highly profitable, making it an attractive crop for farmers (Bobihu et al. 2022; Silitonga et al. 2016; Heristi et al. 2021). Efforts to scale production could further boost returns. Paddy farming needs cost-reduction strategies to improve profitability. Soybeans, while less lucrative, provide a sustainable income source and can complement other crops (Joko et al. 2022; Sujaya et al. 2018; Swastika 2022; Marwoto 2010).
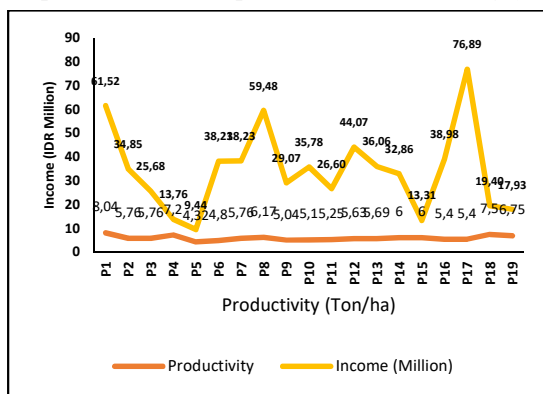

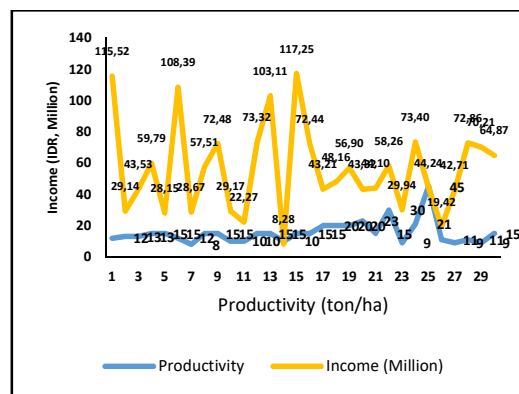**Figure 1. Trend charting comparison of paddy's productivity vs income performances.**

Figure 2. Trend charting comparison of corn's productivity vs income performances.

The orange line represents productivity, which fluctuates over the periods (Figure 1). The yellow line represents Income, also fluctuating but with a generally higher peak compared to productivity in certain periods, suggesting a correlation between productivity and income. The graph provides insights into how income is influenced by productivity across different periods. For example, P17 shows a significant increase in income (76.89 million) even though productivity is lower. Conversely, periods like P1 show high productivity but relatively lower income. This suggests that while productivity plays a key role in income, other factors might influence income as well.

Productivity fluctuates significantly throughout the periods, showing periods of high and low productivity. The yellow line represents Income, which also shows wide fluctuations, with some

peaks (e.g., at periods 3, 5, 7, 15) corresponding to increased income. There is no clear, consistent correlation between productivity and income, as some periods with higher productivity show lower income (e.g., periods 1, 7), while others with lower productivity have higher income (e.g., period 29). The sharp fluctuations suggest that other factors, such as market prices, production costs, or external conditions, may influence income (Erythrina et al. 2022; Mamat and Husen 2021; Bobihu et al. 2022), independent of productivity levels. Productivity varies greatly, income does not always directly correspond to these changes, highlighting the importance of factors beyond just productivity in determining economic performance.

CONCLUSIONS

Farmers consider agriculture as their primary livelihood (100% for paddy, 87% for corn, 75% for soybeans). Paddy farming is traditional and labour-intensive, corn and beans are emerging as modern, flexible alternatives. Paddy farmers are active in agribusiness (100%), while corn (87%) and soybeans (75%) show some inactive participants. Higher education levels (university graduates) are most common among soybeans farmers (26%), followed by corn (12%) and paddy (6%). Most farmers have 0-10 years of experience in corn (73%) and soybeans (75%), while paddy farmers are more experienced (47% with 11-20 years, and 15% with 21-30 years). Productivity of paddy is 4.19 tons/ha while on-site productivity shown 5.87 tons/ha. On-site productivity of corn is 5 tons/ha. On-site soybeans productivity is 2.43 tons/ha. Net Income of paddy is IDR 34,322,343, net income of corn is IDR 56,019,996 (highest among crops). Net Income of soybeans is IDR 40,282,925. Corn generates the highest income. Supporting each crop with tailored interventions can improve sustainability, inclusivity, and productivity in the farming sector. There are differences in productivity, land use, capital investment, and income among paddy, corn, and soybeans farming. Corn is the most profitable. Paddy and soybeans have specific advantages, such as high productivity (paddy) and moderate profitability (soybeans). Targeted interventions to address costs, land use, and productivity gaps could improve overall sustainability and profitability across all crops.

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