Agribusiness Journal
https://usnsj.id/index.php/AJ
journalagribusiness@gmail.com
e-ISSN: 2548-2211, p-ISSN: 2548-379X

DOI : https://doi.org/10.31327/aj.v8i1.2465

Labor Allocation Dynamics in Swamp Rice Farming: Influencing Factors and Adaptive Strategies of Farmers

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Abstract

Labour allocation is a crucial aspect in the sustainability of rice farming, particularly in lebak swamp areas that possess unique ecological characteristics and demand adaptive strategies from farmers. This study aims to analyse the internal and external factors influencing labour allocation, as well as the strategies adopted by farmers in managing labour within the context of lebak swamp rice farming. A descriptive qualitative approach was employed, with data collected through in-depth interviews involving 30 farmers in Pematang Bangsal Village, Pemulutan Selatan District. The data were analysed using thematic coding techniques to identify key patterns. The findings reveal that internal factors such as motivation, farming experience, physical health, and farm management significantly affect labour allocation. Meanwhile, external factors include family support, agroecosystem conditions, and access to production inputs. Farmers' adaptive strategies involve intra-household division of labour, the use of hired labour, and adjustment of planting schedules. The study concludes that labour allocation dynamics in lebak swamp rice farming are complex and shaped by the interplay of multiple factors. Therefore, policy interventions and agricultural extension programs must be contextual and sustainable to effectively support labour management in such agroecological settings.

Keywords: *Farming, Labour, Lebak Swamp Land*

A. Introduction

Rice farming is one of the agricultural sub-sectors that plays a strategic role in ensuring national food security and supporting the welfare of farmers in Indonesia. (Anthoni & Yulianto, 2023; Fitriyah et al., 2020; S. et al., 2022; Siregar et al., 2024). The productivity of rice farming is influenced by various factors, one of which is labour allocation, encompassing the quantity, quality, and time distribution of labour involved in the production process. (C. Liu et al., 2023; Salam et al., 2024). Optimal labour allocation contributes to improved efficiency and productivity, making the understanding of labour allocation determinants essential in the context of farm management. (Salimova et al., 2022; Taramuel-Taramuel et al., 2023).

Lebak swamp areas represent a specific type of land with unique hydrological and physical characteristics, which pose distinct challenges for rice cultivation (Armanto & Wildayana, 2025; Hairani et al., 2024). Farmers managing these lands must adjust their labour allocation patterns in response to seasonal dynamics and changing environmental conditions, such as fluctuating flood levels and soil fertility (Rivera-ferre et al., 2021; Vala et al., 2024; Yeleliere et al., 2023). These conditions demand adaptive and efficient labour management strategies to sustain rice production in swampy areas. In addition to environmental factors, internal farmer-related aspects also significantly influence labour allocation (Xu et al., 2022). Elements such as motivation, experience, technical skills, and the physical health of farmers directly affect labour utilisation effectiveness (Maican et al., 2021; Mellon-Bedi et al., 2020; Zheng et al., 2022).

Meanwhile, external factors such as the availability of seasonal labour, technological support, and agricultural policy interventions also exert considerable influence on labour allocation patterns (Cortignani et al., 2020).

Several previous studies have investigated factors affecting labour allocation in rice farming, but they typically adopt a quantitative approach and focus only on certain variables. For instance, Ge et al. (2022) highlighted the effects of land area and household size on family labour contribution, while Nessa et al. (2020) Emphasised the role of education and farming experience in female labour participation in tidal land areas. However, these studies have not comprehensively addressed the labour dynamics of farmers within the unique ecological and social context of Lebak swamps. Consequently, a scientific gap remains in the integrative analysis of internal and external factors, as well as the strategies adopted by farmers in managing labour allocation in Lebak swamp ecosystems.

This study aims to address that gap through an in-depth qualitative case study approach, focusing on the social, economic, and ecological dynamics influencing labour management in rice farming within the Lebak Swamp region. Accordingly, the objective of this research is to analyse the internal and external factors affecting labour allocation and to examine the labour management strategies employed by farmers in rice farming in Lebak swamp areas using a qualitative case study approach.

B. Methodology

1. Research Design

This study employed a descriptive qualitative approach with a case study design. This approach was chosen to gain an in-depth understanding of the various factors influencing farmers' labour allocation in rice farming in the Lebak swamp areas, by exploring their lived experiences, perspectives, and the socio-economic dynamics they face.

2. Participants/Respondents/Population and Sample

A total of 30 rice farmers who implemented the floating seedbed system in Pematang Bangsal Village, South Pemulutan Subdistrict, were involved in this study. Table 1 summarises the demographic information and key characteristics of the participants.

Table 1. Demographic Distribution of Farmer Participants (n = 30)

	Frequency	Percentage (%)
Gender		
Male	22	73.33
Female	8	26.67
Age Group		
25–35 years (Young Adult)	6	20.00
36–45 years (Middle Adult)	7	23.33
46–55 years (Early Elderly)	10	33.33
56–65 years (Early Elderly)	4	13.33
>65 years (Senior)	3	10.00
Farming Experience		
<20 years	6	20.00
20–30 years	20	66.67
>30 years	4	13.33
Land Area Cultivated		
1.0 ha	10	33.33
1.5 ha	1	3.33
2.0 ha	12	40.00
3.0 ha	2	6.67
3.5 ha	2	6.67
4.0 ha	3	10.00

3. Technique of Data Collection

Data were collected through in-depth interviews, field observations, and documentation. The in-depth interviews were conducted using a semi-structured interview guide, allowing researchers to flexibly explore the participants' experiences and viewpoints. The primary informants were farmers with experience in cultivating rice in Lebak swamp areas, particularly those actively engaged in rice farming activities. The interviews aimed to explore the economic, social, and technical factors influencing farmers' decisions and capacities in allocating labour. In addition to interviews, direct field observations were carried out to examine farming activities, work routines, time allocation, and seasonal patterns faced by the farmers. The documentation technique was used to complement the data, including environmental notes, photos of farming activities, and the collection of local documents relevant to rice farming practices in the study area.

4. Technique of Data Analysis

Data analysis was conducted using a thematic qualitative approach. The process began with transcribing all interview recordings, which facilitated reading and organising the data. A data reduction process was then applied to filter out the most relevant information related to the research focus—factors influencing farmers' labour allocation. This was followed by coding, in which specific labels or codes were assigned to excerpts that revealed significant themes or issues such as economic, socio-cultural, and technical factors. The coded data were subsequently grouped into broader themes that reflected recurring patterns and meanings among participants. Finally, a narrative analysis was developed to interpret the interrelationships between the themes, providing a comprehensive and deep understanding of the dynamics of labour allocation in rice farming within Lebak swamp areas.

C. Findings and Discussion

1. Internal Factors Influencing Labour Allocation

Internal factors refer to aspects originating from within the farmers themselves that influence the extent of labour allocation in rice farming in the Lebak swamp areas. Based on in-depth interview results, several internal factors were identified as influencing farmers' labour allocation, as summarised in Table 2.

Table 2. Internal Factors Influencing Labour Allocation

Category Code	Sub-Code	Number of Respondents		Description	Sample Farmer Responses
		Frequency	Percentage (%)		
Motivation and Attitude Farming Experience	Economic motivation	15	50.00	Desire to increase household income	*"I work hard so that the income is sufficient for my family."*
	Work attitude	10	33.33	Positive and negative attitudes toward farming activities	*"Sometimes I feel tired, so I reduce the amount of labour I contribute."*
Health and Physical Condition	Extensive experience	18	60.00	Farming experience of more than 20 years	*"I have been farming since I was young, so I am more skilled."*
	Limited experience	7	23.33	New or less experienced farmer	*"I am still learning how to manage labour effectively."*
Motivation and Attitude	Good health condition	12	40.00	Farmers with good physical health are	*"My health is still strong, so I can*

Farming Experience				more active in farming	*work longer hours."*
	Declining health	8	26.67	Farmers with declining health limit their labour capacity	*"Sometimes, back pain forces me to rest more often."*
Health and Physical Condition	Good planning	13	43.33	Effective labour planning and management	*"I arrange the family work schedule so we can take turns."*
	Poor planning	5	16.67	Suboptimal labour management	*"I often struggle to divide time between farming and other work."*

Table 2 shows that farming experience is the most frequently mentioned internal factor, reported by 18 respondents (60%). This indicates that farmers with longer experience tend to manage labour more effectively. Economic motivation is also a significant factor, with 15 respondents (50%) stating that financial reasons drive them to work harder. Health conditions are another critical consideration; farmers in good physical health tend to contribute more labour compared to those experiencing health decline.

From the perspective of farm management, proper planning enables farmers to allocate labour more efficiently, while a lack of planning often leads to challenges in labour utilisation. Farmers' attitudes toward work also influence the amount of labour they invest, as fatigue or low motivation may reduce productivity. Overall, these internal factors are interconnected and play a crucial role in determining the intensity of labour allocation in rice farming on the Lebak swamp lands.

2. External Factors Influencing Labour Allocation

External factors refer to influences originating outside the individual that can either encourage or constrain farmers' involvement in farming activities, particularly in terms of labour allocation. Based on in-depth interviews with rice farmers in the Lebak swamp areas, several dominant external factors affecting the magnitude of labour allocation were identified and are summarised in Table 3.

Table 3. External Factors Influencing Labour Allocation

Category Code	Sub-Code	Number of Respondents		Description	Sample Farmer Responses
		Frequency	Percentage (%)		
Climate and Weather Access and Infrastructure	Prolonged rainy season	12	40.00	Prolonged rains delay planting and harvesting, affecting labour	*"If it keeps raining, we will have difficulty starting planting, so we will wait for the water to recede."*
	Annual flooding	7	23.33	Regular flooding submerges fields, delaying work	*"The annual floods cause work to be delayed until all the water recedes."*
Price and Market	Damaged roads	5	16.67	Poor roads hinder the distribution of	*"Damaged roads make transporting*

				production inputs and yields	*fertiliser and rice more difficult and slower."*
Government Policy	Unstable rice prices	4	13.33	Price fluctuations reduce farmers' willingness to increase labour intensity.	*"When prices are low, the motivation to work also decreases."*
Climate and Weather	Uneven subsidy support	2	6.67	Inconsistent subsidy distribution lowers motivation to work on own land	*"Sometimes we don't receive fertiliser subsidies, so our enthusiasm decreases."*

According to Table 3, the primary external factors most frequently mentioned by farmers are climatic and weather conditions, particularly the prolonged rainy season (40%) and annual flooding (23.33%). These conditions cause delays in cultivation and harvesting processes, thereby impacting the amount of labour utilised. Additionally, infrastructural challenges such as damaged roads (16.67%) and unstable rice prices (13.33%) also affect the efficiency and motivation of farmers in allocating their labour. Government policy factors, although less frequently mentioned, indicate that environmental and structural interventions play a significant role in determining labour allocation in swamp rice farming systems.

3. Farmers' Strategies in Managing Labour Allocation

Based on in-depth interviews, it was found that farmers in the swampy lowland areas employ various adaptive strategies in managing labour input. These strategies are chosen situationally, taking into account physical capacity, planting season cycles, and the availability of labour both within the family and from external sources. One dominant strategy is the flexible scheduling of working hours, adjusted according to the farmers' physical condition and the intensity of farming activities. As expressed by Farmer P07, *"When the planting season starts, I divide my time—working in the field from morning until noon, then resting in the afternoon so that my body does not get tired quickly."* This statement reflects an awareness of the importance of labour management to maintain long-term work productivity.

Moreover, involving family members is also a strategic choice to meet labour demands, especially during the harvest period. Farmer P03 explained, *"During the harvest, we work together, my wife helps, sometimes the children also assist when they are on school holidays."* This strategy is not only cost-effective but also strengthens collaboration among family members in supporting the sustainability of farming activities. In some cases, the use of external labour through a daily wage system is employed by farmers who have physical limitations or insufficient family labour. Farmer P14 stated, *"Sometimes I hire workers too, especially for heavy tasks like turning the soil, because my body can no longer handle it."* This indicates an effort to substitute labour by considering individual age and physical capability.

On the other hand, the practice of cooperation (*gotong royong*) remains an effective social strategy to overcome labour shortages, particularly within farming communities that maintain strong social ties. Farmer P09 stated, *"We usually help each other, taking turns working on each other's land. So everyone gets labour assistance and the workload is lighter."* This strategy not only provides practical benefits but also reflects the values of local wisdom in human resource management within the agricultural sector.

Overall, the strategies implemented by farmers demonstrate adaptive responses to the labour challenges they face. The individual, family, and collective approaches show that labour input management is conducted in a planned and contextual manner, considering efficiency, sustainability, and the social dynamics of the surrounding environment.

4. Discussion

The results of this study indicate that labour input in lowland swamp rice farming is influenced by an interaction of internal and external factors. Prominent internal factors include farmers' motivation and work attitudes, farming experience, physical health condition, and managerial capacity in farm operations. On the other hand, external determinants comprise land conditions, availability of external labour, seasonal influences, and access to simple technology. These findings demonstrate that within the challenging context of swampy lowlands, farmers tend to adaptively and contextually adjust their labour allocation.

These results align with the findings of Maican et al. (2021), who reported that age, experience, and motivation significantly correlate with the intensity of farmers' labour in traditional agricultural systems. Similarly, research by Emran et al. (2021) Identified farming experience and management skills as critical components in determining labour productivity in tidal land agriculture. The physical condition of farmers, particularly among older age groups, was also found in this study to affect work time allocation. This reinforces J. Liu et al. (2023) Conclusion that health and age are significant determinants of labour efficiency, especially in physical and seasonal farm work.

Regarding external factors, the current study corroborates the work of Murken & Gornott (2022), which emphasised the importance of physical environment, such as land typology and climatic dynamics, in shaping farmers' labour distribution. When land conditions experience prolonged inundation or extreme drought, farmers adjust their labour strategies by relying on external assistance or altering daily work patterns. The cooperation (*gotong royong*) and family labour utilisation identified in this study further support the findings of Chaudhuri et al. (2021), which highlighted social networks and collective labour as effective socio-economic strategies within traditional agricultural systems.

Thus, this study not only reinforces previous findings but also contributes new contextual insights into labour management in swamp lowlands, which possess unique hydrological and socio-cultural characteristics. The strategic adjustments made by farmers—whether individually, within families, or collectively—reflect adaptive capacities that should be supported through agricultural policies responsive to local contexts.

D. Conclusion

This study concludes that labour input in swamp lowland rice farming is influenced by a variety of internal factors, such as motivation, farming experience, physical condition, and farm management, as well as external factors including land conditions, seasonal variations, and availability of external labour. Amid environmental challenges and limited resources, farmers exhibit adaptive strategies through family labour, cooperation (*gotong royong*), and flexible work scheduling. The implications of these findings underscore the importance of policy interventions that are responsive to local characteristics, such as training in swamp land farm management, support for appropriate technology, and improved access to productive labour. It is also recommended that farmer empowerment programs consider local social and ecological dimensions to effectively promote the sustainability of agricultural labour.

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