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RESEARCH ARTICLE

Potential and Realized of Farmer Household Labor to Support Optimal Performance of Corn and Rice Farming in South Sulawesi Indonesia

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ABSTRACT

The objective of this study is to analyze the potential and realized workforce of corn farmer households in South Sulawesi and discuss the impact of improving efficiency. Surveys were conducted in three regencies in South Sulawesi Indonesia consisting of Gowa Regency (GO), Jeneponto Regency (JE), and Bulukumba Regency (BU). A multistage sampling technique was adopted to get representative data in each regency and a sub-regency was selected based on land area and productivity. Furthermore, two villages were selected from each sub-regency, resulting in a total of six locations. six villages. The primary data were collected through interviews with the respondents based on the research questionnaire guidelines. A total of 300 respondents responded to the questionnaire. The workload calculation was conducted by considering the conversion of the workload into man-equivalent working days (MWD). The MWD of the woman workforce is equivalent to 7 hours of work or 0.7 MWD, while child labor equals 0.5 MWD. The male workforce demonstrated the highest potential, followed by women and children. However, in reality, the female workforce has the largest percentage contribution more than 70% of the potential female workforce is absorbed in farming jobs. This indicates a high proportion of women working in agriculture. The first season of rice cultivation had highest efficiency while the third season demonstrated the lowest efficiency.

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INTRODUCTION

Corn and rice are long-established agricultural commodities in Indonesia. Presently, there is a substantial dry shell corn demand exceeding 10 million tons per year. The highest consumption of corn is for food and animal feed. In aggregate, 72% of national corn production is used for the animal feed industry, 21% for food consumption, and 7% for other industrial needs (Kolo and Hutapea, 2016; Wanto et al., 2019). As one of the essential agricultural commodities, the development of corn production continues to increase to realize self-sufficiency. For that purpose, the development policy of corn agribusiness has been implemented with various strategies. However, the land owners remain encountered some constraints in decisions making for production, labor allocation, and consumption. The availability of farm inputs such as seed quality, availability of fertilizers, pesticides and technological packages largely determines corn

production decisions (Hoar and Fallo, 2017). Meanwhile, the labor allocation including the number and category of workers needs to be regulated so that the land owner can employ them optimally and receive high productivity. The allocation of labor needs attention because the workforce influence farming financing. The number of internal workers from family members of land owners is often insufficient; hence they recruits workers outside their family (Suratiyah, 2015). Attempts to enhance productivity through increasing the workforce are often conducted.

Smallholder farmers generally include their children in work to cut labor expenses. According to the survey conducted by the Central Statistics Agency of Indonesia, the total number of child workers aged 5-17 years was around 58.8 million. The result showed that 48.1 million (81.8%) children attend school, 24.3 million (41.2%) are engaged in the house works, and 6.7 million (11.4%) do not attend school nor are involved in the house works (Rizkianto et al., 2013).

Children are also involved in the labor force in various developing and developed nations (Berlan, 2013; David and Myers, 2006) because the agriculture industry employs the vast majority of child workers. For example, about one-fifth of all Bangladeshi children under 5 and 14 years were classified as child workers in 2000. The result supports the widely-held hypothesis that poverty compels children to work (Salmon, 2005).

South Sulawesi is one of the corn-producing provinces in Indonesia and its production in 2020 ranked fifth. Corn production in this province reaches 1.82 million tons with an area of 377.7 thousand hectares or equivalent to 4.83 tons/ha. In the last five years, corn production in this province has shown a fluctuating trend. This trend is influenced by the decisions of corn farmers in the production process. The number and skills of workers affect the productivity of corn fields. However, increasing the workforce does not always results in higher productivity. Therefore, optimal use of labor has an impact on the income of both land owners and workers. The objective of this study is to analyze the potential and realized workforce of farmer households in South Sulawesi and discuss its impact for improving efficiency.

MATERIALS AND METHODS

The research was conducted in three regencies in South Sulawesi Indonesia consisting of Gowa Regency (GO), Jeneponto Regency (JE), and Bulukumba Regency (BU). Those regencies were selected because of their large corn farms, contributing 41.9% of the corn area in South Sulawesi. Based on the data, GO, JE and BU contributed a corn production area of 42,599 hectares, 49,627 hectares, and 29,047 hectares, respectively. During the rainy season, corn fields are generally utilized to cultivate rain-fed rice. The average corn production is 5.67 tonnes per ha and the price per kilogram was IDR 3500 (equal to 2.4 USD), while the rice production is 4.81 tonnes per ha, and the price per kilogram was IDR 5000 (equal to 3.4 USD).

A multistage sampling technique was adopted to get representative data in each regency, and a sub-regency was selected based on land area and productivity. Furthermore, two villages were selected from each sub-regency, resulting in a total of six locations.

Primary and secondary data were collected in this research. Primary data were collected from respondents through interviews with the guidelines on the research questionnaire. A total of 300 respondents participated in responding to the questionnaire. Secondary data were collected from various sources related to supporting data of total harvest corn price and daily wage.

Data analysis was conducted descriptively, and the calculation of realized workforce (workload output) was conducted by considering the conversion of the

workload into male-equivalent working days (MWD). The MWD of female workforce is equivalent to 7 hours of work or 0.7 MWD, while child labor equals 0.5 MWD. The daily wage MWD is IDR 50,000 (equal to 3.4 USD).

RESULTS

Potential of the workforce among the category in the three regencies

This study showed that the highest workforce potential was found in GO (267.26 MWD/season), while the lowest was found in BU (195.12 MWD/season). The man workforce potential was higher (66.1%) compare to that of women (30.2%) and children (3.8%) (Table 1). The employment potential of both men and women in the GO Regency was greater than that of the JE and BU Regencies.

Potential and realized workforce among the regencies in three seasons

In season 1 (rice cultivation), the realization of workforce output for all categories reached 153.38 MWD, or an average of 51.1% of the available potential. Women contributed the most (69.7%), while children contributed the least (22.16%) (Table 2).

In season 2 (corn cultivation), the realization of workforce output for all categories reached 191.8 MWD or an average of 63.9% of the available potential. Women contributed the most (75%), while children contributed the least (50.1%) (Table 3).

In season 3 (corn cultivation), the realization of workforce output for all categories reached 238.2 MWD or an average of 79.4% of the available potential. Women contributed the most (84.5%), while men contributed the least (74.1%) (Table 4). From these data, it can be seen that there has been a surge in the realization of the workforce for children, even in a one district (BU) reaching more than 100% (157%), this indicates a workload that exceeds the standard.

Realized workload output each season

Realized workload output each season was presented in Table 2 to 4. The total workload output in season 1 (rice cultivation) was 138.08 MWD. The total workload outputs for men, women, and children were 89.67 MWD, 46.80 MWD, and 1.61 MWD respectively. Planting absorbs the most workforce (22.45 MWD), followed by weed clearing 1 (17.95 MWD) and harvesting (17.77 MWD). The output of the man workforce was allocated to planting and weed cleaning 1; that of the woman was allocated to planting and fertilizing 2 and the child was allocated to planting and fertilizing 1 (Table 5).

The total workload output in season 2 (corn cultivation) was 146.37 MWD. The total workload outputs for men, women and children were 93.34 MWD, 49.17 MWD, and 3.86 MWD respectively. Weed cleaning 1 absorbed

Table 1: The farmer workforce potential in each category from three regencies in South Sulawesi

Regencies	Category and potential of the workforce (MWD)/year						Total of potential (MWD)
	Man		Woman		Child		
	MWD	%	MWD	%	MWD	%	
GO	175	65.5	83.16	31.1	9.10	3.4	267.26
JE	129	64.6	61.60	30.8	9.10	4.6	199.70
BU	133	68.2	55.59	28.5	6.53	3.3	195.12
Total	437	198.2	200.35	90.5	24.73	11.3	662.08
Average	145.67	66.1	66.78	30.2	8.24	3.8	220.69

Table 2: Contribution of farmer's household workforce output season 1 for rice commodity in South Sulawesi

Workforce categories	Workforce potential (MWD)			Workforce output (MWD)			Realized workforce output (%)			Average of realized workforce
	GO	JA	BU	GO	JA	BU	GO	JA	BU	
Man	175	129	133	105.7	71.9	91.4	60	55.8	68.7	61.5
Woman	83.2	61.6	55.6	61.7	37.9	40.9	74.2	61.4	73.6	69.7
Child	9.1	9.1	6.5	1.1	0.6	3.1	11.9	6.7	47.9	22.2
Total	267.3	199.7	195.1	168.5	110.4	135.4	146	123.9	190.2	153.4

Table 3: Contribution of Farmer's household work output season 2 for corn commodity in South Sulawesi

Workforce categories	Workforce potential (MWD)			Workforce output (MWD)			Realized workforce output (%)			Average of realized workforce
	GO	JA	BU	GO	JA	BU	GO	JA	BU	
Man	175.0	129.0	133.0	98.2	98.7	90.0	56.1	76.5	67.6	66.8
Woman	83.2	61.6	55.6	52.3	51.8	43.4	62.9	84.1	78.0	75.0
Child	9.1	9.1	6.5	1.1	5.1	5.3	12.2	56.3	81.8	50.1
Total	267.3	199.7	195.1	151.7	155.6	138.7	131.3	216.9	227.4	191.8

Table 4: Contribution of farmer's household work output season 3 for corn commodity in South Sulawesi

Workforce categories	Workforce potential (MWD)			Workforce output (MWD)			Realized workforce output (%)			Average of realized workforce
	GO	JA	BU	GO	JA	BU	GO	JA	BU	
Man	175.0	129.0	133.0	106.8	107.7	103.4	61.0	83.5	77.8	74.1
Woman	83.2	61.6	55.6	55.2	61.2	48.9	66.4	99.3	87.9	84.5
Child	9.1	9.1	6.5	1.3	6.2	10.3	14.2	67.7	157.0	79.6
Total	267.3	199.7	195.1	163.3	175.0	162.5	141.6	250.5	322.6	238.2

the most workforce (23.31 MWD), followed by planting (21.30 MWD) and fertilizing 1 (19.24 MWD). The output of the man workforce was allocated to tilling and weed cleaning 1, and that of woman and child were allocated to weed cleaning 1 and planting (Table 6).

The total workload output in season 3 (corn cultivation) was 172.6 MWD. The total workload outputs for men, women, and children were 108.44 MWD, 57.89 MWD, and 6.26 MWD respectively. Harvesting absorbed the most workforce (25.17 MWD), followed by weed cleaning 1 (24.23 MWD) and weed cleaning 1 (21.79 MWD). The output of the man workforce was allocated to harvesting and tilling, that of the woman was allocated to harvesting and weed cleaning 2, and the child was allocated to harvesting and weed cleaning 1 (Table 7).

Based on the analysis of three seasons, the result showed that in season 1 (rice), the land absorbed 138.08 workforces (equal to 466.5 USD expense), meanwhile, the total gross revenue was 1623.7 USD, resulting in efficiency for gross revenue /workforce expense of 3.48. In the second season, the land absorbed 146.37 workforces (equal to 494.5 USD expense), meanwhile,

the total gross revenue was 1360.8 USD, resulting in efficiency for income/workforce expense of 2.75. In the third season, the land absorbed 172.6 workforces (equal to 583.1 USD expense), meanwhile, the total gross revenue was 1360.8 USD, resulting in efficiency for revenue/workforce expense of 2.33.

The workforce output differed significantly among workforce category ($F = 401.24$; $P < 0.001$), farming activities ($F = 11.25$; $P < 0.001$) and season ($F = 6.66$; $P < 0.01$). There was a significant interaction between the workload category and farming activity, but no interaction between the workforce category and the season as well as between farming activity and season (Table 8).

DISCUSSION

The results showed that the potential for domestic work of corn farmers in South Sulawesi is relatively high. The male workforce demonstrated the highest potential, followed by women and children. However, in reality, the female workforce has the largest percentage contribution more than 70% of the potential female

Table 5: The realized workforce output into farming activities in season 1 (rice)

Farming Activities	Workforce (MWD)			Total workforce
	Man	Woman	Children	
Tillaging	11.87	3.14	0.00	15.01
Planting	13.93	7.83	0.69	22.45
Fertilization 1	10.88	6.27	0.53	17.68
Weed cleaning 1	12.05	5.81	0.10	17.95
Pest control	6.57	0.00	0.00	6.57
Fertilization 2	9.80	7.30	0.16	17.25
Weed Cleaning 2	7.92	5.89	0.00	13.81
Harvesting	11.04	6.61	0.12	17.77
Post-harvesting	5.61	3.96	0.01	9.58
Total workload output	89.67	46.80	1.61	138.08

Table 6: The realized workforce output into farming activities in season 2 (corn)

Farming activities	workforce (MWD)			Total workforce
	Man	Woman	Children	
Tillaging	13.39	4.10	0.59	18.08
Planting	12.86	7.63	0.81	21.30
Fertilization 1	11.59	7.29	0.36	19.24
Weed cleaning 1	13.93	8.55	0.83	23.31
Pest control	7.41	0.03	0.00	7.44
Fertilization 2	6.95	4.37	0.08	11.40
Weed Cleaning 2	8.77	6.14	0.37	15.28
Harvesting	10.98	6.40	0.33	17.71
Post-harvesting	7.45	4.66	0.50	12.61
Total output workload	93.34	49.17	3.86	146.37

Table 7: Output of workforce for each farming activity in season 3 (corn)

Farming Activities	Workforce (MWD)			Mean workforce
	Man	Woman	Children	
Tillaging	14.83	6.34	0.54	21.70
Planting	10.87	6.53	0.65	18.06
Fertilization 1	11.27	7.06	0.42	18.75
Weed cleaning 1	14.66	8.13	1.43	24.23
Pest control	8.02	0.03	0.00	8.05
Fertilization 2	11.44	6.95	0.08	18.47
Weed Cleaning 2	12.66	8.39	0.73	21.79
Harvesting	14.84	8.91	1.43	25.17
Post-harvesting	9.85	5.55	0.98	16.38
Total output workload	108.44	57.89	6.26	172.60

Source: Primary Data, 2017

Table 8: Summary of F statistic followed by the significance of fruit fly abundance and diversity among locations, selling levels, and cultivars

Variables	Workforce category (c)	Farming activity (s)	c x f	c x s	f x s
F	401.24	11.25	6.66	3.83	0.93
P	<0.001	<0.001	0.002	<0.001	0.447

workforce is absorbed in farming jobs. This indicates a high proportion of women working in agriculture. Women contribute a lot to the agricultural sector, especially in rural areas and produce more than 50% of the world's food. In some areas of Africa female

farmers spend less time than men cultivating rice in Africa, except on parboiling. Male farmers generally earn higher income than female farmers because they spent more time in rice production (Medagbe et al., 2020). In addition to working on-farm, males are involved in various off-farm and nonagricultural job activities. Male employees can often do all agricultural work, particularly the labor-intensive tasks that need great physical ability such as plowing. From the analysis of agricultural activities, weed cleaning, planting, and fertilizing absorb a large amount of labor. Another research indicated that women mostly did weeding and harvesting alone. In contrast, males did most of the sowing, seeding, maintenance, transplanting, and irrigation management (Paul and Rani, 2017).

Farmers' working time depends on many factors, including social factors. These include age, marital status, number of dependent family members, work experience, education level, and other occupations (Fauziyah et al., 2017). Marital status, income, and age significantly affect women's participation in agricultural production (Harun, 2014). The results are consistent with previous research that stated that women have a more significant workload than men because they are involved in both agricultural and household activities (Paul and Rani, 2017). Farmer households generally carry out the labor division based on gender. Research in Ethiopia revealed that women spent 26 hours per week in agricultural activities (Harun, 2014). Furthermore, a study conducted on coffee plantations shows the importance of women in cultivating coffee plants. They conduct lighter activities requiring more accuracy and tenacity, such as fertilizing and pruning (Rizki et al., 2019). Research in Kenya shows that men are involved in land clearing, land preparation, planting, and other activities. Therefore, they allocate more time for agricultural activities than women. Women are more involved in growing food crops, watering plants, food storage, and processing. They are also responsible for many productive activities in the house and productive community management activities. As a result, women perform more tasks, have more responsibilities, and work longer hours than men. With the division of tasks, household activities, including food preparation and cooking, are carried out mainly by the wife, followed by the husband. As for children, girls are more involved in the task when compared to boys. Therefore, the continuity of the family role is traditionally associated with women (Lu, 2007).

Research conducted in Yogyakarta (Indonesia), Myanmar, and the Philippines shows that manual planting is common for crop cultivation. Rice is propagated in South Sumatra (Sumatra, Indonesia) and Thailand. Transplants are usually carried out in groups, mainly consisting of women. However, men can assist

in pulling and distributing seedlings. Most women are a good time to weed during the rice-growing phase. The application of fertilizers and pesticides is considered a man's job. Harvesting Guidelines are standard practice in most areas, apart from Thailand and some villages in South Sumatra (Sumatra, Indonesia) (Akter et al., 2017). The men and women occupied most of the activities related to agriculture, but in the case of livestock activities, women's participation was more.

The results differ from previous studies, where the output of male labor is higher than females. The intensity of men's work is also more significant in the household because they have a big responsibility to fulfill members' needs. On the other hand, the output of women's work in farming is lower than that of men. In rice farming, women assist with planting and harvesting activities. Therefore, they focus more on household activities, including looking after children under five (Norfahmi et al., 2017). The men spent more time than women in agricultural business activities as well as work in the non-agriculture sector. Meanwhile, women allocate more time to handle household chores (Adeyonu and Oni, 2014).

The results showed the strong influence of the season on the realized workforce. In the first season, which coincides with the rainy season, farmers generally plant rainfed rice which has a higher level of efficiency. In the following season, the rainfall declined hence the farmers switched to cultivating corn. The higher efficiency of using labor in the rice season because rice cultivation absorbs less labor than corn. Therefore, this study recommends that workers who are not absorbed in the rice cultivation work switch to the other job.

The realization of the contribution of children's labor output is relatively moderate. The average of absorbed child labor potential was 50.6%. Interestingly, it demonstrated a sharp increase in season 3, following an output above 75%, and in one district, the score reaches 157%. This shows that the workload carried out by children exceeds the maximum limit. Internal and external factors influence children's motivation to enter the world of work. A child's decision to work is closely related to the family's economic status and education level (Utama and Handayani, 2020). Farmer household incomes are derived from farming and non-agriculture activities. According to Xu et al., (2017), households adjust labor for agriculture and non-agriculture. Therefore, farmer households increase participation in the local labor market in nonagricultural activities to increase income. Global number of child labors in 2016 reached 152 million children. The decision of children to work due to economic and family demands has introduced various values of rules and responsibilities (ILO, 2017). Children's participation is also related to the value of parents' perspective. This includes parents that view children as exchange values and utilities in

the family. Besides motivation, the other significant concern is the impact of working activities on children's health, education, and social atmosphere. Children in the workforce would have low motivation to continue their education. Therefore, they may become unsuccessful and fall on low work performance.

The results of this study estimate the revenue for corn production of USD 1360.8. In another study, it was reported that maize production revenues in other provinces ranged from USD 1060 to 1163 (Satyarini and Pangarso, 2021). This result is smaller than rice production which can achieve a revenue of USD 1623.7. This result is even smaller than the gross revenue of rice production in Nigeria with a production of 3.3 tonnes/ha earning USD 1,384 (Nwahia, 2020). Corn revenue yields can be equal to or greater than rice if production is more than 6.8 tonnes. Research conducted with Sweet Corn and Hybrid Corn varieties showed yields of 4.4 tonnes and 2.9 tonnes respectively over an area of 0.4 hectares (Dyah and Kahfi, 2021). Therefore, it is highly recommended to increase corn productivity by applying technology or selecting superior types. One technology that has the potential to be developed is yield and soil mapping. Modeling research in the United States shows that this technology increases by 5.6% or 11.9% as a result of map adoption (McFadden et al., 2022). Another option can be selected by adopting organic farming systems (Brock et al., 2021; Choudhary et al., 2021).

In the communities with low income in developing countries, old-fashioned culture and traditions that underestimate the educational process in the school support the growing involvement of child labor. This tradition may be associated with the low parent's education and social and economic levels. Therefore, many parents make odd choices like encouraging their kids to stop school and work on the farm instead of supporting their education. They argued that women do not need school following the high cost of education and unemployment rate among the higher education alumni. With low education and economic powerlessness, parents tend to be narrow-minded about their children's future. Therefore, they lack the consciousness to consider the benefits of higher schools that may improve the welfare of their children's future. This situation encourages children to become laborers. Child labor is a violation of children's rights since it always has a detrimental influence on their physical, emotional, and social development (Hamamah, 2015).

Conclusion

The results indicate that the potential for domestic work of corn farmers in South Sulawesi is relatively high. The male workforce potential means we're the highest, followed by women and children. Furthermore, the farming activities such as weed cleaning, planting, and fertilizer spreading absorb a large workforce. The

contribution of women's work output is higher than that of men since a high proportion are involved in agriculture.

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Author's Contribution

All authors contributed equally to this study.

The authors declared that there is no conflict of interest.

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