

Profitability Analysis of Small-Scale Farmers in Indonesia a Case Study of Hand Tractor use in Jember Regency

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Abstract: In this study, we analyze the constraints of hand tractor ownership and the profitability of small-scale farmers who use hand tractors in Jember Regency, Indonesia. Multistage purposive sampling was used to select 144 small-scale farmers from six districts in Jember Regency. The analysis of social characteristics shows that the main constraints impeding small-scale farmers from owning hand tractors are availability, skills, costs and land condition. The results of the profitability analysis show that small-scale farmers in the Jember Regency have lower labor costs of IDR 4,133,820/ha (USD 295), higher hand tractor costs of IDR 609,890/ha (USD 44) and higher income than the national standard of IDR 14,496,887/ha (USD 1,035). This indicates that hand tractor use results in an increase in the profitability of small-scale farmers by reducing production costs. The significant gross margin (83.7%) is evidence that small-scale farmers in the Jember Regency who use hand tractors for land preparation are more profitable than the national standard.

Key words: Small-scale farmers, hand tractor, profitability analysis, constraints, skills, margin

INTRODUCTION

The agricultural sector in Indonesia is facing many challenges. Indonesian farmers experience high variable risks from human resources and natural resources which have effects on the production of agriculture. This increases production risks and decreases productivity. To increase productivity and mitigate the risk in agriculture, farmers need to implement agricultural technology in an efficient manner. Unfortunately, the progress of technological implementation in Indonesia has been relatively slower than in other Asia Pacific countries such as Thailand, India, Malaysia and Vietnam (Winoto, 2004). Due to insufficient technology, many farmers have failed to achieve optimal production. Moreover, many advanced technologies are not relevant for the real requirements of domestic farmers. Advanced technologies may work appropriately in developed countries but these may be unsuitable for implementation in developing countries such as Indonesia. Furthermore, the high variability in agro-ecosystems and socio-economic characteristics of Indonesian farmers influence decisions concerning the use of technology. Thus, alternative suitable technologies might be required (Lakitan, 2016).

Recently, the government has prioritized agricultural development strategies related to mechanization to

Table 1: The hand tractor usage in Indonesia (unit)

Location	1998	1999	2000	2001	2002	2014
Indonesia	82,180	84,945	97,033	84,664	101,443	192,905
Java	42,107	43,373	49,230	45,195	52,052	107,071
Outside Java	40,073	41,572	47,803	39,469	49,391	85,834

Statistics Indonesia, 2002; CSAM, 2014

support the productivity of Indonesian farmers. Demand for agricultural mechanization such as tractors seems to be increasing. However, the use of tractors in Indonesia is not optimal. In 2000, Indonesia was ranked 169th in terms of tractor use by the population based on a World Bank report. By 2009, the tractor density in Indonesia was only 2 tractors per 1000 ha of arable land, indicating very low tractor use in Indonesia. Most farmers in Indonesia are categorized as small-scale farmers who tend to prefer hand tractors which are more suited to areas under 2 ha as opposed to large machines such as drive tractors. The adoption of technology such as hand tractors has the potential to increase productivity in terms of resources which will in turn improve agricultural production (Djamhari, 2009). Table 1 shows the figures for hand tractor use based on a Statistics Indonesia report. Java is one of largest of the five islands with the greatest populations in Indonesia. The >50% of hand tractors are used in Java where the field areas are well-irrigated. The rest are scattered outside Java.

Some small-scale farmers have limited access to hand tractors and still use traditional methods for land

preparation such as hand hoes and animal drawn vehicles. Farmers who use hand hoes for land preparation require around 40 man-days per ha while animal-drawn methods require 10-12 days per ha. Thus, the former method increases production risk and reduces productivity. Hand tractors are generally operated by one or two operators. Usually, it takes 2-3 days to plow a hectare of a field. The use of hand tractors in land preparation is expected to reduce the labor required and production costs (Jamalus, 2016). Furthermore, hand tractor use will significantly influence the potential profitability of farmers.

Success in hand tractor use can be assessed based on a number of factors such as the increase in investment in hand tractors (hiring or buying) and the profitability of small-scale farmers. However, small-scale farmers may prefer to hire hand tractors rather than buying (Houssou *et al.*, 2014). Therefore, this research is focused on the analysis of constraints concerning hand tractor ownership and the profitability from hand tractor use among small-scale farmers.

MATERIALS AND METHODS

A survey was carried out in September 2015 with 152 small-scale farmers (respondents) in Jember Regency, East Java, Indonesia, through multistage purposive sampling. However due to deficiencies in the data, eight respondents were discarded. As a result, the information provided by 144 respondents was analyzed. Respondents in six districts, i.e., Bangsalsari, Panti, Sukorambi, Mayang, Silo and Ledokombo were randomly selected for data collection. Bangsalsari, Panti and Sukorambi are located in the Northern area while Mayang, Silo and Ledokombo are located in the Eastern area of Jember Regency. Jember Regency was selected as it is known as a main rice production area in East Java, comprising 8% of total rice production in East Java. Jember Regency is located in a lowland area which has a slope of 0-2%. Therefore, the condition of the area is suitable for the application of hand tractors. Most farmers in this area have used hand tractors.

To analyze the constraints impeding hand tractor ownership, information concerning the characteristics of farmers, land conditions and hand tractor use was collected. To analyze the profitability of hand tractor use, we collected data on production costs and income per season. Profitability was analyzed by calculating the gross profit and gross margin. We calculated the average production costs and income of respondents and compared these figures with the national standard provided by the government.

RESULTS AND DISCUSSION

Social characteristic: Farmers in Jember Regency have distinct social characteristics as shown in Table 2. Most of the respondents were male farmers (136) with far fewer (8) female farmers. This is interesting as hand tractors can be accessed and operated by female farmers. The mean of family labor is 3 persons per household (Bangsalsari), less than found in other districts. The implication is that the family labor supply is low. As a result, there is the possibility of using hand tractors as a solution for the labor shortage. Most of the farmers in Jember Regency are categorized as small-scale farmers because they own <2 ha of farm land. All 144 respondents were small-scale farmers. Their main crop was rice however, some farmers undertake crop rotation and grow other crops such as soybean, maize and vegetables.

Based on the survey, most farmers have used hand tractors, mainly for land preparation. Most of the farmers hired tractors from a farmer's group or individual owners. Of the 144 respondents, only 2.7% were individual owners. The farmers who had used hand tractors tended to be inexperienced (<10 years). However, some of the farmers (5.6%) had been using hand tractors for 30 years. They obtained information about hand tractors from extension officers and farmer's groups. The farmers tended to use hand tractors as they could reduce the time and labor necessary for land preparation.

Small-scale farmers realized the benefits of hand tractors but the motivation to purchase hand tractors was low. The patterns of the farmer's decisions to use hand tractors were based on their perceptions of risk. The farmers believed that hand tractor use would reduce production risks. However, they became risk-averse when considering the risk in terms of hand tractor ownership. The farmers preferred to hire hand tractors thus lowering the risk. Under a popular hiring scheme introduced by the government to increase the use of hand tractors by small-scale farmers, they do not need to own hand tractors but can hire from individual farmers or farmer's groups. The farmer's groups purchase hand tractors under a government subsidy and thus within such groups, the purchase costs of hand tractors and their maintenance costs are shared. The hiring cost is set at a special price based on a member's group agreement. However, there is a problem with the hiring scheme as the number of hand tractors available (units) is limited and thus there are insufficient hand tractors for hire when needed. Farmers have to put their names on a waiting list to use hand tractors which causes a delay in planting. As a result, farmer's group performance in hand tractor management is categorized as poor.

Table 2: Social characteristic of small-scale farmers

Characteristic	Bangsalsari	Panti	Sukorambi	Mayang	Silo	Ledokombo
Number of farmers (person)	28	29	16	29	27	15
Female farmers (person)	-	-	-	4	2	2
Mean years of education	7.2	9.6	10.1	8.2	10.4	8.4
No education (%)	2	1.4	-	-	-	2
Elementary school (%)	7	5	2	11.8	3.5	2
Junior high school (%)	8.3	2	3.5	2.7	5	2.7
Senior high school (%)	2	10.4	5	5	9	3.5
University (%)	-	1.4	0.7	0.7	1.4	-
Land area (ha)	0.8	0.48	0.53	0.65	0.65	0.64
Family labor (person)	3.25	2.4	1.9	2.4	0.9	1.7
Hand tractor usage (person)						
Ownership hand tractor	2	-	1	1	-	-
Hired hand tractor	26	29	15	28	27	15
Hand tractor's experience (%)						
<10 years	-	16.7	8.3	1.4	9.7	9
10-19 years	4.9	3.5	3	12.5	4.2	1.4
20-29 years	10.4	-	-	6.3	3.5	-
>30 years	4.2	-	-	-	1.4	-

Field survey of small-scale farmers in Jember Regency

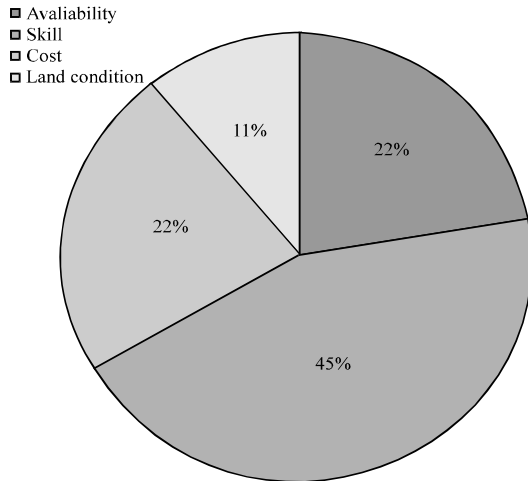


Fig. 1: Constraints of hand tractor ownership, field survey of small-scale farmers in Jember Regency

Individual ownership leads to individual responsibility. Analysis of the survey results shows that hand tractor ownership among small-scale farmers is influenced by certain constraints. As shown in Fig. 1, there are four main constraints with regard to hand tractor ownership, namely: availability, skills, costs and land condition.

Availability (22%): Hand tractor availability is low. The number of agricultural shops which sell hand tractors and spare parts in the local area (district) is limited. Therefore, farmers are forced to buy hand tractors or spare parts from other cities or regencies. In particular, it is difficult to obtain spare parts when needed.

Skills (45%): Without sufficient technical skills, farmers cannot use hand tractors properly. Furthermore, farmers

need skills both to operate and maintain and repair hand tractors. Most farmers in the survey area are users of mechanical machinery but have low experience in terms of the maintenance and repair of machinery such as hand tractors. Therefore, the role of mechanics is very important. However, repair services and facilities in the survey area are limited.

Cost (22%): In terms of determining whether or not hand tractors will increase profit, it is necessary to consider the capital required to own such equipment. However, the purchasing power of small-scale farmers is very low and most do not have the capital resources available. The price of a good quality hand tractor is quite high (the purchase price of a new hand tractor is IDR 27,000,000 or USD 1,928). Some local brands are available at lower prices but with lower capacity and of lower quality than imported brands. Operational costs such as maintenance and repairs, driving operator charges and fuel are additional considerations for farmers in owning hand tractors. Based on the survey, around 60% of the farmers in the sample area received no support from the government to buy hand tractors.

Land condition (11%): The use of hand tractors also depends on the land. A small land area may be suitable for hand tractor implementation but this will result in greater idle time. Some land topology needs different types of plowing tool. In some cases, farmers use hand hoes to plow corner areas which cannot be reached by hand tractors. Hand tractors are used for land preparation for rice and farmers usually plant rice in the rainy season. In the dry season, some land areas have an insufficient water supply, so farmers plant other crops such as soybean or maize without using hand tractors. Therefore, owning a hand tractor is rather risky.

Table 3: Detail of average production cost and income of 144 respondents

Description	National standard ^a	Total cost (%)	Cost/ha/Season ^b	Total cost (%)
Production cost				
Fertilizer	1,257,420 (US\$90)	13.8	1,070,911 (US\$76)	20.9
Seed	462,450 (US\$33)	5.0	368,890 (US\$26)	7.2
Pesticide	265,640 (US\$19)	3.0	180,169 (US\$13)	3.5
Fuel	81,550 (US\$6)	0.9	24,259 (US\$2)	0.5
Labor	6,426,390 (US\$459)	70.6	2,292,570 (US\$164)	44.7
Hand tractor	251,410 (US\$18)	2.7	861,300 (US\$61)	16.8
Others cost	355,560 (US\$25)	4.0	318,904 (US\$23)	6.2
Total cost	9,100,420 (US\$650)	100.0	5,127,540 (US\$366)	100.0
Unit production cost (Rp./ton)	1,516,736 (US\$108)		640,942 (US\$46)	
Income				
Production (ton)	6		8	
Price (Rp./kg)			4,211 (US\$ 0.3)	
Total Income	17,103,220 (US\$1,222)		31,600,107(US\$2,257)	
Analysis:				
Gross profit/season	8,002,800 (US\$572)		26,472,567(US\$1,891)	
Gross profit/month	2,000,700 (US\$143)		6,618,142 (US\$473)	
Gross margin (%)	46.7		83.7	
Household size (person)			3	
Income/Person			2,206,047 (US\$157)	
Regional minimum payment standard			1,460,500 (US\$104)	

Researcher calculation based on field survey of small-scale farmers in Jember Regency, 1 US\$ = Rp. 14.000 based on average exchange rate in September, 2015; ^aBased on statistic Indonesia 2014 in term of currency nominal produced by a household from 1 ha of planted area per season; ^bResearcher calculation

Profitability analysis: The analysis of profitability is based on gross profit and gross margin. The gross profit calculation is based on production costs and income components. The production cost component consists of the costs of seed, fertilizer, pesticides, labor, the hand tractor and other costs. The other costs include tax, irrigation and transportation costs. The income component consists of rice production and the price of rice. The gross profit of rice farming is calculated by subtracting the total production costs from the total income. The gross margin is measured as the proportion of gross profit to total income. This indicates how efficiently small-scale farmers use their raw materials, labor and hand tractors to generate profit. A higher percentage of gross margin is a favorable profit indicator.

Table 3 shows the average production costs and income of 144 respondents. The costs of rice production of small-scale farmers in Jember Regency per hectare are relatively low compared to the national standard. The labor costs comprise the largest proportion of total production costs. The average costs of hand tractors account for IDR 861,300/ha (USD 61), comprising the third major cost of rice production. This is higher than the national standard set by government. As a result, labor effect. The average rice production of the farms surveyed was 8 ton/ha (above the average national standard). Small-scale farmers who use hand tractors tend to sow High Yield Variety (HYV) seed which has a short life span. This variety needs specific periods for planting and irrigation. The use of hand tractors, enabling shorter land

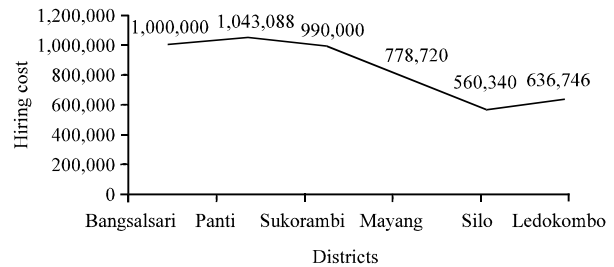


Fig. 2: Average of hand tractor hiring cost (in rupiahs)

preparation time, supports the sowing of HYV seed. The average total income was IDR 31,600,107/ha (USD 2,257). The average size of farm household among our respondents consisted of three persons. Based on household size, we were able to estimate the income of each farmer. The average income received by each farmer was IDR 2,206,047/month (USD 157) (farm households with three family laborers). The result for the gross margin indicates that small-scale farmers in Jember Regency have higher gross margin percentages (83.7%) than the national standard.

Figure 2 shows the average hiring costs for each district in the study area. The hand tractor hiring costs include fuel and operators. The hiring costs may vary according to the availability of hand tractors, land size and condition, operator skills and the performance of the hand tractor. Responses concerning hand tractor hiring costs were collected based on each district and the average hiring cost of each district was calculated. Based

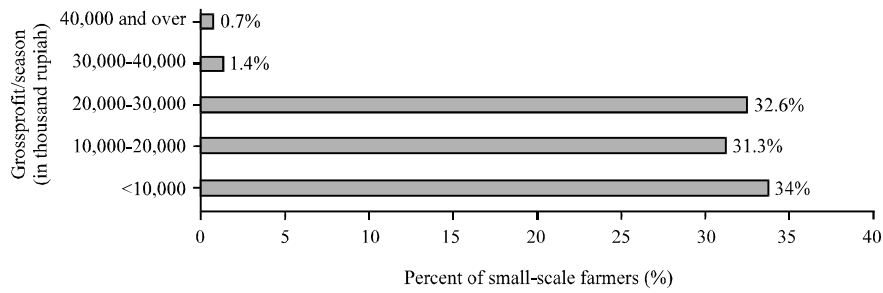


Fig. 3: Distribution of gross profit of small-scale farmers; researcher calculation based on field survey of small-scale farmers in Jember Regency

Table 4: Gross profit levels of small-scale farmers

Group	Gross profit level	Gross profit/ha/season (Rp.)
A	Very high	>40,000,000
B	High	30,000,000~40,000,000
C	Middle	20,000,000~30,000,000
D	Low	10,000,000~20,000,000
E	Very low	<10,000,000

on the results, we found that the highest average hand tractor hiring costs were in the Panti District where farmers spent IDR 1,043,088/ha (USD 74). In contrast, the Silo District had the lowest average of hand tractor hiring costs at only IDR 560,340/ha (USD 40).

The social characteristics of the farmers and their management practices influence production costs and income which are sources of differences in profitability. Some farmers were found have less gross profit and others very high gross profit. The farmer's gross profit was categorized into five levels as shown in Table 4.

The gross profit is calculated by subtracting the total income from the production costs. Figure 3 shows the distribution of gross profit for small-scale farmers. The results are as follows: 0.7% (1 of 144) are categorized in Group A-very high; 1.4% (2 of 144) are in Group B-high. These farmers (in Groups A and B) might be considered successful. There is the opportunity to encourage and motivate them to own hand tractors. They could potentially gain additional income from hiring hand tractors out to other farmers. In contrast, despite hand tractor use, based on their gross profit, 31.3% of the farmers (45 out 144) were still categorized in Group D-low level. Moreover, the gross profit level revealed that 34% (49 of 144) were earning less than IDR 10,000,000 (USD 714) or IDR 2,500,000/month (USD 178). Their income was categorized as very low as their income per person was below the regional minimum payment standard of Jember Regency (IDR 1,460,500 or USD 104). This means that farmers categorized in Groups D and E might still be profitable but do not have sufficient profit from their farms. This may be caused by many factors such as land size area, management skills or combinations of inputs (fertilizers and seeds, etc). The farmers can use hand tractors as one of their tools to reduce production costs but they lack knowledge and management skills.

CONCLUSION

In this research, we have found that availability, skill, costs and land condition are the main constraints that hinder small-scale farmers from owning hand tractors. Buying a hand tractor is a risky investment for small-scale farmers. Therefore, individual ownership of hand tractors is uneconomical. Small-scale farmers tend to choose the safe option by hiring hand tractors. Furthermore, small-scale farmers should receive government assistance and support to do so.

The average rice production for small-scale farmers in Jember Regency was found to be 33% higher than the national standard and the production costs lower than the national standard. According to the national standard, labor costs tend to be 70.6% of the total production costs. However, the small-scale farmers in Jember Regency spend only 44.7% of their total production costs. On the other hand, the costs of hand tractors are higher than the national standard. For small-scale farmers, the costs of hand tractors account for 16.8% of total production costs. The profitability analysis shows that small-scale farmers in Jember Regency who use hand tractors for land preparation are more profitable compared to the national standard based on the gross margin. However, some of them are still categorized as having a very low level of gross profit.

RECOMMENDATIONS

It is necessary to evaluate the performance of small-scale farmers who use hand tractors. In particular, it is important to analyze technical efficiency to maintain small-scale farmer's performance and profitability. The analysis of technical efficiency will help small-scale farmers identify the best management practices to manage their land; indeed such analysis of technical efficiency through non-parametric means, namely Data Envelopment Analysis (DEA) will be considered for future work.

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