# The Economic Potential of Tractor Hire Business in Riau Province, Indonesia; A Case of Small Tractor Use for Small Rice Farms

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## ABSTRACT

This study attempts to evaluate the potential of hand tractor hire business to make the owner's income for small rice farm mechanization. The survey of 56 tractor owners in four regencies of Riau Province was conducted to carry out this evaluation. Approximately 68 percent of the total annual costs is variable costs and the largest single item is labor cost. Most tractors offering custom hire service are profitable with average 23.13 ha per annum. The received profit would be higher with operating tractors themselves. The breakeven area that justifies economical ownership of the small tractor is at 17.35 ha under Riau conditions. The owners require 6.5 years to get back to the investment on the tractors and obtain about 10% of return on the investment. The tractor annual use should be increased to reduce costs or augment profit. The use of tractor for custom hire service should be encouraged for augmenting farmers' income and developing tractor ownership in the province.

**Keywords**: Tractor hire business, small tractor, annual use, tractor costs, break-even point

## 1. INTRODUCTION

Agricultural machinery has become increasingly important to carry out farm works in Riau Province Indonesia and has shown much progress since the 2000s. Tractors are the main farm machines used by farmers for tillage operations instead of human tools and drawn-animal implements. In area of farm tractors for rice cultivation, small type 2 wheel tractors (power tiller) are very popular among farmers due to suitable to the economic conditions and management scales in most areas in Riau province, which are dominated by small-scale farmers and subsistence in production. On the other hand, large tractors are still very limited use in Riau province. A research conducted by Duff (1986) revealed that the small (2-wheel) tractors offer substantial economic advantages compared to the large (4-wheel) tractors.

Of the 835 tractors that are available in Riau Province in 2005, 798 (96%) are small tractors (less than 15 hp), which increased more than three times from 284 in 2000 (Food Crops Agricultural Service, 2005; 2006) while the number of 4-wheel tractors (ranging from 15 to 50 hp) decreased during the same period (Figure 1). In term of density, the number of the small tractors per 1000 ha of cultivated area has increased from 2.3 in 2000 to 6.6 in 2005. Nevertheless, the number is still inadequate to achieve full mechanization stage that requires about 100 tillers / 1000 ha (Herdt, 1983). The most common model used by farmers is Yanmar, dominated by 8.5 horsepower.

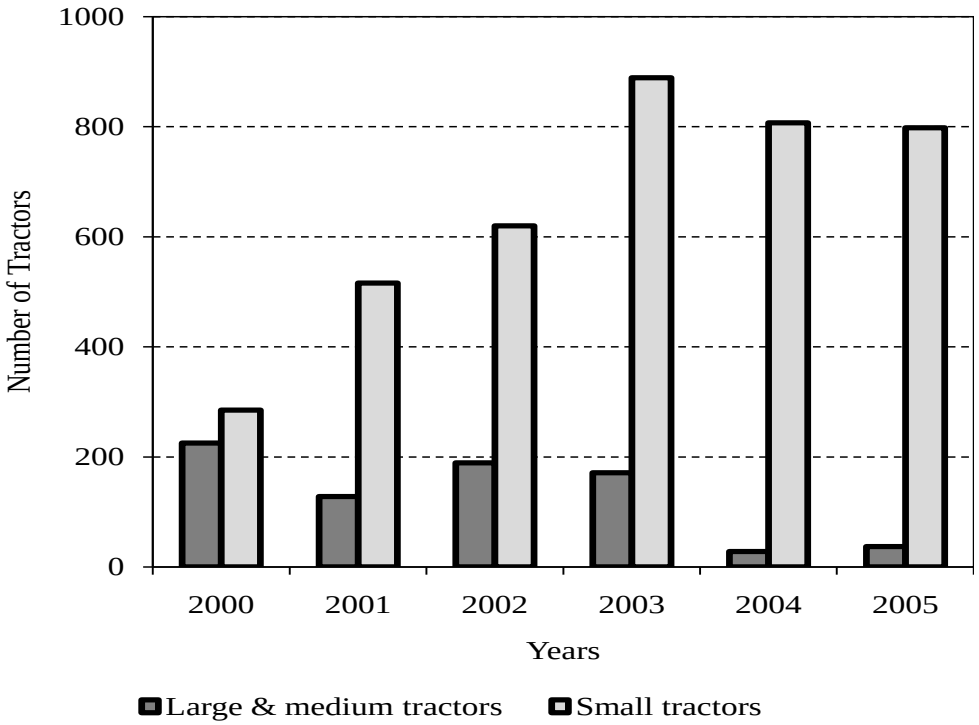


Figure 1. The development of small and large & medium tractors in Riau Province.

In most cases, the management of tractors in small-scale farming is often under capacity and uneconomical. As reported by FAO (1996), most farmers in developing countries cannot justify ownership of the tractor for exclusive use on their own farms due to small farm scale owned. Since tractors are not possible to utilize to their full capacity, small farmers are forced to look for a collective use of the tractor such as private contractors, machinery cooperative, machinery ring, national machinery station and tractor hiring (Gego, 1986). The use of the small tractor for custom hire service which has widely been practiced in many developing countries (Chancellor, 1971, 1986; Kolawole, 1972; Wattanutcharya, 1983; Duff, 1986; Balangkari and Salokhe, 1999) has also become one of the popular methods adopted by small farmers in Riau Province, Indonesia, because such method enables the owners to utilize full tractor capacity and justify economic level of the ownership of the tractors. The other very important benefits in the future will be, that custom hire services can be the main way to make tractors available for other farmers without buying the machines and are potential to make someone's livelihood from the business. As reported by Balangkari and Salokhe (1999) in Coimbatore District India and Kolawale (1974) in Savanna Zone of Western Nigeria, for example, the farmers hired tractors to other farmers to earn extra income. Learning from the above success and experience, provincial government through food crop service has recommended the owners to use their tractors for custom hiring in order to not only get additional income but also encourage the development of using tractor rice farming in the province.

Together with the increasing number of small farmers performing the custom service and the massive effort of the provincial government to popularize its use, there is a need to evaluate the economic potential of such operation method in Riau Province. The primary purpose of this study is to evaluate the potential of tractor hire business to create economic advantages for the owners. Specific objectives are to examine costs and profitability of the business, to

determine a number of hectares which the tractor is economically justified, and to estimate the time that an investment will take to pay for itself.

## 2. METHODOLOGY

Data for this study was collected by field visits during October to December 2005 from four regencies in Riau Province, namely Kampar, Kuantan Sengingi, Rokan Hulu and Siak. Two villages where are of the most importance in term of rice production and largest number of tractors used for custom hiring were selected from each regency. Fifty-six tractors which are usually provided for custom hire service were purposively selected and the owners were personally interviewed. The data was obtained both in dry season and wet season for land preparation of paddy fields.

The collected data includes year of purchase, initial purchase price, hectares of tractor use, costs of tractor operations (operator wage, repair and maintenance, fuel, oil and lubricant costs), and rates of service charge. The data are tabulated and then analyzed using descriptive and simple regression techniques including percentages and means.

Costs which are calculated in this study consist of fixed and variable costs and are expressed in cost per year and cost per hectare. The fixed costs are only depreciation and interest. Other fixed costs, such as insurance, taxes, and shelter, are excluded from analysis for a number of reasons. The housing, for example, is not considered here because most tractors are not kept in houses in Riau province.

The annual depreciation cost is calculated by using the straight-line method for the 8 year useful life according to common economic life of the tractors and has been found in the survey areas. The salvage value of the tractor is assumed to be 10% of the initial purchase price (Kepner et al., 1978; Jacob et al., 1983; Bukhari et al., 1988). The interest rate is set to 8% as representing a current average rate for capital interest calculation. The variable costs are operator wage, repair and maintenance, fuel, and lubricant costs. The repair and maintenance costs (henceforth referred to as repair costs) are the expenditure for parts, repair required by labor and maintenance needs. All costs are calculated into Indonesian Rupiah in which U.S. $1 is equivalent to Rp 8,500 based on average of exchange rate in 2005.

## 3. RESULTS AND DISCUSSION

### 3.1. Cultivated Area Versus Number of Tractor

Approximately 18 percent of Riau's geographical area is used for food crop activities with 1.8% of the area is wetland area which is main land for growing rice. As seen in Table 1, most cultivated areas (76% per year) are done by hand tools (hoe) and drawn-animal implements and only about 24% per year is employed tractors during 2000–05. It is required about 2,348 tractors in average in order to mechanize the entire cultivated area. The figures are predicted under assumption that the tractor capacity is about 40 ha per year. These conditions create a wide opportunity for tractor owners in providing custom hire service in Riau province.

Table 1. Cultivated areas compared with existing tractors

| Years | Annual cultivated area (ha) | Number of small tractors available | Estimated area tilled by tractor | | Tractor requirements (unit) |
|---|---|---|---|---|---|
| | | | ha(*) | % | |
| 2000 | 121876 | 285 | 11400 | 9.35 | 2762 |
| 2001 | 105680 | 516 | 20640 | 19.53 | 2126 |
| 2002 | 123258 | 620 | 24800 | 20.12 | 2461 |
| 2003 | 127359 | 889 | 35560 | 27.92 | 2295 |
| 2004 | 120772 | 807 | 32280 | 26.73 | 2212 |
| 2005 | 121208 | 798 | 31920 | 26.33 | 2234 |
| Average | 120026 | | 26100 | 24.13 | 2348 |

*Source: Food Crops Service of Riau Province, 2005*

(*) Assumption that the tractor capacity is 40 ha.year$^{-1}$

### 3.2. Tractor Ownership and Operator

There are two ownership systems of tractor; individual and cooperative/joint ownerships. Both individual and cooperatives owners are farmers and provide tractor hire service to other farmers and members, respectively, by contractual work. Fifty percent of samples are individual farmers and the others are cooperatives. The individual-owned tractors were new purchased from dealers using farmers' own saving or credit loans with low interest rate from local government bank, while cooperatives owners receive the tractor from government aid through a farm mechanization scheme for small rice farmers.

Tractor operators are the owners, relatives or hired operators. Double operators are the most common found in survey areas. Approximately 60 percent of tractor operators are hired operators who are remunerated on a hectare basis. They are usually contracted during land preparation for growing rice and there is no job order for them during off-season. The problem with hired operators is that they are hardly to find during the season due to very limited number of the operators in survey areas, particularly skilled or trained operators. Therefore, the tractor owners sometimes offer more expensive payment for skilled hired operator to easily find them.

### 3.3. Tractor Utilization

Most tractors worked seasonally according to local cropping system of rice with an average of 52 days each season (ranging from 25 to 57 days). The variation of working days between tractors is due to differences in local climatic conditions that directly affect the length of the season. The working hours average about 7 hours /day with an average capacity of about 0.1 ha.h$^{-1}$.

The tractor work was focused on land preparation of paddy field, including plowing and pudling operations. Tractor owners only offered services to carry out those operations during rice cropping season. There is no demand of hire service for other operations and also outside of the season. The tractors are stored in the shed, porch or put in outside during off-operation.

Table 2 shows that total annual use of tractors average 23.13 ha (ranging from 7 to 40 ha). There is large variation of annual use among farmers due to the differences in field and

infrastructure conditions, skill of the tractor operators, frequency of tractor breakdowns and time required to repair, and the desire of farmers themselves. The discussion with farmers reveals that the field and infrastructure conditions are the major factors that influence tractor annual use.

Table 2. Average annual use by individual and cooperative farmers for each work and season per tractor

| Items | Number of farmers | Cultivated area (ha) | Percentage |
|---|---|---|---|
| Individual farmers | 28 | 23.80 | |
| - Own farm | | 1.27 | 5.3 |
| - Hire service | | 22.53 | 94.7 |
| Cooperative farmers | 28 | 22.38 | |
| - Member | | 17.49 | 78.2 |
| - Hire service | | 4.89 | 21.8 |
| Individual farmers | 28 | 23.80 | |
| - Wet season | | 15.41 | 64.7 |
| - Dry season | | 8.39 | 35.3 |
| Cooperative farmers | 28 | 22.38 | |
| - Wet season | | 15.45 | 69.0 |
| - Dry season | | 6.93 | 31.0 |
| Total | 54 | 23.13 | |

In many cases, the owners could only operate the tractor in a limited radius due to fragmented fields and in adequate access to user's fields as consequence of poor infrastructure conditions. This condition held down the amount of the annual use particularly from contractual works. On the other hand, some owners, particularly in good infrastructure areas, had more annual use by travelling long distance (ranging from 3 to 5 km) to other villages.

Most of the total annual use of farmers' cooperative (78%) was from member farms and the remaining 22% was non-member farms. It means that they provide tractor service primarily to group members and only use any surplus capacity to non-member farmers. The individual farmers focused on tractor service for other farmers. Approximately 95% of the annual use was for custom services and only about 5% was from owned farm. It was also found that few individual farmers provided the custom services when they have completed their works in their own farms.

Most of the annual use for individual farmers (65%) and cooperative farmers (69%) worked during wet season and the remaining 35% and 31% were during dry season, respectively. It means that total cultivated area which is planted rice or other crops is less than 100% during dry season. In Siak Case, Khan (1996) reported that only 60 – 70% of the cultivated area is possible for planting rice crop in dry season due to lack of water from rainfall as well as irrigation. The planted area and cropping intensity for rice crop can be increased to be 70 – 90% and 200-300% by improving drainage and irrigation conditions and then affect on increasing tractor use especially on dry season.

### 3.4. Annual Cost of Tractor and Functions

The annual costs of the tractor operations were calculated to be Rp6,99 million (U.S. $823) in average with a range from Rp1,43 million (U.S. $169) to Rp8,90 million (U.S. $1,047). The variable costs jointly account for about 62% of the total costs and the remaining 38% is fixed costs. The relative importance of the annual cost items is presented in Table 3. Labor is the largest (38%) single costs of the total costs, followed by depreciation (27%) and fuel cost (13%). Repair costs which are frequently the largest costs in other developing countries (Henderson and Fanash, 1984; Bukhari et al., 1988) were found to only about 9% of the total costs. The smaller repair costs are found here because the most tractors (63%) had been operating for less than 6 years, in which not many serious breakdowns were occurred. Interviews with the tractor owners revealed that they commonly did not use the aged tractor for hire operation due to lower power and high rate of breakdowns. The cost of fuel was accounted for about 14% of the total costs. This cost can be vary depending on the place of purchasing of the fuel at which the price is cheaper at gas station than fuel supplier within villages and the increase of the following the world's oil price. The results also indicate that the largest variation (86%) occurs in the repair costs as shown by the value for the coefficient of variation (cv). It may be due to differences in tractor age, annual use, operator skill, maintenance management, and field conditions.

The repair, variable, fixed and total costs of the different annual use rates are depicted in Figure 2. The curves describe in terms of data points which related to the above cost items per hectare to annual hectares of use. The curves show the same trend and negatively correlated. It is clear that as tractor annual use increases, the repair and variable costs per hectare tend to slightly decrease. This finding is in agreement with Butterworth and Nix (1983) who state that repair costs per hectare might fall to some extent with increased annual use. As a result, it is a relatively cheap operation of the tractors since the high rate of use means lower operating costs. The fixed and total costs per hectare show a quick decline with an increase of annual use. This result suggests that there is a great potential to reduce fixed and also total costs by increasing annual hectare of use. It is because the costs spread over the number of hectares and later cost per hectare would be smaller.

Table 3. The importance of annual costs item of tractor operations.

| Item | Annual cost (Rp) | C.V* (%) | % of fixed or variable costs | % of total costs |
|---|---|---|---|---|
| Fixed costs | 2,631,436 (U.S.$310) | | 100,00 | - |
| - Depreciation | 1,891,607 (U.S. $223) | 13 | 71.88 | 27.04 |
| - Interest | 739,829 (U.S. $87) | 13 | 28.12 | 10.58 |
| Variable costs | 4,363,086 (U.S. $513) | | 100,00 | - |
| - Repair | 640,913 (U.S. $75) | 86 | 14.68 | 9.16 |
| - Labor (operator) | 2,633,433 (U.S. $310) | 38 | 60.36 | 37.65 |
| - Diesel fuel | 956,731 (U.S. $113) | 51 | 21.93 | 13.68 |
| - Oil and lubricants | 132,009 (U.S. $16) | 32 | 3.03 | 1.89 |
| Total costs | 6,994,522 (U.S. $823) | - | - | 100,00 |

*Note: * Coefficient of Variation*

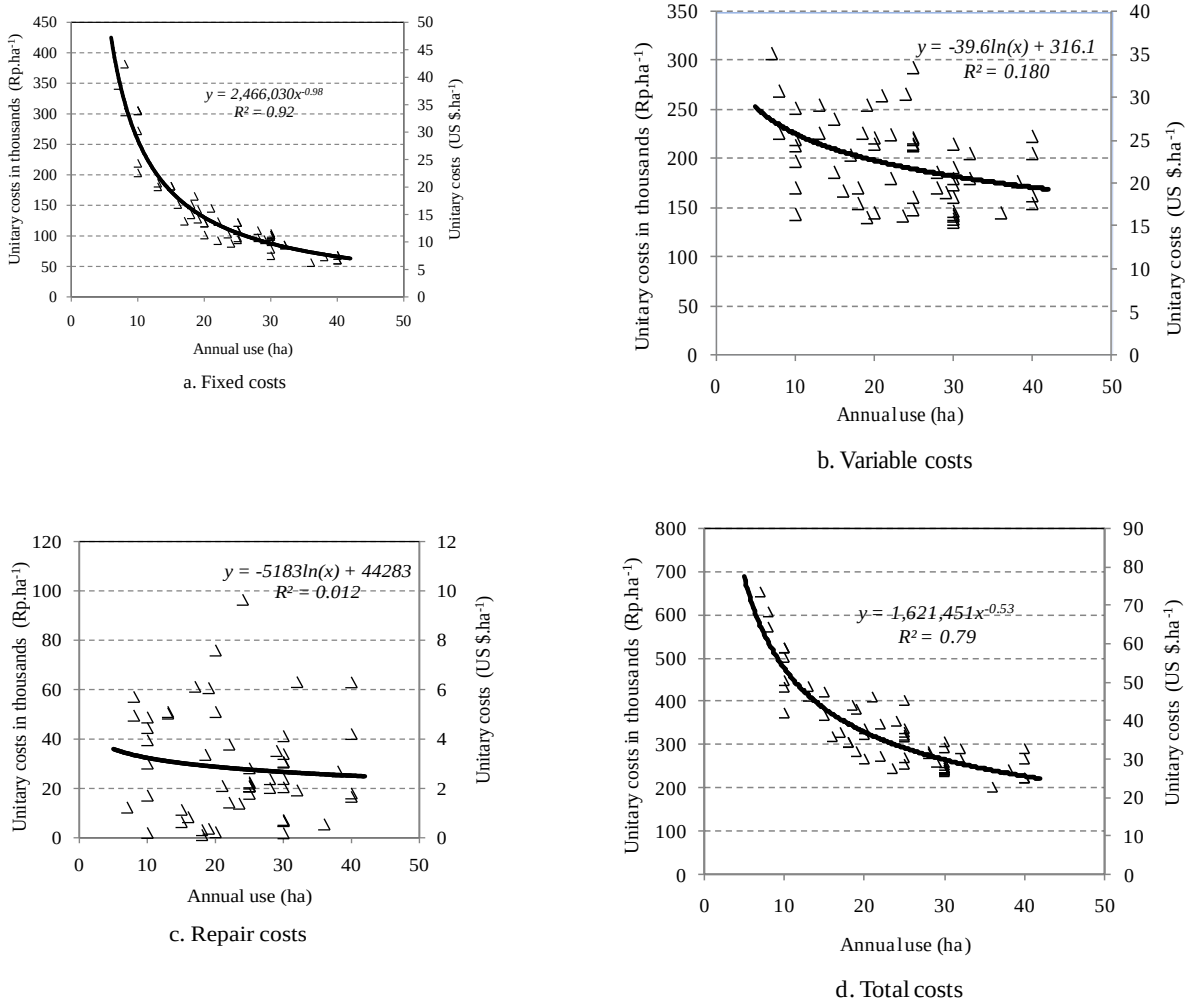


Figure 2. The relationship between four cost components per hectare and annual use of tractors

In order to derive function for each cost item above, least squares regression method were used to determine the best fit function. The repair, variable, fixed, and total costs are taken as dependent variable ($y$) and annual use rates as independent variable ($x$). Simple functional relationships, such as linear, polynomial, exponential and power equations has tried. The derived functions which gave the best result are presented in Table 4.

Table 4. Annual cost functions derived from study data

| Cost items | Form | Equation | $r^2$ |
|---|---|---|---|
| Fixed costs | Power | $y = (2.47x^{-0.98})10^6$ | 0.92 |
| Total costs | Power | $y = (1.62x^{-0.53})10^6$ | 0.79 |

The variation of the curves is visible. A power function gave as good a result as any, accounting for 92% and 79% of the observed variations in fixed and total costs per hectare, respectively. These mean that there is a significant contribution of annual use on decreasing fixed and total costs. A logarithmic function could explain only 1% and 18% of the observed variation in repair and variable costs per hectare, respectively (Figure 2b and 2c). The very low $r^2$ value suggests that annual use of a tractor is not a major determinant for both repair and variable costs per hectare.

### 3.5. Service Charge, Revenue, and Profitability

The tractor owners mostly received job contract from neighbor farmers. The contractual work between tractor owner and hiring farmer is made directly and agreed on in advance (at the beginning of the season). Tractor service rate was calculated on a hectare basis as a common standard practiced by most farmers in the survey areas. The rate took into account the conditions of the field being worked, distance and size of field plots, weed growth on the field, and prevailing rate of local wages. The level of competition among tractor owners may affect the rate of service charge. These conditions made the service charge relatively vary among owners.

The charge rates for service ranged from Rp300 thousand (U.S. $35) to Rp450 thousand (U.S. $53) with an average of Rp348 thousand (U.S. $41) for both plowing and puddling works. The charges are lower than the government's recommended charge rate of Rp500 thousand (U.S. $59) per hectare due primarily to low economic ability of hiring farmers and competition among owners. The charge for the service is usually paid in two stages (50 percent for each stage payment), before starting work and after completion of the work. The first payment is intended to be used to buy fuel, oil and other cash costs by the tractor owners. In some cases, the hiring farmers failed to pay off the payment at the second stage (50 percent) after completion of the work and the payment could just be paid off after harvest. Nevertheless, there is not an additional charge for that late payment.

Table 5. Average amount of revenue and profitability of tractor operation

| Item | Value (Rp.year$^{-1}$) | C.V, % | % of Revenue |
|---|---|---|---|
| Revenue (gross income) | 7,920,089 (U.S. $932) | 39 | |
| Total costs | 6,994,522 (U.S. $823) | 25 | 88.31 |
| Return on Labor | 3,559,000 (U.S. $419) | 73 | 44.94 |
| Return over variable costs | 3,557,003 (U.S. $418) | 49 | 44.91 |
| Profit (net income) | 925,567 (U.S. $109) | 186 | 11.69 |
| Break-even area (ha) | 17.23 | | |
| Payback period (yr) | 6.50 | | |
| Rate of return on investment (%) | 10.02 | | |

Revenue, which was estimated by multiplying the number of annual use (service work and own farm) and the service charge is presented in Table 5. In this analysis assumed that rate of service charge for own farm is the same for custom hire service. The annual revenue were derived from the operation averages Rp7.92 million (U.S. $932) or ranges from Rp3 million

(U.S. $353) to Rp14 million (U.S. $1647). The variations are caused primarily by difference in the number of job contracts and service charges between owners.

Profit, which is estimated from the differences between revenue and total costs (Riggs et al., 1996), averages Rp926 thousand (U.S. $109) annually or about 12% of the revenue. The variation in the profit is extreme high as indicated by the value for coefficient of variation (cv). According to the survey, about 34 percent of tractor samples did not make profit because of either lower annual use or higher costs. This suggests the owners to increase the annual use by travelling to other villages to find new customers and eventually will receive more profit. Nevertheless, the owners who operate the tractor themselves got more return from labor wage. According to Table 5, the return received by the owners is an average of Rp3.56 million (U.S. $419) or about 45% of the revenue. This result implies that the owners should operate tractor by themselves to receive more return from the operation. Furthermore, another alternative that can be received by tractor owners from the operation is return over variable costs, accounting for Rp3.55 million (U.S. $418).

The annual tractor use required for economic viability was evaluated using break-even point analysis and the result is illustrated in Figure 3. According to Butterworth and Nix (1983), the break-even area was calculated by dividing the fixed costs per annum by differences between the service charge and the variable costs. The analysis result indicates that the break-even area was found to be 17.23 ha.year$^{-1}$, while the actual average annual used in this study was 23.13 ha. After this point, one additional hectare of use that has made would produce a profit. It is reasonable to conclude that tractors used for custom service, on average, make profit from their operations. The result suggests that the tractor annual use should be more than the figure to economically justify operating a tractor under Riau conditions.

This finding is lower than that derived by Duff (1986) who stated that the annual use should be 25.12 ha.year$^{-1}$ and 62.8 ha.year$^{-1}$ to justify owning for similar tractor type under west Java and South Sulawesi conditions, respectively. He was also found that the small tractor would achieve economic level to about 33 ha in Philippine, 5.8 ha in Thailand. These differences may be caused by the differences in maintenance management of tractor and field conditions among farm sites.

The breakeven area may be affected by changing a number of assumptions made in the analysis, such as costs and service charge. One of the most important assumptions which may be controlled by the tractor owners is the rate of depreciation. We assume that the tractors would last ten years (two years is longer than assumption was made in previous analysis), the annual fixed costs would reduce from Rp2.63 million (U.S. $310) to Rp2.25 million (U.S. $265) and the break-even area would then be 14.75 ha.year$^{-1}$. This result suggests tractor owners to prolong economic life of the tractors by taking good care of them and maintenance practices in order to shorten break-even area and also reduce costs.

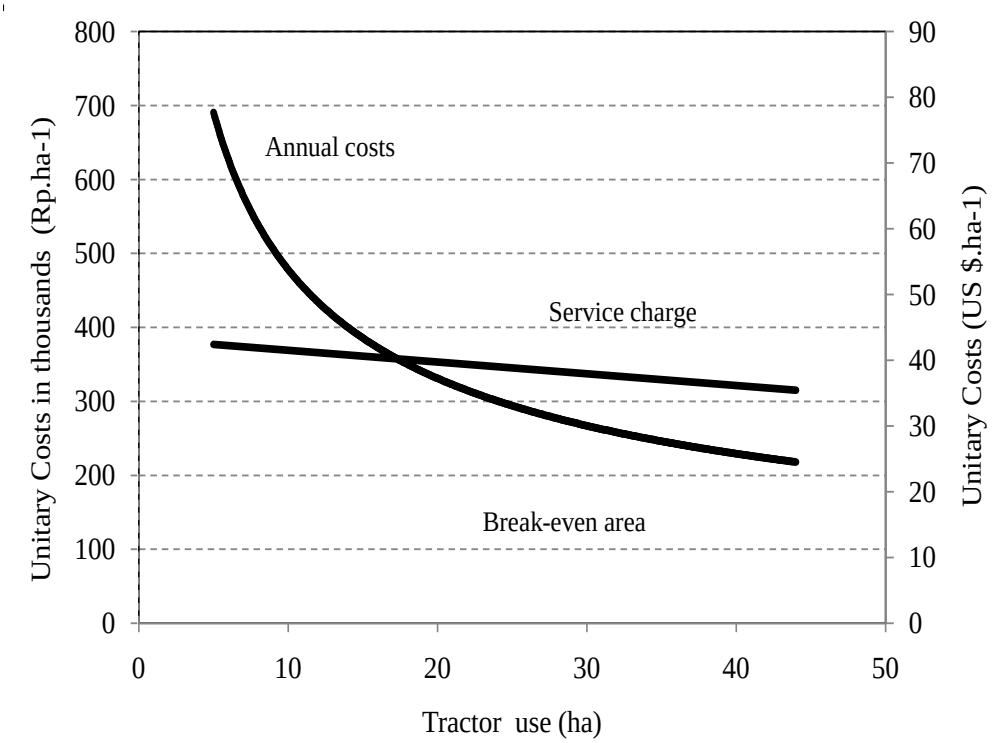


Figure 3. Break-even analysis using annual cost and service charge per hectare

Furthermore, this break-even analysis can also give a consideration for farmers to decide whether buying a tractor or hiring a tractor contractor service. The result implies that a farmer is more economic to purchase the machine if the annual use is above the area; conversely the contractor service is the less expensive for below the area.

Table 5 also presents the average payback period, i.e. the number of years that an investment takes to pay for itself (Butterworth and Nix, 1983). The payback period was analyzed to be 6.5 years of the tractor operation. It means that the tractor investment would pay for itself after that payback period. The rate of return on tractor investment was also found to about 10%. It is relatively good tractor investment for use in hire operation because the payback period is shorter than the expectation of most farmers for tractor economic life of 8 years.

## 4. CONCLUSIONS

Most of the total annual costs of Rp6.99 million (U.S. $823) are contributed by variable costs (68%) and labor cost is the largest single item (38%) of the total costs. Majority of the tractor hire operation is profitable under operating in wetland paddy field in Riau Province. Tractor owners receive profit in average of Rp926 thousand (U.S. $109) per annum under annual use of 23.13 ha and service charge of Rp348 thousand (U.S. $41). The tractor owners also got an additional income from labor return as Rp3.56 million (U.S. $419) for the tractor operated by owners themselves. The annual use needs about 17.23 ha to justify economically ownership of the small tractor under Riau conditions. The owners require 6.5 years to get back the investment on the tractors and obtain about 10% of return on the investment. The annual use should be increased to reduce annual costs or augment farmers' profit. The annual use can be increased by increasing cropping intensity and extending operating area to other villages by

improving the infrastructures, such as irrigation and road. The use of tractor for custom hire service should be encouraged because of being a source of farmers' income and one of the effective ways to develop private tractor ownership in the province.

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