Economic feasibility analysis of service business of agricultural equipment and machinery in Kubu Raya Regency, Indonesia

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Abstract. Agricultural equipment and machinery have become the main farmer's need as technically it can accelerate and improve the quality of soil cultivation, water supply, increase the cropping index, reduce lost yields and preserve the environmental functions. Economically, it can increase the added values through product processing, productivity, and resource efficiency. Institutional service business of agricultural equipment and machinery (UPJA) needs to develop to facilitate farmers' access to the use of affordable agricultural equipment and machinery in order to increase the sustainable food production. The sustainability of the service business is influenced by many aspects including economic aspects. This study aimed to analyze financial feasibility of UPJA in Parit Keladi village, Sungai Kakap subdistrict, Kubu Raya Regency. Analysis of R/C ratio and B/C ratio was applied. Based on R/C ratio of feasibility analysis, all kinds of agricultural equipment and machinery including transplanter, water pump, rice thresher, mini combine harvester, and hand tractor provided by the service business were feasible, shown by \( R/C > 1.52 \) and \( B/C > 0.52 \). Whereas, The R/C value of water pump of 2.5; hand tractor 2.0; 1.81 transplant machine and 1.67 mini combaine and 1.31 power thresher machine, respectively.

1. Introduction

In agricultural business, the use of agricultural equipment and machinery has become the main need of all production processes including pre-production, production, harvest, post-harvest, and distribution. Based on the Regulation of the Indonesian Ministry of Agriculture Number 25/Permentan/PL.130/5/2008 on the Guideline for Growing and Developing Agricultural Machinery Custom Hiring Business, the use of agricultural equipment and machinery can accelerate and improve the quality of soil cultivation, water supply, planting intensity, as well as livestock productivity, reduce lost yields, maintain freshness and completeness, increase the added values through processing the crops and preserving the environmental functions, increase productivity and resource efficiency [1]. Moreover, the use of the equipment and machinery results in efficient use of manpower, cost, and time of harvest and reduced lost yields [2]. Economically, the utilization promotes new job opportunities for units of service business of agricultural equipment and machinery, spare part provider, and workshop [3], and it encourages the development of agricultural businesses [4].

Kubu Raya Regency is one of rice production centrals in West Kalimantan. With 27,957 ha of harvest width, it is able to produce 92,452 tons of rice, 14.86% of the total rice production in West
Kalimantan [5]. One of subdistrict becoming the rice production central is Sungai Kakap subdistrict. It is an integrated agribusiness area applying relatively high agricultural technology, using 1,456 units of the agricultural equipment as machinery for the production processes, from soil cultivation to post-harvest. It is expected that the large number of the equipment and machinery increase the rice production of Sungai Kakap Subdistrict. According to [6], besides improving both agricultural productivity and efficiency, agricultural equipment and machinery widen job opportunities in rural areas. Seed availability, number of rice mill, and pest management [7], post-harvest technology and cultivation technology are influential attributes of sustainable rice availability [8]. Harvester machine and rice thresher can press the lost yields due to delayed harvest; it is 1.92% during the harvest time and 1.74% in the beginning [9]. Referring to the strategic roles, the supply of agricultural equipment and machinery can be mainly considered by the government for the improvement of national food production.

Utilization of agricultural equipment and machinery in the field was entrusted to institutional unit of service business of agricultural equipment and machinery. It is village economic institution which activity is providing service for optimizing agricultural equipment and machinery to gain business profits for both members and non-members of farmer groups/united farmer groups. The presence of the institution is socially and economically service supply solution of agricultural equipment and machinery and manpower for farmers who do not have capital to buy the needed equipment and machinery by themselves. The institutional unit of service business of agricultural equipment and machinery accelerating the adoption of the equipment and machinery is considered good by farmers as it has clear regulation and it ease the farmers’ access to the equipment and machinery [2].

Farmers can do process of production, harvest, post-harvest, and distribution effectively and efficiently by paying the rental cost only. The management of the institutional unit of service business of agricultural equipment and machinery is feasible with B/C ratio > 1 [10]; rice transplanter is feasible to be developed with B/C ratio 2.41 [11]. In fact, however, the unit is difficult to develop. In the period of 2015–2017, the number of active units decreased by 42.75%, from 917 units in 2015 to 525 units in 2015. The challenges impeding sustainability of the institutional units, from farmers’ side, include the low farmers’ capital capacity to rent the equipment and machinery. From the institutions’ side, the broken equipment and machinery, low operator skills, expensive spare parts, and very rare nearby workshop lead to increasing costs paid by the institutions, and if forced to implement, it is economically infeasible. These problems can impede the development of the institutional unit of service business of agricultural equipment and machinery if they are not solved immediately. This study aimed to analyze financial feasibility for sustainability of service business of agricultural equipment and machinery in Kubu Raya Regency.

2. Methods

This study was conducted in December 2019 at UPJA Madiun Mandiri in Parit Keladi Village, Sungai Kakap Subdistrict, Kubu Raya Regency. The location was selected based on a consideration that the subdistrict is a production central of rice in Kubu Raya Regency.

The financial feasibility of the service business unit of agricultural equipment and machinery was calculated with several measurement criteria of investment feasibility:

\[ \frac{R}{C} = \frac{TR}{TC} \]

In which:  
- \( TR \) = total revenue.  
- \( TC \) = total cost  

with result criteria:
1. \( R/C \) ratio > 1 : feasible  
2. \( R/C \) ratio = 1 : Break Even Point (BEP)  
3. \( R/C \) ratio < 1 : infeasible
3. Results and discussion
Service business unit of Agricultural Equipment and machinery in Sungai Kakap Subdistrict, Kubu Raya Regency is a business unit of farmer groups which have been developing. The available agricultural equipment and machinery was from government aid intended for increasing the production of crops in West Kalimantan. The national aid distribution of the equipment and machinery was considerably big, mainly after the development of Upsus program for accelerating production of rice, corn, and soybean [12]. All available equipment and machinery in Kubu Raya Regency are still dominated for production of crops mainly rice. Therefore, the available equipment and machinery in the regency are still dominated by those specified for crop production, generally for small scale agribusinesses, in which the equipment and machinery are only used for farming activities needed physical power such as soil cultivation, irrigation, harvest, and post-harvest. The equipment and machinery include hand tractor, mini combine, power thresher, direct seeder, water pump, and transplanter.

The sustainability of service business unit of agricultural equipment and machinery in Sungai Kakap Subdistrict is economically determined by its rental revenue and the spent costs. The costs for operational in one planting season include cost of fuel, lubricant, damage, and operator (Table 1).

**Table 1.** The total costs spent for each equipment in one planting season service business unit of agricultural equipment and machinery Madiun Mandiri in Sungai Kakap subdistrict of Kubu Raya Regency.

| No | Types of agricultural equipment and machinery | Total unit | Fuel cost | Lubricant cost | Operator cost | Maintenance cost | Total cost |
|----|-----------------------------------------------|------------|-----------|---------------|--------------|----------------|------------|
| 1  | Transplanter                                  | 3          | 448,000   | 52,000        | 2,100,000    | 300,000        | 2,900,000  |
| 2  | Water Pump                                    | 1          | 504,000   | 52,000        | 2,250,000    | 600,000        | 3,406,000  |
| 3  | Power thresher                                | 1          | 420,000   | 104,000       | 3,000,000    | 800,000        | 4,324,000  |
| 4  | Mini Combine                                  | 3          | 180,000   | 104,000       | 2,600,000    | 400,000        | 3,564,000  |
| 5  | Hand Tractor                                  | 2          | 1,552,000 | 312,000       | 10,230,000   | 2,300,000      | 14,394,000 |

Source: Primary Data Analysis, 2019

Table 1 shows the total costs spent for each equipment in one planting season: mini combine (4,324,000 rupiahs), the biggest one, followed by hand tractor (3,564,000 rupiahs), power thresher (3,406,000 rupiahs), transplanter (2,900,000 rupiahs), and water pump (200,000 rupiahs). Considering the total cost of all kinds of agricultural equipment and machinery managed by the service business unit, 71.07% (10,230,000 rupiahs) is for operator cost, 15.98% (2,300,000 rupiahs) is for damage/maintenance cost, 10.78% (1,552,000 rupiahs) is for fuel cost, and 2.17% (312,000 rupiahs) is for lubricant cost. The amount of costs influences the management of the service business unit. The small number of operators capable to operate the equipment and machinery well leads to high operator cost paid by the service business unit. Operators have important role for the management; they are needed for operating and maintaining the agricultural machinery appropriately so that the capacity of field work increases [13]. Consequently, technical training for management of agricultural equipment and machinery and operator is required for farmer groups, United farmer groups, managers of the service business unit, planting and harvesting brigades receiving aids, and agricultural extension officers assisting in the location of aid receivers [14]. In addition, the initial investment cost and the way to press the operational cost are influential variables which highly contribute to the management of the service business into of agricultural equipment and machinery [15].

The revenue of the service business unit is from farmers who use the equipment and machinery. The rental costs vary, depending on types of equipment and machinery, and like other expenses the costs economically influence the sustainability of feasible service business unit (Table 2).
Based on Table 2, the service business unit of agricultural equipment and machinery (UPJA Madiun Mandiri) is economically feasible to operate and develop with 1.52 R/C ratio and 0.52 Net B/C ratio. The benefit rate per one planting season is 20,019,000 rupiahs from ten units of agricultural equipment and machinery managed by the service business unit. Regarding each type of equipment and machinery, the highest R/C ratio is by water pump (2.5), followed by hand tractor (2.0), transplanter (1.81), mini combine (1.67), and rice thresher (1.31). Empirically, the use of water pump in rainy season is intended to support the lack of gravity irrigation (conjunctive use), and it functions as substitute of gravity irrigation in rainfed areas [16].

Referring to the BEP, to be feasible for operation, the minimum work capacity which must be achieved by each agricultural equipment and machinery is 4 ha for transplanter, 4 days for water pump, 9 tons for rice thresher, 8 tons for mini combine, and 3 ha for hand tractor.

### 4. Conclusion

Based on the feasibility analysis, the management of the service business unit of agricultural equipment and machinery Madiun Mandiri is beneficial and feasible for operation with 1.52 R/C ratio, 0.52 Net B/C ratio, and 20,019,000 rupiahs benefit rate. Considering the feasibility level, the highest R/C ratio is by water pump, followed by hand tractor (2.0), transplanter (1.81), mini combine (1.67), and rice thresher (1.31). To be feasible for operation, the minimum work capacity which must be achieved by

**Table 2. Feasibility analysis of service business unit of agricultural equipment and machinery Madiun Mandiri in Sungai Kakap subdistrict of Kubu Raya Regency.**

| Description | Transplanter | Water pump | Power thresher | Mini combine | Hand tractor | Total |
|-------------|--------------|------------|----------------|--------------|--------------|-------|
| Number of equipment and machinery work capacity | 7 Ha MT<sup>1</sup> | 10 days | 15 Tons MT<sup>1</sup> | 12 Tons MT<sup>1</sup> | 6 Ha MT<sup>1</sup> | - |
| Rental price (IDR) | 750,000 | 50,000 | 400,000 | 600,000 | 1,200,000 | - |
| Revenue (IDR/Unit) | 5,250,000 | 500,000 | 6,000,000 | 7,000,000 | 7,200,000 | - |
| Cost (IDR/Unit) | 2,900,000 | 200,000 | 3,406,000 | 4,324,000 | 3,564,000 | - |
| Benefit (IDR/Unit) | 2,350,000 | 300,000 | 2,594,000 | 2,876,000 | 3,636,000 | - |
| R/C per unit of agricultural equipment and machinery | 1.81 | 2.5 | 1.31 | 1.67 | 2.0 | - |
| B/C per unit of agricultural equipment and machinery | 0.79 | 1.5 | 0.76 | 0.67 | 1.02 | - |
| BEP | 4 Ha | 4 days | 9 Tons | 8 Tons | 3 Ha | - |
| Total revenue of the service business unit | 15,750,000 | 500,000 | 6,000,000 | 21,600,000 | 14,400,000 | 58,250,000 |
| Operational cost of agricultural equipment and machinery | 8,700,000 | 200,000 | 3,406,000 | 12,972,000 | 7,128,000 | 32,406,000 |
| Other costs | - | - | - | - | - | 5,825,000 |
| Total costs | - | - | - | - | - | 38,231,000 |
| Benefit | - | - | - | - | - | 20,019,000 |
| R/C of the service business unit | - | - | - | - | - | 1.52 |
| B/C of the service business unit | - | - | - | - | - | 0.52 |

Source: Primary data analysis, 2019
each agricultural equipment and machinery is 4 ha for transplanter, 4 days for water pump, 9 tons for rice thresher, 8 tons for mini combine, and 3 ha for hand tractor.

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References
[1] Hutahaean L, Anasiru R H and Sarasutha I 2005 J. Pengkaj. dan Pengemb. Teknol. Pertan. 8 150–63
[2] Purwantini T B and Susilowati S H 2018 Anal. Kebijak. Pertan. 16 73–88
[3] Hartadi M A 2016 Analisis Kinerja Usaha Pelayanan Jasa Alat Mesin Pertanian (UPJA) di Kabupaten Nunukan (Jakarta: Universitas Terbuka)
[4] Suheiti K 2007 Balai Pengkajian Teknologi Pertanian (BPTP). Available from: http://jambi.litbang.pertanian.go.id/ind/images/PDF/Kiki1.pdf
[5] BPS, 2019 Provinsi Kalimantan Barat Dalam Angka 2019 (Kalimantan Barat Province in Number) 2019 (Kalimantan Barat: Badan Pusat Statistik Provinsi Kalimantan Barat)
[6] Umar S 2013 J. Teknol. Pertan. 8 37–48
[7] Primawaty E, Basukriadi A, Syamsu J A and Soesilo T E B 2013 Procedia Environ. Sci. 17 53–9
[8] Ekawati, Kusnandar, Kusrini N and Darsono 2018 Bulg. J. Agric. Sci. 24 942–8
[9] Kannan E, Kumar P, Vishnu K and Abraham H 2013 Assessment of Pre and Post Harvest Losses of Rice and Red Gram in Karnataka (Bangalore: Institute for Social and Economic Change)
[10] Subagiyo 2016 J. Agros. 18 33–48
[11] Farizan F, Fauzi F and Makmur M 2018 J. Ilm. Mhs. Pertan. 3 160–72
[12] Aldillah R 2016 Forum Penelit. Agro Ekon. 34 163–77
[13] Paman U, Inaba S and Uchida S 2014 Appl. Eng. Agric. 30 699–705
[14] Udin A 2019 Meningkatkan Kompetensi Operator Alsintan melalui Pelatihan (Increase the Competence of Alsintan Operators through Training) Available from: http://www.swadayaonline.com/artikel/4434/Meningkatkan-Kompetensi-Operator-Alsintan-melalui-Pelatihan/ (cited 28 July 2020)
[15] Hanggana S 2017 Anal. Kebijak. Pertan. 15 137–49
[16] Friyatno S, Rachman H P and Supriyadi 2004 Kelembagaan jasa alat dan mesin pertanian (alsintan), Efisiensi dan Daya Saing Sistem Usahatani Beberapa Komoditas Pertanian di Lahan Sawah Available from: http://pse.litbang.pertanian.go.id/ind/pdf/files/pros-10_2004.pdf