

Root causes of underutilisation of assisted agricultural machinery on rice production in Indonesia

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Abstract. Several studies have shown that government-assisted agricultural machinery to increase rice production is underutilised optimally. This study aims to identify the problem of this non-optimality. This study employed the Root Cause Analysis (RCA) method with the Cause Effect Diagram (CED) and used data collected from in-depth interviews with 60 experts, who were selected deliberately. Respondents interviewed used the five whys analysis (FWA) technique to investigate the causal relationships of why agricultural machinery was underutilised and to choose policy alternatives employing the prospective simulations approach. The root causes of the non-optimal use of agricultural machinery consist of the suitability of the types of machinery, the limited number and lack of human resource capacities, the business environment, and business management. Policy and program synchronisation and synergy between local and central governments are needed to resolve the root causes of optimising the use of agricultural machinery to increase rice production.

1 Introduction

The use of agricultural machinery is one of the most important strategies to support agricultural production activities, starting from the land preparation stage to post-harvest, so that the production process can be carried out more quickly and efficiently. However, Indonesia lags behind Malaysia and Thailand [1]. Agricultural mechanisation can reduce poverty and contribute to food security by increasing land productivity and income. For example, smallholder farmers in Zambia who used mechanisation services increased their yields and incomes by 25% [2]. However, Agricultural mechanisation is not necessarily applicable to traditional farming practices. Smallholders must expand production and switch to high-demand, market-oriented crops to compensate for production costs [3].

In the last decade, the government has carried out a program to distribute pre-harvest, harvest, and post-harvest agricultural equipment and machinery through the Ministry of Agriculture. The massive distribution of tractors, tools, and agricultural machinery in recent times is expected to change the situation of farmers to operate more mechanised and modern

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agriculture [4]. The existence of agricultural machinery assistance from the government is not in line with its utilisation in the field. Several studies have found that agricultural machinery use is not optimal, unproductive, and even abandoned until it is not sustainable [5]. This agricultural machinery was found to be damaged and stored in warehouses without being repaired due to the limited costs of the association of farmer groups and the difficulty of obtaining the necessary spare parts [6].

Studies that discuss the root causes of the non-optimal utilisation of government-assisted agricultural machinery are still limited. The use of agricultural equipment and machinery in the field has resulted in many multi-dimensional problems, including technical, socio-cultural, economic, and environmental problems. The development and application of agricultural equipment and machinery are influenced by the type of agricultural tools and machinery that are suitable for the location, the availability of skilled operational personnel, workshop facilities, the availability of spare parts, access to financing, and government policies in avoiding the negative impacts of agricultural mechanisation [7–9]. The study by Azis et al. [10] shows that the sustainability of the tool and machinery assistance program does not provide benefits following the ultimate goal to be achieved, and the level of utilisation of agricultural machinery assistance is low, so it is not sustained, especially on 2-wheeled tractors and four-wheeled tractors. Therefore, this study was conducted to determine the root causes of the non-optimal use of government-assisted agricultural machinery.

2 Methodology

The analysis used primary data and a literature review. Data were analysed using the Root Cause Analysis (RCA) method with stages of analysis based on both primary and secondary data. A cause and effect diagram (CED), also known as a cause and effect chart in some literature, is an analytical tool that is easily applied/used to analyse the possible causes of a problem. Meanwhile, the Five Whys Analysis (FWA) is a system or analysis as an approach used to investigate causal relationships more deeply. The FWA investigates the cause and effect until the root cause is found a maximum of five times, asking why. FWA is used based on the meaning that root causes are often hidden below the surface; root causes provide support or serve as a basis; root causes relate to origins and sources; root causes can be primary and fundamental; and root causes exist and take root to cause a problem or event.

The root of the problem was obtained from in-depth interviews with 60 purposively selected respondents consisting of central, provincial, and city district officials, Field Agricultural Extension Workers (PPL), Farmer Groups/Gapoktan, and Agricultural Machinery Service Businesses (UPJA) in the provinces of Yogyakarta and Lampung which were then mapped into the CED.

Using an expert judgment approach, a Likert scale (weak = 1, medium = 2, and strong = 3) can be generated to measure the strength of the influence of alternative policy formulations and prospective analysis. Prospective simulations were conducted to choose policy alternatives with the most significant positive impact among existing policy options.

3 Results and discussion

Setiyanto [11] stated several causes of ineffective agricultural machinery assistance: (1) agricultural tools and machinery are not in accordance with local agroecosystems; (2) social conflicts arise due to shifts in rice labour and rice planting, as well as competition with pre-existing tractor and agricultural service providers; (3) there are no skilled operators and no workshops available in case of damage, difficulty in obtaining fuel in sufficient quantities; (4) management of extensive agricultural tools and machinery requires the provision of

warehouses and not all farmer groups have them, theft of agricultural machinery, especially tractors and water pumps, is increasing rapidly; (5) its use is dominated by elite groups and recipient group members in general lack adequate access to utilise; (6) recipients of assistance do not meet the requirements, have poor group management, and machines are not utilised; (7) lack of verifiers both in terms of verifying prospective recipients and verifying the suitability of agricultural machinery held with their submission, (8) inadequate socialisation, mentoring, coaching, monitoring and evaluation, and reporting.

Many countries have developed agricultural mechanisation, but its success has generally exceeded expectations. Studies from various countries show that mechanisation is considered the engine of agricultural transformation; only precise farm operations are still performed manually in high- and middle-income countries [12], while farm machinery and tractor power in Sub-Saharan Africa, parts of Latin America, and South Asia are almost negligible given the unsuitable total cultivated land area [13,14]. However, there is still potential for improvement, as the benefits of mechanisation options appropriate for smallholders' land size and resources can be substantial [15]. This is particularly the case in countries with increasing manual labour shortages caused by rural-to-urban migration of youth, which increases pressure on those left behind or staying in rural areas, especially female-headed farming households [13,16,17]. Despite increasing interest from policymakers and international donors to use mechanisation as an effective means of rural transformation [14,18], efforts to improve smallholder farm mechanisation have not been consistently successful.

The results of FGDs in Yogyakarta and Lampung Provinces show that the level of utilisation and the density of agricultural machinery at the aid location are the determining factors for the success and failure of the dynamics of managing government-assisted agricultural machinery. Both must concern all parties at the central, regional, and farmer group/UPJA levels. The low utilisation of agricultural machinery causes optimal agricultural machinery to meet the work capacity that should be insufficient to complete the work capacity. The absence of accurate data on land area and the number of agricultural machinery, both assistance and not every year, is a separate problem in making the right policy in optimising the utilisation of agricultural machinery assistance from the process to the outcome of a program. The design, technology level, and size of agricultural machinery with the specific conditions of the application area, which also vary, are other determining factors that impact the inefficiency of agricultural machinery utilisation and production performance. The density of the distribution of agricultural machinery causes saturation between dense and sparse areas, further reducing the effectiveness of the assisted agricultural machinery program. Mobilisation management between dense and sparse areas depends on distance, technical aspects such as water availability seasonality, and economic aspects such as profit and markets. These are separate considerations of the group/UPJA/Brigade-implementing actors in the field.

On the other hand, monitoring, evaluation, and reporting that do not work correctly at the centre, accompanied by weak data collection, monitoring, and evaluation due to limited human resources and regional budgets, become a source of social conflict and interests, giving rise to unfair competition, and better tools are idle. Based on the general and technical guidelines for activities, the objectives to be achieved are to ensure the availability, optimisation of use, professional management, and independence and sustainability of agricultural machinery at the farm level. Agricultural machinery assistance activities must have good planning and budgeting; however, this is not the case. Aspiration is one source of the assistance problem in one village or sub-district location. Development performance indicators, significantly increasing IP (planting area and harvest area) and productivity, escape the attention of those responsible for procuring agricultural machinery at the centre.

The results of the in-depth interviews lead to the conclusion that the deep conditions that cause the non-optimal utilisation of government-assisted agricultural machinery also arise

from the aspect of the type of agricultural machinery itself. The main thing is that it is easily damaged without after-sales services. The problem is spare parts that are expensive or obtained, and sometimes unavailable (not produced or must be imported). Issues also arise in the mismatch of agricultural machinery with the location and wishes of farmer groups. In other conditions, especially those related to the incompatibility of assisted agricultural machinery, it tends not to be utilised due to the unsynchronised identification of the needs of prospective beneficiaries against the availability of relatively uniform procurement of assisted agricultural machinery.

In addition, the availability of human resources who understand the operation, care, and maintenance coupled with the managerial aspects of poor management of assisted agricultural machinery is why agricultural machinery cannot optimally fulfil its maximum work capacity. Procurement activities for government-assisted agricultural machinery are not always carried out immediately through mentoring, training, and institutional capacity-building activities on the management of assisted agricultural machinery.

Increasing the utilisation of agricultural machinery is partly determined by the availability of workshop facilities and infrastructure, the ability to operate profit-oriented UPJA, and the availability of fuel. Intense competition between business actors in the rental of agricultural machinery services is one of the factors causing non-optimal agricultural machinery assistance. The density of the distribution of agricultural machinery causes saturation between dense and sparse areas, further reducing the effectiveness of the aid program. Mobilisation management between dense and sparse areas depends on distance, technical aspects such as water availability and seasonality, and economic aspects such as profit and markets. These are separate considerations of the group/UPJA/Brigade-implementing actors in the field. The external conditions of the business are very much determined by the maximisation of the utilisation of agricultural machinery assistance through investments such as improving workshop facilities and infrastructure and the ability to operate profit-oriented UPJA.

The result of the non-optimal utilisation of assisted agricultural machinery is the low utilisation rate and the density of agricultural machinery in an area. Non-optimal utilisation of agricultural machinery leaves various problems. The causes are successive and boil down to four root problems: (1) suitability of the type of agricultural machinery, (2) limited number and capacity of human resources, (3) business environment, and (4) business management. The complete root cause analysis is shown in Appendix 1, and the prospective policy analysis is presented in Appendix 2.

In-depth conditions of the causes of non-optimal utilisation of assisted agricultural machinery from the aspect of the type of agricultural machinery itself, the main ones are damaged, mismatched agricultural machinery to the location and wishes of farmers. Damaged aid equipment is more because it has reached its economic lifespan. In contrast, the observation of damaged equipment before reaching an economic age is caused by problems with the availability of spare parts, which are expensive, difficult to obtain, and sometimes no longer available. In other conditions, especially related to the mismatch of assisted agricultural machinery, it tends not to be utilised due to the unsynchronised identification of the needs of prospective beneficiaries against the availability of relatively uniform procurement of assisted agricultural machinery.

The availability of human resources who understand the operation, care, and maintenance coupled with the managerial aspects of poor management of assisted agricultural machinery is why agricultural machinery cannot optimally fulfil the expected maximum work capacity. The procurement activities of government-assisted agricultural machinery are not always immediately carried out through mentoring, training, and institutional capacity-building activities on the management of assisted agricultural machinery.

The management of agricultural machinery businesses, which is expected to bring more value to the institutional development of assisted agricultural machinery, is not shown. The average UPJA to Brigade, which is relatively advanced in management in the field, still records manually, and only a few group recipients can create investment opportunities from the utilisation of assisted agricultural machinery. The source of adding agricultural machinery asset units is still assisted agricultural machinery. In other words, recipients still expect to get new agricultural machinery to replace old machinery that has been damaged or has reached an economic lifespan.

The common thread of the root causes described comes from the effectiveness of implementation activities to the distribution and utilisation of agricultural machinery by central and regional governments. The performance of the utilisation rate and the indicator of the density level show the failure of the centralised procurement system of assisted agricultural machinery, and this is suspected to be the cause of the non-optimal utilisation of assisted agricultural machinery ranging from weak identification of needs to the distribution of assisted agricultural machinery, fostering recipient groups to develop into UPJA and other things, such as the problem of meeting the operational fuel needs of agricultural machinery still occurs in the field because the fuel filling station is not all willing to serve, showing many issues that must be addressed. Interesting findings in the area show that the procurement of agricultural machinery assistance by the region is considered better because the region knows the type of agricultural machinery needed better.

4 Conclusions and policy recommendations

Several causes of underutilisation of government-assisted agricultural machinery were found in this study. First, planning and procurement systems and mechanisms at the recentre are not well coordinated with the regions. Second, monitoring, evaluation, and reporting have not been conducted properly. Third, social and interest conflicts, unfair competition, and idle equipment result from a lack of coordination and synchronisation in the planning, procurement, and distribution of assistance between the recentre and the regions. Fourth, the specifications of the tools and machinery do not follow the proposals and needs. Fifth, there is a lack of mentoring, training, and institutional capacity-building for managing assisted agricultural machinery.

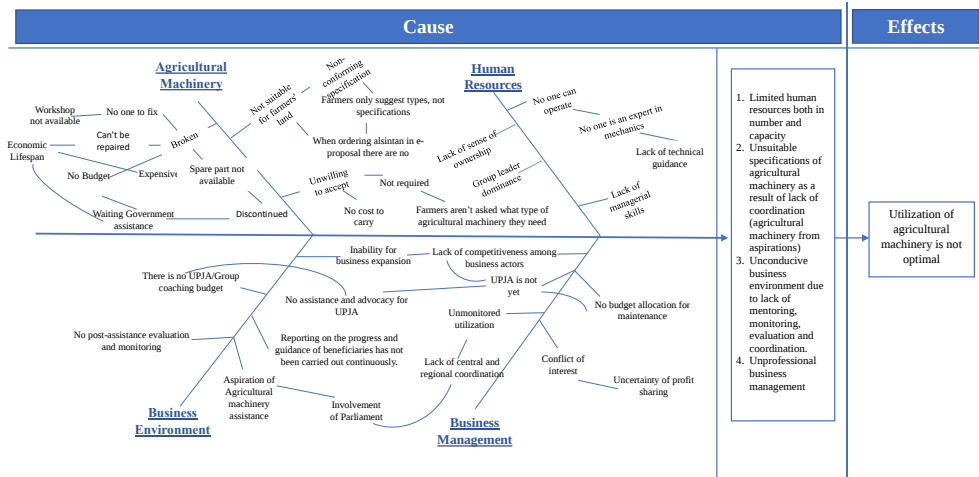
The central government needs to improve the planning, procurement, and distribution of agricultural machinery with a more balanced combination of the central government and regions. The role of the centre is more to coordinate with agricultural machinery providers regarding the number and expansion of after-sales services for assisted agricultural machinery (spare parts) and coordination with regions regarding the allocation and reallocation of types of agricultural machinery that are not optimally utilised between recipient locations that lack and need agricultural machinery and provide support and or training programs, guidance, and coaching for operators and managers that are more extensive and massive.

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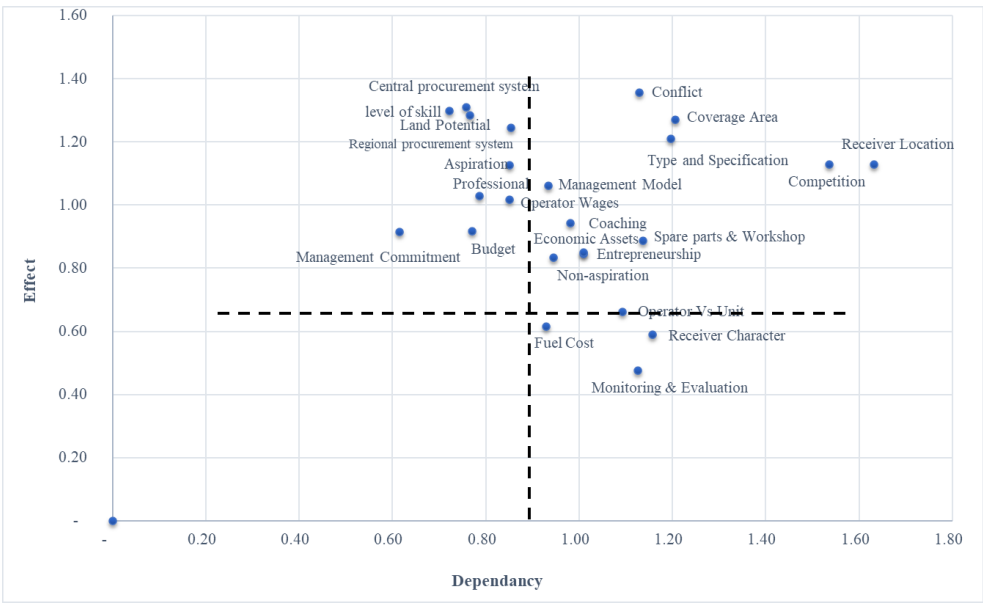
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Appendix



Appendix 1. Results of root cause analysis of optimising the utilisation of government-assisted agricultural machinery.



Appendix 2. Results of a prospective analysis of increased optimisation of government government-assisted agricultural machinery.