Bulletin of Community Engagement
Vol. 4, No. 3, December 2024
https://attractivejournal.com/index.php/bce//index

Application of Smart Rice Transplanter (SRT) to Improve Efficiency and Yield in Agricultural Areas

Salsabila Thifal Nabil Haq[1*], Wahyu Tri Handoko[2], Moh Zainul Falah[3], Imam Tree Utomo[4], Akmah Atikah Amilia[4], Fuad Indra Kusuma[4]
[1,2,3,4,5,6] *Univesitas Negeri Malang, Indonesia*

Corresponding Author : salsabilathifalnh@gmail.com

ARTICLE INFO
Article history:
Received
September 14, 2024
Revised
October 26, 2024
Accepted
November 19, 2024

Abstract

Seboro Village is located in Krejengan District, Probolinggo, East Java Province, with an area of 94.75 ha (4.50 mi^2) consisting of residential land, agricultural land, public facilities, and plantations. The main agricultural products in Seboro Village are rice in the rainy season and tobacco in the dry season. Seboro Village agriculture plays a very important role in maintaining food security because rice is the main raw material for food and also as the main agricultural producer. In the process of planting rice in Seboro Village itself, it is still relatively traditional, only using hands for the planting process in rice fields, so it requires a lot of workers so that the rice seedling planting process is completed quickly. On the other hand, the planting distance between rice seedlings is not the same so that it can interfere with the growth process between rice plants. Therefore, this community service activity proposes a hand-pushed rice planting tool or Smart Rice Transplanter (SRT) which is a tool to help plant rice in agricultural land efficiently and effectively without having to involve many workers. By using the Smart Rice Transplanter (SRT), it can also produce maximum rice harvest production because there is a system for providing planting distance when planting rice seedlings.

Keywords: Smart Rice Transplanter, Seboro Village, Agriculture

Published by CV. Creative Tugu Pena
ISSN 2774-7077
Website https://attractivejournal.com/index.php/bce/

INTRODUCTION

Indonesia is an agricultural country that has the potential to grow various agricultural crops such as rice, cassava, paddy fields, and other food crops that are important for national agriculture. Rice is very important for life because it is the main source of raw materials for carbohydrate content among various types of food, and has a strategic role in the development of the agricultural sector and the national economy (Falah dkk., 2023; Syairozi, 2020). By expanding rice farming, we can make a positive contribution to the provision of food and basic raw materials. (Wardhiani, 2019). Therefore, large-scale rice farming with higher yields can increase farmers' incomes and the local economy. (Handoko dkk., 2024; Kusumaningrum, 2019; Sujito dkk., 2022; Syah dkk., 2023).

Figure 1. Location of Seboro Village Partners

Seboro Village is located in the Krejengan area of Probolinggo, East Java, with an area of 94.75 ha (4.50 mi^2) consisting of residential land, agricultural land, public facilities and plantations (Maghfiroh dkk., 2021). The Seboro Village area consists of four hamlets with a village head. Located in the lowlands, Seboro Village has a flat land contour and fertile soil conditions, as well as a fairly good irrigation system so that it has great potential in producing large agricultural yields.

In Seboro Village, the results of agricultural harvests in the fields during the rainy season are rice and tobacco during the dry season. Rice is used as the main staple food in meeting life (Bahri, 2020; Latif dkk., 2022; Siregar, 2023). The results of the rice harvest in Seboro Village are less than optimal, sometimes unable to meet the needs due to increasing market demand and resulting in price increases(Vullo dkk., 2023). On the other hand, the process of planting rice in the fields is still carried out traditionally as in Figure 2. which requires a lot of labor in the rice planting process. This results in an increase in the cost of planting rice.

Figure 2 Agricultural Conditions in Seboro Village

In this context, because the rice harvest is less than optimal while market demand is increasing, the planting process is often carried out with a fairly close distance between rice plants. Of course, this is done in an effort to increase the harvest production results. However, the growth and development of plants will take longer because planting with a

certain distance is done in a traditional and unmeasured way(Bawa dkk., 2024; Ficetola dkk., 2024; Kothari & Schweiger, 2022; Panzarella, 2024; Rúa & Hoeksema, 2024).

Based on the problem put forward by Mr. Mosta'in as a partner who is the Head of Seboro Village, Krejengan District, Probolinggo, because there is no adequate equipment in the rice planting process which drains a lot of costs and is not measurable in regulating the planting distance which interferes with the growth and development of rice plants so that there needs to be a way to minimize costs and effectiveness of planting time and increase rice harvest production.

METHOD

For the problems and solutions provided to Mitra Desa Seboro, Krejengan District, Probolinggo Regency. A framework was prepared that explains the sequence that will be implemented next, such as observation to Smart Rice Transplanter training. In general, the implementation of community service includes:

1. Observation, this activity aims to identify partner needs. To obtain direct observation results, the team travels directly to the partner's location, conducts direct interviews with partners, and conducts documentation.
2. Preparation and design of Smart Rice Transplanter, this activity is carried out for one month and includes making agreements with partners and action plans, designing and calculating system design before field implementation, field results and observations obtained in the following steps:

a. Prepare the necessary materials, such as Smart Rice Transplanter equipment and rice seeds.
b. Cut the steel pipe to the desired size to form the rice planting machine frame. Install the hopper and clamp to complete the function of the Smart Rice Transplanter.
c. Prepare a seed container attached to the frame. The seed container has a clamp so that the rice seeds do not decompose.
d. Ensure that all tool components are properly and securely installed so that the tool can function properly when used.

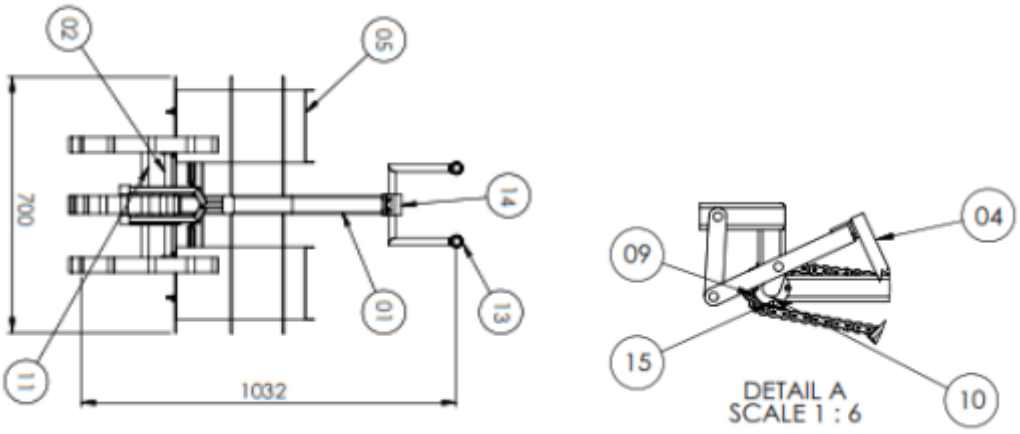

Figure 3. Smart Rice Transplanter Design

This Smart Rice Transplanter tool uses the principle of pulling the tool by hand (walking backwards) which is able to plant rice in agricultural land efficiently and effectively. In terms of use, this tool is equipped with a rotating wheel and a handle that makes it easy for users to move the tool. The Smart Rice Transplanter according to specifications consists of several parts as in Figure 3. where part 1. plant axis 2. planting arm 3. planting finger 4. Rice seedling holder 5. Sprocket 1 6. Sprocket 2 7. Chain 8. Bearing holder 9. Bearing 10. Rear wheel axle 11. Rear wheel 12. Handlebar 13. Handlebar holder 14. Bolt 15. Front wheel axle 16. Front wheel 17.

1. Simulation of the use and maintenance of Smart Rice Transplanter. This activity is carried out directly on site, with the following steps:
a. Training on the use of Smart Rice Transplanter. Partners will be given guidance to be able to use and maintain the Smart Rice Transplanter. This mechanism will be carried out directly in the field.
b. Demonstrating the correct and safe use of the tool. explaining how to fill the seeds, operate the tool, and plant rice using this tool.
c. giving training participants the opportunity to try using the tool directly. We will monitor and provide advice if we find errors in using the tool.
d. Explaining the benefits of using rice planting tools, such as saving time and energy, and increasing productivity.
2. Testing performance. System performance is tested to determine whether the prepared tool can work properly.
3. Team representatives with partners carry out the handover of the Smart Rice Transplanter whose use has previously been simulated.
4. Documentation. Either in the form of photos or videos of this activity starting from the beginning to the end of the process.
5. Evaluation.
a. Monitoring the use of the tool regularly to ensure that the tool is still in good condition and functioning properly.
b. In an effort to increase the use of tools in the long term, feedback needs to be provided to tool users.
c. Conducting an evaluation of the success of tool use in increasing productivity and efficiency in planting rice.

RESULT AND DISCUSSION

This community service activity was successfully implemented in Seboro Village with the main objective of increasing efficiency and yields in agricultural areas as one of the relevant innovations in this era. This series of activities aims to ensure that the tools can be utilized optimally and farmers have the technical skills needed to operate and maintain the tools, as well as foster a sense of responsibility in their use to increase rice yields in the village. The following are the stages of the results of this activity:

1. Tool Making

The making of the Smart Rice Transplanter (SRT) tool began with design planning and technical specifications according to the needs of agricultural land in Seboro Village. The technical team designed a tool that is efficient, lightweight, and easy to operate. Materials were selected to ensure durability in field conditions and ease of maintenance by local farmers. After the tool was completed, a functional test was conducted to ensure that the tool could operate properly in the field.

2. Tool Use Socialization

Socialization is carried out to introduce the SRT tool to farmers and show how to use it to maximize results and maintain the durability of the tool. Socialization activities include farmer group meetings at the village hall, basic technical training on how to operate and maintain the tool, and direct simulations on agricultural land. In this session, farmers are given the opportunity to try the tool, ask questions, and understand the technical use of the tool.

Figure 4. Socialization of Tool Use

3. Signing of the Handover Document of the Equipment

Before the equipment is handed over, the team carries out a process of signing the handover document as a form of documentation and responsibility. The file contains equipment data, technical specifications, and the responsibility for use by the village as well as the commitment to equipment maintenance by the farmer group. This process is carried out officially in the presence of village officials, community leaders, and members of the farmer group.

Figure 4. Signing of the equipment handover documents

4. Handover of the Tool

The handover of the Smart Rice Transplanter tool to the farmer group as the final stage of the activity. The handover was carried out symbolically at the village hall, attended by members of the farmer group and village officials. This tool is expected to be able to increase agricultural productivity in Seboro Village and be an inspiration for the use of efficient agricultural technology in the future.

Figure 5. Handover of tools to partners

Table 1. Impact of Benefits Before and After Activities

Aspect	Before Acticity	After Activity
Rice Plant Productivity	The yield is relatively low with less than optimal yield per hectare	Productivity increases by 15-20% with more uniform yields and an increased number of tillers per clump
Labor Efficiency	Requires more labor with time-consuming manual planting process	Labor efficiency increases by 30%, and planting time is reduced by 40%
Operating Costs	Higher operating costs due to intensive manual labor	Operating costs down by up to 25%, reducing labor requirements, making long-term spending more efficient
Soil Health and Condition	Soil often becomes compacted and uneven due to manual planting methods	Soil structure is more stable, plant roots are stronger, and nutrient distribution is better
Farmer Knowledge and Skills	Limited to manual planting techniques without the use of modern technology	Farmers are more skilled in modern planting technology through training in the use of SRT
Economic Impact on Farmers	Income is relatively stable, but less increased due to low yields	Income increases due to higher productivity, reduced labor costs, and time efficiency

CONCLUSION

The application of the Smart Rice Transplanter (SRT) in this community service activity has a significant positive impact on rice plant productivity and the efficiency of the planting process in Seboro Village. The increase in harvest yields by 15-20% proves that this technology is able to improve the quality and quantity of production. In addition, the labor efficiency achieved, with a reduction in labor requirements of up to 30% and a reduction in planting time by 40%, shows that SRT not only increases productivity but also reduces overall operational costs. This activity has succeeded in increasing farmers' skills and knowledge about modern technology in agriculture, as well as introducing more structured and systematic planting methods. With intensive socialization and training, farmers in Seboro Village are now able to operate and maintain SRT independently. The official handover process also creates a sense of responsibility for farmers to utilize and maintain the tools properly for the sustainability of this technology in supporting increased harvest yields in the future. Overall, this activity achieved its objectives, namely increasing productivity, efficiency, and knowledge of farmers in implementing modern agricultural technology. The results of this activity are expected to inspire the development of similar agricultural technology in other villages, so that it can support food security through increasing sustainable agricultural yields.

ACKNOWLEDGEMENT

A special thanks to the State University of Malang's Institute for Research and Community Service (LP2M) for providing the service team with help, money, and opportunities through non-APBN funding UM Fund Source for Fiscal Year 2024. Thank you also to the partners of the for allowing the crew to participate in this activity. We would want to thank all of the participants in this activity for helping to ensure that it works successfully.

REFERENCES

Bahri, S. (2020). Dampak Penyuluhan Pertanian Terhadap Produktivitas Padi Sawah. *JU-ke (Jurnal Ketahanan Pangan)*, *3*(2), 15–19.

Bawa, G., Liu, Z., Yu, X., Tran, L.-S. P., & Sun, X. (2024). Introducing single cell stereo-sequencing technology to transform the plant transcriptome landscape. *Trends in Plant Science*. https://www.cell.com/trends/plant-science/fulltext/S1360-1385(23)00329-1

Falah, M. Z., Handoko, W. T., Syah, A. I., Azizah, F. Z., Sujito, & Gumilar, L. (2023). IMPLEMENTATION OF SMART FARMING BASED SOLAR CELL SYSTEM IN HYDROPONIC IN THE AGRICULTURAL AREA OF BLITAR VILLAGE. *Community Development Journal : Jurnal Pengabdian Masyarakat*, *4*(4), Article 4. https://doi.org/10.31004/cdj.v4i4.18161

Ficetola, G. F., Marta, S., Guerrieri, A., Cantera, I., Bonin, A., Cauvy-Fraunié, S., Ambrosini, R., Caccianiga, M., Anthelme, F., & Azzoni, R. S. (2024). The development of terrestrial ecosystems emerging after glacier retreat. *Nature*, *632*(8024), 336–342.

Handoko, W. T., Falah, M. Z., Fakhruddin, D., Itqon, M. S., Gumilar, L., & Afifah, F. W. (2024). Implementation of Caterpillar Pest Control (CPC) on Solar Cell Based Onion Plants to Increase Productivity. *Bulletin of Community Engagement*, *4*(2), 126–133.

Kothari, S., & Schweiger, A. K. (2022). Plant spectra as integrative measures of plant phenotypes. *Journal of Ecology*, *110*(11), 2536–2554. https://doi.org/10.1111/1365-2745.13972

Kusumaningrum, S. I. (2019). Pemanfaatan sektor pertanian sebagai penunjang pertumbuhan perekonomian indonesia. *Transaksi*, *11*(1), 80–89.

Latif, A., Ilsan, M., & Rosada, I. (2022). Hubungan peran penyuluh pertanian terhadap produktivitas petani padi. *Wiratani: Jurnal Ilmiah Agribisnis*, *5*(1), 11–21.

Maghfiroh, R., Ati, N. U., & Sunariyanto, S. (2021). IMPLEMENTASI KEBIJAKAN DINAS KETAHANAN PANGAN DAN PERTANIAN DALAM MENINGKATKAN KESEJAHTERAAN PETANI (Studi Dinas Ketahanan Pangan Dan Pertanian Kabupaten Probolinggo). *Respon Publik*, *15*(4), 67–74.

Panzarella, B. (2024). *Hügelkultur at Wairarapa Moana: Exploring the effects of buried coarse woody debris on revegetation efforts in a high-stress growing environment* [PhD Thesis, Open Access Te Herenga Waka-Victoria University of Wellington]. https://openaccess.wgtn.ac.nz/articles/thesis/H_gelkultur_at_Wairarapa_Moana_Exploring_the_effects_of_buried_coarse_woody_debris_on_revegetation_efforts_in_a_high-stress_growing_environment/26094238

Rúa, M. A., & Hoeksema, J. D. (2024). Interspecific selection in a diverse mycorrhizal symbiosis. *Scientific Reports*, *14*(1), 12151.

Siregar, M. A. R. (2023). *PENINGKATAN PRODUKTIVITAS TANAMAN PADI MELALUI PENERAPAN TEKNOLOGI PERTANIAN TERKINI*. https://osf.io/g98xr/download

Sujito, S., Soekopitojo, S., Susanto, H., Wirawan, I. M., Falah, M. Z., Basthony, R. M., & Bharotoyakti, A. (2022). Pemberdayaan Masyarakat Dalam Pengolahan Hasil Pertanian Sebagai Ketahanan Ekonomi Selama Pandemi Covid-19 Di Desa Pejok Kecamatan Kepohbaru Kabupaten Bojonegoro. *Prosiding Seminar Nasional*

Pengabdian kepada Masyarakat (SINAPMAS), *0*, Article 0. http://conference.um.ac.id/index.php/sinapmas/article/view/3714

Syah, A. I., Handoko, W. T., Falah, M. Z., Kurniawan, R., Hafid, A., & Prasetya, D. D. (2023). Implementation of Smart Corn Planter (SCP) to Support Food Security in Agricultural Area Gondosuli Village Probolinggo Regency. *Bulletin of Community Engagement*, *3*(2), 136–143.

Syairozi, M. I. (2020). Analisis Kemiskinan di Sektor Pertanian (Studi Kasus Komoditas Padi di Kabupaten Malang). *Media Ekonomi*, *28*(2), 113–128.

Vullo, L., Palermo, V., Boer, R., Wahid, L., Hadinata, F., Kinasih, S., Rakhman, A., & Bertoldi, P. (2023). *Technical Guidance for Development of Cities' CAP in Indonesia in the frame of GCoM*. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC131301/JRC131301_01.pdf

Wardhiani, W. F. (2019). Peran Politik Pertanian dalam Pembangunan Pertanian menghadapi Era Revolusi Industri 4.0 di Sektor Pertanian. *JISIPOL| Jurnal Ilmu Sosial Dan Ilmu Politik*, *3*(2), 83–94.