:: IJEBD ::
(International Journal of Entrepreneurship and Business Development)
Volume 06 Number 06 November 2023

ISSN : 2597-4785 (ONLINE)
ISSN : 2597-4750 (PRINTED)

Solar Power Water Pump Technology Ellak Daya Village Farmers, Modern Business, Economic and Rural Agricultural Irrigation Supported by Smart Hybrid Inverter System in Ellak Daya Village, Sumenep, Indonesia

Cholilul Chayati[1], Ahmad Suwandi[1], Ribut Santosa[1], Muhammad Ikhsan Setiawan[2], Adi Prawito[2], Agus Sukoco[2]
[1]Faculty of Engineering, Wiraraja University, Sumenep, Indonesia
[2]Narotama University, Surabaya, Indonesia
Corresponding Author*: cholilul@wiraraja.ac.id

ABSTRACT

Purpose: Ellak Daya Village, situated in the Lenteng sub-district of Sumenep Regency, primarily features dry land, constituting 63.3% of its total area. The main crops cultivated on this arid land include corn, beans, soybeans, rice, and herbal chilies. However, the productivity of these fields significantly decreases during the dry season, posing a challenge to the village's economic well-being. This circumstance has labeled Ellak Village as having the potential for extreme poverty, as identified through a problem analysis. Issues primarily revolve around management, encompassing the organization of planting patterns and irrigation schedules. In the processing sector, challenges include the absence of cost-effective irrigation facilities and effective irrigation methods. The objective of the training and mentoring initiatives is to equip farmer groups with the skills needed to regulate planting patterns, manage irrigation schedules, and integrate technology, such as solar cell pumps utilizing natural energy sources.

Design/methodology/approach: The activities, encompassing FGD, socialization, training, and mentoring, are scheduled to take place between September 26 and November 20, 2023, at both the village hall and the residences of farmer groups. Challenges in this initiative include the advanced age (50 years and above) and lower educational levels of the participants.

Findings: The program's success will be evaluated through Pre-Test and Post-Test assessments, with the goal of ensuring that 100% of participants are knowledgeable about planting procedures, and 40% comprehend the intricacies of setting planting patterns. It is noteworthy that attendance at training and mentoring activities averages above 65% of the total member count.

Paper type: Research Paper

Keywords: *Ellak Daya Village, Farmer, Village Economic, Drainage Systems, Solar Cell*

Received : August 13th
Revised : October 18th
Published : November 30th

I. INTRODUCTION

Ellak Daya Village, situated in the Lenteng sub-district of Sumenep City, is characterized by its location in a highland area and is primarily engaged in agricultural activities. The village's agricultural land spans 67 hectares of rice fields, 399.09 hectares of moorland, dry land, and huma, constituting approximately 63.3% of the total agricultural land. Additionally, there are 5 community forests covering 00 hectares, while the remaining 49.50 hectares are designated for residential use. The predominant economic activity in Ellak Daya is agriculture, with most residents working as farmers. While the village holds substantial potential in agriculture, activities are predominantly confined to the rainy season, limiting the cultivation of crops such as rice, soybeans, and corn. In the dry season, the lack of a reliable water source poses a challenge, with existing water pumps having limited

ISSN : 2597-4785 (ONLINE)
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capacity and high operational costs, particularly burdensome for small-scale farmers. This limitation results in reduced productivity during the dry season, contributing to the village's potential classification as experiencing extreme poverty. Management of planting patterns becomes crucial for determining water requirements in dry lands, and irrigation scheduling is essential for ensuring timely and adequate water supply to all fields. One of the pressing issues in processing is the inefficiency of current irrigation facilities, often utilizing expensive small pumps that do not reach all dry lands, especially those distant from water sources. With high operational costs and time constraints, an alternative approach, such as using solar-powered water pumps, is proposed to enhance effectiveness and efficiency. Corn serves as an example of agricultural productivity, with the land capable of producing 400 kg/1,250 m² during the rainy season, but facing limitations in the dry season. The proposed solar-powered water pump infrastructure aims not only to irrigate agricultural land effectively but also to meet the clean water needs of the Ellak Daya community. This initiative seeks to boost the income of local farmers, enhancing overall business income from agricultural products in Ellak Daya. The assistance provided will focus on management and processing technology, with predetermined key performance indicators aligning with the intended benefits for the community partners [1]-[7]

II. METHODS

Insufficiency in power and water availability poses challenges for farmers. Conventional irrigation methods lack efficiency in addressing multifaceted concerns such as water availability, energy sources, and timely soil profile analysis. Combining automation with traditional irrigation methods presents a significant opportunity to alleviate water and power crises. Cost-effective solar power emerges as a viable solution for energy needs, particularly in the context of Indian farmers. Solar-powered smart irrigation systems, featuring a solar-powered water pump and automatic water flow control through a moisture sensor, offer a compelling solution to the current energy crisis faced by Indian farmers. However, it's essential to note that this system operates only during daylight hours and is ineffective in areas without a grid. Indian farmers commonly utilize drip or sprinkler systems, which, aside from wasting water, can lead to issues like root rot, stunted growth, and reduced yields. Employing an automated irrigation system becomes crucial for conserving water and labor resources. The integration of smart technology in irrigation represents a significant shift from traditional methods, offering advantages in efficiency. The proposed smart irrigation system, powered by solar energy, automates the irrigation process, utilizing the sun's energy to operate the water pump. In addressing management challenges related to planting patterns, the PKM team aims to simplify the process for partners who find recording or creating planting patterns complicated. Training will be provided to enhance skills in recording simple planting patterns, streamlining partner business records. Addressing irrigation schedule system management issues, the team will impart an understanding of calculations for scheduling irrigation based on water needs and a rotation system. The target is a 100% achievement in partners' ability to create and apply this system. The rotation system, managed by operators or officers, ensures optimal water distribution for partner agricultural land. In the processing sector, the focus is on designing an effective, efficient, and affordable water pump technology, exemplified by the Solar Power Pump Farmer Technology with a smart hybrid inverter. Partners will receive training on operating the new pumps. The application of sound business management and processing technology is expected to achieve agricultural production targets, directly impacting partner income and motivating other farmers to harness their potential productively [8]-[19]

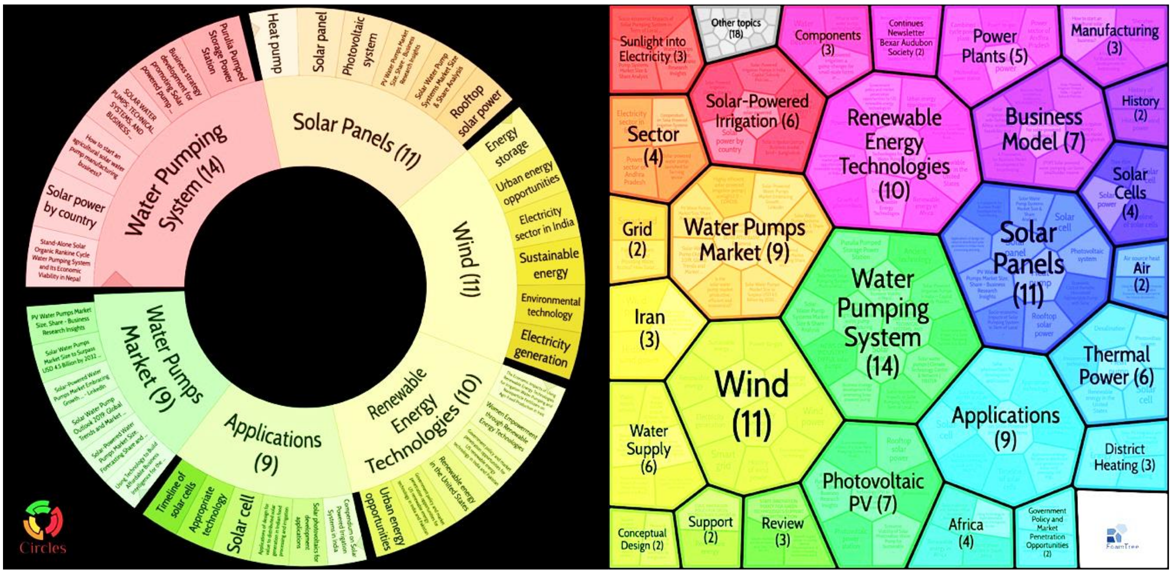

Figure 1. Solar Power Water Pump Technology, Economic, and Business, research trend in Web https://search.carrot2.org/

III. RESULTS AND DISCUSSION

This program is executed through several stages, addressing identified problems and agreed-upon solutions by the KOSABANGSA Team in collaboration with activity and target partners. The activities involve training and mentoring and are structured. Scheduled for September 26, 2023 (offline) and September 27, 2023 (online) at the village head's residence. Participants include the Accompanying Team, Implementation Team, Village Head, Village Apparatus, chairperson of the target farmer group, representatives of farmer groups, and students. Objectives include initial coordination of the Accompanying Team with partners for land condition assessment and construction planning and the socialization of planned activities and technology to target partner members. Conducted on November 14, 2023, at the Ellak Daya village hall. Participants include the Implementation Team, village head, hamlet head, 2 members of the farmer group, and students. The aim is to provide training and assistance to farmer groups on organizing planting patterns based on crop type, agricultural land area, and water availability. Implemented in two activities, each conducted within specific groups to ensure thorough understanding by farmer groups. Held at the ABDIKA Farmer's group on November 15, 2023, at the house of the head of the farmer's group, Mr. Syarkawi. Participants include the implementing team, all members of the farmer's group, village heads, and hamlet heads. Conducted at the MATHLUBI Farmer group on November 20, 2023, at the house of the head of the farmer group, Mr. Ahmad. Participants include the implementing team, all members of the farmer group, village heads, and hamlet heads. These activities aim to enhance the skills and understanding of farmer groups in critical aspects of agricultural management and processing, contributing to the overall success of the program.

OBSTACLES TO ACTIVITIES: (1) The average age of actively participating members in farmer groups is above 50 years, and their educational background ranges from elementary to high school, resulting in a suboptimal grasp of the training material; (2) The execution of training activities deviated from the planned schedule due to the need for adjustments to accommodate the group's availability for attendance; (3) The heightened engagement of both activity partners and target partners has influenced the execution of the Solarpower Pump Farmer Technology in Ellak Daya Village, focusing on modern rural agricultural irrigation facilitated by a smart hybrid inverter system; (4) The younger generation exhibits diminished interest in cultivating the existing agricultural land.

ISSN : 2597-4785 (ONLINE)
ISSN : 2597-4750 (PRINTED)

Figure 1. Solar Power Water Pump Install in Ellak Daya, Sumenep

ACHIEVEMENT OF ACTIVITY TARGET: The assessment of program success is gauged through Pre-Test and Post-Test evaluations administered to participants, delineated as follows: (1) In the Management training focused on setting planting patterns, 35 members from the two partner groups participated. Before the training, the Pre-Test results indicated that 25% on average were unfamiliar with planting pattern procedures. Following the training, the Post-Test revealed a 50% improvement in knowledge about planting pattern procedures. (2) In the Management processing training concerning regulating the irrigation system using the rotation method, the ABDIKA farmer group, comprising 26 members, saw 18 participants attending (70% of total members). All attending farmer group members displayed significant interest in the training, with 100% understanding of the conveyed material on land irrigation through the rotation method. Pre-Test and Post-Test results demonstrated the partners' enhanced comprehension of the irrigation system's arrangement using the rotation method. The average Pre-Test score was 25, which increased by 82%. (3) In the Management processing training focusing on regulating the water system using the rotation method within the MATHLUBI farmer group, 17 members attended (70% of total members). Similar to the ABDIKA group, all participating farmer group members exhibited keen interest in the training, with a 100% understanding of the conveyed material about land irrigation using the rotation method. The Pre-Test and Post-Test results revealed the partners' improved understanding of the drainage system arrangement using the Rotation method, with the average Pre-Test score of 25 increasing by 82%.

ISSN : 2597-4785 (ONLINE)
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Figure 2. Solar Power Water Pump in MATLUBI and ABDIKA Farmer Group, Ellak Daya, Sumenep

The location of Solar Power Water Pump Install in Ellak Daya village, are: (1) Location 1, ABDIKA: Water depth 48 meters, water surface 20 meters, pipe size 5'; and (2) Location 2, MATLUBI: Water depth 56 meters, water surface 28 meters, pipe size 5'.

V. ACKNOWLEDGEMENT

This Program Kosabangsa was supported by the grant of Directorate of Research, Technology, and Community Service, Directorate General of Higher Education, Research, and Technology, Ministry of Education, Culture, Research, and Technology, year 2023

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