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MINERAL WATER TREATMENT TECHNOLOGY USING RO MACHINES TO IMPROVE HEALTHY LIVING QUALITY & ECONOMY FOR MDT AL-KARIMAH AND THE SURROUNDING COMMUNITY

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Abstract

The Community Service Program (PKM) was carried out at Madrasah Diniyah Takmiliyah (MDT) Al-Karimah, Cibunar Village, Kadudampit District, Sukabumi Regency, West Java. The background of the activity is the problem of limited access to healthy mineral water and the need to improve the economy of the MDT and the surrounding community. The solution of this program is to improve the quality of healthy living through the provision of mineral water based on Reverse Osmosis (RO) technology while empowering the economy of MDT Al-Karimah through the management of drinking water refill depots. The implementation method includes program socialization, technical and managerial training, installation of RO machines with a capacity of ±80 gallons/day, operational assistance, and sustainability evaluation. This activity is participatory, involving students, MDT administrators, and the local community, with the support of the village and sub-district governments. The results of the activity showed that the mineral water produced passed the feasibility test of the Sukabumi Regency Health Office, so it was safe for consumption. The conclusion is that this program has contributed for providing dual benefits, namely improving the quality of public health through access to hygienic drinking water and strengthening the economy of MDT-based communities.
Keywords: Abdimas, Reverse Osmosis, Mineral Water, Economic Empowerment, DTA Al-Karimah

INTRODUCTION

1. Analysis of Partner Situations and Problems

Madrasah Diniyah Takmiliyah (MDT) Alkarimah, domiciled; at Address: Cibunar Village RT.19 RW.05, Kadudampit Village/District, Sukabumi Regency, West Java. DTA is engaged in the Field: Education and Social, with permission from the Head of the Office of the Ministry of Religion of Sukabumi Regency, West Answer, Number: 5172, Year 2021, August 3, 2023, and MDT Statistical Number: 311.2.32.02.1543. with Accredited status A. This MDT houses several institutions that play a role in the development of education and religion in the surrounding environment.

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Figure 1. Madrasah and Al-Karimah Mosque Building

MDT Al-Karimah was founded by KH. Uwes Al-Qorni, with the composition of the board consisting of, Head: KH. Uwes Al-Qorni, Advisors: H. Idim Dimyati, and Lukmanul Hakim, Supervisors: Aris Sabara, and Arbi Rodibillah SH., Secretary: Rina Nurafiyah., Treasurer: Sara Fadla

MDT Al-Karimah's vision is to become an educational and social institution based on Islamic values, contribute to educating the nation's life, and build a society that is moral and independent.

MDT Al-Karimah's mission, To provide quality and affordable Islamic-based education for the community, to nurture the young generation to have a strong understanding of religion, to have noble character, and to be able to compete in the modern era, to develop social activities that can help the underprivileged, including the provision of educational, economic, and humanitarian assistance, to increase the role of mosques and taklim assemblies as centers of Islamic learning and to strengthen Islamic ukhuwah, Establish cooperation with various parties, both government and private, in supporting educational and social programs.

MDT Al-Karimah Activities, MDT Alkarimah Cibunar Education is active in various activities that support education and social, including, Formal & Non-Formal Education, Managing Madrasah Diniyah as a place to learn religion for children and adolescents, Organizing Islamic studies to improve people's religious understanding, Social and Religious Activities, Compensation for orphans and the poor, Waqf and alms programs for the construction of educational and religious facilities, Routine recitation and training for students and congregations of the taklim assembly, the Thirty Recitation Community Development (KTT) which was attended in 47 districts and its members were also mosque worshippers in these sub-districts. The Summit activities were strengthened by Regent Regulation Number. 55/Year 2022

Community Empowerment includes Training Skills to increase self-reliance community economy, Free tutoring programs for underprivileged children.

Figure 2. Students/students fostered by MDT Al-Karimah

MDT Alkarimah Cibunar is committed to continuing to contribute to the development of human resources based on Islamic values and social good. Hopefully the existence of this MDT will provide more benefits to the surrounding community.

Figure 3 Religious Ceremonial Activities in MDT Al-Karimah

2. Purpose of the Activity

One of MDT Al-Karimah's visions is to develop social activities that can help underprivileged communities, including the provision of mineral water to improve the quality of healthy life and improve the economy for MDT Al Karimah and the surrounding community. In order to carry out the community empowerment, the PKM program will hold an RO (Reverse Osmosis) machine to process clean water into healthy mineral water for the needs of MDT Al Karimah and the surrounding community, as well as improve the economy (provide a source of income) for MDT Al Karimah for every gallon of mineral water from consumers or the surrounding community.1

This PKM program aims to improve the quality of healthy life for MDT Al Karimah and the surrounding community through Mineral Water Treatment Technology Using RO Guna Machine, and improve the economy (providing a source of income) for MDT Al Karimah.2

One of the activity programs carried out by MDT is the provision of clean water traditionally, and is managed by the student community and the surrounding community. However, the clean water does not yet have a healthy quality of mineral water for direct consumption.3 Limited capital/investment is the main obstacle in the procurement of clean water. Another problem is the lack of understanding of partners in the implementation of sustainable and efficient healthy quality drinking water (mineral water) technology, both in

technical and managerial aspects4.

This activity also supports the implementation of the Independent Learning Independent Campus (MBKM) program and the Main Performance Indicators (KPIs) of universities in community service.

Improving the quality of healthy life (mineral water) and economy through the application of RO (Reverse Osmosis) machine technology. The specific objectives of this PKM include:

1) Improving Partner Skills and Capacity: Through training and mentoring, partners will have a better understanding of managing a healthy quality of life (mineral water) intensively.
2) Increasing Partner Income: With RO (Reverse Osmosis) machine technology, it is hoped that partners can obtain additional sources of income (economy) from gallon refill activities to consumers and the surrounding community, which has an impact on partners to improve serving and fostering the community through a healthy lifestyle as well as having an impact on the health of the surrounding community, as well as improving the development of the wider community.
3) Implementing environmentally friendly technology in the form of RO (Reverse Osmosis) machine technology that produces mineral water (healthy quality of life).
4) Encouraging the economic independence of MDT Al Karimah in a sustainable manner with an innovative approach based on research and service.

IMPLEMENTATION METHOD

The method of implementing this program is designed with the stages of program implementation including:

1. Stages or Steps in Implementing Solutions

In order for the program to be implemented effectively and have a sustainable impact, its implementation is designed through the following systematic stages:

a. Program Socialization

In the initial stage, socialization activities were carried out to the main partner (MDT AL-KARIMAH), local residents, and students. The goal is to Convey the program's intent, objectives, and benefits holistically, Build shared participation and commitment from the start, and Identify local potential and community support.

b. Training and Capacity Building

After socialization, training was carried out which covered two aspects of RO (Reverse Osmosis) machine technology, including maintenance, water quality measurement, and equipment utilization, and managerial business of mineral drinking water refill depots, such as financial records, business analysis, and crop marketing strategies.

This training is aimed at students, MDT administrators, and residents who will be the main implementers of the business.

c. Application of RO (Reverse Osmosis) Machine Technology:

This stage is the direct application of technological solutions in the form of installation/installation of RO machines, this installation is also a pilot project model that can be replicated to other units.

d. Mentoring and Evaluation

Assistance is carried out periodically by the implementation team to monitor the effectiveness of the technology and business management applied, Evaluation is carried out by measuring changes in productivity, water quality, partner skills, and market potential, Feedback is obtained from partners for technical refinement and sustainability strategies.

e. Program Sustainability Strategy

Strategies were prepared so that the program could continue to run after the intervention, such as the formation of a fisheries joint business group (KUB), the preparation of SOPs, the involvement of MDT administrators, and the search for marketing partners were also carried out to support sustainability, opportunities for the development of long-term collaboration with the government, corporate CSR, and education donors were also opened.

2. Method of Stages of Implementation of Community Service

This service program is implemented gradually and systematically to ensure that each intervention has a real and sustainable impact. The following is a description of each stage of implementation:

a. Socialization

This initial stage aims to introduce the program comprehensively to all relevant parties. Meeting with Partners: Socialization was carried out through a discussion forum between the implementation team, MDT Al-Karimah management, and community leaders. The objectives, benefits, and mechanisms of the program were conveyed openly. Stakeholder Involvement: Invite village governments, representatives of local fisheries agencies, and fishing communities to provide support, direction, and open opportunities for cross-sector synergy.

b. Training

The training is carried out intensively and applicatively so that partners have practical skills that can be applied immediately. Technical Training: Focus on how to use and maintain electric-powered waterwheels, including water quality measurement and pond management, Managerial Training: Includes simple financial recording techniques, feed stock management, as well as business planning and crop marketing. Business Plan Assistance: Partners are guided to prepare a refillable drinking water depot business plan, in order to be able to manage the business independently and in a long-term orientation.

c. Application of Technology

This is the phase of real implementation of the technological solutions proposed in the program, RO (Reverse Osmosis) Machine: Carried out at the MDT Al Karimah Location which is close to the source of clean water, Effectiveness Testing: The team observed the use of RO machines whether they could produce refillable drinking water effectively, Local Technology Adaptation: Adjusting the use and operation of the device to local conditions to make it more efficient and easy to maintain by the community.

d. Mentoring and Evaluation

This stage serves to ensure that all programs run according to plan and can be improved based on field conditions. Routine Monitoring: Periodic inspection of the quality of water sources, and the performance of RO (Reverse Osmosis) machines, Skill Evaluation: Measuring the effectiveness of training by looking at changes in behavior and partners' ability to manage businesses, Strategy Adjustments: Based on the results of the evaluation, technical or

managerial revisions are carried out to optimize the program. Objective: Ensure the effectiveness of the program and support gradual capacity building.

e. Program Sustainability

This step is a determinant of the long-term success of the service program. Formation of Management Team: Formed from elements of MDT and the community in charge of maintaining facilities and managing fishery businesses, Long-Term Collaboration: Collaborating with academics and government agencies to support the replication of programs to other communities or on a larger scale. Objective: Maintain the sustainability of the program, ensuring sustainable benefits.

3. Methods of Approach and Application of Technology and Innovation

In implementing this service program, the approach used is participatory, adaptive, and based on the real needs of partners, by utilizing appropriate technological innovations (RO / Reverse Osmosis machines).

This approach is done through the following key strategies:

a. Suitability of Work Volume

This program ensures that the technological capacity and activities carried out are proportionate and in accordance with the carrying capacity of clean water sources and partners' capabilities.

- The number and specifications of RO (Reverse Osmosis) machines are adjusted to the size of the clean water source and the ability to supply clean water raw materials.
- The volume of training and the intensity of mentoring are regulated based on the number of active participants and the ability to absorb material.

Objective: Ensure that the technology used is truly optimal and effective.

b. Priority Scale Suitability

The program is focused on the main problems of the partners, which have been identified in advance in the field assessment process. Three main focuses are priorities:

1. Improving Water Quality: By using clean local water sources to optimize the quality of refillable drinking water, thus supporting the growth of production.
2. Production Efficiency: Encourage the systematic and efficient use of RO (Reverse Osmosis) machines so that the production of mineral drinking water is maximized at minimal cost.
3. Marketing Access: Connecting production products with a wider and more competitive market to increase the selling value of refillable mineral drinking water.

Objective: To direct program resources to aspects that have a major impact on the success of the partner's business.

c. Partner Participation

The partner is not only the object of the activity, but also the active subject in the entire service process. Partners are involved in the process of planning, training, observing the process of installing tools, to evaluating results, Encouraged to develop business groups based on collaboration and mutual help between fellow residents or students, Active participation of partners strengthens the sense of ownership and sustainability of the program. Objective: To foster the independence of partners and strengthen business sustainability.

d. Evaluation and Sustainability

The application of technology and innovation will be monitored and evaluated

periodically to ensure the effectiveness and opportunities for further development. The success indicators used include Increase in refillable mineral water production by at least 10%-20%, Operational and electricity cost efficiency, Formation of sustainable business groups, Evaluation is also used to adjust technical approaches and improve weaknesses that arise in the field, Sustainability plans will be drawn up with partners, including advanced training and the formation of a local management team. Objective: To make the program not stop at the initial intervention phase, but to continue to grow and benefit in the long run.

4. Implementation Stages Based on Partner Characteristics for Economically Unproductive Partners

This service program is designed by considering the characteristics of partners, namely not yet economically productive, and has great potential to be developed through social and technological empowerment. Therefore, the approach is carried out through four main aspects:

1) Social Aspects of Society

Focus on improving the quality of human resources and public awareness in utilizing technology for economic empowerment.

a. Provision of Pilot Facilities

Built an RO (Reverse Osmosis) machine unit as an educational and demonstrative model for students and the community around MDT.

b. Fish Farming Skills Training

Students, MDT administrators, and residents are trained directly on Operation techniques of onalization of RO machines, Clean water source management, Maintenance of equipment and supporting systems, Maintenance of the condition of the RO machine so that it is always excellent and productive

2) Improvement of Services and Infrastructure

It is focused on increasing institutional capacity and providing facilities that support the sustainability of activities.

e. MDT Capacity Building

Through managerial training and business plan assistance, MDT is able to manage the mineral water refill depot program professionally.

f. Provision of Supporting Tools and Facilities

Such as RO (Reverse Osmosis) machines, water quality measuring devices, and basic machine infrastructure, to support the productivity and efficiency of drinking water refill depots. Objective: To make MDT a center for economic-productive and educational activities based on environmentally friendly technology.

3) Partner's Participation in Program Implementation

Active involvement of partners is the key to the program's success.

a. Involvement from Planning to Implementation

Partners are involved in initial discussions, activity design, and technical implementation to create a sense of ownership.

b. Technology Operations and Evaluation

Partners are trained and responsible for running technological tools (RO machines), as well as participating in the process of evaluating the results of activities.

c. Involvement of Students

Students from MDT will be given a special role in RO machine maintenance, water quality monitoring, and equipment management as part of vocational education. Objective: To empower partners as a whole so that the program runs independently.

4) Program Implementation and Sustainability Evaluation

Evaluations and long-term plans are prepared from the beginning of implementation.

a. Periodic Evaluation and Success Indicators

Evaluation is carried out periodically (monthly/semi-monthly) with indicators such as Increase in refillable drinking water production, Increase in partner income, Active participation of students in the program,

Table 1. Periodic Evaluation of the Abdimas Team

Name	Roles and Duties
Team Leader	Preparing Proposals, responsible for the implementation of Community Service activities, Making: Reports and Publications.
Member	Proposal Review, Support for the Implementation of Abdimas, Report Review and Publication Support.
	Providing technical assistance in the use of electric waterwheels.
Student	Playing a role in program implementation and partner mentoring.
	Documentation

1. Framework for Methods of Implementing Activities

a. Stages in implementing PKM Solutions and Implementation

Figure 4. Stages of PKM Implementation

b. Methods of Approach and Application of Technology and Innovation

Figure 5. Methods of Applying Technology and Innovation

a. Implementation Stages Based on Partner Characteristics

For Economically Unproductive Partners:

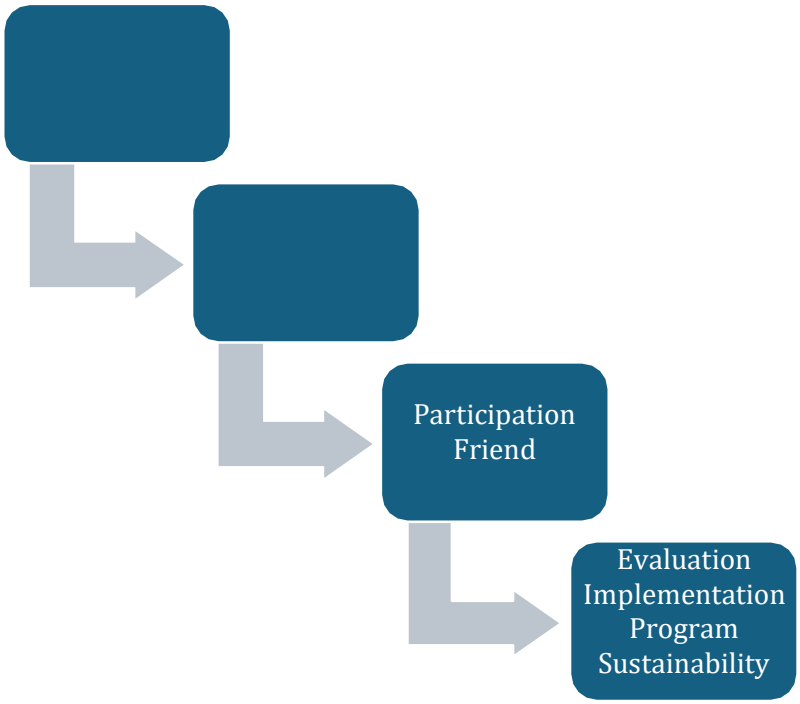

Figure 6. Stages of Implementation of Economically Unproductive Partners

RESULTS AND DISCUSSION

The implementation of Community Service (PKM) activities in 2025 has gone according to plan. The program focuses on the application of Reverse Osmosis (RO) machine-based mineral water treatment technology at Madrasah DTA Al-Karimah, Cibunar Village, Kadudampit Village, Sukabumi.

The Community Service Team (PKM) of the Impact Science Higher Education Grant represented by the Community Service Team of the Faculty of Economics and Business, Mercu Buana University, Jakarta held an ABDIMAS program with the theme "Mineral Water Treatment Technology Using RO Machines to Improve the Quality of Healthy and Economic Life for DTA Al-Karimah and the Surrounding Community" at DTA Al-Karimah Madrasah, Cibunar Village, Kadudampit Village, Sukabumi Regency, West Java. The event will be held on August 9, 2025.

This activity aims to empower the community through the management of drinking water depots based on Reverse Osmosis (RO) technology that is able to produce high-quality water, as well as open up business opportunities to improve the economic status of residents.

The event began at 08.30 WIB with the opening of the training, followed by a Customer Service session which emphasized the preparation of service SOPs and their installation in the water depot room. The PKM team also provides training on the maintenance and maintenance of RO machines, including maintenance SOPs to keep the equipment optimal.

At 10.45 WIB, the session continued with a briefing on marketing strategies, logo design, development of bottled water products, and marketing techniques at religious events such as grand tabligh and da'wah activities. After resting, praying, and eating (11.45–13.00 WIB), the event continued with the Inauguration and Soft Opening of the Drinking Water Depot.

Figure 7. Abdimas Team and Partners

This inauguration was attended by the Head of Kadudampit Sub-district, Mr. Susandikrillah, S.IP, M.AP. The Head of Kadudampit Village, Mr. Iip Firdaus, the Head of the Health Center, Mr. H. Idris Sardi SKM, the Chairman of DKM Al-Karimah, Mr. Lukman Al Hakim, the Chairman of the Al Karimah Foundation, Mr. Arbi Rodibillah, S.H.I., THE Head of Madrasah DTA Al-Karimah KH Uweis Alqorni, the heads of RT and RW, teachers, guardians, and local community leaders.

The Head of the PKM Team, Muhammad Laras Widyanto, in his remarks. Deliver :

> "This program not only presents quality drinking water treatment technology, but also instills business management, marketing, and customer service skills. Hopefully, this will be a sustainable source of income for DTA Al-Karimah and the surrounding residents."

Kadudampit Sub-district Head, Susandikrillah, added, "We need to support initiatives like this together. In addition to providing access to clean water, this program empowers the community's economy in an independent and sustainable way."

Figure 8. Ribbon cutting was carried out by Kadu Dampit Sub-district Head

Furthermore, the Head of the Sub-district and accompanied by the Head of the Community Service Team made a ribbon cutting, as a sign that the Mineral Water and RO Management Depot was officially handed over by the Community Service Team of Mercu Buana University Jakarta representing the Ministry of Research, Technology and Higher Education and Science Impact on DTA-Alkarimah, Cibunar, Kadudampit, Sukabumi Regency. After the inauguration session was completed at 14.30 WIB, the activity continued at 15.00

WIB with transaction recording and bookkeeping training for the entire Depot Management Team and treasurer. This training equips participants with simple administrative and accounting skills so that business management runs transparently, orderly, and accountably. This session ended at 16.30 WIB and was the closing of the series of activities on that day.

Figure 9. The Head of the Health Center gave a speech

It should be noted that before the implementation of the soft opening, the installation and installation of the RO mineral water treatment machine had been carried out on August 6, 2025 by a team from INVIRO as a vendor. After that, a water treatment trial was carried out for two days. Furthermore, the Al-Karimah DTA will conduct laboratory tests on the quality of the RO mineral water and take care of all applicable permits, so that the drinking water depot can fully operate to serve the community.

The next Grand Opening will be held on September 6, 2025, in Cibunar Village, Kadu Dampit Village, Kadu Dampit District, Sukabumi Regency, to coincide with the celebration of the Birthday of the Prophet Muhammad SAW at Madrasah DTA Al-Karimah. This activity is an important momentum for launching the marketing of mineral water and Reverse Osmosis (RO) water to the local community. A total of 146 parents of Madrasah DTA Al-Karimah students attended the series of events that took place from 13:15 to 17:15 WIB.

Figure 10. The Chairman of the Partner is giving a speech

The series of events, starting at 13:15 with the opening by MC Ustadzah Sara Fadlah, continued with the reading of prayers, teachers' wills, and joint prayers. At the peak, the UMB lecturer team provided socialization related to the benefits and marketing strategies of RO

mineral water, Muhammad Laras Widyanto, as the Head of the Abdimas Team, explained community-based marketing strategies, including opportunities to develop a multi-level marketing system that provides commissions for people who also market products, Dony Ari Nugroho, explained the importance of mineral water consumption and RO for health, especially for parents in maintaining family fitness, Sofyan Halim, provided material on the maintenance and maintenance of water treatment equipment to keep it hygienic, while emphasizing the importance of transparent financial recording and reporting, considering that the facility has state-owned status. In addition to socialization, the event was also filled with a lecture on the Prophet's Birthday by KH. Uwes Alqorni, before closing with a joint prayer, and hospitality, the event ended at 17:15.

RO Water Passes the Feasibility Test, Mineral water and RO produced through this program have been declared fit for consumption after going through a feasibility test from the UPTD Health Office, Regional Health Clinic and Regional Health Laboratory of Sukabumi Regency.

Hope for the Future, With the presence of this RO mineral water treatment technology, the people in Cibunar Village not only get access to hygienic healthy water, but also the opportunity to improve the economy through a structured marketing model.

Figure 11. The Head of the Abdimas Team provides Marketing Training

Figure 12. Team 2 Member, providing Maintenance training

Gamable 13. Team 1 member is giving bookkeeping training

DISCUSSION

Mineral Water Treatment Technology

The community now has access to hygienic healthy water while opening up new economic opportunities for foundations and residents.

Figure 14. Reverse Osmis (RO) technology, which is used for drinking water treatment

Results achieved:

1. **RO Machine Installation**

- The ±80 gallon/day capacity RO machine was installed by vendor INVIRO on August 6, 2025 and tested for two days before the soft opening
- . The water produced has passed the feasibility test from the Sukabumi Regency Health Office, so it is suitable for consumption

2. **Technical & Managerial Training**

- Students, teachers, and foundation administrators are trained to operate and maintain the RO machine.
- The training includes SOPs for customer service, machine maintenance, marketing strategies, and financial bookkeeping

3. Inauguration & Soft Opening

- The RO Drinking Water Depot was inaugurated on August 9, 2025 by the Kadudampit Sub-district Head, witnessed by community leaders, village heads, health centers, teachers, parents, and residents
- The grand opening will be held on September 5, 2025, coinciding with the celebration of the Prophet PBUH's Birthday, attended by 146 guardians of students

4. Early Reach

- The mineral water depot began serving the community with a sales target of 40 gallons/day at a price of IDR 3,000/gallon for mineral water, and IDR 5,000 for RO water which is equivalent to a potential turnover of IDR 5,000,000/month

Based on the 2025 achievements, the next stage plan is focused on strengthening program sustainability, increasing partner capacity, and achieving additional outputs. Planned stages:

1. Optimization of RO Air Depot Operations, Increase distribution capacity with a sales target of >50 gallons/day. Strengthening SOPs for customer service and mineral water stock management.
2. Capacity Building of Partner Human Resources, Advanced Training on financial recording based on simple applications (digital bookkeeping). Digital marketing assistance for the promotion of RO mineral water through social media and local marketplaces.
3. Market Expansion & Business Model, Implementation of a community-based marketing strategy (multi-level marketing) with commissions for participating communities.
4. Collaboration with local stalls/stores for the distribution of gallon water refills.
5. Research & Service Roadmap, RO machine installation, basic training, soft opening & grand opening, water feasibility test, media publications. And Optimization of depot operations, improvement of distribution & marketing, digitization of bookkeeping, additional publications.

CONCLUSION

The implementation of the PKM Dikti Dikti Grant with Impact in 2025 has succeeded in achieving the main goal of providing access to healthy and hygienic mineral water to the people of Cibunar Village. Improving the skills of partners in managing the RO drinking water depot business. Creating new economic opportunities for the Al-Karimah Islamic Education Foundation through gallon refill businesses. Producing output achievements in the form of scientific articles, media publications, videos, posters, and sustainable RO machine-based water depot operations.

This program has been proven to provide dual benefits, namely improving the quality of healthy life of the community and strengthening the community-based economy.

Suggestion

1. For Partners (DTA Al-Karimah), Maintaining the sustainability of the water depot business by paying attention to the quality of service and maintenance of the machine. Develop

community-based marketing strategies to reach consumers more widely. Involving the younger generation (students) in business management for long-term sustainability.

2. For Regional Governments, support the licensing and regulation of water depot businesses to be faster and more efficient. Providing additional training facilities on social entrepreneurship for the pesantren community.
3. For the Academic Team, Continue collaborative research in the field of clean water technology and socio-economic pesantren.

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c. The DTA Al-Karimah Islamic Education Foundation (YPI), Cibunar Village, Kadudampit, Sukabumi as the main partner who has made a full contribution in the form of facilities, infrastructure, and the active participation of students, teachers, and the community in the entire series of activities.
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