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Students' interest in school Al-Kautsar Al Akbar Medan supported food security in Northern Sumatera, Indonesia

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ABSTRACT

Agriculture is a vital sector for the economy and food security, especially for Islamic boarding schools (Pesantren) that have limited resources, such as access to water and electricity. Many Islamic boarding schools in remote areas face challenges in achieving economic independence, while available land is not optimally utilized. Therefore, technology-based innovation is needed to optimize existing resources and increase agricultural productivity. The Indonesian Collaborative Community Service (PMKI) USU 2025 aims to select 32 students and teachers during July–October 2025 who demonstrate interest, potential, and a sense of belonging in gardening activities to introduce and implement a smart farming-based agroecosystem in Al Kautsar Al Akbar Islamic Boarding School. Agripreneur activities train participants in suitable cultivation techniques, organic fertilizer production, seed selection, and marketing of organic fertilizer products to the community. Smart farming systems enable more precise and strategic decision-making through the use of sensors and Internet of Things (IoT)-based collected data.

INTRODUCTION

Islamic boarding schools, as Islamic educational institutions, play a crucial role in shaping the character and psychological well-being of their students (Arifin and Maulan, 2024). According to Ahmad and Siregar (2022), one approach to improving this well-being is through organic gardening activities involving students and teachers to support food security in the Islamic Boarding School. This activity not only supports the school's food security but also enhances a sense of

belonging within the school environment (Wardila, 2023).

Research shows that a strong sense of belonging in students can increase involvement in school activities and reduce negative behavior. According to Goodenow (1993), a sense of belonging is the feeling of being accepted, valued, and part of the school community. Organic gardening activities involving the active participation of students and teachers can be an effective way to foster these feelings. Students

involved in these organic gardening activities are selected based on their interest in gardening, which will be measured using a gardening interest questionnaire developed from the Kuder Preference Inventory (KPI) instrument (Suyasa & Tommy, 2011).

Agriculture is a vital sector for the economy and food security, especially for Islamic boarding schools (Pesantren) that have limited resources, such as access to water and electricity. Many Islamic boarding schools in remote areas face challenges in achieving economic independence, while available land is not optimally utilized. Therefore, technology-based innovation is needed to optimize existing resources and increase agricultural productivity. One approach that can be implemented is a smart farming system, which integrates renewable energy, automated irrigation, and a data-driven fertilization system to improve agricultural efficiency and yields.

Smart farming systems enable more precise and strategic decision-making thanks to the use of data obtained through sensors and Internet of Things (IoT) devices. According to Sambas et al. (2023), technologies such as soil moisture and plant nutrient sensors enable farmers to schedule irrigation and fertilization more accurately, thereby reducing resource waste and increasing overall yields (Anwarudin et al., 2020). Data-driven technology is even predicted to increase agricultural productivity by up to 70% by 2050.

The Al Kausar Al Akbar Modern Islamic Boarding School, located on Jalan Pelajar, Binjai, Medan Denai District, Medan City, ZIP Code 20226, integrates religious and scientific knowledge into its educational system. This 90-hectare Islamic boarding school has land that has not been optimally utilized for agricultural production. Therefore, in this proposal, the yard will be used to grow vegetables and tubers. To achieve optimal production, adequate water and fertilizer are required. A drip irrigation system is an innovative solution that can increase water use efficiency in agriculture. This method is designed to deliver water directly to plant roots, thereby reducing water wastage and increasing the effectiveness of plant absorption (Rusmayadi et al., 2023).

Furthermore, implementing this system can increase plant growth rates, as demonstrated in research on cayenne pepper plants (Ishak & Asri,

2022; Yuniati et al., 2024). Drip irrigation has also been shown to be more environmentally friendly, as it reduces the risk of groundwater pollution by reducing runoff and evaporation (Aminah et al., 2023; As'ari and Qiram, 2023).

IoT another advantage of drip irrigation systems is their ability to increase agricultural productivity. Research shows that using this system can produce better, higher-quality harvests and reduce farmers' workload (Nanda et al., 2024; Gede et al., 2024). By utilizing soil moisture sensors, farmers can more easily set optimal watering schedules, thereby reducing uncertainty in water management (Nugroho et al., 2023; Supria et al., 2022). Furthermore, training and community empowerment related to drip irrigation technology have been conducted in various regions, demonstrating a positive impact on increasing farmers' awareness and skills in water resource management (Sinaga et al., 2021, 2024; Wildani, 2024).

In the context of community service, the implementation of a drip irrigation system at the Al Kautsar Al Akbar Islamic Boarding School, Medan is highly relevant for improving the sustainability and efficiency of agriculture in the area. Through training and mentoring, farmers will learn how to design and manage efficient irrigation systems, which in turn can improve crop yields and their well-being (Safarina et al., 2020; Prayoga et al., 2024).

From a sustainability perspective, the development of agricultural ecosystems in Islamic boarding schools can be optimized by implementing an eco-pesantren model. According to Gunawan & Alfari (2023), the eco-pesantren concept is not only able to improve environmental management but also provides a positive contribution to the overall development of Islamic boarding schools. By utilizing renewable energy, water efficiency, and smart agricultural technology, Islamic boarding schools can become centers of modern, sustainable agriculture and adapt to the challenges of climate change.

To ensure optimal crop growth, a sensor-based monitoring system is implemented, including sensors for temperature, air humidity, soil pH, and nutrient content. Mini weather stations are also installed to predict weather changes, allowing irrigation and fertilization systems to adjust

automatically to reduce the risk of crop failure. Furthermore, a smart fertigation-based fertilization system allows liquid fertilizer to be distributed through the irrigation system at doses controlled using nutrient and Electrical Conductivity (EC) sensors. With the support of data-driven fertilizer distribution automation, fertilizer use becomes more efficient, and waste is reduced (Yunita et al., 2024).

In addition to increasing agricultural productivity, the implementation of the Smart Farming system in Islamic boarding schools also has great potential for increasing economic independence. This technology-based agricultural program can provide a source of income for Islamic boarding schools through the sale of crops. Furthermore, students can be directly involved in technology-based agricultural management, thereby acquiring new skills in modern agriculture. A study by Urrosyidah & Alfi (2022) shows that training programs in land selection, organic fertilizer production, and agricultural product marketing can increase the independence of Islamic boarding schools in terms of food and economics. The entrepreneurship education developed in this program also contributes to the development of independent and innovative student characters (Ishak & Asri, 2022). Agribusiness plants in Islamic boarding schools can be developed using an upstream-downstream concept, where the Islamic boarding school acts not only as a producer but also as a processor and distributor. Objectives: selecting students who have the interest, potential, and sense of belonging of students and teachers to the Islamic boarding school environment through gardening activities introducing the application of the smart farming system in Islamic.

The objectives of services communities of PMKI USU 2025, consist of: (1) To select students who demonstrate interest, potential, and a sense of belonging among both students and teachers in the Islamic boarding school environment through gardening activities; (2) To introduce a smart farming system application in Islamic boarding schools to address limited gardening knowledge, water constraints, fertilization, and detection of

frequently encountered plant pests and diseases; (3) To optimize the use of available land and increase agricultural productivity.

The purpose and benefits of this community service are to enable partners to use the smart farming system application in Islamic boarding schools, addressing frequently encountered resource limitations such as water and electricity. By integrating renewable energy, automatic irrigation, and a data-driven fertilization system, Islamic boarding schools can optimize the use of available land and increase agricultural productivity. Furthermore, this system enables Islamic boarding schools to achieve food self-sufficiency and generate additional income through the sale of harvested produce. Furthermore, the students' involvement in technology-based agricultural management provides them with new skills in modern agriculture.

Furthermore, the Indonesian Collaborative Community Service (PMKI) USU 2025 is the implementation of a smart farming-based agro-ecosystem in Islamic boarding schools to address adaptive conditions of climate change using technology and food independence so as to create sustainable growth.

METHODS

Location and Time of Implementation

The community service program is located at the Al Kausar Al Akbar Modern Islamic Boarding School on Jalan Pelajar, Binjai, Medan Denai District, Medan City, North Sumatra Province 20226. This community service program will be implemented from April to November 2025.

Community Service Implementation at the Co-Host University Sumateera Utara (USU)

This community service activity is designed with systematic stages, encompassing planning, program outreach, technical training, mentoring, and evaluation of the success and economic impact of the smart farming system on Islamic boarding schools and the community. This is described in Table 1 below.

Table 1. Description of activities, objectives, methods, and timeline of implementation for Community Service Program (PMKI) USU 2025

Activity	The aim of study	Methods	Time of implementation
Determine of location, identification students interest of gardening	To select students who demonstrate interest, potential, and a sense of belonging among both students and teachers in the Islamic boarding school environment through gardening activities.	Observation, implementation and training	Month 4, 5
Program Socialization, training, analysis data, and coordination with Stakeholders	Introducing the program smart farming to Islamic boarding schools, namely the interest students of gardening, land cultivation of smart farming.	Direct meetings, discussions, and program	Month 6,7
Strategy disseminating program of PMKI USU 2025	Dissemination and publication of results PMKI USU 2025 in seminar, technology and publication.	Seminar, Creation of Modules, Publications in Newspaper, Video Youtube, and Journal	Month 7,8
Program Impact Evaluation	Measuring the effectiveness of the program and the economy.	Surveys, observations, and interviews with partners and the community	Month 8

Implementation Method

This community service activity is carried out starting from the socialization stage, conducting a gardening interest survey to all students, short interviews to assess the motivation and commitment of prospective participants. Furthermore, training in technology application, mentoring, and evaluation are carried out so that the sustainability of the results can be sustainable. The use of IoT also allows for the control of automated systems, such as sprinkler irrigation systems that can be automatically set to provide water only when needed by plants, which avoids water waste and ensures efficient water use (Bayu et. al., 2023). In addition, the use of IoT in plantation management can increase the efficiency of fertilization with the IoT system. With real-time data collection, the target community service team can identify problems quickly and take appropriate action to address pests, diseases, or unfavorable weather conditions. Real-time data collection allows.

The implementation methods to be applied in this PMKI USU 2025 are: Planning stage begins with discussions and outreach within PMKI partner groups regarding the community service activities to be implemented. This activity involves the

Islamic boarding school, the village head, and relevant stakeholders described within Al Kautsar Al Akbar Islamic boarding School, Medan.

The implementation stage begins with a survey, outreach, and training on gardening interests among students at the Al Kautsar Islamic boarding school. This is followed by a questionnaire and field data collection. Meanwhile, Questionnaire data analysis well done in community service evaluation. can identify problems quickly and take appropriate action to address pests, diseases, or unfavorable weather conditions. Real-time data collection allows.

RESULTS AND DISCUSSION

The research results can be concluded from the interest of students in gardening, the higher the organic farming skills, the higher the students' entrepreneurial skills, and regression equation relationship will be measure and described into Table 3. The better the students' quality of life before and during the program showed almost increase in knowledge, awareness and implementation from 60% to 85-90%.

Training is the first step in providing resources to empower students through increased knowledge,

which can then be implemented through various action programs. Such as gardening, manufacturing eco-enzyme, and cultivation of smart farming. In addition to religious knowledge, students also gain knowledge that is very much in line with current developments, such as agricultural and other business ventures, through educational models, internships, and hands-on practice. Results of measuring sense of students of belonging to gardening in Al Kautsar Al Akbar Islamic Boarding

School Medan, consist of number of 32 students participating in the smart farming activity: 24 females and 8 males with grade categorization consist of: Very Low (10-15); Low (16-25); Currently (26-35); Higher (36-45), and Very High (46-50). Overall descriptive which number N is 32, Mean = 37.344, and SD SOB are 5.971. The data from Table 2 showed questionnaire data collected from 32 students Al Kautsar Al Akbar Islamic Boarding School, Medan.

Table 2. Questionnaire data collected from 32 students Al Kautsar Al Akbar Islamic Boarding School.

Name	Gender	Age	Total	SOB Score	Categories
Nur Rezkiana	Female	16	12	50	Very high
Suci Aprilia Sitompul	Female	15	10	46	Very high
Anza Rukmadhani Nasution	Female	16	12	41	Higher
Nurhusna Nabila Nduru	Female	16	10	41	Higher
Syifa Eldzakirah	Female	16	12	40	Higher
Nailah Thalita Zahra Ahmad	Female	14	10	40	Higher
Zahra Nakhwah Aqilah	Female	17	12	39	Higher
Chelsea Sry Karina Br Sembiring	Female	16	12	39	Higher
Nazwa Syafira Marbun	Female	16	12	38	Higher
Fiyonda Zulaika	Female	17	12	37	Higher
Nabila Sari	Female	17	12	36	Higher
Izzaratul Quenita Lingga	Female	14	10	36	Higher
Kholidda Lalitya	Female	17	12	36	Higher
Adelia Noviyani Lubis	Female	16	12	34	Currently
Rizka Rolaito	Female	17	12	34	Currently
Mutia Hafiza	Female	17	12	33	Currently
Putri Sakinah Pohan	Female	17	12	33	Currently
Ashila Az Zahra	Female	15	10	33	Currently
Fakhrun Nisa	Female	17	12	32	Currently
Alya Adeeba	Female	15	10	31	Currently
Khairunnisa Siregar	Female	15	10	31	Currently
Yupi Yalisma Ritonga	Female	17	12	30	Currently
Eska Azhari Sihotang	Female	17	12	30	Currently
Najla Syakira Afaf	Female	14	10	27	Currently
Muhammad Farrel Althaf	Male	15	10	49	Very high
Lukman Hakim Harahap	Male	15	10	46	Very high
Muhammad Syafiq	Male	15	10	46	Very high
Miftahul Qolbi Sagala	Male	16	12	44	Higher
Fahri Mudzakir Luthfi Kabu	Male	13	8	40	Higher
Ihsan Kamil Nasution	Male	14	10	39	Higher
Ridho Aufar Azmi Tarigan	Male	13	8	35	Currently
Muhammad Darrel Fairuz	Male	15	10	29	Currently

The involvement of students in agricultural activities is very high. Students are always present and actively participate in discussions during agricultural theory sessions at Islamic boarding schools. This encourages students to continue to deepen their agricultural knowledge. They realize that by participating in these activities, they can develop skills and knowledge relevant to the world of agriculture, which will provide long-term benefits in life. Students' interest in agriculture is also high. They want to deepen their knowledge and skills in agriculture because they find these activities more interesting and enthusiastic.

The results of this study are in line with research conducted by Nadhira (2015); Effendy et. al, (2020); Yusuf (2021), and Yusuf and Rini (2022) where the entrepreneurial interest of students at Islamic boarding schools is influenced by several internal and external factors such as intelligence, personal motivation, education and training, environment, and information sources. The results of this study indicate that students need to have the ability to adapt to the demands of new situations and circumstances, one of which is in the world of business or entrepreneurship, thus fostering their desire to learn it. On the other hand, the independent lifestyle of these students is in line with an entrepreneurial spirit, so that the students are also motivated to live a successful life in the future, for example by becoming entrepreneurs and professional preachers.

Furthermore, the religious education or values instilled by the religious teacher (ustadz) about entrepreneurship and the environment around the students, which is always a place to gain lessons and experience, have influenced the students to be interested in entrepreneurship. The results of the study also show that students who have entrepreneurial skills must be supported by spiritual intelligence. Spiritual intelligence can shape entrepreneurial skills in students. To develop good entrepreneurial skills, it is necessary to provide spiritual intelligence about organic farming to the students. Implications that can be taken as a follow-up to the results of this study include awareness of the need for all stakeholders and leaders of Islamic boarding schools to continuously improve spiritual intelligence, so that entrepreneurial skills in students can also be improved. To improve spiritual intelligence properly, various methods can be done,

including through books or other learning media and creating learning about spiritual intelligence itself.

Discussion session between head of the Al Kautsar Al Akbar Islamic Boarding School in Medan, Mr. Sheikh Ali Akbar Marbun with Leader of PMIK USU, Assoc. Prof. Ameilia Zuliyanti Siregar, M.Sc, Ph.D. He was supported the service community program, PMKI USU 2025 and hope Supprted by Wahyudi et al. (2024) were applied in Assa'adah in Cikeusal Serangautomatic of watering systems with soil moisture sensors have been deployed near fish ponds, ensuring plants receive the essential water elements efficiently. This system is powered by solar energy, making it an environmentally friendly option. Furthermore, the student (santri) consumed livestock and agricultural products, demonstrating that the pesantren has a sustainable resource source, reducing daily accommodation expenses.

From the questionnaire test from 32 students of interest gardening, then we were taken as much as 5 persons (Very high) and 7 persons was higher score. The students were separately 2 groups as rule model to assess the motivation and commitment of millennial agricultural entrepreneurs (*agri-preuner*) in Al Kautsar Al Akbar Islamic Boarding School Medan. They are role models encouraging students to enjoy gardening, making organic fertilizer, and growing vegetables. It is hoped that the enthusiasm of the 12 Islamic boarding school students will spread the millennial farming virus, supporting future food security in the future. Smart farming can also serve as a basis for educational tourism. From an economic standpoint, these practices are being developed, and further research is anticipated to enhance Pesantren's financial prospects.

CONCLUSIONS

The Millennial Santri Farmer Group (Agripreneur) trains participants or students to be able to choose good and suitable cultivation, training in making organic fertilizer, selecting seeds, and marketing several organic fertilizer products to the community. The agripreneur has fulfilled food needs as evidenced by the presence of food need indicators. The students' interest in agricultural activities at the Al Al Kautsar Akbar Islamic Boarding School, Medan is included in the high category. The indicators of student interest in

this study are interest and involvement. The results of the analysis concluded that both internal and external factors simultaneously and partially have a significant influence on students' interest in agricultural activities. The following are recommendations based on the results and discussion of this research: (1) To enhance students' knowledge, a guidebook can be developed and distributed to students as a guide and reference for the material they receive in carrying out agricultural activities; (2) To develop students' potential in agriculture, a regular schedule for student participation in activities can be further optimized. This can enhance students' abilities and provide a future orientation for them.

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