



Training Program on the Fabrication and Maintenance of Rapid Ice Cube Production Systems Utilizing Split Air Conditioner Compressors for the Youth of Reuleut Timu Village

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ABSTRACT

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The demand for ice cubes among the community and vendors around the Universitas Malikussaleh campus has increased in tandem with the university's expansion. Reuleut Timu, a village situated within the university's vicinity, possesses the potential to develop ice cube production and distribution enterprises, particularly catering to beverage and juice vendors managed by local residents and students. This condition presents an opportunity for the youth of Reuleut Timu to generate income and stimulate the growth of the creative economy. The production process involves utilizing repurposed air conditioner (AC) compressors. This assembly is characterized by its ease of construction, energy efficiency, and the ability to produce ice cubes in a relatively short duration of 3 to 4 hours. The objective of this training is to provide knowledge and information to the local youth regarding rapid ice-making equipment, with the aim of establishing village-owned or private enterprises. The methodology employed included training in equipment assembly and maintenance, followed by a one-month internship for the participants. The results of the training indicated high levels of participant enthusiasm, with attendees gaining proficiency in the construction and maintenance of rapid ice-making machines. Community support for this initiative was substantial, evidenced by orders placed for the equipment to be used for business purposes. Participants intend to utilize this equipment as a village-based enterprise to serve as a source of revenue, fulfilling the significant local demand for beverage-related businesses.

1. Introduction

1.1 Research Background

Reuleut Timu is categorized as a Digital Village, having established a community website as a result of a community service project (Fakhrurrazi et al., 2022). The village website, accessible at <https://reuleuttimu.com/>, serves as a platform for information services. University support for the development of surrounding villages is manifested through a specific community service scheme (SKIM) dedicated to the development of 'Fostered Villages' (Desa Binaan). The Faculty of Law and the Department of

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Informatics have previously conducted community service programs in this village, which have significantly impacted its development.

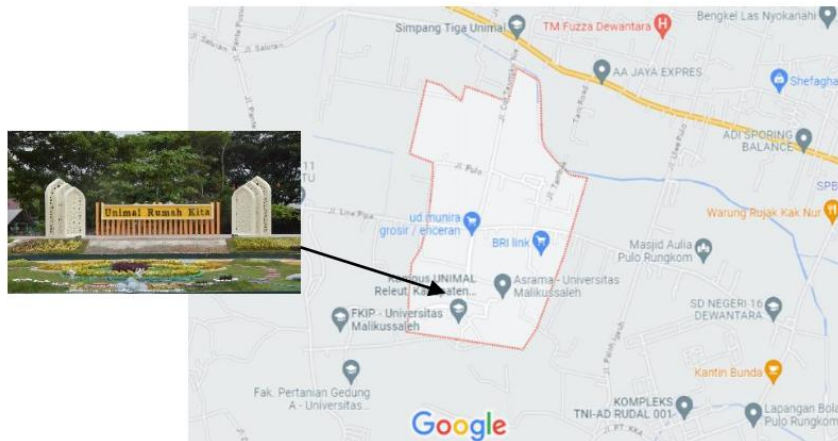


Figure 1. Location of Community service

In 2024, split AC maintenance training for local youth was conducted by Muhammad et al., resulting in several participants becoming AC technicians who subsequently interned with industrial partners. As a follow-up to these activities, community youth leaders requested training on the construction of rapid ice-making machines, similar to those available through online retailers. These commercial units are relatively expensive, with prices reaching approximately 12 million Rupiah

In general, ice cubes are produced by placing water in plastic bags, which are then chilled in a refrigerator and placed in a freezer. This process typically requires up to 24 hours for the water to reach a fully frozen state. Such a prolonged freezing duration frequently poses a significant constraint, particularly during periods of high demand or increased commercial activity.

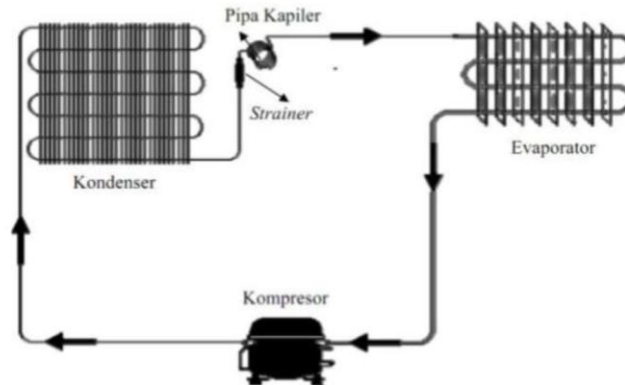


Figure 2. AC cyclic

The design and construction of this ice-making machine are intended to assist lower-middle-class communities in establishing ice production businesses. While similar machines are available on the market, their high cost remains prohibitive for this demographic. The distinguishing feature of this machine, compared to commercial models, is its utilization of repurposed refrigeration components that remain in viable condition. Thus, the development of this machine is expected to be more accessible for individuals seeking to either purchase or manufacture their own equipment for business purposes. The system utilizes a 1/5 HP compressor, an AC outdoor unit, evaporator piping, and a single-door refrigerator compartment, assembled according to standard refrigeration principles. Based on observational data, the results can be analyzed as follows: Trial 1 produced ice with crystal formations on the edges after 150 minutes of operation. Trial 2 showed crystal clusters after 90 minutes. Trial 3 yielded crystal clusters within 60 minutes and larger ice formations at 120 minutes. Trials 4 through 7 consistently produced ice crystals within 30 minutes, larger

formations within 90 minutes, and reached a fully solid (frozen) state in an average of 180 minutes (Muhammad et al., 2021).

Partner Problem and Solution

The residents of Reuleut Timu are predominantly engaged in farming and casual labor, which often results in underutilized leisure time. The local youth are similarly employed as freelance workers, assistants in brick-making enterprises, or serve as custodial staff in boarding houses, photocopy services, and local eateries. Additionally, a portion of the youth demographic consists of university and secondary school students.

The rapid expansion of Universitas Malikussaleh has catalyzed significant regional development, primarily driven by the increasing influx of students residing in the village as boarders. This growth is further augmented by substantial investor interest in constructing student housing, leading to a progressive socio-economic transformation of the area. The local economic circulation has intensified due to the student population, fostering the emergence of various small-scale enterprises, particularly beverage vendors. Consequently, there is a high demand for ice cubes; however, to date, local vendors have been compelled to procure ice supplies from external sources outside the village.

To obtain detailed information regarding the situation and the challenges faced by the partners, the team implemented the following initial steps:

1. The community service team conducted consultations regarding the business prospects of air conditioning maintenance services with Mitra Berkat Jaya Service. The interviews revealed a strategic opportunity to involve Reuleut Timu Village as a primary participant in the training program.
2. The team and the industrial partner engaged with the youth chairperson and local youth representatives to present the project concept, the underlying background, and the anticipated outcomes of the proposed activities

2. Methodology

The methodology employed in this community service initiative is the community development method, an approach oriented toward community empowerment by positioning the community as both the subject and the object of development through direct involvement (Rahdiana et al., 2022). This method ensures that the technology transfer—specifically the production of rapid ice-making machines—is not merely a technical handover but a sustainable socio-economic intervention. The implementation of the community development framework encompasses four distinct stages (Rinaldy et al., 2017; Septiam MN et al., 2021):

1. **Village Assessment Stage:** This initial phase involves identifying the specific needs of the Reuleut Timu community, particularly the local vendors and youth. It focuses on analyzing the gap between the high demand for ice cubes due to the expansion of Universitas Malikussaleh and the current supply limitations, where vendors must procure ice from external sources.
2. **Program Planning Stage:** At this stage, the team designs a strategic roadmap for the assembly of ice-making machines using repurposed AC compressors. Planning involves collaborating with Mitra Berkat Jaya Service to determine the technical specifications required to produce ice efficiently within a 3–4 hour window, ensuring the technology is both affordable and accessible for the target demographic.
3. **Implementation Stage:** This stage focuses on the actual transfer of knowledge through hands-on training. Participants are taught to assemble, operate, and maintain the rapid ice-making machines. The goal is to transform the youth from passive observers into active producers who can manage their own small-scale ice production businesses.
4. **Monitoring and Evaluation Stage:** To ensure sustainability, the team monitors the operational success of the fabricated tools and the participants' ability to manage the enterprise. Evaluation is based on the machine's performance (e.g., freezing time consistency) and its impact on the participants' income generation and the fulfillment of local market demand

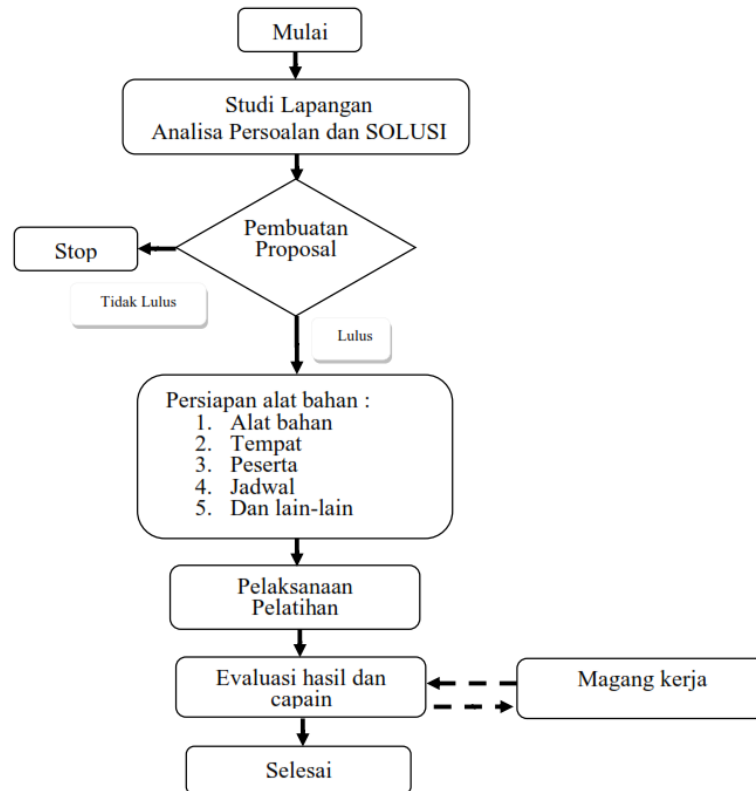


Figure 3. Activities Flowchart

3. Activities and Finding

3.1. Activities

The community service project was formally initiated in July 2025, beginning with the comprehensive formulation of the technical proposal and the strategic mapping of community needs. Following a rigorous review process, the training program and field implementation were officially commenced after the formalization of the grant agreement with the Chairperson of the Institute for Research and Community Service (LPPM) at Universitas Malikussaleh on August 15, 2025. This contractual milestone served as the legal and operational basis for deploying the rapid ice-making technology to the Reuleut Timu community. The systematic execution of the program—ranging from the procurement of repurposed components to the intensive mentoring of local youth—is designed to ensure both technical proficiency and entrepreneurial readiness. The specific chronological stages and detailed operational milestones of this initiative are systematically presented in the table below:

| NO | HARI TANGGAL | AGENDA | KETERANGAN | TANGGUNG JAWAB |
|----|----------------------------|---|---|--|
| 1 | Senin : 04 Agustus 2025 | Perbaikan Proposal/cetak proposal | Penyerahan Ke LPPM dan Penandatanganan Kontrak | Ketua / Anggota 1 |
| 2 | Selasa 05 Agustus 2025 | Rapat dengan Anggota | Pertemuan Dengan Anggota Membahas Agenda kegiatan dan Tupoksi | Ketua dan Seluruh Tim |
| 3 | Rabu : 06 Agustus 2025 | Pertemuan Dengan Pimpinan Desa Reuleut Timu dan Mitra | Terkait Kerjasama dan pembahasan Pelaksanaan Kegiatan | KETUA |
| | | Rapat Dengan Tim Terkait tempat Kegiatan | Tempat pelaksanaan Lab Teknik Mesin Tempat Praktek di Berkah Java Service | Seluruh Personil |
| 4 | Kamis : 07 Agustus 2025 | Pembuatan Spanduk Pembelian Belanja Bahan | Desain dan Cetak Belanja Barang | Faizar Rianda Reza Putra dan Dailami |
| | Sabtu : 09 Agustus 2025 | Finalisasi Pembuatan Modul Penerimaan Peserta | Cetak Modul dan perbanyak Google Form dan lembaran Biodata Presensi Undangan | Dr Muhammad Nurul Islami Abdul Rahman Muhammad Gazza |
| 5 | Senin : 11 Agustus 2025 | Foto Copi Bahan kegiatan Persiapan Tempat | | Muhammad Gazza, Dailami. Reza Putra. Nurul Islami |
| 6 | Selasa, 12 Agustus 2025 | Belanja Bahan | | Seluruh Tim |
| 7 | Rabu : 13 Agustus 2025 | Belanja Bahan Pembuatan Absensi | Berkah Maju Servise | Seluruh Tim Reza Putra Dailami |

| | | | | |
|----------------------|--|------------------------------------|---|--|
| 8 | Kamis 14 Agustus 2025 | Persiapan Tempat Dan finalisasi | Berkah Maju Service | Seluruh Tim |
| Pelaksanaan Kegiatan | | | | |
| 9 | Sabtu 16 Agustus 2025 | Hari I | Pembukaan dan Pengarahan Tes Awal Materi Tentang ES Pengenalan alat bahan Pembuatan Berita Koran | Dailami Abdul Rahaman Muhammad, Reza Putra Muhammad Gazza |
| 9 | Minggu, 17 Agustus 2025 | Hari II | Pengenalan K3. Demonstrasi Alat Pembuat ES untuk contoh Pemotongan tubing Pemotongan Besi holo | Reza Putra Dailami Muhammad M. Gazza |
| 10 | Senin 18 Agustus 2025 | Hari III | Proses Pembuatan Rangka Modifikasi Kompresor Panitia membawa alat Pembuat Es Batu Ikut Pameran Dies Natalis | Dailami Abdul Rahaman Muhammad, Reza Putra Muhammad Gazza |
| 11 | Selasa 19 Agustus 2023 | Hari Ke IV | Pembuatan Evaporator Pembuatan Rangka Modifikasi Kapiler AC Proses Vakum dan Pengisian Freon | Dailami Abdul Rahaman Muhammad, Reza Putra Muhammad Gazza |
| 12 | Sabtu 23 Agustus 2025 | Hari ke V | Uji Coba Alat Penutupan kegiatan | Dailami Abdul Rahaman Muhammad, Reza Putra Muhammad Gazza |
| 13 | Pelaporan dan penyelesaian target Luaran | | | |

The implementation process was conducted across two primary locations, with a significant portion of the technical activities centered at the Berkat Maju Service workshop. The selection of Berkat Maju Service as a strategic site was intended to facilitate the participants' learning process, as the facility offers comprehensive technical equipment and a highly conducive environment for mechanical assembly. By utilizing this professional venue, the program ensures that participants have direct access to standard industrial tools and a workspace that meets the safety and operational requirements for fabricating ice-making machines.

The program officially commenced on August 16, 2025, at the Berkat Maju Service workshop, involving a cohort of 13 dedicated participants. The inaugural session was strategically designed to align the participants' expectations with the program's core objectives, followed by a theoretical discourse on the thermodynamic principles governing rapid ice-making technology. To bridge the gap between theory and practice, the facilitators conducted a real-time demonstration of the ice-making process, allowing participants to observe the phase transition of water into ice within the accelerated timeframe of the prototype.

The technical curriculum progressed into a detailed identification of critical system components, emphasizing the functional roles of copper tubing, hollow steel structural members, compressors, and refrigerants. Particular attention was given to the utilization of brine solutions as a secondary coolant to optimize heat transfer, housed within high-density fiber insulation boxes. The fabrication phase began with the structural assembly, where participants engaged in the precision cutting of hollow steel for the machine's chassis and the intricate bending of tubing for the evaporator coils. Furthermore, the training emphasized the importance of technical diagnostic procedures; participants were trained to use pressure gauges for vacuum testing—ensuring a leak-free system—and instruments for measuring brine concentration. The session culminated in a hands-on welding module, specifically focusing on silver brazing techniques essential for maintaining the hermetic integrity of the refrigeration circuit.

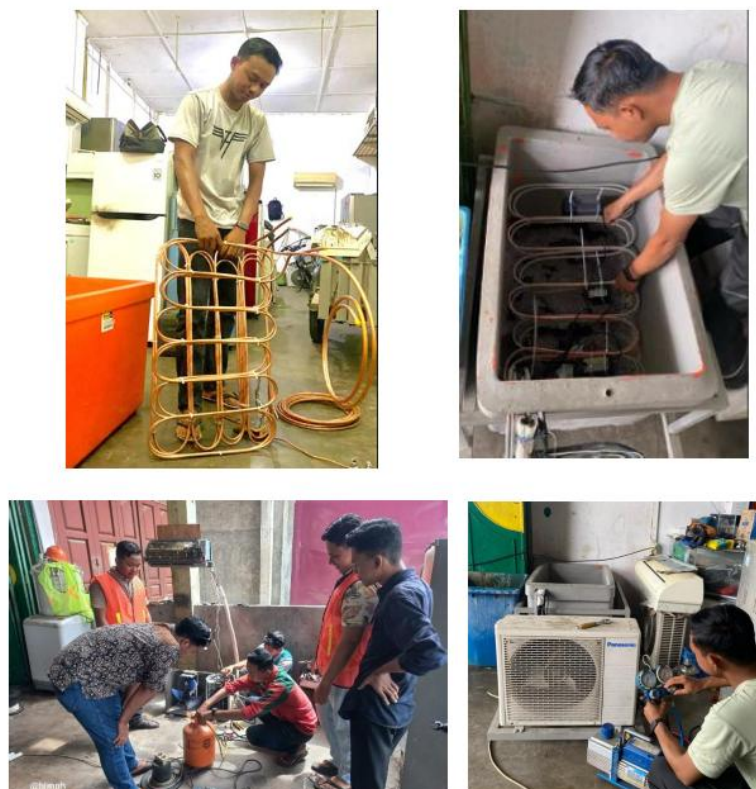


Figure 4. Documentation of Training

3.2. Impact and Implications of the Program

The community service initiative has yielded significant transformative effects, particularly regarding the technical and economic capacity of the participants. Through this program, participants have achieved a high level of technical proficiency, moving beyond theoretical understanding to a comprehensive mastery of the operational mechanisms and assembly of rapid ice-making technology. This empowerment enables them to independently fabricate and maintain these refrigeration units, ensuring the long-term sustainability of the technology within the village. Furthermore, the training has broadened their entrepreneurial horizons by introducing the commercial potential of manufacturing these units as a specialized service. A crucial outcome of this intervention is the establishment of a strategic partnership with Berkas Maju Service, which offers participants a pathway for professional development through freelance opportunities and potential recruitment for future production orders. Ultimately, this program serves as a catalyst for the emergence of local micro-enterprises, allowing youth to transition from casual laborers to independent entrepreneurs in the ice production sector.

Beyond the immediate scope of the trainees, the program has exerted a profound socio-economic impact on the broader community and the regional market. The successful transfer of knowledge has stimulated external interest, as evidenced by the procurement of a rapid ice-making unit by a resident of the Dewantara District. This specific application of the technology for fish preservation highlights its versatility and its vital role in supporting the local fishery supply chain. The visibility of the program was significantly enhanced through strategic information dissemination across mass media and social media platforms. This public exposure has not only validated the university's innovative efforts but has also bridged the gap between academic research and practical community needs, positioning the rapid ice-making machine as a viable solution for local industrial challenges and a driver for regional creative economic growth.



Figure 5. Production stage of Community services

4. Conclusions

The execution of this community service initiative has led to several pivotal conclusions regarding the empowerment of local youth and the practical application of refrigeration technology. It is concluded that the participants have successfully internalized the technical knowledge required to repurpose AC compressors into efficient, rapid ice-making units. By utilizing accessible tools and leveraging the hands-on experience gained during the training, the participants have demonstrated the capability to assemble complex mechanical systems from readily available components. This newfound expertise serves a dual purpose: it qualifies the participants to serve as specialized technicians within the refrigeration industry and, more significantly, empowers them to establish independent enterprises. By catering to the high demand for ice supplies among local beverage vendors, these newly trained individuals are positioned to drive local economic circulation.

Furthermore, this program offers a strategic recommendation for the development of village-based creative industries. The fabrication of rapid ice-making machines is highly recommended as a sustainable revenue stream for village administrations (Gampong). This can be implemented through a collaborative business model, such as a revenue-sharing agreement between the trained youth and the village-owned enterprises (BUMG). Such a partnership would not only provide a consistent source of income for the village but also ensure the institutionalization of creative economy initiatives at the grassroots level. Ultimately, this model transforms the village from a passive consumer of external goods into a self-sufficient producer, fostering long-term socio-economic resilience in the university's surrounding environment.

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