Empowering Mosque Communities with Recycled Ablution Water for Urban Hydroponic Food Resilience

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Abstract. Urban food insecurity and water wastage from ablution practices pose critical challenges in Muslim-majority cities. This study addresses both issues by introducing a mosque-based hydroponic system using recycled ablution water. Conducted at Al-Ittihad Mosque in Yogyakarta, Indonesia, the project involved installing a simple greywater filtration system and delivering hands-on hydroponic training to 40 community participants. Data were collected through pre- and post-training surveys covering Knowledge, Attitude, and Practice (KAP) and Rogers' innovation adoption dimensions. The Wilcoxon Signed-Rank Test confirmed a statistically significant improvement in KAP scores ($p < 0.05$). Perception results showed high observability and cultural compatibility, though complexity and cost remained concerns. A multidimensional sustainability assessment indicated strong potential for replication, particularly in economic, environmental, and social dimensions. The project showed that adding eco-friendly features to religious buildings can get people more involved in their communities and take better care of the environment. This model supports all-encompassing food resilience strategies that align with Islamic values and the Sustainable Development Goals (SDGs).

Introduction

Indonesia is one of the countries with the largest Muslim population in the world, where ablution (wudhu) is an essential ritual performed before each of the five daily prayers.[1]
The ritual cleansing is spiritually significant and involves using clean water in relatively high volumes.[2] Studies indicate that a typical ablution session uses approximately 2.5 liters of water per person. When multiplied across five prayer times daily, the cumulative water usage per individual can reach 12.5 liters daily. Considering the population density in urban mosques, the collective water consumption for ablution becomes substantial. This level of water usage is particularly apparent in large congregational settings such as the Al-Ittihad Mosque in Yogyakarta, which serves over 900 worshippers daily and up to 1,500 on Fridays. During peak religious activities, the estimated volume of ablution water can exceed 3,000 liters per day. (Fig1)

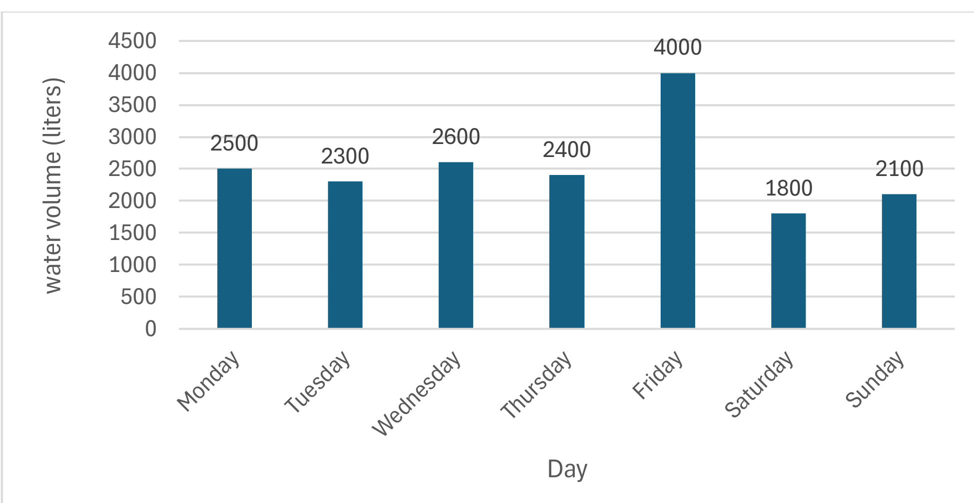

Fig 1. Average Daily Ablution Water Volume at Al-Ittihad Mosque (liters/day)

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Even though this water is fairly clean, it is usually dumped straight into the drainage system and not used again, which adds to the water [3]. The environmental implications of such practices underscore the urgency for sustainable water management strategies within religious institutions.

Greywater, including ablution water, is classified as lightly polluted wastewater from non-toilet activities such as handwashing and bathing [4]. Unlike blackwater, greywater contains fewer pathogens and can be effectively treated using simple, low-cost technologies such as sedimentation, sand filtration, activated carbon, and ultraviolet sterilization [5]. Several studies have demonstrated the feasibility of reusing greywater for non-potable purposes, particularly in urban agricultural systems. In mosques, ablution water is a resource that is mostly unused, always available, and fairly clean. Collecting and treating it in a planned way can help reduce water waste and make cities more environmentally friendly. [6][7]

Hydroponics is a method of cultivating plants without the use of soil. that uses water solutions with added nutrients to do so in a controlled space.[8] This method uses very little space and water, which makes it perfect for urban farming where land is limited. Studies show that hydroponic systems can cut water use by as much as 70% compared to traditional farming while still growing crops that yield a lot. Using recycled greywater in hydroponic farming has two benefits: it helps people in cities who don't have enough food and it makes people use water more wisely. . Using recycled greywater in hydroponic farming has two benefits: it helps solve the problem of food insecurity in cities and encourages people to use water more efficiently. [9]. When implemented at mosque facilities, such a system aligns with Islamic values of resource stewardship and can serve as a model of ecological consciousness embedded within religious practice.

Controlled Environment Agriculture (CEA), like hydroponics, is a new way to grow food in cities. By controlling temperature, humidity, light, and nutrients, CEA systems make sure that the yields are always the same and that resources are used wisely. But even though these technologies could be useful, they aren't used very much in cities with low to middle incomes.. Some of the barriers are insufficient technical knowledge, access to funding, and insufficient support from institutions. Addressing these constraints requires technological readiness and culturally grounded platforms for community engagement and education.

Mosques are deeply rooted religious institutions that significantly impact their communities' values, norms, and behaviors [10]. Mosques in cities where Muslims live are places to pray and learn, meet people, and work together. They are great places to introduce socially aligned innovations because they are always there, and people trust them. Using mosque buildings for environmental projects like recycling greywater and urban hydroponics is a culturally relevant way to promote sustainable development. This model is beneficial when the government doesn't always fully support environmental programs. Using mosque infrastructure for environmentally friendly projects like recycling greywater and urban hydroponics is a culturally relevant way to promote sustainable development. This model is beneficial in places where the government may not be able to fully support environmental programs or where support may be spread out.

According to Rogers (2003), five important perceptual dimensions affect how people accept new ideas: relative advantage, compatibility, complexity, trialability, and observability. These dimensions give us a useful way to think about how people and groups judge and accept new technologies. When trusted organizations like mosques back new ideas, they can become much more visible, relevant, and useful.. This study aims to (1) analyze public perceptions of mosque-based hydroponics using recycled ablution water, (2)assess how well training programs improve knowledge, attitudes, and behaviors (KAP) , and (3) assess the Sustainability of the initiative across economic, social, environmental, and institutional dimensions.

This study helps make a model for using greywater in religious settings that can be used repeatedly. The project aligns with environmental Sustainability and social justice values because it combines ecological care with faith-based action. Moreover, it supports multiple United Nations Sustainable Development Goals (SDGs), including Goal 2 (Zero Hunger), Goal 6 (Clean Water and Sanitation), Goal 11 (Sustainable Cities and Communities), and Goal 12 (Responsible Consumption and Production). The study seeks to demonstrate that sustainable innovation can be most effective when embedded within local institutions and cultural systems that command trust and participation

2. Methodology

This study adopted a mixed-methods approach within the framework of community-based participatory research (CBPR). This method enabled a complete picture of how the community felt about using recycled toilet water for hydroponic systems in mosques, how well the capacity-building training worked, and how long the program would last in many ways.

2.1. Study Site and Participants Options

The research was conducted at Al-Ittihad Mosque, Yogyakarta, Indonesia, which was purposively selected due to its high congregational activity and potential for greywater-based hydroponic development. A total of 40 respondents were selected through purposive sampling, including mosque administrators, active worshippers, youth members, and cleaning staff involved in the pilot hydroponic program.

2.2. Data Collection Techniques

Three main instruments were used to collect primary data by the research objectives:

a. Perception Survey
   A structured questionnaire was developed based on Rogers' Diffusion of Innovations Theory (2003), covering five core dimensions: relative advantage, compatibility, complexity, trialability, and observability. Responses were measured using a 5-point Likert scale.
b. Pre- and Posttest on KAP
   Pre- and posttests were administered to assess the effectiveness of training in improving participants' knowledge, attitudes, and practices (KAP) regarding using greywater for hydroponic agriculture. Experts in agricultural extension and Islamic environmental ethics validated the instruments.
c. Sustainability Assessment Matrix
   A perception-based matrix was utilized to assess program sustainability across four dimensions: economic, social, environmental, and institutional. Data were analyzed and depicted using radar charts to illustrate changes pre-and post-intervention.

2.3. Data Analysis Techniques

Data analysis followed several steps:

a. Descriptive Statistics were used to summarize respondent characteristics and the distribution of perception scores.
b. The Wilcoxon Signed-Rank Test was applied to determine significant differences in KAP scores between the pre-and post-training phases.
c. Radar Chart Visualization was employed to depict multidimensional sustainability scores comparatively.

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3 Results and Discussion

3.1. Community Perception Toward Recycled Greywater Hydroponics

This study used perception data from 40 community member respondents using a Likert-scale questionnaire developed based on the five dimensions of innovation introduced by Rogers (2003): Relative Advantage, Compatibility, Complexity, Trialability, and Observability. These dimensions were selected to assess the multidimensional readiness of communities to adopt hydroponic systems that recycle greywater, particularly ablution water collected from mosques.

Each dimension is operationalized through a series of statements, representing core attitudes toward efficiency, cultural fit, technical difficulty, testability, and visibility of results. Responses are measured on a five-point Likert scale, where one indicates "strongly disagree" and five indicates "strongly agree."

Table 1 shows a detailed breakdown of the observed variables, grouped by innovation dimension and their mean scores. These numbers give a general idea of how people in the community feel about each part of the recycled hydroponic innovation. The scores help identify which aspects are perceived as enablers or barriers to adoption. In Table 1, the results of the study show that Observability (average = 3.775) and Complexity (average = 3.695) are the most widely perceived dimensions, while Trialability has the lowest average (3.500). However, all dimensions scored above the midpoint (3.0), indicating a good perception of the wastewater recycling hydroponic system.

Relative Advantage. This dimension reflects respondents' perceptions of the overall benefits offered by the hydroponic system using recycled ablution water compared to conventional agricultural methods. The moderately high average score (3.59 on a 5-point Likert scale) suggests that most community members view the technology as offering practical advantages and contextual relevance in urban settings.

Respondents said that the system could be a way for households to make extra money by growing high-demand vegetables in small spaces with little water use. This fits with research that shows that urban hydroponics can help people make more money and get more food, especially in places without much land. [8] [9]

Table 1. Perception Scores by Innovation Dimension (Relative Advantage, Compatibility, Complexity, Trialability, and Observability)

Innovation Dimension	Statement	Mean Score	Dimension Average
Relative Advantage	Recycled wastewater hydroponics seems more efficient than conventional irrigation.	3.525	3.585
	The perception is that technology contributes to enhancing urban food security.	3.500	
	The belief is that the system has the potential to generate additional household income.	3.700	
	The belief is that hydroponic veggies grown in ablution water are as good as regular ones.	3.575	
	The perception is that the system offers an innovative solution for managing mosque greywater.	3.625	
Compatibility	The belief is that the technology aligns with Islamic environmental ethics on water conservation.	3.450	3.615
	Acceptability of the system for mosque-based and Muslim community use.	4.075	
	The perception that technology fits the local culture and social norms.	3.375	
	Expectation that locals would support greywater hydroponics	3.425	
	The perception is that the system aids in water conservation and Sustainability.	3.750	
Complexity	Perceived difficulty in understanding how the hydroponic system operates.	3.525	3.695
	The belief is that training or external support is needed before implementation.	3.750	
	Concern that the initial investment cost is prohibitively high.	3.800	
	Concern regarding long-term maintenance and system reliability	4.025	
	Preference for conventional farming methods over hydroponics	3.675	
Trialability	Willingness to test the system on a limited scale before full adoption.	3.375	3.500
	I am interested in participating in hydroponic training programs or workshops.	3.450	
	Increased confidence in adopting if local demonstration sites are available.	3.675	
Observability	Desire to observe live demonstrations of system operation.	3.775	3.775
	Confidence in adopting the system increases upon witnessing tangible results (e.g., vegetable harvests).	3.825	
	Interest in visiting communities that have successfully implemented the system.	3.725	

Also, people liked that the system was good for the environment, especially that it could turn mosque greywater into something useful for farming. People saw this benefit as a way to help cities stay green and follow Islamic teachings that stress the importance of not wasting resources and ethically managing them.[11]

These results all suggest that the intersection of economic feasibility, environmental responsibility, and spiritual values shapes relative advantage. This intersection makes the technology seem much more helpful in Muslim urban communities.

The compatibility dimension refers to the degree to which the hydroponic technology using recycled ablution water aligns with the community's values, beliefs, and social norms. The average score of 3.62 is high, meaning that most people who answered think the innovation fits well with their religious, cultural, and environmental values.

Those who answered said that the technology aligns with Islamic teachings on protecting the environment, especially the focus on saving water, avoiding waste, and using resources wisely. In Islam, water is considered a sacred trust (Amanah) and must be utilized responsibly. The use of ablution water for hydroponics was, therefore, seen as technically appropriate and spiritually commendable.

Moreover, the system was viewed as socially acceptable within Muslim communities, particularly because it can be implemented in spaces closely tied to communal life, such as mosques and Islamic schools. People who answered also thought their local communities would support these projects because the system's goals are similar to Islamic environmental ethics. This view is what Rogers (2003) calls "value congruence," which is essential in speeding up the adoption of new ideas.

These findings are supported by Rahman et al. (2019), who emphasize that religious framing of environmental technologies enhances cultural legitimacy and increases acceptance in faith-based communities. Likewise, Nuraini and Salim (2021) found that hydroponic systems framed within Islamic values had higher perceived acceptability and trust in Urban farming projects led by Indonesian mosques. In short, compatibility in this study means being ready for technology and being religiously and morally responsible toward nature, which is a key factor in adoption.

The complexity dimension measures how hard respondents think it is to understand, set up, and keep up with a hydroponic system that uses recycled ablution water. This dimension has a mean score of 3.70, which is pretty high. This shows that people generally like the technology but still have concerns about how it works and how it is built.

Respondents were worried about how hard it would be to set up the system, mainly because it would require specialized knowledge, calibrating equipment, and regular maintenance. There were also worries about the cost of the initial investment, which was seen as a barrier, especially for people with low incomes or who were adopting for the first time. Also, many community members said they needed structured training and hands-on help before they could confidently run the system

independently. These findings reflect [12] Rogers' (2003) assertion that innovations perceived as challenging to use or requiring new skills often experience slower adoption rates. This is made worse in community-based settings because agricultural extension services are hard to get to, and people don't know much about soilless cultivation systems.[13] also, smallholder communities often have trouble getting the information and technical help they need to switch to more sustainable technologies. Without the right support systems, even new ideas that are good for the environment can seem scary or impractical.

To make these problems less harmful, [14] suggests using localized technical training, participatory workshops, and peer mentoring, especially in urban agriculture programs based in mosques. These changes not only make things seem less complicated, but they also make people more confident in the system. In conclusion, while community members view the technology favorably, its long-term adoption depends heavily on institutional support, technical literacy, and the availability of accessible demonstration units that can simplify the learning process.

Trialability is how much an innovation can be tested on a small scale before it is fully adopted. The average score of 3.50 in this study shows that community members are willing to try the hydroponic system on a small scale using recycled ablution water. There is interest, but the score is low because people need safe, low-risk conditions to experiment

with. Respondents stressed how important it was to see the system in action and have the chance to test its feasibility for themselves before committing time, money, or labor. This finding supports Rogers' (2003) theory that trialability makes it easier for people to adopt something by letting them see real results without s

pending much money upfront.

People in the community also said they would be excited to participate in hands-on workshops, especially if they were held at mosques or community centers, where religious values and social trust help people learn and get involved. These results are similar to those of [16], who found that demonstration-based learning made it much easier for Muslim-majority farming communities

to use new technologies.

On the other hand, the lower score compared to other dimensions suggests that there are still not many chances to try things out. This could be because they don't have access to the materials, no demonstration plots, or aren't sure how well the technology will work. Potential adopters may still be hesitant if they don't have structured chances to try things out.

To make things easier to try out, project managers should focus on pilot projects, interactive training modules, and community-led trial gardens as key entry points. These initiatives improve the perceived ease of adoption and build local champions who can lead by example and reduce uncertainty across the broader community.

Observability reflects the extent to which the results of an innovation are visible and easily communicated to others. Among the five innovation dimensions, observability received the highest average score of 3.78, suggesting that tangible demonstrations of success strongly influence community willingness to adopt the hydroponic system using recycled ablution water.

Respondents expressed greater confidence when they could directly observe the outcomes of the technology—such as healthy vegetable growth, clean system operation, and water reuse from mosques. These visible markers were a way to prove that the system works in real life. Rogers' (2003) diffusion theory[12] says that new ideas are more likely to be adopted quickly when their effects are easy to see. This is especially true in collectivist societies where peer pressure is significant.

Additionally, many participants highlighted the importance of visiting other communities or mosques that had successfully implemented similar hydroponic systems. These site visits made the technology more understandable and created a sense of achievable possibility. In Islamic settings, visibility is also connected to shariah-compliant transparency, which means that having physical proof of effectiveness helps build trust in religion and society [17].

In Muslim-majority farming communities, visual confirmation and word-of-mouth support are the most critical factors in deciding whether to adopt something [18]. In this case, observability serves as an informational and motivational driver, increasing credibility, lowering uncertainty, and encouraging replication.

To capitalize on this strength, program designers should invest in well-maintained pilot plots, organize open-house demonstrations, and document success stories that can be shared through community networks, particularly mosque-based communication channels.

3.2. Knowledge, Attitude, and Practice (KAP) Enhancement

The training outcomes were evaluated by analyzing changes in participants' Knowledge, Attitudes, and Practices (KAP) related to hydroponic systems and recycled ablution water. The assessment utilized ten core indicators, with scores measured before (pretest) and after (posttest) the training.

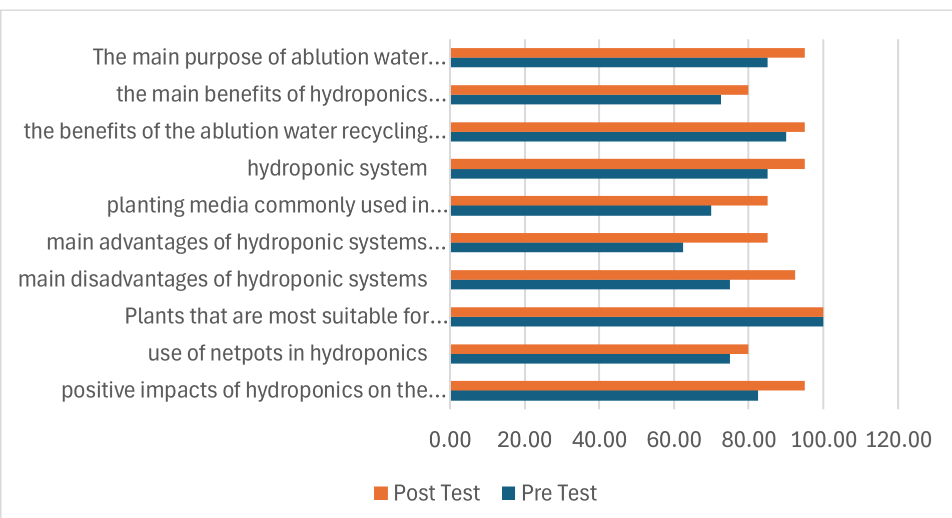

Fig 1. Knowledge, Attitudes, and Practices (KAP) before (pretest) and after (posttest) the training.

The training outcomes were evaluated by measuring participants' knowledge, attitudes, and practices (KAP) through 10 key indicators related to hydroponics and ablution water recycling technology. The average score in the pretest was 79.75%, which increased to 90.25% in the posttest, representing a 10.5 percentage point improvement.

The indicator "Main advantages of hydroponic systems compared to conventional farming" saw the most significant change, from 62.5% to 85%. This shows that people learned more about how well hydroponics works. The indicator "Main disadvantages of hydroponic systems" increased significantly, from 75% to 92.5%. This suggests that the people who took the training understood the practical limitations better. The "Plants suitable for hydroponics"

indicator stayed at 100%, which shows that the baseline knowledge was powerful. This steady improvement across most indicators shows that new information is being shared and old knowledge is being reinforced, especially on topics with high baseline scores. These results affirm that structured and contextualized training, in this case, hydroponics linked with religious practices like ablution, can lead to meaningful changes in knowledge and awareness within community-based education.
These findings indicate a statistically significant impact of the training ($p < 0.05$). The training consistently enhanced participants' KAP in understanding and adopting hydroponic systems based on recycled ablution water.
The Wilcoxon Signed-Rank Test was utilized to ascertain the statistical significance of the observed score changes. The summary of the test outcomes is as follows:

Table 2. The summary of test results Wilcoxon Signed-Rank Test

Statistik	**Nilai**
N Total	40
Positif Rank (Post > Pre)	30
Ties (Post = Pre)	10
Negatif Rank (Post < Pre)	0
Z	4.922
p-value (2-tailed)	**0**

The results are consistent with previous literature. [19] emphasize that the Wilcoxon test is appropriate for evaluating knowledge-based training outcomes. [20]help use pretest-post-test designs to look at how behavior and thought have changed. [21] found that training based on hydroponic technology also dramatically improves the knowledge and skill
s of the community.
In the real world, these results show how mosque-based training could bring together religious and environmental approaches, making the model both technically sound and meaningful. These programs can be long-lasting and community-based examples for future empowerment efforts.
Using recycled ablution water for hydroponic training has dramatically increased the participants' knowledge. Other suggestions include making these kinds of programs available to more people and adding this model to local food resilience plans based on mosques.

3.3. Sustainability Evaluation

Sustainability analysis across economic, environmental, social, and institutional dimensions showed an overall increase in perception scores. The community acknowledged the system's contribution to (a) Water conservation (environmental dimension), (b) Economic feasibility through reduced vegetable expenditures, (c) Social cohesion via collective action at the mosque, and (d) Institutional legitimacy backed by the mosque leadership and religious narratives. These results align with prior findings that mosque-based environmental programs enhance collective efficacy and are more likely to be sustained when aligned with communal values [22]
Economic Sustainability. The economic indicators reveal a mixed perception among respondents. The belief that hydroponic products are competitive in the market got the highest score (Mean = 4.08), which suggests that people are very sure that the produce can be sold. The willingness to buy the harvested vegetables (M = 3.78) and the belief that the program could make money for the community (M = 3.78) also show that people are generally hopeful about the project's ability to make money. However, the indicator had a big problem, which concerned operational costs. The statement "The operational cost is too high for long-term sustainability" got a low mean (M = 1.98 after reverse scoring), which suggests that people think the system might not be cost-effective yet. This finding aligns with earlier research by [23], which said that hydroponic systems use resources well. Still, their high initial and maintenance costs can make it hard for communities to adopt them without government help or new technology. Therefore, despite its market appeal, economic Sustainability remains the most vulnerable aspect and calls for improvements in energy efficiency, cost reduction, and potential public-private funding partnerships.

Table 3. Indicator-Level Descriptive Statistics of Economic, Social, Environmental, and Institutional

Sustainability in a Community-Based Hydroponic Program

Sustainability	Indicators	Score	Analysis
Economic	The hydroponic program can generate income for the community.	3.78	Most respondents believe the program has economic potential as a community-based income source.
	The hydroponic products can compete in the market.	4.08	A high level of confidence in hydroponic products' market competitiveness indicates promising commercial prospects.
	The operational cost is too high for long-term Sustainability.	1.98	After reversing the score, this low mean suggests that respondents still perceive operational costs as a significant barrier to Sustainability.
	I am willing to buy the hydroponic harvest to support the program.	3.78	A strong indication of local market support and community willingness to participate economically in the program.
Social	The community supports the Sustainability of the hydroponic program.	3.70	There is general agreement that the program is socially endorsed, though some respondents remain neutral or uncertain.
	I am willing to be part of the hydroponic management team if needed.	3.78	A positive attitude toward active involvement in program operations.
	This program increases social solidarity in my community.	4.00	The strong agreement suggests the program has a unifying social effect.
	The program provides real social benefits to society.	4.18	The highest social score confirms that respondents see this program as delivering tangible social value.
Environmental	This program helps reduce wasted ablution water.	4.38	Respondents overwhelmingly agree on the environmental benefit of water reuse, especially in a religious context.
	Hydroponics using ablution water is more eco-friendly than conventional farming.	3.88	General agreement on the ecological advantage of the system, though slightly lower than other environmental scores.
	The program helps conserve water resources.	4.05	High recognition of the water-saving potential of the system.
	This program can serve as a model for sustainable urban agriculture.	3.63	Moderately positive views on replicability suggest more awareness-building is needed.
Institutional	The program has clear and organized management.	3.98	Respondents express confidence in the current management structure.
	There is a sound management system to maintain Sustainability.	3.93	Reinforces the perception that systems are in place to ensure long-term function.
	I am willing to help in the program's management if needed.	3.83	Indicates community readiness to support program operations.
	I would be confident if there were clear regulations from relevant institutions.	3.83	Highlights the need for formal regulations or support from external agencies.

Social Sustainability. Sustainability in society. Many people supported social Sustainability, which shows that the initiative focused on the community. The belief that the program helps people socially got the highest score in this area (M = 4.18). This means that the community sees the project as more than just a way to grow food; they also see it as a way to make things better for everyone. Also, social solidarity (M = 4.00) and willingness to help run the program (M = 3.78) show the community is willing to participate. The moderately high agreement on communal support (M = 3.70) confirms that the program is socially embraced. These findings are consistent with [24], who found that participatory agricultural innovation tends to thrive in tight-knit communities with high social cohesion. Hence, the hydroponic program not only fulfills nutritional or economic goals but also serves as a social platform for collective empowerment and resilience.

Environmental Sustainability. Environmental indicators received the highest overall ratings among all four dimensions. The statement "This program helps reduce wasted ablution waste" scored the highest of all indicators (M = 4.38), reflecting a strong awareness of water reuse and conservation benefits. Other things that did well were saving water resources (M = 4.05), being better for the environment than traditional farming (M = 3.88), and havingand could be a model for cities that are environmentally friendly agriculture (M = 3.63). Studies like [9] back up these results. They focused on how decentralized hydroponic systems could be used in cities, especially when combined with greywater recycling. Also, using water again in religious places like mosques aligns with Islamic environmental ethics, which encourages responsible use of natural resources. [25].The program demonstrates exceptional environmental relevance and may serve as a prototype for sustainable agriculture in other urban religious communities.

Institutional Sustainability Institutional indicators also yielded consistently high scores. People who answered said they were sure about the program's governance, especially regarding clear organization (M = 3.98) and effective management systems (M = 3.93). People are very dedicated to their jobs and know they need help from outside sources. For example, they are willing to help with management (M = 3.83) and want more clear government rules (M = 3.83). These results show that local management structures are working well. Formal policy support from the right authorities would make them more credible and help them last longer. . As argued by [26], multi-level institutional arrangements are essential for scaling community-based environmental programs. So, in this case, institutional Sustainability is stable right now, but it would be better if it were officially recognized and included in larger urban agricultural policies.

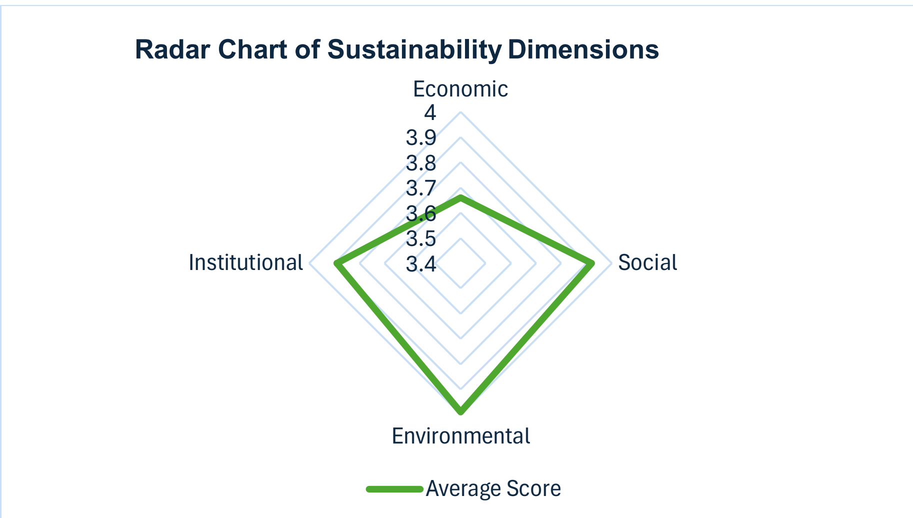

Fig 2. Radar hart of Sustainability Dimensions

The radar analysis shows the strongest environmental dimension, followed closely by the social and institutional dimensions. The economic sustainability dimension is still the weakest link. These results suggest that these community-driven systems need policy changes, better technology, and targeted training to keep going financially. Also, because of its high social and environmental ratings, the model has a lot of potential to grow through partnerships with other mosques or with local governments and green NGOs.

4. Conclusion

Integrating recycled ablution water into mosque-based hydroponic systems significantly improved community knowledge, attitudes, and practices (KAP), with a 10.5% average score increase post-training. The Wilcoxon Signed-Rank Test confirmed this improvement as statistically significant ($p < 0.05$).

Perception scores across Rogers' five innovation dimensions (Relative Advantage, Compatibility, Complexity, Trialability, Observability) all exceeded the neutral threshold (mean > 3.0), indicating general community readiness. Observability scored the highest (3.78), highlighting the importance of visible proof in adoption decisions.

Sustainability assessment across four dimensions showed high perceived environmental benefits (mean 4.38 for water reduction) and strong social solidarity (mean 4.18), with institutional support from mosque leadership enhancing trust and legitimacy.

Despite the positive reception, complexity (mean 3.70) and concerns over operational costs (mean reversed score = 1.98) were identified as key barriers, especially in low-income settings. Trialability got the lowest score (3.50), meaning there aren't many chances for small-scale
testing. The model has a lot of potential for use in other urban mosques, especially in areas where Muslims comprise most of the population. It supports multiple SDGs (2, 6, 11, 12) because it aligns with religious values, helps with urban food security, and encourages water reuse.

Recommendations for Further Development:

To enhance adoption and Sustainability: Develop demonstration sites and open-house events to improve observability and trialability; Provide structured training and peer-led mentoring to reduce perceived complexity. Collaborate with local governments and NGOs to subsidize start-up costs and embed the system within broader urban agricultural policies.

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