E-BOOK OF EXTENDED ABSTRACT

THE 14TH INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025

14TH INDES 2025

ENVIRONMENTAL • SOCIAL • GOVERNANCE

UNIVERSITI TEKNOLOGI MARA

RIICAN Research Innovation Industry Community & Alumni Network

E-BOOK OF EXTENDED ABSTRACT

THE 14th INTERNATIONAL
INVENTION, INNOVATION &
DESIGN COMPETITION 2025

Organized by:

Office of Research, Industry,
Community & Alumni Network
UiTM Perak Branch

Perpustakaan Negara Malaysia Cataloguing in Publication Data

No e- ISBN: 978-967-2776-52-9

Cover Design: Dr. Mohd Khairulnizam Ramlie

Typesetting : Georgia

EDITORIAL BOARD

KEKEBUN: PORTABLE SOLAR HYDROPONICS FOR SUSTAINABLE HOME FARMING

Mohd Nasiruddin Abdul Aziz1, Muhammad Kamil Mohamad Faizar2, Nur Syafinaz Saari3, Faiz Hilmi Faizol4, Muhammad Solehin Abdul Halim5

[1]Faculty of Arts and Design, UiTM Perak Branch, Seri Iskandar Campus, 32610 Seri Iskandar, Perak, Malaysia
[2,3,4,5] No 42. Jalan Lakeville 2, Bandar Universiti, 32610 Bandar Seri Iskandar, Perak, Malaysia

Mohdn571@uitm.edu.my,
kekebunofficial@gmail.com

ABSTRACT

Kekebun is an innovative and portable hydroponic system that combines solar power and automated watering to support sustainable home farming. It is designed for urban users who face space and access limitations to electricity, allowing them to grow fresh vegetables efficiently without relying on traditional power sources. The system features a vertical planting structure to maximize growing capacity, a solar-powered pump for automatic nutrient circulation, and a wheeled frame for easy mobility and placement. Unlike conventional hydroponic systems, Kekebun offers energy independence, low maintenance, and user-friendly operation, making it suitable for homes, educational institutions, and small community projects. Since its launch, Kekebun has sold more than 300 units in both local and international markets, demonstrating strong commercial potential and market acceptance. Buyers have consistently highlighted its practicality, cost efficiency, and environmental benefits. In addition to its commercial success, Kekebun has played an active role in promoting sustainability through collaborations with schools, government agencies, universities, and local communities. These partnerships support knowledge sharing and environmental education, further expanding the impact of the product beyond home farming. Kekebun makes meaningful contributions to global efforts in clean energy, responsible consumption, and urban food security, positioning it as a scalable and market-ready solution for sustainable urban agriculture.

Keyword: Hydroponics, Solar Energy, Urban Farming, Sustainable Innovation, Product Commercialization

1. INTRODUCTION

Urban agriculture is emerging as a vital strategy to address global challenges, including food insecurity, land scarcity, and environmental sustainability. Hydroponic farming, which enables the cultivation of crops without soil and with efficient water use, is particularly suitable for compact urban spaces. However, most conventional hydroponic systems rely on electricity for nutrient circulation and lighting, resulting in increased energy costs and reduced accessibility for communities with limited resources (Dorr et al., 2024). These limitations hinder the realization of Sustainable Development Goal 2 (Zero Hunger) and SDG 11 (Sustainable Cities and Communities), which emphasize the importance of food access and resilient urban living.

In addition to high energy dependency, many hydroponic setups are stationary and require frequent manual intervention. These constraints make such systems impractical for individuals with limited gardening knowledge, physical limitations, or time. The lack of automation and mobility in current designs also limits their potential use in educational and community-based urban farming initiatives (Smith & Lee, 2024). Addressing these barriers is crucial to promoting SDG 12 (Responsible Consumption and Production), which advocates for efficient and user-friendly systems that reduce waste and support sustainable practices.

In response, Kekebun was developed as a portable hydroponic farming system powered entirely by solar energy and equipped with automatic watering technology. This solution not only minimises the need for electricity and manual labor but also promotes clean energy usage, aligning with SDG 7 (Affordable and Clean Energy). Its compact, mobile design encourages sustainable food production at home, in schools, and communities, with high potential for commercialization and scalability in urban environments (Khatri, Kunwar, & Bist, 2024).

2. METHODOLOGY

The design and development of Kekebun focused on creating a compact, user-friendly hydroponic system that runs entirely on solar energy. The system was designed with a vertical layout to maximize planting space, making it ideal for limited urban areas (Refer to Fig. 1). Key components included a solar panel, charge controller, rechargeable battery, and a submersible pump to automate the watering process. A nutrient reservoir was connected to a network of PVC channels, allowing a consistent flow of water to all plants. To enhance mobility, the entire structure was mounted on a wheeled metal frame, allowing for easy movement to achieve optimal sunlight exposure. Material selection prioritised durability, low cost, and ease of maintenance, ensuring the design could be scaled for commercial production or home use.

Figure 1: The Structure and the Application of Kekebun

3. FINDINGS

The Kekebun system has demonstrated a significant impact and market acceptance since its introduction. Unlike conventional hydroponic systems, Kekebun integrates a solar-powered irrigation mechanism within a portable vertical structure, allowing users to grow fresh produce without relying on electricity or fixed locations. Its compact, wheeled design enhances mobility and usability in various urban settings, including balconies, schools, and small community spaces. This combination of portability, automation, and renewable energy use distinguishes it from other existing hydroponic models in the market.

Figure 2: Kekebun Installations to Customer

Within just three years of commercialization, Kekebun has sold over 300 units, both locally and internationally. This strong uptake reflects the product's alignment with growing demand for sustainable, home-based food production solutions. Buyers have included home gardeners, educators, researchers, and institutional adopters from Malaysia and overseas markets. Positive feedback from users consistently highlights the system's ease of use, energy independence, and contribution to sustainable living, especially in reducing water and energy consumption.

Kekebun's innovation has also fostered numerous collaborations for knowledge transfer and community engagement. The product has been utilised in educational programs, government outreach projects, and university research initiatives, serving as a platform to promote urban agriculture and environmental awareness. These partnerships have further strengthened its reputation and proven its versatility as both a learning tool and a practical farming solution. The high level of market response and institutional support underscores Kekebun's substantial potential for continued commercialization and social impact.

4. CONCLUSION

Kekebun has demonstrated strong potential as a practical and sustainable hydroponic solution for modern urban living. By combining solar energy, automated watering, and a mobile vertical design, it overcomes key limitations of conventional systems, such as reliance on electricity and lack of portability. Its ability to operate off-grid makes it accessible to a broader group of users, including those in low-resource settings. The design also promotes efficient land use and supports food self-sufficiency at home, in schools, and within community spaces.

With more than 300 units sold over three years, both locally and internationally, Kekebun has proven its high commercialization value. Positive feedback from users highlights the product's energy efficiency, ease of use, and its contribution to sustainable lifestyles. Beyond sales, Kekebun has played an active role in knowledge transfer through collaborations with educational institutions, government agencies, and community programs. This positions the product not only as a market-ready innovation but also as a tool for environmental education and long-term social impact.

REFERENCES

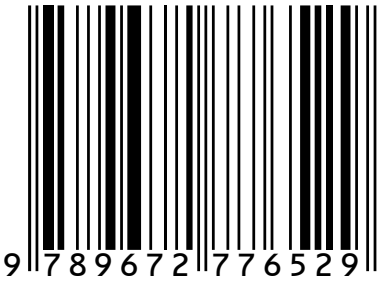
Dorr, E., Alwan, M., & Tan, Y. (2024). Energy consumption as the main challenge faced by indoor farming. *Journal of Indoor Agriculture, 5*(2), 123–135. https://doi.org/10.1016/j.jia.2024.02.005

Smith, J., & Lee, A. (2024). Urban small-scale hydroponics: A compact, smart home-based solution. *Urban Agriculture Journal, 12*(3), 45–58. https://doi.org/10.1016/j.urbagri.2024.03.002

Khatri, L., Kunwar, A., & Bist, D. R. (2024). Utilization of solar energy in hydroponic systems for enhancing energy independence in farming communities. *Journal of Sustainable Agriculture and Renewable Energy, 8*(1), 67–79. https://doi.org/10.1016/j.jsare.2024.01.008

E-Book of Extended Abstract THE 14th INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025

e ISBN 978-967-2776-52-9



Unit Penerbitan UiTM Perak
.

(online)