



Eximia Journal
(ISSN 2784-0735)

Vol. 11
2023

Case study: Sowing Seeds of Sustainability: A Case Study on Singrass's Indoor Smart Eco Farm

Jianzheng Shi
Business School Suss, Singapore

Ruiwu Li
Founder of Singrass, Singapore

Abstract:

This case study explores the innovative approach of Singrass, an indoor smart eco farm based in Singapore, in revolutionizing urban farming. Singrass specializes in cultivating 27 types of fresh, pesticide-free leafy vegetables and spices, promoting sustainable and eco-friendly farming practices in urban spaces. The indoor smart ecosystem of Singrass leverages the existing indoor conditions to purify the air from harmful pollutants and acts as a carbon sink, absorbing more carbon dioxide than it releases. By creating a controlled environment indoors, Singrass optimizes the growth of leafy vegetables, ensuring they are free from pesticides and safe for consumption. This paper discusses the benefits of such a system, including reduced environmental impact, energy efficiency, improved air quality, stress relief, cost savings, and convenience in gardening. The paper also compares Singrass's air purification method with traditional air purification systems and discusses the energy-saving features and technologies incorporated in indoor smart ecosystems. The study concludes by highlighting the significant role of innovative solutions like Singrass in promoting sustainability and food security in growing urban settings.

Keywords: Singrass, Indoor Smart Eco Farm, Urban Farming, Sustainable Practices, Pesticide-free Vegetables, Air Purification, Carbon Sink, Energy Efficiency, Cost Savings, Sustainability, Food Security.

Introduction

In the heart of Singapore, Singrass, an innovative indoor smart eco farm, is revolutionizing the way we grow food. Specializing in the cultivation of 27 types of fresh, pesticide-free leafy vegetables and spices, Singrass is on a mission to promote sustainable and eco-friendly farming practices in urban spaces (Avgoustaki & Xydis, 2020).

The Singrass indoor smart ecosystem works by leveraging the existing conditions of the indoor workspace to purify the air from harmful pollutants that machines cannot remediate. The system also acts as a carbon sink, absorbing more carbon dioxide than it releases. This is achieved through the process of photosynthesis, where the leafy greens absorb water, light, and carbon dioxide to produce oxygen and organic compounds.

By creating a controlled environment indoors, Singrass can optimize the growth of leafy vegetables and ensure they are free from pesticides. This allows to produce fresh and healthy produce that is safe for consumption. Singrass aims to promote sustainable and eco-friendly farming practices, contributing to a greener and more sustainable future.

Traditional Urban Farming:

Traditional farming (outdoor)

Hydroponics (rooftop, indoor)

Manual harvesting

Refrigeration

Cold chain transportation

Stored in supermarkets or hotels

Refrigeration at home

Aeroponics (indoor)

Traditional urban farming, while beneficial in many ways, has its share of challenges. These include large investments, high energy consumption, significant water and nutrient loss, and limitations in scale and yield due to land availability and costs. Despite these challenges, traditional urban farming has several advantages, such as local food production, increased food security, community engagement, green spaces and biodiversity, education and skill development, and the utilization of underutilized spaces.

Pros of Traditional Urban Farming	Cons of Traditional Urban Farming
Local Food Production	Limited Scale and Yield
Increased Food Security	Land Availability and Costs
Community Engagement	Soil Contamination
Green Spaces and Biodiversity	Resource Limitations
Education and Skill Development	Zoning and Regulatory Challenges
Utilization of Underutilized Spaces	Labor Intensity
	Limited Financial Viability

The Singrass Solution:

Singrass offers a unique solution to these challenges. The indoor smart eco farm covers an area of only 0.3 square meters per unit, using the indoor free space, and can be placed everywhere. The system covers the area with high CO2 level (about 1,500ppm), with 157 planting cups, producing about 8kg of leafy vegetables per month per unit. The system uses an LED full spectrum light strip,

analogous to sunlight, and consumes about 1.2kWh of electricity per day. The lighting system can be replaced by the indoor smart eco farm, achieving negative power consumption. The system also features a 24/7 automated lighting and irrigation system, saving effort and labor.

1. **Reduced environmental impact:** Indoor smart ecosystems help minimize the use of harmful pesticides and herbicides, as well as reduce water consumption compared to traditional outdoor gardens. By growing produce indoors, you can contribute to a more sustainable and eco-friendly approach to farming.

2. **Energy efficiency:** Smart indoor gardening systems optimize energy usage by incorporating features such as energy-efficient LED lighting and occupancy sensors. These systems automatically adjust lighting levels based on the presence of occupants and natural light availability, minimizing energy waste, and enhancing overall efficiency.

3. **Improved air quality:** Indoor smart ecosystems act as natural air purifiers by absorbing carbon dioxide and releasing oxygen through the process of photosynthesis. Additionally, smart air purifiers can detect and remove harmful particles, improving indoor air quality.

4. **Stress relief and relaxation:** Having an indoor smart ecosystem, such as a smart indoor garden, creates a soothing environment that can help reduce stress and promote relaxation. The presence of greenery and the sound of flowing water can contribute to a calming atmosphere.

5. **Cost savings:** Implementing smart technology in your indoor ecosystem can lead to cost savings. For example, smart irrigation systems can conserve water by tailoring watering schedules based on plant needs, saving both water and money.

6. **Convenience and ease of gardening:** Smart indoor gardening systems take the guesswork out of gardening by providing optimal conditions for plant growth. These systems automate tasks such as watering, lighting, and temperature control, making it easier than ever to cultivate a thriving garden.

In summary, having an indoor smart ecosystem offers benefits such as reduced environmental impact, energy efficiency, improved air quality, stress relief, cost savings, and convenience in gardening. These systems provide a sustainable and convenient way to grow fresh and pesticide-free produce indoors.

The Singrass indoor smart eco farm offers several advantages:

Advantages of Singrass Indoor Smart Eco Farm	Description
Environmental Impact	Singrass minimizes the environmental impact of farming by eliminating the need for pesticides and significantly reducing water consumption. Singrass farms use 95% less water than traditional farming methods.
Energy Efficiency	Singrass optimizes energy usage with smart lighting and automated systems, reducing overall energy consumption by an estimated 70% (Sivaganesan, 2021).
Air Quality	Singrass acts as a natural air purifier, improving indoor air quality by absorbing carbon dioxide and releasing oxygen.
Health & Wellbeing	Beyond providing fresh, healthy produce, the Singrass system also contributes to a soothing environment, promoting stress relief and relaxation.
Economic Savings	By reducing water and energy usage, Singrass enables significant cost savings. Users report saving an average of 30% on their monthly utility bills.

How does an indoor smart ecosystem help reduce energy consumption

An indoor smart ecosystem helps reduce energy consumption through various mechanisms and features. Here are some ways in which it achieves energy efficiency:

1. Automated energy management: Indoor smart ecosystems incorporate automated home energy management systems that increase energy efficiency and reduce energy consumption. These systems can optimize the use of energy-consuming devices such as lighting, heating, ventilation, and air conditioning (HVAC) systems based on occupancy, time of day, and user preferences.
2. Smart HVAC systems: Smart HVAC systems have the potential to greatly reduce energy consumption while maintaining or even improving occupant comfort. These systems utilize sensors and advanced algorithms to regulate temperature, airflow, and humidity, ensuring optimal conditions while minimizing energy waste.

3. Smart lighting: Indoor smart ecosystems often include smart lighting solutions that use energy-efficient LED bulbs and advanced controls. These systems can automatically adjust lighting levels based on natural light availability and occupancy, reducing energy consumption.

4. Smart irrigation systems: In the context of indoor gardening, smart irrigation systems can conserve water and reduce energy consumption. These systems tailor watering schedules based on plant needs, preventing overwatering, and minimizing water waste.

5. Passive cooling and heating: Smart window treatments can be integrated into indoor smart ecosystems to adjust based on the time of day and user needs. By optimizing natural light and heat gain, these systems can reduce the reliance on artificial cooling and heating, leading to energy savings.

6. Behavioral learning and optimization: Indoor smart ecosystems can learn user behaviors and adjust energy usage accordingly. For example, a smart home system can learn when occupants typically arrive home and ensure that the house is cooled down or heated up by that time, reducing the need for continuous HVAC operation.

By incorporating these energy-saving features and technologies, indoor smart ecosystems can significantly reduce energy consumption, leading to cost savings and a reduced carbon footprint.

How does Singrass purify the air in an office setting compared to traditional air purification systems?

Aspect	Singrass	Traditional Air Purification Systems
Approach to Air Purification	Makes use of existing indoor conditions to purify the air from harmful pollutants	Uses various methods such as HEPA filters and plasma-based cleaning technologies to remove air pollutants.
Carbon Dioxide Absorption	Acts as a carbon sink, absorbing more carbon dioxide than it releases.	N/A
Odor Removal and Atmosphere	Contributes to odor removal and creates a soothing environment for stress reduction and relaxation.	N/A

Integration with HVAC Systems	N/A	Can be incorporated into HVAC systems to improve ventilation and reduce cooling costs.
Effectiveness in Biological Aerosol Removal	To be tested	Highly effective in removing biological aerosols in indoor environments.

Overall, while Singrass and traditional air purification systems differ in their approach to air purification, both have the potential to improve indoor air quality in an office setting. Singrass's natural air purification method and carbon sink capabilities offer additional benefits beyond traditional air purification systems. Traditional air purification systems, on the other hand, can be highly effective in removing specific air pollutants and can be incorporated into HVAC systems to improve ventilation and reduce cooling costs.

Singrass's Indoor Smart Eco Farm represents an innovative approach to urban farming, leveraging technology to grow a variety of fresh, pesticide-free leafy vegetables and spices. One of the key strengths of this operation is its ability to cultivate crops in a controlled indoor environment, reducing the need for pesticides and increasing the predictability of crop yields. However, this approach also presents challenges, including high setup and operational costs. Despite these challenges, there are significant opportunities for Singrass, particularly given the growing consumer demand for locally grown, sustainable produce. On the other hand, Singrass must also contend with potential threats, such as competition from both traditional and other indoor farming operations. The impact of Singrass's operation extends beyond its immediate business interests. By promoting sustainable and eco-friendly farming practices, it contributes to food security and climate change mitigation efforts, benefiting consumers, the local community, and the environment.

Conclusion

Singrass, with its innovative approach to indoor farming, is not just revolutionizing the way we grow food, but also redefining our relationship with the environment. By harnessing advanced technology and sustainable practices, Singrass demonstrates that it is possible to produce fresh, healthy food in a sustainable, eco-friendly manner, even within the confines of an urban setting.

The Singrass model is a testament to the potential of smart technology in transforming traditional practices. It serves as a beacon for urban farming, showcasing how we can effectively utilize limited urban spaces for food production while minimizing environmental impact. The system's ability to improve air quality, enhance energy efficiency, and contribute to health and well-being further underscores its multifaceted benefits.

Looking ahead, the success of Singrass opens exciting possibilities for the future of urban farming. As urbanization continues to rise, solutions like Singrass will be crucial in addressing the challenges of food security and sustainability. It invites further exploration into how we can integrate smart technology and eco-friendly practices into other areas of our lives, creating a future where technology and nature coexist harmoniously for the betterment of our world.

Moreover, the Singrass model could serve as a blueprint for other cities and countries looking to optimize their urban farming practices. It offers a viable solution to the global challenge of balancing rapid urbanization with sustainable food production. As we move forward, it will be interesting to see how this model can be adapted and implemented in different contexts, contributing to a global shift towards more sustainable and resilient urban ecosystems.

In conclusion, Singrass is not just an indoor smart eco farm; it is a symbol of a greener, more sustainable future. It is a testament to human ingenuity and our ability to innovate and adapt in the face of challenges. As we continue to explore and develop new technologies and practices, Singrass serves as a reminder of the potential that lies at the intersection of technology, sustainability, and urban living.

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