GreenCape

Green Economy Enterprise Development and Investment

Green technology for mushroom cultivation

Purpose

This case study highlights the application of a green technology solution for urban food production in Cape Town. It has been commissioned by the City of Cape Town's Enterprise and Investment department as part of their strategic objectives to identify technology options for intensive food production that minimise resource use and food waste.

The green economy holds significant financial value for small and medium-sized enterprises (SMEs) and the supply and uptake of green technologies has the potential to make them more resilient in the face of acute shocks and chronic stresses of society.

Mushroom Guru (Pty) Ltd has implemented controlled environment agriculture and vertical farming techniques to cultivate mushrooms for use in the medical sector. In so doing, the company has demonstrated urban agriculture enabled by green technologies.

In the developing world, SMEs are considered vehicles for national job creation and economic growth, and their agile nature allows them to pivot quickly, particularly during times of acute shock. It is becoming clear that green economy innovations will be at the heart of the continued growth and resilience of South African SMEs.

KEY INSIGHTS

- ✓ Investment in green technology enables intensive and resource efficient production of niche produce such as mushrooms in the urban context.
- ✓ Urban agriculture can contribute to reducing food loss and waste and enable the transition to a circular and resilient economy.
- ✓ Training and access to a cooperation platform for small scale growers can enable initial, and secure ongoing, market access.

The case study discusses:

- Controlled environment agriculture
- Mushroom cultivation as an example of urban agriculture
- Green technology and related opportunities in mushroom cultivation
- Innovation in the urban agriculture space

It is written for:

Cities

- looking for innovative urban agriculture solutions
- looking for innovative organic waste diversion solutions
- looking for urban agriculture SMME growth opportunities

Entrepreneurs

- looking to pursue opportunities in urban agriculture
- looking for examples of innovation in urban agriculture, vertical farming and controlled environment agriculture

What is resilience?

In human terms, resilience refers to "the ability of an individual to recover from setbacks, adapt well to change and to keep going even when facing difficult circumstances". A resilient Cape Town is a compassionate, connected, and capable City, where Capetonians collaborate across households, communities and institutions, to build collective responses to the current and future social, environmental and economic challenges.

Background

Increasing population and rapid urbanisation are driving up the demand for resources (such as food, land, water) and employment opportunities. In the City of Cape Town Metropolitan Municipality, the population grew at an average annual rate of 2% from 2010 to 2019 to reach 4.5 million people[1]. This represents about 65% of the population in the Western Cape. The growing population in Cape Town presents a challenge to meet the demand for food, but also an opportunity for innovative food production and employment opportunities.

Mushroom Guru demonstrates a practical example of the many emerging opportunities in the urban agriculture space.
- Tokelo Shai, Agriculture Sector Desk, GreenCape

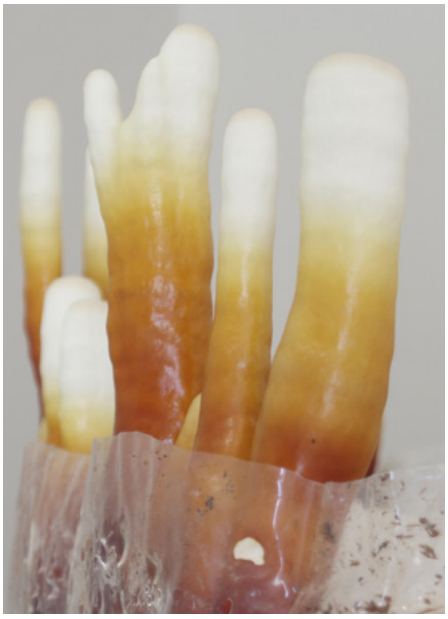
[1] Quantec (2020). Retrieved from: https://www.quantec.co.za/

Solution

Indoor vertical farming, which involves the growing of food on vertically mounted shelves, is emerging across the world. The global market for vertical farming is rapidly growing, worth an estimated USD 3.13 billion in 2019 and projected to grow to USD 9.96 billion by 2025 (CAGR of 21.3%).[2] This type of farming is often associated with growing food in cities due to the ability to utilise limited space and to benefit from shorter distances to local markets. Most vertical farms include controlled environment agriculture (CEA) where growing conditions such as temperature, light, humidity and carbon dioxide are controlled. Additionally, growing methods such as hydroponic, aquaponic and aeroponic systems, where plants are grown in soilless mediums, are typically used in vertical farms.

Vertical farming is mainly targeted at niche produce such as leafy greens, salad mixes, herbs, microgreens and mushrooms. There are several economic, environmental and social benefits of vertical farming compared to conventional farming. These include, but not limited to[3]:

- Increased incomes per square metre (m^2) of urban space
- Less fertiliser and water use (about 70 – 95% less water), which may result in reduced input costs
- Increased shelf life of produce due to reduced transportation
- Reduced carbon footprint
- Secured food supply during times of climatic stress
- Potential job opportunities from value added activities



Business overview

A local company, **Mushroom Guru (Pty) Ltd** (Mushroom Guru), is cultivating medicinal mushrooms using indoor vertical farming technology. The company was launched in 2013 cultivating uniquely grown Reishi mushrooms and providing valuable information on their associated benefits in tackling various diseases. The main focus of the business is processing the Reishi mushrooms into medicinal extracts. The extract, MG-LZ8, is widely used for its benefits linked to reduced inflammation and improved immune function.

In addition, Mushroom Guru provides training on the cultivation of gourmet mushrooms such as oyster mushrooms, in low-tech growing systems.

To date, over 600 workshop attendees have been trained and about 125 people have graduated from their Advanced Fungi course. Most of the trained students go on to develop small-enterprises cultivating gourmet mushrooms and which they sell to local markets, while others remain empowered to grow for home consumption.

To support mushroom cultivators, Mushroom Guru established *Fungkifriend*, which is a cooperative system in which old and new mushroom cultivators gain exposure for their mushroom products. The platform is freely available to workshop and course attendees that train with Mushroom Guru.

Looking into the future, Mushroom Guru plans to grow the *Fungkifriend community* to more than a 1 000 growers producing mushroom derived products. In addition, the company aims to continue expanding and disseminating information on the associated health benefits of medicinal mushrooms and to continue supporting mushroom cultivators.

[2] CAGR = compound annual growth rate. Grand View Research (2020). Retrieved from: https://www.grandviewresearch.com/industry-analysis/vertical-farming-market

[3] Agricultural Research Council (n.d.). Hydroponic Vegetable Production. [Online] http://www.arc.agric.za/arc-vopi/Pages/Crop%20Science/Hydroponic-Vegetable-Production.aspx. Accessed on 4 October 2016.

Green technology overview

The grow houses for mushroom cultivation can range from low-tech to high-tech systems. The variation depends on the level of automation integrated into the system and the type of mushroom cultivated. A typical grow house requires sufficient light, oxygen and well-regulated temperature. The equipment used includes a fan for ventilation and either access to skylight or low-energy LED lighting.

The cost of setting up a grow house can range from R5 000 for a low tech grow house to about R45 000 for the more advanced grow houses.

The grow house at Mushroom Guru uses more advanced growing techniques such as aeroponics where nutrients are delivered to the mushrooms via the air or in mist. Aeroponic growing techniques use about 95% less water compared to other growing techniques.

Furthermore, the method of growing mushrooms uses bio-based processes by recovering agricultural waste such as sawdust, straw or coffee waste to be used as substrate for mushroom cultivation. In so doing, it contributes towards the transition to a circular economy.

Green technology benefits

Gourmet and medicinal mushroom cultivation form part of a growing niche market in South Africa. With the growing trends towards healthier lifestyles and consumer demand for nutritious foods, the market demand for gourmet mushrooms and mushroom-derived products is expected to continue growing. The use of indoor vertical farming systems will be essential in meeting this demand, as they allow for intensive food production, better utilisation of urban space and reduced vulnerability to climate risks. In addition, such intensive urban food production provides additional incomes and a constant supply of food.

Depending on the size of the growing area and the advancement of the technology used, there is potential for intensive production of mushrooms which can either be sold fresh to the local market or processed into value-added products. For example, an oyster mushroom grower can grow about 15 to 18kg of mushrooms per square metre of growing area. The growing cycle takes about four weeks for the mushrooms to be harvested and the mushrooms can be sold fresh to local markets.

Lessons learned and opportunities

This case study illustrates that:

1. Investment in green technology enables intensive and resource efficient production of niche produce such as mushrooms in the urban context.
2. Urban agriculture can contribute to reducing food loss and waste and enable the transition to a circular economy.
3. Training and access to a cooperation platform for small scale growers can enable initial, and secure ongoing, market access.

In addition, investment in green technology for food production unlocks opportunities for players both downstream and upstream in the food value chain. In the case of mushrooms (edible or medicinal), these include:

1. Opportunities for local manufacturers to develop green technology infrastructure and equipment such as grow tents and LED lighting for supply to existing and new entrants into the mushroom industry.
2. Mushroom producers require spawn for them to cultivate mushrooms. Thus, there are opportunities for businesses to maintain master cultures and grow spawn which can be sold to producers.
3. There is an opportunity for new entrants into the mushroom industry to cultivate mushrooms for the local market or processing industry. Such enterprises can be dedicated enterprises or existing small-scale growers of other produce that can diversify their incomes by entering new markets. A key enabler is training of new entrants in mushroom growing, particularly in the use of green technologies that enable intensive and resilient cultivation in the urban context.

IN THE CONTEXT OF CAPE TOWN'S RESILIENCE STRATEGY, THIS ENTERPRISE & INVESTMENT CASE STUDY ADDRESSES

Stresses / Shocks

- Economic crisis
- Rapid urbanisation
- Unemployment
- Food insecurity

Qualities of a resilient city

- Job-creating city
- Adaptable city
- Robust city
- Fexible city
- Resourceful city

RESILIENT CAPE TOWN PILLARS

PILLAR 1: People **Compassionate,** holistically healthy city

PILLAR 2: Place & Space **Connected,** climate adaptive city

PILLAR 3: Economy **Capable,** job creating city

PILLAR 4: Disaster readiness **Collectively,** shock-ready city

PILLAR 5: Governance **Collaborative,** forward-looking city

PILLAR 3
Cape Town is a capable, job-creating City

VISION
Capetonians turn the challenges of resource constraints and rapid technological change into new opportunities.

GOAL 3.1	GOAL 3.2	GOAL 3.3	GOAL 3.4
Foster green economic growth	Enable enterprise development in the informal economy	**Connect the workforce with a changing economy**	Collaborate with businesses to achieve a resilient local economy

WHAT IS THE GREEN ECONOMY?

The working definition for the green economy as it relates to Cape Town is: "expanded economic opportunities created through the provision of goods and services and the use of production processes that are more resource-efficient, enhance environmental resilience, optimise the use of natural assets and promote social inclusivity."

For more information and support contact:

GreenCape: info@greencape.co.za.

Additional resources relating to circular economy and sustainable agriculture are available from: www.greencape.co.za

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