



Examining Strategies for Vertical Farming Business in Malaysia: A Qualitative Research

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ABSTRACT

The research study is aimed at examining strategies of vertical farming businesses in Malaysia. The concept of sustainable agriculture is studied in detail and an attempt is made at modelling sustainable agricultural enterprises in Malaysia to act as a benchmark for vertical farming businesses. The purpose of this study is to raise awareness on the unsustainability of traditional agricultural practices and introduce vertical farming as one of the solutions. The three research objectives focus on studying the business models of sustainable agriculture enterprises in Malaysia, examining the challenges and critical success factors of vertical farms and developing a vertical farming business model that enables sustainable agriculture in Malaysia. The underpinning theory is the Resource Based View which will be used to analyse and interpret the resources of the case study organisations to understand how they can achieve a sustainable competitive advantage in vertical farming. An exploratory research design is employed to study the various stakeholders in the vertical farming value chain to understand their existing practices, challenges and critical success factors in managing successful vertical farms in Malaysia. This study employed a Type 4 Case Study design based on Yin's (2018) typology where 4 vertical farms in Malaysia were studied. In addition to the case studies, in-depth qualitative interviews were conducted with 4 individual stakeholders involved in vertical farming in Malaysia. The findings indicate that vertical farming is seen as a solution to increased production of fresh produce for a growing population as it generates 3 times more crops as compared to conventional farming. It is a welcoming solution to countries who have limited land for agriculture or land which has been depleted of its nutrients as the concept of indoor farming practiced in vertical farming addresses the scarcity of land and is seen as a healthier and more sustainable solution than traditional farming.

Keywords: Agriculture, Vertical Farming, Resource Based View, Competitive Strategies & Critical Success Factors

1. INTRODUCTION

Farming has changed significantly since the end of World War II. The 'Green Upheaval' began in 1960 to satisfy the worldwide food need. The objective of the Green Revolution is to increase the yield of crops by presenting higher-yielding strains of plants and new inorganic manures. The initiative began in Mexico in 1940 and began to spread into India, South East Asia, the Center East and Latin America. Because of the Green Revolution, food and fiber efficiency has improved due to new innovations and motorisation expanded synthetic use. Besides, specialisation and government policies that supported maximising production and reducing food prices have permitted less farmers to deliver more food and fiber at lower costs.

In spite of the fact that the green revolution has numerous beneficial outcomes and decreased numerous dangers in cultivating, they additionally represent a huge effect on nature, social prosperity and financial aspects. Noticeable among the impacts of the green revolution are topsoil depletion, groundwater defilement, air contamination, greenhouse gas emissions, the decline of local family farms, disregard of the living and working states of farm workers, new dangers to human wellbeing and security because of the spread of new pathogens, monetary fixation in food and agriculture

enterprises and disintegration of rural communities (Gliessman, S. R., 2000).

Traditional farming methods are proving to be unsustainable. This is due to land scarcity, depletion of soil quality, changing weather patterns and the excessive use of chemical fertilisers and pesticides. Agriculture run offs which destroys biodiversity and organic matter in the ground directly impacts and puts a threat on our food nutrition and food security. It is imperative that sustainable vertical farming models are designed to address food security and enhance food nutrition to the rising urban population. This research aims to model sustainable agriculture enterprises in designing a sustainable vertical farming model for the urban population.

The purpose of this study is to examine strategies of vertical farming businesses in Malaysia. This study also aims to introduce a sustainable method of producing food using sustainable practices which doesn't harm the environment and its consumers.

2. RESEARCH METHODOLOGY

This study meets the criteria of the qualitative approach because based on the research objectives, the study will gather the type of data concerned with the accumulation of

subjective judgment of information, views, and perceptions. The information collected from many stakeholders, including academic scholars, suppliers, distributors, retailers, the Vertical Farming Community, and the Ministry of Agriculture, is used to compile in-depth data on sustainable agriculture businesses. In addition, the characteristics of this study appear to be related to the various qualitative approach characteristics summarised by Stake (1995). These characteristics include case-bounded system-oriented, field-oriented, interpretive, which relies on the interaction between the researcher and the subject, and emphatic, which attends to actor intentionality and experience.

The case study method is used to achieve the research objectives and providing the most detailed answers to the research questions. Creswell et al. (2007) define a case study as employing several methodologies or sources of information to conduct an in-depth examination of one or more events, programs, activities, entities, or individuals within a delimited system. This study investigates the perspectives and opinions of various categories of stakeholders utilizing several sources of information that appear to conform to Creswell's (2017) definition of the case study approach.

This study's design calls for homogenous purposive sampling. This strategy focuses on people who share similar characteristics or categories. The goal is to concentrate on the unmistakable resemblance and how it relates to the under-researched topic. This strategy is compatible with gathering opinions, points of view, and knowledge from a specific type of person. Homogeneous sampling necessitates an intentional method for locating and gaining access to individuals directly involved in vertical farming.

Eight stakeholders from different categories were interviewed for this investigation. This study employed a Type 4 case study design based on Yin's (2018) typology. Multiple embedded cases or studies are dealt with in this form of case study methodology—the embedded design institutes multiple subunits, each of which is investigated separately. In the end, the findings of these units are combined to form a larger vision.

3. RESULTS AND DISCUSSION

For the purpose of this study, case study verbatims was used to produce authentic data transcription from the interviews conducted. Atlas.ti Version 7 is used to analyze the qualitative data collected from the interview. There are five significant themes which are studied and analyzed. The five themes are sustainable agriculture practices, challenges of managing a vertical farm, critical success factors, competitive strategies of vertical farming management and finally sustainable business model of vertical farms.

Sustainable Agriculture Practices

Under the first theme, the researcher analyses three sub themes which are part of Sustainable Agriculture Practices. The three themes are Social, Environment and Economics. Under sub theme social, there are four factors discussed, under sub theme Environment there are a total of eight factors discussed and finally under Economics there is a total of five factors discussed. Among the seventeen factors analyzed the top factor for each sub theme is shared below taking evidence

from the case study analysis. Under sub theme social, 'Food Safety – Good conditions for consumer health' scored the highest percentage. As for sub theme environment, 'Resilient to climate change' scored the highest percentage and finally under sub theme economics, 'Economic opportunity for land scarcity.' Accordingly, six of the eight respondents found that the following factors resonate the vertical farming practices specific to sustainability. The findings are listed below:

Sub Theme 1: Social – Good Condition for Consumer Health

Food safety has become an important component in consumerism today. How food is produced, where food is produced and who is producing the food that we consume has become an increasingly strong factor amongst consumers living in urbanized communities around the world. The media and print sources have raised awareness on selecting food which are grown responsibly and clean for consumer consumption. Of such, six of the eight respondents found that vertical farming solves the issue of food safety. One researcher however from AGR Agrotech found that there are chemical residues from the chemical fertilisers some farmers use and this does not contribute to good condition for consumer health. Aside from that one respondent, the rest found the method to be viable in ensure food is produced in a safe and clean condition for consumer health.

1:10 ¶ 49 in Case Study 1_Babylon Vertical Farm

We use only organic chemicals, organic foliage sprays, probiotics, The chemical part will be the nutrition solution because we are using hydroponics, its powdered base mixture water soluble, we don't spray any pesticides on our plants, so its edible and we don't use any soil.

2:11 ¶ 57 in Case Study 2_Cultivet

We concord our own nutrients. We realize when we buy outside, it is inconsistent. We find out what diet each plant requires. We have 4 PhD holders that calculate what each plant needs for its nutrient and feeds it exactly that. They work on the R&D side. I spend a lot of time and money on R&D so stay ahead.

3:7 ¶ 47 in Case Study 3_VFarm

Our food is very safe to consume, I say this because as you know we started the farm because of the indicators in the United Nations Sustainable Development Goals (UNSGD) and we consume it ourselves. Since no pesticides are used directly to the consumable leaves of the basil plant, it is safe to be eaten fresh off the farm.

4:8 ¶ 47 in Case Study 4_CityFarm

Definitely. So, we don't use any pesticides, we don't use any added hormones, we only use the fertilizer for the plants. That's the only non-organic solution that is used.

7:6 ¶ 48 in Case Study 7_Eleanor Sunway X Farms

Nutrition, super high because for us we practice 3 to 5 hours of farm to table supply chain so typically we harvest on a Friday most of it for our customers, the restaurants throughout the week but typically when a plant is harvest in 3 hours it is in the hands of the consumers.

8:6 ¶ 47 in Case Study 8_GreenBugs

We harvest the vegetables on the spot and ask consumers to eat it on the spot to proof it is clean. We have been doing this for half a year. Customers ask us, sure or not don't need to wash the vegetables, and we tell them yes, it's been half a year, and everything seems fine. Because of the hygiene factor it starts with us the operators. Food safety standards are there. No nasty chemicals and GMO to improve the output.

Sub Theme 2: Environment – Resilient to Climate Change

The method of farming indoors or within a controlled environment, is deemed to be a practice that protects the crops from the changes in climate and the intensity of weather conditions. Due to the nature of vertical farming, seven respondents agreed that vertical farming is a great solution in addressing the changes in climate and is a resilient model in ensuring food is produced everyday all year long. The following verbatims provide evidence to support the argument that vertical farming is resilient towards climate change.

1:10 ¶ 49 in Case Study 1_Babylon Vertical Farm

Yes definitely, the plants could be in an environment which could be super-hot, extra cool, nothing is going to change the quality of the plants as its indoor.

2:11 ¶ 57 in Case Study 2_VFarm

This indoor system is proven to be very resilient against climate change, but climate change includes earthquakes and if you are located in a location prone to earth quakes you may be affected since VF are set up indoors and in buildings most times. However, we are able to control the temperature and not affected by the weather such as extreme rain or sunshine (drought).

4:8 ¶ 47 in Case Study 4_CityFarm

Yes so, we are growing our crops in a controlled environment so whatever happens outside we are not affected by it.

5:7 ¶ 48 in Case Study 5_AGR SMART

Not affected because they are indoors. Free from pest and climate change.

6:2 ¶ 47 in Case Study 6_Dr. Nalini

Yes, definitely because plants are grown indoors and with the use of artificial lights.

7:6 ¶ 48 in Case Study 7_Eleanor Sunway X Farms

Indoor farming works best. Q4 typically rainy season so it will affect and takes a longer time to grow but obviously a lot better than traditional farm – soil-based farming. You can't really do much a about it. We can tweak the nutrition and you can grow throughout the year so long there is no power cut. Very climate proof.

8:6 ¶ 47 in Case Study 8_GreenBugs

Not affected by weather. Unless lighting or air-condition problem.

Sub Theme 3: Economics – Economic opportunity for land scarcity

With the shrinking percentage of arable land in Malaysia, there is an opportunity to leverage into indoor farming which uses less space compared to conventional farming. Since conventional farming land has become scarce not only because of the total arable land available but also because the land that is allocated for farming suffers from top soil depletion, it makes good economic sense to produce food in an indoor environment using technology and having food available closer to its consumers. In vertical farming, the method promises a minimum of two times the amount of yields produced compared to open field farming. This is because crops are stacked vertically to increase the amount of yield per square foot. A summary of the findings from the respondents are analyzed below to provide a further understanding of how vertical farming promises economics opportunity for land scarcity.

1:5 ¶ 27 in Case Study 1_Babylon Vertical Farm

It can go up 4 or 5 levels total plants can get about 5000 plus divided by 320 square feet in a container you then get an average of 17 plants per square feet. This is for a container farm. That includes the space required for the walkway. Which is about 4 feet wide. So, the walkway itself adds up taking about 160 feet. But we only use 128 square feet for production space. So, because of that, technically its 42 plants per square feet.

2:5 ¶ 34 in Case Study 2_Cultivet

Yes. So now traditional farms, one square feet is one plant. So, the same thing in a vertical farm, one square feet depends on how high is the structure. A typical A Frame is about 4 times the yield.

3:2 ¶ 25 in Case Study 3_VFarm

Most definitely there is an increase of output per square feet since the farm has growing chambers which are stacked vertically. Hence, we see 4 to 5 times compared to traditional farming.

4:3 ¶ 25 in Case Study 4_CityFarm

Yes, that is true, vertical farming helps to save land. Of course, there is a give and take so. Upside is you have high yield per square feet compared to conventional farms, but the downside is you need to use more energy, more resources. At the minimum the ratio of yield is 5 times more than a conventional farm. It can be 10 times, 20 times, depend on how you optimize the system and space.

5:3 ¶ 25 in Case Study 5_AGR SMART

Definitely agree it increases the productivity area by how much I am not sure of that.

7:2 ¶ 25 in Case Study 7_Eleanor Sunway X Farms

Of course, if you want to argue the vertical farms where you stack up the layers or if you are talking about the towers where the plans grow on towers you can typically reach 100 to 200 plants per square feet easily but of course it comes with a lot of limitations such as the technologies are not suitable to produce vegetables that are commercially acceptable

8:2 ¶ 25 in Case Study 8_GreenBugs

Yes definitely. It can be more than 3 times compared to traditional farming.

Table 1: Summary of Results Theme 1 – Sustainable Agriculture Practices

Themes	Sub Themes	Factors	Results
Sustainable Agriculture Practices	Social	S1: Food Safety - Good conditions of consumer health	11.21%
		S2: Food Security – sufficient food for present and future periods	6.54%
		S3: Improvement in working or living conditions of laborer's	5.61%
		S4: Food Security – Fulfilling the rural community needs (job opportunities)	3.74%
	Environment	E1: Resilient to climate change	7.48%
		E2: Reduction in water demands	6.54%
		E3: Reduction in salinization, nutrient overloads, and pesticide contamination	5.61%
		E4: Energy saving	4.67%
		E5: Reduction of Herbicides and Pesticides	4.67%
		E6: More productivity per unit of area	3.74%
		E7: Healthy food provision	2.80%
		E8: Reduction of carbon footprints and the effect to air quality	2.80%
	Economics	C1: Reduction in external energy input	10.28%
		C3: Economic opportunity for land scarcity.	7.48%
		C5: Low Prices of Food	7.48%
		C4: Return on Investment / Break-even point	5.61%
		C2: Substitution of non-renewable energy	3.74%

4. CONCLUSION

Based on the quotations above it can be concluded that for sub theme social, vertical farming is seen as a solution that is able to produce food in a clean and safe manner. This includes the practice of eliminating the use of chemical fertilizers and pesticides at the farm level. This automatically reduces any residue chemicals which are stored either in the leaves, stems or root of the plant. Aside from the elimination of chemicals compound, vertical farms are extremely clean compared to soil farming. Clean conditions would mean that there is lower possibilities of contaminations from bacteria. Finally, since food is prepared closer to its consumers, vertical farming is seen as an option in providing food which are high in quality since it is fresher compared to traditional farming produce which has more food miles before reaching its consumers.

Secondly it can be concluded that for sub theme environment, vertical farming is seen as a solution that is able to ensure that

crops are resilient towards climate change. The nature of vertical farming stresses on the concept of controlled environment agriculture (CEA) which looks at controlling and managing all aspects of the farm which includes the environment, air, water, light and other factors. Since food is produced in an indoor environment or in a green house, this method of vertical farming and CEA is definitely a method which paves the way for resilience towards climate changes.

Finally, it can be concluded that for sub theme economics, vertical farming is seen as a solution that is able to produce more than two times and up to forty times the yield compared to traditional soil farming. This opportunity if levels of production capacity in urbanized communities definitely pose an advantage in producing more food per square foot and having it available closer to its consumers. In return, reducing the food cost for its consumers. Hence the economic opportunity of vertical farming has several advantages simply because crops are easily doubled in production capacity with the use of 'A Frame' structures of vertical grow towers.

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