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BUSINESS FEASIBILITY ANALYSIS WITH HYDROPONIC SYSTEM IN KENDARI CITY (Case Study of *Family Garden* Hydroponic Vegetable Business)

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ABSTRACT

Rapid global population growth, climate change, and pressure on natural resources have driven the need for innovative and sustainable agricultural solutions. Hydroponic systems have emerged as an attractive alternative that promises to meet the world's food needs while reducing adverse environmental impacts. This study aims to determine the financial feasibility of Family Garden's hydroponic vegetable business in Poasia District, Kendari City. This research was conducted from April 2021 to July 2022 using the case study method. The research respondents were Family Garden business owners. The research variables include initial investment, operating costs, and projected income. The analytical tools used in this research are Net Present Value (NPV), Net Benefit-Cost Ratio (Net B/C), Internal Rate of Return (IRR), Payback Period (PP), and Sensitivity Analysis. The results showed that the Family Garden hydroponic vegetable business is financially viable. NPV analysis at a discount factor (df) of 15% shows a value of Rp196,307,009. A net B/C of 1.93 shows that the benefits outweigh the costs, making the business feasible. The IRR of 44% shows a high rate of return on capital, more significant than the 15% discount rate. The Payback Period shows that the investment will be returned within three years, three months, and 18 days, a relatively quick payback period. Sensitivity analysis shows that the business is still viable despite a 10% decrease in seed and nutrient prices or a 15% decrease in production. This study shows that marketing crops through social media such as WhatsApp and Instagram can be an effective strategy. The business is expected to reduce production costs by selecting quality seeds, taking good care of equipment, and maintaining water quality. This research contributes to modern agricultural literature by establishing a new theory on the financial viability of hydroponic businesses in areas with limited agricultural land.

Keywords: hydroponics; financial viability; Kendari City.

INTRODUCTION

The agricultural sector in Indonesia plays an essential role in economic growth, serving as a source of food security, poverty reduction, employment, and community income (Gina et al., 2023). Agribusiness, including horticultural commodities, is vital to the Indonesian economy, contributing significantly to GDP, providing employment, and being environmentally friendly (Muslimah et al., 2023). However, the sector faces challenges such as a declining workforce and aging workers, which necessitates attracting the younger generation through increased productivity and adoption of digital technology (Ngadi et al., 2023). Regional development based on agriculture and manufacturing sectors can boost economic growth, but productivity issues in agriculture and low contribution from manufacturing need to be addressed (Nurcayah et al., 2023). The positive impact of the agricultural sector on other sectors, household income, and employment opportunities underscores its importance in the Indonesian economy, making it the leading sector relied upon for income and employment generation (Azhari & Purnomo, 2022). Hydroponics, a soil-less cultivation method, presents a modern

approach to agriculture, offering various systems such as wick, kul water tour, flow, drip, NFT, and tidal systems for efficient crop production (Azhari & Purnomo, 2022).

Rapid global population growth necessitates a significant increase in food production, yet the conversion of agricultural land for urban and industrial uses has reduced land available for agricultural activities. To address this challenge, hydroponics has emerged as a promising solution, offering a soil-less cultivation method that can be applied in limited spaces and providing an alternative source of income for farmers with small plots of land. Hydroponics enables higher crop yields in less time and with fewer resources and addresses issues such as climate change, freshwater scarcity, and the need for arable land, making it a viable option to meet the increasing food demand sustainably (Rai et al., 2023), (Kumar, Vikanksha & Singh, 2023), (Chaube et al., 2022), (Gartmann et al., 2023), (Supritha et al., 2023).

Feasibility analysis of hydroponic systems has contributed significantly to filling the gap in modern agricultural literature. This study comprehensively analyzed costs, estimated revenues, technical efficiency, risks, and social and environmental impacts, highlighting Kendari City as a center for developing horticultural crops with hydroponic systems promoted by the local government (Sisodia et al., 2021). The cultivation of annual vegetables such as mustard, kale, spinach, and long beans in Kendari City faces challenges due to shrinking agricultural land, despite the market opportunities presented by hydroponic farming to increase vegetable production in both quantity and quality (Sisodia et al., 2021). The integration of hydroponic systems in Kendari City not only addresses the limitations of traditional farming but is also in line with the global trend towards sustainable and innovative agricultural practices, emphasizing the importance of urban aquaponics for sustainable food production (Wirza & Nazir, 2021). Based on the data (BPS Kendari City, 2021), the land productivity in Poasia Sub-district is 532 hectares. This figure is relatively low compared to that in Kendari city. In addition, the demand for vegetable commodities is increasing, especially in certain seasons.

Family Garden started a hydroponic vegetable business in 2017, utilizing hydroponic technology with limited facilities and infrastructure, including non-optimal greenhouses, but strictly following SOPs from seeding to post-harvest packaging. (Aqhsal, 2023). This business uses NFT and floating raft systems in greenhouses for sowing seeds and rejuvenating plants, protecting plants from rain and mold growth. (Aqhsal, 2023). Despite the high initial capital requirements for greenhouse construction and hydroponic setups, the quality and quantity of vegetables surpass conventional crops due to improved pest and disease protection (Aqhsal, 2023). To assess the venture's feasibility, financial aspects and sensitivity analysis are essential to determine profitability and sustainability (Aqhsal, 2023). Such considerations are essential for establishing and expanding hydroponic businesses, ensuring optimal return on investment and operational feasibility.

The financial viability of hydroponic vegetable farming in Indonesia has been the subject of recent research, particularly in locations such as Kendari City and Southeast Sulawesi (Sukendar & Dewi, 2023), (Indahsari et al., 2022), (Indahsari et al., 2022). Studies have shown that home gardens, including those integrated with agribusiness subsystems, play an essential role in sustainable agricultural production systems, with indicators such as crop diversity and soil quality critical in assessing sustainability (Katja, 2007). Moreover, during the COVID-19 pandemic, hydroponic vegetable businesses have demonstrated varying degrees of sustainability across economic, social, environmental, and technological aspects, highlighting the importance of analyzing different dimensions for long-term success (Waliyanti et al., 2022). Therefore, the research conducted at Family Garden, Poasia Village, Poasia Sub-district, Kendari City, Southeast Sulawesi, with a focus on the financial viability of hydroponic vegetable cultivation, is in line with the broader trend and importance of such businesses in the region. This study aimed to determine the financial feasibility of the hydroponic vegetable business venture run by Famiy Garden in Poasia District, Kendari City.

MATERIALS AND METHODS

The research was conducted in *Family Garden*, Poasia Village, Poasia Sub-district, Kendari City, Southeast Sulawesi. The research location was determined *purposively*, considering that the business owner has a business line integrated with the agribusiness subsystem. This research aims to analyze the feasibility of the financial aspects of the *Family Garden* hydroponic vegetable cultivation business. This research was conducted from April 2021 to July 2022.

The data analyzed in this study are primary data obtained through survey techniques with interviews (using questionnaire surveys as the primary source of information). Respondents in this study were *Family Garden* business owners. The data in this study were analyzed quantitatively by calculating *Net Present Value* (NPV), *Benefit Cost Ratio (Net* B/C) analysis, *internal rate of return*

(IRR), *Payback period* (PP), and Sensitivity Analysis. The analysis was carried out to determine the business's financial feasibility level. Analyzing the financial feasibility of the Family Garden business through quantitative methods such as NPV, Net B/C, IRR, PP, and Sensitivity Analysis is essential to assess its long-term sustainability and success, in line with the broader literature on family business and garden management (Fitri et al., 2022).

RESULTS AND DISCUSSION

Business Overview

Hydroponics offers significant advantages, especially in small land areas, with benefits such as increased crop success, higher production yields, sustainable harvests, decreased susceptibility to pests and diseases, and protection from flooding (Idham et al., 2022). An example of successful urban farming with hydroponics is the Family Garden system, utilizing NFT hydroponics and floating rafts for vegetable cultivation, allowing for an efficient supply of water, nutrients, and oxygen to the plants (Idham et al., 2022). This innovative approach optimizes land use and extends farming to underutilized water bodies, such as lakes and rivers, alleviating pressure on traditional farmland (Idham et al., 2022). The growth of the Family Garden from 500 to 7,000 planting holes demonstrates the scalability and success of the hydroponic system, focusing on the cultivation of lettuce and pakcoy mustard due to its suitability to Indonesia's tropical climate and short harvest cycle (Idham et al., 2022).

The Family Garden Hydroponics business, located on Jalan Kelapa in the Poasia sub-district with an area of 600m², has expanded to commercially sell hydroponic vegetables, including lettuce, pakcoy mustard, caisim mustard, samhong mustard, and celery (Ady Dwi Tegar et al., 2023). The main crops cultivated are lettuce, pakcoy mustard, and caisim mustard, and partnerships have been established with various companies such as Hypermart, Indogrosir, KFC, and hotels in Kendari (Ady Dwi Tegar et al., 2023). The organizational structure includes business leaders, workers, and owners directly involved in the cultivation activities (Ady Dwi Tegar et al., 2023). The business employs four permanent workers who are paid monthly, with tasks ranging from sowing seeds to post-harvest processes and additional admin staff (Ady Dwi Tegar et al., 2023). Operations run seven days a week, with eight-hour shifts from 07:00 to 16:00.

Financial Feasibility Analysis

The financial aspect in analyzing the feasibility of the laying hens business relates to all activities carried out by the business owner from a financial perspective. The feasibility of an Urban Farming vegetable business with a hydroponic system, "Family Garden," will be assessed using investment assessment criteria, including NPV, Net B/C, IRR, and Payback Period and sensitivity analysis.

Net Present Value (NPV) analysis determines the net present value obtained from an investment activity. Based on the results of the NPV calculation, the net present value (NPV) at a discount factor (df) of 15% is IDR196,307,009 - until this Hydroponic business runs for ten years (2027). This figure shows that the Family Garden Hydroponic business is profitable and feasible because the NPV obtained is positive or greater than zero. Seeing this, it is expected that the Family Garden business can expand its production area and business network, especially in the marketing field. (Sukendar & Dewi, 2023).

Net B / C is the ratio between positive NPV and negative NPV or the ratio between the value of benefits and current costs at the applicable discount factor level of 15%. The results of the Net B/C analysis with a discount factor of 15% amounted to 1.93, which means that the Family Garden business is feasible because the value obtained is more significant than one (Net B/C> 1). As mentioned in the investment appraisal criteria, if the net B/C is> 1, the business is feasible to run (profit). Therefore, the Hydroponic Family Garden business is expected to continue to be run because the Net B/C value obtained is quite significant (Fitri et al., 2022), (Saparamadu, 2013).

The Internal Rate of Return (IRR) analysis is used to determine the extent to which the owner of the Hydroponic Family Garden can return the amount of capital invested. From the results of the IRR analysis presented in Appendix 8, an IRR value of 44% was obtained. This shows that the Family Garden Hydroponics business will survive even if there is an increase in the discount factor level by 50%. Thus, based on the IRR criteria, the Hydroponic Family Garden business is feasible because the rate of return on capital obtained is higher than the 15% discount factor level.

The payback Period (PP) is the return on investment period spent through the profits obtained from this Hydroponic Family Garden business. The payback period of the investment in this Family

Garden Hydroponic business is three years, three months, and 18 days. This is because, in the first year, it still cannot cover operational costs with those obtained (Fitri et al., 2022).

The purpose of sensitivity analysis is to see what happens to the business analysis if there is a change in costs and benefits, such as an increase in variable costs and a decrease in production. Cost components that sometimes experience price increases, assuming inflation occurs, so that all cost components experience a 15% increase. At that time, the business was still feasible to run because the NPV was more significant than 0, the Net B/C was more significant than one, and the IRR was more significant than the discount factor and payback period before the business's life. The tolerance limit for nutrient price increases is 300% (Zaresta et al., 2022), (Sukendar & Dewi, 2023). If the price increase exceeds the tolerance limit, the business will generate an NPV smaller than 0 so that the business becomes unviable. The increase in nutrition is usually caused by the scarcity of raw materials for nutrition in Java and other regions. The results of the sensitivity analysis calculation can be seen in the following table:

Table 1. Calculation results of sensitivity analysis of increasing nutrient prices and decreasing vegetable selling prices.

Description	Percentage	Sensitivity Analysis Results			
		NPV (IDR)	Net B/C	IRR (%)	PP (Year)
Normal Condition		196,307,009	1,93	44	3.30
Nutrient Price Increase	15	100,547,330	1.44	35	4.68
Decrease in the Selling Price of Vegetables	15	37,466,379	0.74	30	6.69

Source: Primary Data Processed 2022

In the context of vegetable sales, price fluctuations can affect product acceptance. Factors such as increased competition and surplus vegetables from neighboring areas offering lower prices may lead to price reductions by hydroponic vegetable farmers to retain customers. Research has shown that a 15% decrease in vegetable prices still maintains the viability of the business, indicated by a positive Net Present Value (NPV), Net Benefit-Cost Ratio (B/C), Internal Rate of Return (IRR) exceeding the discount rate, and payback period within the business timeframe. However, sustained price declines exceeding 18% can lead to negative NPV and potential bankruptcy if not addressed immediately, emphasizing the importance of strategic pricing management to ensure long-term sustainability (Rahmaningtyas et al., 2022), (Chen et al., 2020), (Rani & Rao, 2014).

Sensitivity analysis plays an essential role in assessing the resilience of the Hydroponics Family Garden initiative to address potential impacts arising from changing conditions, as highlighted in the literature (Korpelainen, 2023). This analysis is essential due to the inherent uncertainty surrounding future projections, emphasizing the need to evaluate the system's ability to adapt to varying circumstances (Lewis et al., 2019), (Quach et al., 2021). With the increasing vulnerability of urban green infrastructure to climate change effects such as flooding and drought (Lewis et al., 2019), the utilization of hydroponic systems, especially in small island developing states (SIDS), presents a promising solution to improve food security and sustainability in the face of intensifying climate challenges. (Quach et al., 2021). By conducting sensitivity analyses, researchers and practitioners can better understand the potential of hydroponic technologies to survive and thrive in evolving environmental conditions, ensuring such initiatives' long-term success and viability.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the financial analysis, this business shows good feasibility with Net Present Value (NPV) at a discount factor (df) of 15% of Rp196,307,009, Net B/C of 1.93, Internal Rate of Return (IRR) of 44%, and Payback Period (PP) within three years three months 18 days. Sensitivity analysis shows that the Family Garden business is still feasible despite a 10% decrease in seed and nutrient prices or a 15% decrease in production. Marketing is done through social media, such as WhatsApp and Instagram, hoping this business can reduce production costs by choosing quality seeds, maintaining equipment, and maintaining water quality. Researchers are advised to pay attention to bookkeeping and financial recording and explore more efficient procedures in hydroponic businesses. This research contributes to modern agricultural literature by creating a new theory on the financial viability of hydroponic businesses in areas with limited agricultural land.

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