Evaluating the Market Potential of Hydroponic Lettuce Production in Selected Municipalities in Bukidnon

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ABSTRACT

This study aimed to evaluate the market potential of hydroponic lettuce production in selected Bukidnon municipalities (Kadingilan, Kibawe, Don Carlos) using a quantitative descriptive approach. The data was gathered from food businesses and markets to analyze the influence of business profiles (years in operation, location, type) and production levels (quality, quantity, variety) on market potential (size, growth, competition). The research sought to inform sustainable agricultural practices and enhance local food security by evaluating the feasibility of hydroponics a midst rising lettuce demand. The findings revealed that market potential significantly varies by business type and location, but not by the number of years a business has been operating. Also, the quality and variety of hydroponic lettuce were the key determinants of market potential, reflecting consumer preferences. The business type and location are essential factors influencing the market potential of hydroponic lettuce.

Keyword: Hydroponic Lettuce, Market Potential, Production Level, Business Opportunity

INTRODUCTION

The hydroponics technique for farming has emerged as a promising alternative to conventional agriculture, offering a sustainable and efficient method for producing high-quality crops like lettuce. This innovative technique replaces soil with nutrient-rich water solutions, allowing for precise control over the growing environment. This leads to a more predictable and often faster cultivation process, which is less dependent on external environmental factors like climate and soil quality. As a result, hydroponics can enhance a consistent supply of fresh produce year-round, making solutions of the inherent challenges associated with traditional farming methods, such as seasonal limitations and resource dependency.

The global hydroponics market is a testament to this method's economic viability, valued at approximately USD 5 billion and projected to grow at a compound annual growth rate (CAGR) of 12.4% from 2024 to 2030. This growth is driven by the increasing demand for fresh, locally sourced, and high-quality produce, a trend fueled by a growing population and a rising preference for healthier food options. Despite this significant market potential and the proven feasibility of growing vegetables hydroponically, a notable gap exists between supply and demand. This shortage often leads to higher prices for hydroponic produce, highlighting a critical need to evaluate and enhance production capabilities to meet the market's needs.

This study, therefore, aims to bridge this gap by evaluating the market potential of hydroponic lettuce production in selected municipalities in Bukidnon. By focusing on a specific local context, the research seeks to determine the factors that influence the feasibility of large-scale hydroponic operations and the effective distribution of the resulting supply. The findings will contribute to the development of sustainable agricultural practices, improve food security in rural communities, and stimulate local economic growth by enabling farmers and entrepreneurs to meet the rising demand for hydroponic lettuce.

This study is anchored on two foundational economic theories: the Law of Supply and Demand by Alfred Marshall (1890) and the "Bigger is Better Theory" by Jacks and Novy (2018). The Law of Supply and Demand posits that a product's price and its supply are directly related, with the level of production being a key determinant of supply. This research will apply this principle by examining how production factors—specifically

quality, quantity, and variety (MacDuffie et al., 1996) influence the supply of hydroponic lettuce and, consequently, its market price and demand. Concurrently, the "Bigger is Better Theory" will be utilized to analyze the importance of market size, growth rate, and competition. A substantial and expanding market for fresh produce, coupled with a growing preference for locally sourced goods, creates a favorable environment for hydroponic lettuce (MBA Skool, 2024).

METHODOLOGY

Research Design

This study used a quantitative descriptive research method to evaluate how business profiles and production levels significantly influence market potential. The researchers collected quantifiable data from respondents' from Kadingilan, Kibawe, and Don Carlos, Bukidnon. The purpose was to accurately describe the existing situation. Through thoroughly describing the selected areas, the study aimed to provide insights into the market potential of hydroponically grown lettuce. Descriptive statistics, includes percentage, frequency, mean, and standard deviation, were used for data analysis.

Research Participants

This study was conducted in Kadingilan, Kibawe, and Don Carlos Bukidnon. These places were selected because of increasing opportunities for hydroponic lettuce: strong market demand, local government support, and skilled labor. These areas were ideal for our research due to favorable climate conditions and agricultural potential since it is situated in the southern part of Bukidnon. Kadingilan was known for its agricultural potential and scenic landscape. The locality had demonstrated a commitment to agricultural development productivity and sustainability. Kibawe, located in the central part of Bukidnon, was a growing municipality with a mix of urban and rural areas; its developing nature suggests an increasing demand for fresh produce for agricultural products. Don Carlos was known for its rich cultural heritage and agricultural landscape; this ensures optimal nutrient delivery and environmental conditions, leading to improved hydroponic lettuce productivity. The selected municipalities ensured a comprehensive understanding of hydroponic lettuce productivity across Bukidnon's diverse geographical climate and socioeconomic conditions.

The study participants were located in Kadingilan, Kibawe, and Don Carlos. From a population of 175, a sample of 100 were selected. In identifying the respondents, the participants had to be the sellers or owners of any of the three categories: eatery, fast food, and vegetable. The eatery or fast food category had to use lettuce in its products. Vegetable sellers had to be registered sellers. From each stratum, the researcher randomly selected the participants.

Sampling Design and Procedure

The researcher used a stratified sampling design. In this design, the population was divided into strata and randomly selected using Web- based random selectors to ensure proper representation of the respondents.

The researcher used a questionnaire to gather data from the selected respondents. Before administering the research instrument, the researchers approached the participants and properly asked them to participate. The researchers briefly introduced the study, informed participants that their responses would be confidential, and reiterated their voluntary participation. The survey questionnaire was designed to collect respondents' business profiles and responses about the production level and market potential for hydroponic lettuce. By doing so, the researcher was able to compile the necessary data for this study. Additionally, the research was conducted exclusively within the school year 2024 and any data collected outside this period was considered. After being approved by a panel of experts, the final questionnaire was distributed to the identified participants of the research study.

Research Instrument

The research instrument was a researcher-made questionnaire designed to achieve the study's objectives. It contained aligned and appropriate questions to research problem. The researchers utilized a survey questionnaire

with generalized questions to gather the necessary data for the study. The survey questionnaire was created based on the readings of relevant published or unpublished works, and the test questionnaire consisted of three parts.

The first part aimed to obtain the necessary business profiles of the respondents. The business profile asked the respondents about the type of their business, how long they have been operating, and where the business was located. The second part of the survey questionnaire asked for their response about the hydroponic lettuce production level. The questions were adhered to the schematic diagram. This section will include questions about quality, quantity, and variety. The third part consisted of statements regarding the level of market potential. This section inquired about responses about the elements of market potential: market size, growth rate, and competition.

To ensure the validity of the research instrument, the survey questionnaire underwent pilot testing, which included 30 participants. It was subjected to Cronbach's alpha reliability test. The questionnaire was also content validated by a panel of experts from the Business Administration Department and General Education Department. The experts assessed the questions in terms of clarity, comprehensibility, and appropriateness to the study and the research participants.

Scoring Procedure

The researcher used a 4-point Likert scale. For the level of production it ranges from 4 (Highly produce) to 1 (Rarely produce). For the level of market potential it ranges from 4 (Very high potential) to 1 (Very low potential). The response indicated how significant business profile purchase influences a variety of market potentials of hydroponic lettuce production in selected municipalities in Bukidnon.

Treatment of Data

The following statistical tools were used in the analysis of the data that were gathered in this study:

For problem number one, frequency and percentage were used to determine the business profile of respondents. For problem number two, mean and standard deviation were used to identify the production level. For problem number three, mean and standard deviation were used to identify the level of market potential. For problem number four in determining the scope of market potential according to their profile, a one-way analysis of variance (ANOVA) was used as statistical tool in this study. For problem number five, linear regression analysis was used to determine the influence of hydroponic lettuce production on market potential.

Ethical Consideration

Before the actual data gathering, researchers ensured that participants fully understood their involvement in the study, the research purpose, and the methods used. The researchers provided all necessary information, ensuring nothing was withheld from the participants to maintain transparency.

Participants were informed that their decision to participate or not would be respected and valued and they had the right to withdraw from the study at any time. The study maintained the participants' privacy, all gathered information was kept confidential and used solely for the completion of the study. The study ensured no damage to their self-esteem and no intent to disclose information that could harm the participants' welfare.

To maintain academic integrity, the research ensures proper acknowledgment of other authors’ or researchers’

works to credit their ideas and words. The study was committed to accuracy, ensuring that no data was added, constructed inaccurately, or based on incomplete or assumed results to fit a theoretical expectation.

RESULT AND DISCUSSION

The analyses and interpretations of the data gathered in relation to the study’s objectives are presented in this chapter.

Business Profile of the Respondents

Table 1

As shown in table 1, presents the demographic profile of the respondents in terms of their type of business. The respondent's type of business is important in the research study because it provides a background for classifying businesses that buy, sell, and use hydroponic lettuce. Classification makes it easier to interpret the data results.

Table 1 Demographic Profile of the Respondents in terms Type of Business

Type of Business	Frequency	Percentage
Cafe / Snack Hub	21	21%
Restaurant / Eatery	20	20%
Vegetable Seller / Stall	59	59%
Total	**100**	**100**

Out of 100 respondents, it is noticeable that the vegetable seller/stall category got the highest percentage, or 59% of the total respondents. This indicates that most of this category buy, sell, and use lettuce in their business. Cafes and eatery categories only got 21% and 20%, respectively. This reflects a larger local market for fresh produce. It also implies that cafes and eatery in the selected municipalities useless hydroponic lettuce as an ingredient in their product or bought for consumption. There is a higher demand for hydroponic lettuce from vegetable sellers/stalls and less demand for cafes and eatery. Many factors could contribute to this. The study of Vahoniya and Rajwadi (2023) revealed that market potential is not a uniform concept but rather one that is fundamentally linked to the type of business and the specific market in which it operates. The study outlines that understanding the relationship between business type and market potential is important for businesses to make informed strategic decisions. The findings revealed that market potential significantly varies by business type and location.

Table 2 Demographic Profile of the Respondents in terms of Number of Years Operating

Number of Years Operating	Frequency	Percentage
0 - 3 year	29	29%
4 - 6 years	71	71%
7 - 10 years	0	0%
More than 10 years	0	0%
Total	**100**	**100**

The demographic profile of the respondents regarding their years of business operation reveals a clear trend towards established businesses. A significant majority of the respondents (71%) have been operating their businesses for 4 to 6 years, indicating a strong presence of mid-term enterprises within the surveyed group. This figure is particularly notable as it represents more than two-thirds of the total sample. Conversely, a smaller portion, 29% of the respondents, consists of relatively newer businesses that have been in operation for 0 to 3 years. The complete absence of businesses operating for 7 to 10 years or more than 10 years further emphasizes that the surveyed population is primarily composed of businesses that have successfully moved past the initial startup phase but have not yet reached long-term, multi-decade longevity. This distribution suggests a study focused on businesses in their early to mid-growth stages.

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Table 3 Demographic Profile of the Respondents in terms of Location

As revealed in the tabulation of data gathered, the majority of the respondents, 43%, are located in Don Carlos, making it the area with the highest concentration of surveyed businesses. This indicates that most of the study's participants were from the Don Carlos area. Following Don Carlos, the next most common location is Kadingilan, which accounts for 29% of the respondents. The fewest respondents, at 28%, are from Kibawe. The study by Ritonga, Hanum, and Rambe (2021) suggests that a strategically chosen and easily accessible business location significantly influences sales performance. This may imply that there is a higher demand for businesses in Don Carlos compared to Kadingilan and Kibawe, which could be a reason for the higher number of respondents from that location.

Table 3 Demographic Profile of the Respondents in terms of Location		
Location	Frequency	Percentage
Kadingilan	29	29%
Kibawe	28	28%
Don Carlos	43	43%
Total	**100**	**100%**

Level of Production of Hydroponic Lettuce

Table 4 Level of Production of Hydroponic Lettuce in terms of the Quality

As reveals that customers are satisfied with the overall quality of the hydroponic lettuce they purchase. The highest mean score was for the statement that the color of the lettuce received is always fresh, crisp, vibrant and free from discoloration, with a mean of 3.62. This suggests that positive attributes like cleanliness and a more greenish texture offset any negative experiences. The study by Mampholo et al. (2016), which is anchored to this study, emphasizes the importance of visual attributes like color and size, textural qualities, and taste. The study by Sandoya et al. (2021) notes that maintaining optimal environmental conditions is essential for producing healthy and flavorful lettuce.

Table 4 Level of Production of Hydroponic Lettuce in terms of the Quality			
Statement	Mean	Standard Deviation	Interpretation
The color of the lettuce I receive is always fresh, crisp, vibrant and free from discoloration.	3.62	0.58	Highly Produced
I am satisfied with the overall quality of the lettuce I purchase.	3.50	0.69	Highly Produced
The lettuce purchased is consistently free from wilting, dirt or insects.	3.47	0.77	Highly Produced
The texture of the lettuce I buy is consistently firm and appealing.	3.41	0.67	Highly Produced
I rarely received complaints from customers regarding lettuce quality.	2.75	1.24	Moderately Produced
Total	**3.35**	**0.48**	**Highly Produced**

Table 5 Level of Production of Hydroponic Lettuce in terms of the Quantity

Indicates a generally effective supply management system for hydroponic lettuce, reflected by an overall mean score of 3.35. Key strengths include high reliability in receiving exact orders from suppliers (mean 3.45) and frequent large-quantity purchases (mean 3.36) to maintain inventory. While customer demand is largely met, a

lower mean (3.22) suggests occasional shortages, highlighting areas for improved forecasting and demand alignment. The market potential for hydroponic lettuce is strong, driven by its high yields, consistent supply, and alignment with sustainable practices, rather than individual purchase volumes. Hydroponics' efficiency (AlShrouf, 2017) enhances its market appeal and contributes to a more secure food system, despite potential supply chain challenges in large-scale operations. This leads to Table 6, which evaluates preferred lettuce varieties in Bukidnon.

Table 5 Level of Production of Hydroponic Lettuce in terms of the Quantity			
Statement	Mean	Standard Deviation	Interpretation
I always receive the exact amount of lettuce I ordered from my supplier.	3.45	0.74	Highly Produced
I always have enough lettuce to meet customers' demand.	3.42	0.65	Highly Produced
I always purchase lettuce in large quantities.	3.36	0.67	Highly Produced
I rarely have excess lettuce that goes to waste.	3.29	0.89	Highly Produced
I rarely experience shortage in my lettuce supply.	3.22	0.82	Moderately Produced
Total	**3.35**	**0.52**	**Highly Produced**

Table 6 Level of Production of Hydroponic Lettuce in terms of the Variety

Hydroponic lettuce producers are strongly committed to offering a wide variety of lettuce, as indicated by a high overall mean of 3.31. This commitment is reflected in their purchasing habits, with a mean of 3.47, and their customer offerings, with a mean of 3.34, both interpreted as "Highly Produced." Businesses are also introducing new varieties, with a mean of 3.30, demonstrating an effort to keep their product line fresh and appealing. While they generally have good access to multiple varieties from suppliers (mean 3.27), there's a slight opportunity for improvement in requesting specific types of lettuce, with a lower mean of 3.17, which is interpreted as "Moderately Produced." This data aligns with the research of Zajkowski (2021), emphasizing the critical role of understanding consumer preferences to influence purchasing and production decisions. Overall, as the global hydroponics industry expands, meeting market demands through optimized and diverse production will be key to maximizing consumer satisfaction and ensuring efficient operations.

Table 6 Level of Market Potential

Level of Production of Hydroponic Lettuce in terms of the Variety			
Statement	Mean	Standard Deviation	Interpretation
I always preferred to purchase different varieties of lettuce.	3.47	0.83	Highly Produced
I always offer multiple lettuce varieties to my customers.	3.34	0.83	Highly Produced
I always introduce new lettuce varieties to my customers.	3.3	0.89	Highly Produced
I always request specific types of lettuce.	3.17	0.85	Moderately Produced
I can easily access multiple lettuce varieties from my supplier.	3.27	0.85	Highly Produced
Total	**3.31**	**0.75**	**Highly Produced**

Table 6 Level of Market Potential

Table 7 Level of Market Potential in terms of the Market Size

Indicates that if there's enough market demand to expand lettuce business got the highest mean of 3.30. Respondents also revealed a stable customer base for lettuce products, with a mean score of 3.15. They can also easily sell the lettuce they stock without difficulty, supported by a mean of 3.12. The overall mean score of 3.17 suggests that respondents generally agree that the market size has potential. The results reveal potential market development for hydroponic lettuce, a positive response to customer-based statements, and increasing customer interest

Table 7 Level of Market Potential in terms of the Market Size			
Statement	Mean	Standard Deviation	Interpretation
There is enough market demand to expand my lettuce business.	3.30	0.87	Very High Potential
I see an increasing number of customers interested in buying lettuce.	3.28	0.87	Very High Potential
There is a stable customer base for my lettuce products.	3.15	0.88	High Potential
I can easily sell the lettuce I stock without difficulty.	3.12	0.96	High Potential
The demand for hydroponic lettuce in my area is growing.	3.02	1.06	High Potential
Total	**3.17**	**0.77**	**High Potential**

Table 8 Level of Market Potential in terms of the Growth Rate

Indicates a strong upward trend in hydroponic lettuce growth, with a high mean of 3.31. Business expansion potential is also significant (mean 3.35), while demand for different lettuce varieties is moderate (mean 3.23). Overall, the lettuce business shows favorable growth in performance and monitoring (mean 3.16). Hydroponics offers increased yields and precise control over growing conditions (Rajaseger et al., 2023), contributing to food security. Cost-benefit analyses (Mishra et al., 2024) indicate that increased yields and resource savings can offset initial setup costs, making hydroponics an economically viable and sustainable solution.

Table 8 Level of Market Potential in terms of the Growth Rate			
Statement	Mean	Standard Deviation	Interpretation
The lettuce business is favorable based on its performance monitoring.	3.43	0.70	Very High Potential
The lettuce business has potential to grow significantly.	3.35	0.73	Very High Potential
There is a steady increase in the hydroponic lettuce sales over time.	3.31	0.83	Very High Potential
I believe my lettuce has the potential to grow significantly.	3.26	0.79	Very High Potential
The variety of lettuce is expanding because of its demand.	3.23	0.79	High Potential
Total	**3.31**	**0.63**	**High Potential**

Table 9 Level of Market Potential in terms of the Competition

The results show that businesses selling hydroponic lettuce face strong competition. Many respondents believe their lettuce has an advantage over others, and they actively monitor competitors' prices and marketing strategies. However, they also find it challenging to compete, and they often compare their lettuce quality with others. The overall score suggests that competition is high, but businesses are aware of their strengths and are trying to stand out in the market.

Table 9 Level of Market Potential in terms of the Competition			
Statement	Mean	Standard Deviation	Interpretation
I believe my lettuce products have an advantage over my competitors.	3.26	0.93	Very High Potential
I monitor my competitors pricing and marketing strategies.	3.26	0.99	Very High Potential
I find it challenging to compete with other lettuce sellers.	3.24	0.93	High Potential
I often compare my lettuce quality with that of my competitors.	3.20	0.93	High Potential
Other businesses are selling hydroponic lettuce in my area.	3.20	1.02	High Potential
Total	**3.23**	**0.85**	**High Potential**

ANOVA Result for Market Potential

Table 10

Presents the one-way Analysis of Variance (ANOVA) results. It indicates whether the first null hypothesis is accepted or rejected. The first null hypothesis stated, "There is no significant difference of market potential when grouped according to their profile."

Table 10 Dependent Variable: Market Potential					
	SS	df	MS	F	Sig.
Type of Business	3.548	2	1.774	6.387	0.003
Years Operating	0.6	5	0.12	0.432	0.825
Location	8.741	2	4.371	15.735	0

The ANOVA test shows that market potential is different depending on the type of business and location. Businesses like vegetable stalls and those in Don Carlos have stronger market potential. However, the number of years a business has been operating does not make a big difference. This means newer businesses can still succeed if they are in the right place and have the right type.

Linear Regression for Market Potential

Table 11

Presents the results of the linear regression analysis. These results determine whether the second null hypothesis is accepted or rejected. The second null hypothesis stated, "The production level has no significant influence on market potential."

Table 11 Linear Regression for Market Potential						
Predictor	Estimate	SE	t	p	R	R^2
Intercept	0.608	0.389	1.564	0.121	0.614	0.377
Quality	0.33	0.114	2.905	0.005		
Quantity	0.169	0.114	1.48	0.142		
Variety	0.29	0.078	3.738	<0.001		

The regression results show that the quality and variety of hydroponic lettuce strongly affect market potential. Customers care more about how good the lettuce is and having different types to choose from. Quantity, or how much is produced, does not have a big effect. So, businesses should focus on improving quality and offering more varieties to attract more buyers.

CONCLUSION AND RECOMMENDATION

The study revealed that the hydroponic lettuce market in the region showed high growth potential, though it was currently small and had significant room for expansion. The market potential for hydroponic lettuce varied significantly depending on the type of business and its location. Understanding these specific characteristics was essential for effectively targeting the hydroponic lettuce market. Quality and variety strongly influenced the market potential of hydroponic lettuce. Producers focused on offering diverse, high-quality options to meet market demand, as quantity alone did not significantly influence market potential.

The higher demand for hydroponic lettuce in Don Carlos can be associated to its strong agricultural landscape and favorable climate, which makes it an ideal location for cultivation and a hub for distribution. The prevalence of vegetable sellers in the area further reflects a strong local market for fresh produce. The high level of competition highlighted in the research implies that businesses cannot rely on a growing market alone; they must actively monitor competitors and differentiate themselves to gain a market advantage. This leads to the strategic importance of focusing on quality and variety over quantity, as customers' purchasing decisions are strongly influenced by the superior visual attributes, freshness, and diverse options available. The study suggests that producing a large volume is less significant than meeting consumer preferences for high-quality, varied products to ensure market success and sustainability.

Based on the study's findings, several specific and viable recommendations are proposed such as businesses exploring more types of lettuce to attract a broader customer base and meet diverse preferences. Secondly, entrepreneurs consideration establishing businesses in municipalities where demand is high, such Don Carlos, while also creating awareness in areas with lower engagement. Thirdly, improvement of marketing focus on clear advertising and promotion to stand out from competitors, highlighting the quality of hydroponic lettuce. Fourth, consumers knowledge about the benefits of hydroponic lettuce, such as freshness, controlled production methods, and health advantages. Fifth, build partnerships with other local producers, sellers, or government agencies to strengthen the supply chain and reach more customers. Lastly, using insights from the study to prepare for future expansion, considering stable demand and favorable growth rates.

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