



# Aquaponics Marketing Mix Strategy: A Five Forces Porter Analysis to Build Resilience in Kundasang Aquafarm, Sabah, Malaysia

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## ABSTRACT

*A leader in aquaponics farming in Sabah, Malaysia, Kundasang Aquafarm combines hydroponics and fish farming to solve issues with sustainable food production and encourage environmentally friendly methods. With the help of secondary research on aquaponics and market dynamics and primary data from field observations and interviews, this study uses Porter's Five Forces framework to examine the farm's marketing strategy and business resiliency. The results show that, in spite of obstacles including high operating expenses and pressure from competitors, Kundasang Aquafarm has successfully used strategic marketing, competitive pricing, and excellent distribution networks to forge a strong market position. The study comes to the conclusion that Kundasang Aquafarm's long-term viability and competitiveness in the expanding aquaponics sector depend on constant innovation, product diversification, and the use of digital marketing technology.*

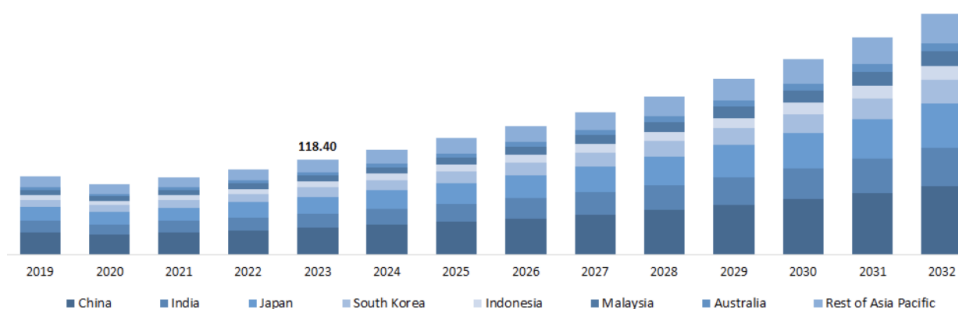
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## I. INTRODUCTION

Aquaponics has developed into one of the globally recognized aquaculture systems to address the challenges of food security and environmental sustainability. Various countries, such as Japan[1], agree that this technology is considered an innovative solution for meeting food needs sustainably, reducing dependence on natural resources, and minimizing negative impacts on ecosystems. With the ongoing global food crisis driven by climate change, declining soil quality, and over-exploitation of water resources, aquaponics offers an efficient and environmentally friendly solution, leading to its increasing adoption in the agriculture and aquaculture sectors[2].

Aquaponics combines the concepts of aquaculture (fish farming) and hydroponics (soil-less plant cultivation) into a mutually beneficial system[3]. In practice, aquaponics allows for the circulation of nutrients from fish waste, which is converted into natural fertilizer for the plants, while the plants help filter the water that returns to the fish pond[4]. This creates a closed-loop system that is sustainable and minimizes waste, while producing safe and chemical-free food products. As a solution for food security, aquaponics not only increases productivity but also offers cultivation methods that are more efficient in terms of water and land use.



**Figure1:** Asia Pacific Aquaponics Market Size, By Region, 2019-2032 (USD Dolar)  
(Source : Polaris Market Research, 2024)

The Polaris Market Research (2024) report highlights the burgeoning aquaponics market in the Asia Pacific, fueled by the increasing need for sustainable and efficient food production systems. Grand View Research (2024)[5] projects a substantial 437.7 USD growth in the global aquaponics market value between 2023 and 2030, reflecting the rising consumer demand for organic and eco-friendly food. The promising economic potential of aquaponics has attracted significant interest from businesses and investors worldwide. Yet, challenges such as high setup costs and competition from traditional farming methods persist, as noted by Ibrahim[6].

Porter's Five Forces framework is a valuable tool for assessing the competitive landscape of an industry, including strategies for long-term sustainability[7]. In the aquaponics sector, this framework can help identify five key competitive forces: the threat of new entrants, the threat of substitute products, the bargaining power of suppliers, the bargaining power of buyers, and the intensity of competitive rivalry. By applying this framework, Kundasang Aquafarm can develop strategic initiatives to overcome challenges related to technology, market dynamics, and regulatory changes.

Aquaponics has been gaining traction in Malaysia, especially in resource-abundant areas like Sabah[8]. Kundasang, situated at the base of Mount Kinabalu, offers a conducive environment for aquaponic farming. The region's cool climate and ample water supply make it an ideal location for developing aquaponic farms. Additionally, the burgeoning tourism industry in Kundasang presents a promising market for aquaponic products, both for locals and tourists[9].



**Figure2:** Kundasang Aquafarm, Sabah, Malaysia.  
(Source : Writer, 2024)

As a frontrunner in Sabah's aquaponics industry, Kundasang Aquafarm operates in a dynamic environment characterized by both opportunities and challenges. The increasing consumer preference for healthy and sustainable food sources offers a promising market for Kundasang Aquafarm. Nonetheless, the business must navigate competitive pressures from conventional food products and address challenges related to operational costs, distribution, and consumer education. A strategic approach is therefore essential for the long-term success and competitiveness of the farm.

Kundasang Aquafarm needs to build resilience by understanding the competitive structure of its industry. Through a Porter's Five Forces analysis, the farm can identify external factors that influence its sustainability and competitiveness, including threats from potential new entrants, the bargaining power of suppliers and customers, and the threat of substitute products. By conducting this analysis, the company can

formulate more robust strategies to address various external pressures. This research aims to provide guidance for other aquaponics businesses in developing adaptive and resilient strategies in a dynamic competitive landscape.

## **II. LITERATURE REVIEW**

### **2.1 Aquaponics: A Sustainable Solution for Local Food Production**

Aquaponics, a combination of aquaculture (fish farming) and hydroponics (soil-less plant cultivation), has emerged as an innovative solution for sustainable agriculture in Malaysia[10]. This system allows for the simultaneous production of fish and vegetables in a closed ecosystem, where fish waste provides nutrients for plants, while plants help purify the water for fish. This approach is not only efficient in resource utilization but also environmentally friendly, reducing the need for chemical fertilizers and pesticides. Universiti Malaysia Terengganu (UMT) has developed a low-cost aquaponics system called LB-PONIC, which has been introduced to local communities to improve their economic well-being[11].

The implementation of aquaponics in Malaysia has had a positive impact on the local economy[12]. For instance, as reported in *Malaysia Aktif* (2024), the Rukun Tetangga Taman Intan 2 community in Kluang started an aquaponics project with an initial capital of RM 2,500 and successfully developed assets worth tens of thousands of ringgit. They utilized a 0.6-hectare community hall area for cultivating red tilapia and various vegetables, which were then sold to local residents. This project not only increased the community's income but also provided a source of fresh and healthy food for the surrounding community.

Beyond economic benefits, aquaponics also plays a role in enhancing food security and promoting sustainable agricultural practices in Malaysia[13]. Its highly efficient water usage—up to 90% less compared to conventional agriculture—makes aquaponics an ideal solution for areas with limited land and water resources. Companies like Endona Sdn Bhd have been promoting aquaponics technology as part of smart agriculture solutions in Malaysia, emphasizing space efficiency and water conservation. Thus, aquaponics not only contributes to local economic growth but also supports national efforts in achieving food security and environmental sustainability[14].

### **2.2 Sustainability and Resilience of Aquaponics Enterprises in Malaysia**

The adoption of aquaponics technology has shown great potential in revolutionizing agricultural practices in Malaysia. The integration of sensors, automation, and data analytics in aquaponics systems enhances efficiency and productivity[15]. Sensors monitor water quality, nutrient levels, and fish health in real-time, ensuring optimal conditions for plant and fish growth. This approach not only increases yields but also reduces environmental impact, aligning with sustainable agricultural practices[16].

However, challenges in maintaining an aquaponics business still exist. One key to success is ensuring a balance between the number of fish and plants cultivated[17]. Imbalance can lead to excessive nitrite accumulation, which can potentially harm the growth of both fish and plants. Therefore, careful planning and regular monitoring are crucial to maintaining system stability and ensuring optimal production.

Beyond the integration of aquaponic systems, effective marketing strategies significantly influence the sustainability of aquaponics businesses. Identifying specific consumer segments, such as restaurants seeking organic raw materials or urban consumers concerned about health, can be undertaken by aquaponics businesses to provide products and services that meet market needs. Clear market positioning, such as emphasizing the advantages of organic and environmentally friendly products, can enhance competitiveness and attract more customers.

Overall, a comprehensive marketing strategy, including the implementation of the 4P marketing mix, appropriate market segmentation, and the integration of smart technology, is essential for sustaining and growing the aquaponics business in Asia, particularly in Malaysia. This approach not only enhances operational efficiency but also ensures that the products produced meet the needs and preferences of consumers, thereby strengthening the position of the aquaponics business in a competitive market.

### **2.3 Porter's Five Forces Analysis in Aquaponics Business**

Porter's Five Forces analysis is a framework used to understand the competitive dynamics within a particular industry, focusing on five key forces that influence a business's competitiveness[18]. Developed by Michael E. Porter, this model encompasses five forces: the threat of new entrants, the bargaining power of suppliers, the bargaining power of buyers, the threat of substitute products or services, and the rivalry among

existing firms in the industry. In the context of the aquaponics business, this analysis provides insights into how various external factors can affect the sustainability and profitability of the business. According to a recent study by Paramadita and Hidayat[19], the use of the Five Forces to evaluate competitiveness and market opportunities in sustainable agriculture businesses, such as aquaponics, is crucial for assessing growth potential and innovation strategies.

Technology-based sustainable aquaponics businesses face significant threats from new entrants, primarily due to relatively low initial investments and the growing interest in environmentally friendly agriculture. However, entry into the market can be limited by several factors, such as the need for high technical knowledge and compliance with strict environmental standards. According to research by Channa, et. al.[14], expertise and the availability of suitable land are major barriers to entry in the aquaponics business. On the other hand, increasing public awareness of organic products makes the aquaponics business more attractive to new investors, meaning competition may intensify over time.

In the aquaponics business, primary suppliers are providers of fish seed, plant seedlings, and technological equipment that support the aquaponics system. The bargaining power of suppliers is greatly influenced by the availability of alternative suppliers, which can reduce or increase the operational costs of the business. A study by Saarani, et. al.[13] shows that the existence of suppliers in the aquaponics ecosystem is quite limited, which increases their bargaining power. On the other hand, the bargaining power of buyers also plays a significant role, especially in markets dominated by consumers who are increasingly aware of food quality and safety. Buyers of aquaponics products generally have a preference for local and organic products, so they tend to have higher bargaining power in determining market prices.

Aquaponics faces threats from substitute products such as conventionally grown vegetables. Traditional agricultural products are usually cheaper due to lower production costs, which can affect the competitiveness of aquaponics products in the market. However, with the increasing demand for environmentally friendly products, the threat from these substitutes is decreasing. Within the aquaponics industry itself, competition among companies occurs primarily in terms of technological innovation and production efficiency. A study by Krastanova, et. al.[20] highlights the importance of continuous innovation in maintaining competitiveness in this industry. This competition also drives aquaponics companies to improve quality and productivity to be able to compete in an ever-evolving market.

### **III. RESEARCH METHODOLOGY**

This research focuses on analyzing the marketing mix strategy in the context of aquaponics using Porter's Five Forces framework, applied to build the business resilience of Kundasang Aquafarm, an aquaponics farm located in Kundasang, Sabah, Malaysia. Kundasang Aquafarm was chosen as the research site due to its position as one of the pioneers in the aquaponics industry in the region, as well as its role in promoting sustainable farming practices.

This research employs qualitative approach with a combination of primary and secondary data to obtain comprehensive and relevant information. Primary data was collected through interviews and direct field observations. Interviews were conducted with a manager and twenty operational staff at Kundasang Aquafarm to understand the marketing mix strategies implemented and the challenges faced in maintaining business sustainability and engaging with the local market. Additionally, direct observations were carried out to gain a concrete understanding of the daily operations of Kundasang Aquafarm and the aquaponics cultivation methods employed. The use of primary data aims to delve into in-depth information not available in secondary sources and to understand the unique characteristics of the aquaponics business in this region.

In addition to primary data, this study also utilized secondary data, including literature on marketing mix strategies, agricultural industry reports, and academic studies on the application of Porter's Five Forces framework in agribusiness. Secondary data was obtained from various scientific journals, industry reports, and publications from government and local agricultural organizations relevant to aquaponics practices in Malaysia. This secondary data provided a broader context and theoretical validation for the Porter's Five Forces analysis, aiding in a more holistic understanding of Kundasang Aquafarm's position within the aquaponics industry.

The analytical lens employed in this research is based on Porter's Five Forces. Introduced by Michael E. Porter, this analytical tool is used to evaluate the competitive intensity of an industry through five forces: threat of new entrants, bargaining power of suppliers, bargaining power of buyers, threat of substitute products or services, and rivalry among existing business. By utilizing this analysis, the study aims to assess the external factors influencing Kundasang Aquafarm's competitive position and how its marketing mix strategy can be optimized to address threats and leverage opportunities

## IV. RESULT AND DISCUSSION

This research focuses on analyzing the marketing mix strategy in the context of aquaponics using Porter's Five Forces framework, applied to build the business resilience of Kundasang Aquafarm, an aquaponics farm located in Kundasang, Sabah, Malaysia. Kundasang Aquafarm was chosen as the research site due to its position as one of the pioneers in the aquaponics industry in the region, as well as its role in promoting sustainable farming practices.

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### 4.1 RESULT

#### 4.1.1 MARKETING MIX

##### 4.1.1.1 PRODUCT

Kundasang Aquafarm sells three types of vegetables: Taiwan cabbage, red coral lettuce, and green coral lettuce. Taiwan cabbage has bright green leaves that are smooth and a bit crunchy. It's great for stir-fries or soups. Red coral lettuce is unique with its purplish-red color and layered look. It adds a nice touch to dishes and tastes slightly sweet and crunchy. Green coral lettuce has bright green, curly leaves that are soft and crunchy. It's often used in salads because it's fresh and has a mild taste.



**Figure3:** Product of Kundasang Aquafarm.  
(Source : Writer, 2024)



Observations revealed that these three vegetables not only varied in color and texture but also offered diverse flavors and culinary uses, making them a popular choice among Kundasang Aquafarm customers seeking variety in their fresh produce

#### 4.1.1.2 PRICE

The prices offered by Kundasang Aquafarm are quite competitive. According to interviews with operational staff, the price difference between Kundasang Aquafarm's vegetables and the market price is between MYR 1.00 and MYR 2.00. The following is a list of prices offered for each product at Kundasang Aquafarm.

**Table 1: Product of Kundasang (2024)**

| No | Name of Product     | Price          |
|----|---------------------|----------------|
| 1  | Taiwan Cabbage      | MYR 2,00 / pcs |
| 2  | Green Coral Lettuce | MYR 5,00 / pcs |
| 3  | Red Coral Lettuce   | MYR 5,00 / pcs |

(Source : Primary Data, 2024)

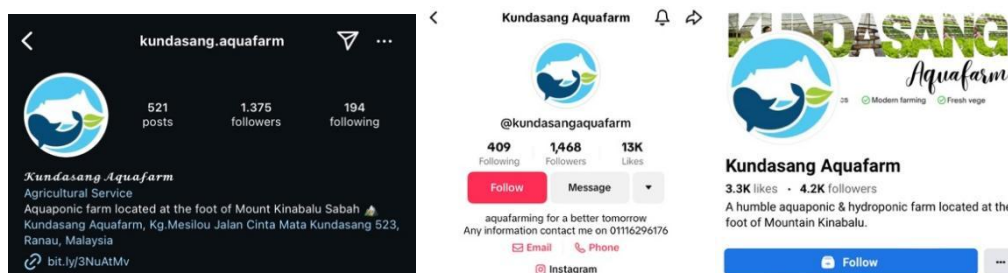
#### 4.1.1.3 PLACE

Kundasang Aquafarm maximizes its distribution reach by selling vegetables in bulk to businesses requiring large supplies, including restaurants, hotels, and markets both on the Peninsula and in Sabah and Sarawak. As a supplier, Kundasang Aquafarm ensures a consistent supply of fresh vegetables in large quantities to meet the needs of customers who rely on high-quality products.

Furthermore, Kundasang Aquafarm serves the local community in Sabah by providing easily accessible fresh vegetables. This distribution channel helps maintain positive relationships with the local community and provides nutritious, fresh vegetables for residents. Located at the foot of Mount Kinabalu, a popular tourist destination, Kundasang Aquafarm also attracts international tourists, particularly from China. Chinese tourists are known to favor red coral lettuce, making it a special attraction for these visitors. The presence of Kundasang Aquafarm in Kundasang allows tourists to enjoy and purchase fresh produce directly after harvest.

#### 4.1.1.4 PROMOTION

Kundasang Aquafarm actively utilizes social media platforms such as Facebook, TikTok, and Instagram to enhance visibility and attract a wider audience. Through these platforms, Kundasang Aquafarm shares mirrored content showcasing their fresh produce, including nutritional benefits and quality advantages. Social media posts encompass promotional sales, updates on new stock, and collaborations with local businesses or events in Kundasang, fostering relationships with the local community and loyal customers.



**Figure4:** Social Media of Instagram, TikToc, dan Facebook (left to right) Kundasang Aquafarm (Source : Internet, 2024)

## 4.2 DISCUSSION

### 4.2.1 ANALYSIS PORTER FIVE FORCES

#### 4.2.1.1 THREAT OF NEW ENTRANTS

As a long-standing player, Kundasang Aquafarm possesses a competitive advantage in terms of experience and has mastered the supply chain and local market. However, new entrants still have the potential to

enter this industry, especially with the growing demand for fresh food products in both the local and regional markets. Key factors enabling new entrants include sufficient capital, abundant natural resources such as land and water, and technology to accelerate production and maintain product quality.

However, there are several barriers that make it difficult for new entrants to compete with Kundasang Aquafarm. One significant hurdle is the need for substantial investment in infrastructure such as ponds, water filtration systems, and water quality monitoring equipment. Additionally, Kundasang Aquafarm has established strong relationships with customers and suppliers, enabling them to maintain a stable supply and the quality that the market expects. The reputation built since 2016 provides a competitive advantage, making consumers more loyal and likely to continue choosing products from Kundasang Aquafarm over untested newcomers

#### **4.2.1.2 RIVARLY AMONG EISTING BUSINESS**

Competition in the aquaponics industry in Sabah has intensified with the emergence of new competitors, Farm Tokou and Lush Aquaponics. As a pioneer, Kundasang Aquafarm needs to continue innovating and finding ways to differentiate its products to remain attractive to consumers. The presence of new competitors presents both challenges and opportunities for all players to improve product quality and services, as well as expand market reach.

#### **4.2.1.3 BARGAINING POWER OF SUPPLIERS**

Kundasang Aquafarm has successfully reduced its reliance on external suppliers through the development of modern aquaculture facilities. By producing most of the fish and seedlings required in-house, they now have greater control over product quality and flexibility in meeting market demand. This strategic move not only enhances production efficiency but also contributes to environmental conservation and the development of the surrounding community. Nevertheless, the company needs to remain vigilant against potential challenges such as climate change and fish diseases, and continue innovating to maintain its competitive edge.

#### **4.2.1.4 BARGAINING POWER OF BUYER**

Kundasang Aquafarm has successfully cultivated a loyal customer base, generally resulting in lower buyer bargaining power. However, with the presence of a business market segment, particularly restaurants and hotels in tourist areas, market dynamics become more complex. These businesses, with larger purchase volumes, tend to have higher bargaining power and are more sensitive to price and product quality. To address these diverse market dynamics, Kundasang Aquafarm needs to balance the needs of both market segments. Building strong long-term relationships with both individual consumers and businesses is key to reducing overall buyer bargaining power. By providing excellent service, consistently meeting customer needs, and creating unique value, Kundasang Aquafarm can retain customers and reduce the risk of switching to competitors.

#### **4.2.1.5 THREAT OF SUBSTITUTE PRODUCTS OR SERVICES**

Substitute products for aquaponic produce, such as organic vegetables, include products derived from other cultivation methods like hydroponics, conventional agriculture, and traditional capture or aquaculture. These products pose a competitive threat by offering cheaper alternatives, greater availability, or distinct perceived quality attributes. For instance, conventional vegetables grown in soil may be more familiar to local consumers due to their traditional methods.

However, these substitute products cannot fully replace the unique value of aquaponics. Aquaponics offers advantages in sustainability, with more efficient use of water and resources, and the absence of pesticides or chemicals. Kundasang Aquafarm leverages this to differentiate its products from alternatives. By educating consumers about the nutritional benefits, safety, and positive environmental impact of aquaponic products, the company can create greater awareness of its products' superiority compared to substitutes.

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## **V. CONCLUSION**

Aquaponics, as an integrated system of fish and plant cultivation, is increasingly recognized as an innovative solution to address global food challenges. This system offers more sustainable and efficient products, attracting both investors and consumers. However, competition from conventional methods and challenges related to costs and distribution remain obstacles. To survive and thrive, aquaponics businesses like Kundasang Aquafarm need to understand the dynamics of their industry. Porter's Five Forces analysis can be an effective tool to identify business strengths and weaknesses, and to formulate appropriate strategies to address threats from competitors, suppliers, and buyers. By understanding its competitive position, Kundasang Aquafarm can build business resilience and capitalize on the growing market potential for organic and sustainable food products.

This research aims to analyze the marketing strategy of Kundasang Aquafarm, a pioneer in aquaponics in Sabah, Malaysia, using Porter's Five Forces framework. The study combines primary data from interviews and field observations with secondary data from literature and industry reports to gain a comprehensive understanding. Primary data is used to understand the business practices and challenges faced by Kundasang Aquafarm firsthand, while secondary data provides a broader theoretical context and market data. Porter's Five Forces analysis is applied to identify the strengths and weaknesses of Kundasang Aquafarm in the context of the aquaponics industry. By understanding the five major forces influencing this industry, this research aims to provide effective marketing strategy recommendations for Kundasang Aquafarm, enabling it to strengthen its competitive position and achieve business sustainability.

Kundasang Aquafarm has successfully implemented an effective marketing strategy focused on a diverse range of hydroponic vegetables, competitive pricing, and extensive distribution. The three main vegetable varieties offered, Taiwanese cabbage, red coral lettuce, and green coral lettuce, possess unique characteristics that appeal to consumers. Additionally, the company has leveraged social media platforms to increase visibility and market reach, particularly among tourists. By optimizing distribution channels to both large businesses and local markets, Kundasang Aquafarm has established a reputation as a supplier of high-quality fresh vegetables. This marketing strategy has helped the company expand its market and ensure business sustainability.

A Porter's Five Forces analysis of Kundasang Aquafarm reveals that the company has successfully established a strong position in the Sabah aquaponics industry. Despite facing competition from new entrants such as Farm Tokou and Lush Aquaponics, Kundasang Aquafarm possesses a competitive advantage due to its experience, strong network, and established reputation. The company's ability to independently manage its supply chain has reduced reliance on external suppliers and increased flexibility in meeting market demands. However, the company needs to continue innovating and maintaining product quality to sustain its competitive advantage. Additionally, Kundasang Aquafarm should pay attention to the increasingly complex market dynamics, especially when dealing with business customers who have higher bargaining power

## **VI. RECOMMENDATION**

To strengthen its competitive position and achieve sustainable growth, Kundasang Aquafarm is recommended to undertake several initiatives, including strengthening innovation, expanding product diversification, and leveraging marketing technology. Strengthening innovation is key to the sustainability and growth of Kundasang Aquafarm. By continuously innovating, the company can create unique new products that appeal to consumers. Some examples of innovations that can be implemented include:

- Developing new varieties[21]: Through research and development, Kundasang Aquafarm can create hydroponic vegetable varieties with unique characteristics, such as better taste, higher nutritional content, or more attractive colors.
- Adopting new cultivation technologies[22]: By adopting more advanced cultivation technologies, such as vertical hydroponic systems or aeroponics, the company can increase production efficiency, reduce resource use, and produce higher quality products.
- Collaborating with research institutions[22]: Building partnerships with research institutions to develop new products or improve the quality of existing products.

Product diversification is an effective strategy to expand market share and increase revenue. Kundasang Aquafarm can diversify its product line by[23]:



- Processing products into ready-to-eat meals: In addition to selling fresh vegetables, the company can process vegetables into ready-to-eat products such as packaged salads, frozen vegetables, or vegetable juices. This can extend the shelf life of products and open up new market opportunities.
- Offering product bundles: Creating product bundles consisting of various types of vegetables and other processed products. These product bundles can be tailored to consumer needs, such as diet packages, baby food packages, or packages for specific cuisines.
- Creating by-products: Utilizing production waste to create by-products, such as organic fertilizer or animal feed.
- Leveraging marketing technology is crucial for increasing brand visibility and reaching a wider audience[24]. Some examples of marketing technologies that Kundasang Aquafarm can utilize include:
- E-commerce: Building an online store to facilitate online purchases. Additionally, the company can leverage existing marketplace platforms to expand its market reach.
- Influencer marketing: Collaborating with food or healthy lifestyle influencers to promote products to a wider audience.
- Content marketing: Creating engaging and informative content, such as recipes, health tips, or gardening tutorials, to attract consumers and build trust

## REFERENCES

- [1]. Worawut, Kanokkan, et. al. (2024). Integrated Aquaponics System by Combining Japanese Cucumber Cultivation with Efficient Hybrid Catfish Farming for Enhanced Farmer Quality of Life. *ASEAN Journal of Scientific and Technological Reports* 27(5).
- [2]. Pohshna, Chwadaka, et. al. (2024). Aquaponics: An Approach to Sustainable Agriculture. *Agriculture & Food : E-Newsletter* 6(5).
- [3]. Joo, James H., et. al. (2024). Accelerating Aquaponics Adoption in Asia: Essential Technical and Policy Considerations. *Journal of Advanced Agricultural Technologies*, 11(01).
- [4]. Khandelwal, Govinda, et. al. (2024). A Comprehensive Review on : Aquaponic Farming Water Quality Prediction. *International Journal of Scientific Research in Computer Science Engineering and Information Technology* 10(4).
- [5]. Grand View Research. (2024). Asia Pacific aquaponics market size & outlook, 2030. Grand View Research. Retrieved November 13, 2024, from <https://www.grandviewresearch.com/horizon/outlook/aquaponics-market/asia-pacific>.
- [6]. Ibrahim, Lubna A., et. al. (2023). Aquaponics: A Sustainable Path to Food Sovereignty and Enhanced Water Use Efficiency. *Water*, 15(24), 4310.
- [7]. Pranoto, Ari & Rhian Indradewa. (2024). Analysis of External Factors Based on Porter's Five Forces Method at PT Gipan Metal Teknik Indonesia. *Advances in Social Humanities Research* 2(2).
- [8]. Samit, Afiezul. (2024). Perhatian Penuh Kerajaan. *Suara Sarawak*. Retrieved November 13, 2024, from <https://suarasarawak.my/perhatian-penuh-kerajaan/>
- [9]. Yusof, Nurulhuda Mohamad, et. al. (2021). Heritage Tourism and Its Impact on The Local Communities: A Case Study in Ranau, Sabah. *International Journal of Academic Research in Business and Social Sciences* 11(12).
- [10]. Syamsia, S., et. al. (2024). Socialization of Aquaponics Techniques for Business Efficiency at Aling Hydroponic Farm, Sandakan Sabah Malaysia. *Journal of Community Service and Empowerment* 5(3).
- [11]. Manan, Norhidayah Abdul. (2024). Sistem Akuaponik (LB-Ponic) Memacu Pertumbuhan Sosio-ekonomi Penduduk Sekitar Kuala Nerus Terengganu. *Majalahsains.com*. Retrieved November 14, 2024, from <https://www.majalahsains.com/sistem-akuaponik-lb-ponic-memacu-pertumbuhan-sosio-ekonomi-penduduk-sekitar-kuala-nerus-terengganu/>
- [12]. Colin, Kiu Qi-Song, et. al. (2024). Aquaponics vs Recirculating Aquaculture System: Assessing Productivity and Water Use Efficiency of Native Fish Species Empurau (Tor tambroides) and Jelawat (Leptobarbus hoevenii) Compared to Red Hybrid Tilapia. *Sains Malaysiana* 53(4)(2024): 747-757
- [13]. Saarani, Puteri Sidrotul Nabihah, et. al. (2024). Urban Farming Practice Concerning Life Cycle Cost Components. *Planning Malaysia: Journal of the Malaysian Institute of Planners* 22(2).
- [14]. Channa, Abdul Aziz, et. al. (2024). Optimisation of Small-Scale Aquaponics Systems Using Artificial Intelligence and the IoT: Current Status, Challenges, and Opportunities. *Encyclopedia*. 2024; 4(1).
- [15]. Gichana, Zipporah. (2024). Phytoremediation Potential of Selected Plants & Growth of *Oreochromis Niloticus* (Linnaeus, 1758) in Aquaponic Systems. *Asian Journal of Fisheries and Aquatic Research* 26(4).
- [16]. Garnida, Yudi. (2023). Aquaponics As A Solution for Family Food Security in Urban Areas. *Jurnal Multidisiplin Sahombu* 2023; 3(1).
- [17]. Tarigan, Nurhayati Br, et. al. (2021). Explorative Study of Aquaponics Systems in Indonesia. *Journal Sustainability* 13(22).
- [18]. Paksoy, Turan, et. al. (2024). Overall Competitiveness Efficiency: A Quantitative Approach to The Five Forces Model. *Science Direct : Computers & Industrial Engineering* 182.
- [19]. Paramadita, Siti & Desman Hidayat. (2022). Industry Competitiveness Analysis Using Porter's Five Forces: Indonesian Multi-industry Study Case. *ARBITRASE: Journal of Economics and Accounting*.
- [20]. Krastanova, Milena, et. al. (2022). Aquaponic Systems: Biological and Technological Parameters. *Biotechnology & Biotechnological Equipment*.
- [21]. Zhang, Yong, Yu-kun Zhang, & Zhe Li. (2022). A new and improved aquaponics system model for food production patterns for urban architecture. *Journal of Cleaner Production* 34:2022.
- [22]. Ghaffar, Amna, et. al. (2024). Innovations in Aquaponics Technology and Building Sustainable Infrastructure for Agriculture. *International Journal of Agriculture and Environmental Analytics (IJAEA)* 3(2).
- [23]. Bhanja, Avik, et. al. (2024). Aquaponics Advancements: A Comprehensive Exploration of Sustainable Aqua-Agriculture Practices in the Indian Context. *Current Agriculture Research Journal* 12(3).
- [24]. Masrianto, A., Hartoyo, Aida V. S. Hubeis, & Nur Hasanah. 2024. How to Boost Your Firm's Digital Marketing Capability?. *International Journal of Technology* 15(3).