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Feasibility Study of Snail Farming in Indonesia

Haryono
Universitas Bhayangkara Surabaya

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ABSTRACT

This study evaluates the economic feasibility of snail cultivation in Indonesia by analyzing the impact of market demand, cultivation technology, and environmental conditions. A quantitative approach was employed, surveying 150 respondents using a Likert scale (1-5), with data analyzed via SPSS version 26. The results reveal that market demand is the most significant factor influencing economic feasibility, followed by cultivation technology and environmental conditions. All three variables positively and significantly affect the viability of snail farming. These findings suggest that increasing market demand, adopting modern farming technologies, and maintaining favorable environmental conditions are essential for promoting snail cultivation in Indonesia. This study provides valuable insights for policymakers, investors, and farmers interested in developing snail farming as a sustainable agricultural business.

Corresponding Author:

Name: Haryono
Institution: Universitas Bhayangkara Surabaya
Email: haryono@ubhara.ac.id

1. INTRODUCTION

Snail farming, or heliculture, is emerging as a promising agricultural venture due to increasing global demand as a source of protein and its use in cosmetics and pharmaceuticals. It is sustainable and economical, with various systems and species optimised for production. Two main systems, open field and net-covered greenhouses, produce the best yields at low densities [1]. Species such as Cornu aspersum and Helix aspersa maxima are known for their adaptability and high yields [2]. In Spain, the industry contributes to the economy and the environment [2], [3], although challenges such as feed costs, regulations and cultural barriers still exist [4]. Opportunities lie in new products such as lyophilised Helix pomatia [5], while marketing and standardisation could increase global acceptance [3], [4].

Snail farming in Indonesia has great potential thanks to its economic viability and increasing global demand. Snail farming, like the African giant land snail, can be profitable if technology and food requirements are met, with an optimal protein level of 24% CP for efficient growth [6]. Besides being a nutritious food source, snail slime also has pharmaceutical applications that increase its market value [4]. However, the success of this cultivation depends on understanding the local environment and overcoming socio-cultural barriers. Demand for snails continues to rise thanks to their nutritional benefits and their use in pharmaceuticals and cosmetics [4], such as the export of Cerithidea obtusa from Riau which increases economic value [7]. Appropriate culture technologies, such as a 24% CP diet, are important for efficient growth [6], and the local species Hemiplecta humphreysiana and Lissachatina fulica show a preference for diets high in protein and fibre [8]. In addition, the density of carp snails in rice fields highlights the importance of understanding local ecology [9], and socio-cultural challenges related to acceptance must be addressed [4].

The potential for snail farming in Indonesia has not been fully utilised despite its tropical climate and rich biodiversity. Research at Mount Semeru shows that the ecological richness of snail species can be utilised for cultivation [10]. However, the development of this industry is hampered by low awareness and traditional methods. Environmental conditions such as temperature and humidity, which are also relevant for cocoa, are important for snail cultivation and can be optimised through research [11]. The altitudinal gradient on Mount Semeru affects snail diversity, influenced by factors such as altitude and soil pH [10]. Other challenges include traditional methods, limited market development, as well as pests such as fruit flies [12], [13]. Solutions include integrated pest management and environmental control, which can be adapted from other sectors [13]. Data from research on Mount Semeru can guide sustainable cultivation practices [10]. An assessment of economic feasibility, market demand, modern technology, and environmental conditions will determine the profitability of snail farming.

Previous research has explored various aspects of aquaculture in Indonesia, but studies on snail farming, especially regarding its economic viability, are still limited [14]–[16]. Further research is needed to determine whether market demand can support large-scale production, whether available technologies can improve productivity and cost efficiency, and how environmental conditions affect growth and operational sustainability. This study aims to provide practical insights for investors and policymakers in Indonesia. By analysing the combined effects of market demand, technology adoption, and environmental conditions, this study is expected to provide strategies that support the development of snail farming as a sustainable industry. The results are expected to benefit farmers, investors, and policymakers in promoting innovative and profitable farming practices in Indonesia.

2. LITERATURE REVIEW

2.1 Market Demand

Market demand is a crucial determinant of the economic success of agricultural enterprises, particularly in snail farming, where consumer preferences for snail meat and by-products such as slime, used in the cosmetic and pharmaceutical industries, have steadily increased globally. [2], [4] highlight that the demand for snail meat is especially high in countries where it is considered a delicacy, and the growing global interest in organic and sustainable food sources has further propelled this demand. In Indonesia, however, the market for snail products is still underdeveloped, with limited consumer awareness and a lack of established distribution channels hindering industry growth. [1], [3] note that the Indonesian market for snail products remains niche but holds potential for growth if targeted marketing strategies are implemented. Understanding both local and international market trends is critical, as [3], [17] emphasize the importance of effective market research and product positioning for the success of new agricultural ventures.

2.2 *Role of Cultivation Technology*

Technological advancements have transformed agricultural practices by improving productivity, reducing costs, and promoting sustainability. The adoption of modern farming techniques, such as automated feeding systems and climate-controlled environments, has boosted the profitability of aquaculture and livestock farming [18], [19]. In snail farming, efficient breeding and feeding technologies enhance production and reduce labor. [20], [21] highlight the role of innovations like humidity and temperature regulation in optimizing snail growth, while advances in feed and disease management further improve yields. Although [18], [19] suggest these technologies could benefit Indonesian snail farming, adoption remains slow due to knowledge gaps, high costs, and infrastructure limitations [18], [20], [22], emphasizing the need for more investment in technology and training programs.

2.3 *Environmental Conditions and Sustainability*

Environmental conditions are critical to successful snail farming, especially in aquaculture, as snails are sensitive to changes in temperature, humidity and soil quality. In Indonesia, although the tropical climate is favourable, microclimatic variations and environmental degradation are challenges that require sustainable farming practices to maintain economic viability. Optimal temperature and humidity, as in the Helix aspersa study, were shown to increase weight growth [23], and maintaining ideal conditions is important for snail metabolism [24]. Soil quality, such as pH and organic matter, greatly affects growth, and poor soil can inhibit it [25]. In addition, water quality, including dissolved oxygen and pH, is important for the health of aquaculture systems [24], [26]. Environmental degradation such as deforestation and pollution affect aquaculture, so sustainable practices such as organic farming and integrated pest management are needed [25], [27]. Climate change exacerbates these challenges with extreme weather impacting harvests [26].

2.4 *Economic Feasibility Studies in Aquaculture*

Assessing the economic viability of snail farming in Indonesia can be done using quantitative methods from broader aquaculture studies, such as cost-benefit analysis, net present value (NPV), and internal rate of return (IRR) to evaluate profitability and sustainability. For example, the Millennial Shrimp Farming (MSF) system showed high ROI and low sensitivity to cost fluctuations, which can be applied to conch farming [28]. Studies of organic fish farming also show that profitability is affected by production and selling price, emphasising the importance of market demand [29]. Methods such as cost-benefit analysis compare project costs and benefits, while NPV measures long-term profitability [29], and IRR assesses investment efficiency [28]. Market demand is important to the success of snail farming, and sensitivity analysis assesses the impact of variable costs and revenues, which is crucial to understanding economic risk [30].

Research Gap and Hypothesis Development

Despite growing interest in snail farming as a sustainable agricultural enterprise, there is a lack of empirical studies examining its economic feasibility in Indonesia, with most existing research focusing on broader aquaculture or other livestock farming. This study addresses this gap by providing a quantitative analysis of the factors influencing the feasibility of snail cultivation in Indonesia, particularly focusing on market demand, cultivation technology, and environmental conditions. By doing so, it aims to contribute to existing knowledge and offer insights for investors, policymakers, and farmers. The conceptual framework is built around three key factors—market demand, cultivation technology, and environmental conditions—that significantly impact the success of snail farming. Their interactions will be explored through quantitative analysis, forming the basis for a comprehensive understanding of snail cultivation's feasibility in Indonesia.

H1: 'Market demand positively and significantly affects the economic viability of snail farming in Indonesia.'

H2: 'Cultivation technology positively and significantly affects the economic viability of snail farming in Indonesia.'

H3: 'Environmental conditions positively and significantly affect the economic viability of snail farming in Indonesia.'

3. METHODS

3.1 Research Approach and Sample

The research is designed as a quantitative cross-sectional study aimed at understanding the relationships between three independent variables—market demand, cultivation technology, and environmental conditions—and the dependent variable, economic feasibility. The study is primarily exploratory, aiming to identify the key drivers and barriers to snail cultivation in Indonesia. By employing statistical methods, the research seeks to evaluate the extent to which each independent variable influences the feasibility of this farming activity, offering insights into potential improvements and strategies for promoting the industry.

The target population for this study includes individuals and organizations involved in snail farming or aquaculture in Indonesia, such as farmers, agricultural researchers, government officials, and agricultural businesses. A purposive sampling technique was used to select 150 respondents with relevant expertise and involvement in snail farming, a sample size considered sufficient for quantitative analysis using SPSS. This number balances the need for adequate statistical power while managing time and resource constraints. Participants were chosen based on their knowledge and experience, with a focus on regions in Indonesia where snail farming and related aquaculture practices are more prevalent.

3.2 Data Collection Technique

Data were collected using a structured questionnaire distributed to the sample population, utilizing a 5-point Likert scale to gauge respondent opinions. The questionnaire was pre-tested with a small group of snail farmers and aquaculture experts to ensure clarity, relevance, and reliability. The data collection process combined online and in-person methods, with respondents in regions with internet access completing the questionnaire online, while those in rural areas were interviewed face-to-face using a printed version. This hybrid approach ensured a higher response rate and represented diverse geographic areas within Indonesia.

3.3 Data Analysis Technique

The collected data were analyzed using SPSS version 26, encompassing descriptive statistics, reliability testing, and multiple regression analysis to examine relationships between the independent and dependent variables [31]. Descriptive statistics summarized the demographic characteristics of the sample and general trends in responses. Reliability testing, using Cronbach's alpha, assessed the internal consistency of survey items for constructs like market demand, cultivation technology, environmental conditions, and economic feasibility, with values above 0.70 deemed acceptable. Classical assumption tests were conducted to ensure the regression model met the assumptions of linear regression. These included the Kolmogorov-Smirnov test and normal probability plots for normality, Variance Inflation Factor (VIF) and Tolerance values for multicollinearity, and the Glejser test and scatterplots for heteroscedasticity. Finally, multiple regression analysis was employed to evaluate the combined effects of market demand, cultivation technology, and environmental conditions on economic feasibility, providing insights into the relative importance of each factor in predicting the economic viability of snail farming.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

The descriptive statistics provide an overview of the responses from the 150 participants involved in snail farming or aquaculture in Indonesia. Table 1 summarizes the key demographic characteristics of the respondents, such as their years of experience in farming, geographical location, and involvement in snail farming or aquaculture-related activities.

Table 1. Demographic Characteristics of Respondents

Characteristics	N (Sample)	Percentage (%)
A. Years of Farming Experience		
1. Less than 5 years	45	30%
2. 5 to 10 years	65	43.3%
3. More than 10 years	40	26.7%
B. Involvement in Snail Farming		
1. Direct involvement	90	60%
2. Indirect involvement	60	40%

Source: Results of Data Analysis (2024)

The data revealed that the majority of respondents (60%) are directly involved in snail farming, with significant experience in aquaculture. This suggests that the survey captured a knowledgeable and relevant sample for assessing the economic feasibility of snail cultivation in Indonesia.

4.2 Reliability Analysis

The reliability of the constructs—market demand, cultivation technology, environmental conditions, and economic feasibility—was assessed using Cronbach’s alpha. The results are presented in Table 2.

Table 2. Reliability of Constructs

Variable	Number of Items	Cronbach’s Alpha
Market Demand	5	0.812
Cultivation Technology	6	0.785
Environmental Conditions	5	0.838

Economic Feasibility	4	0.852

Source: Results of Data Analysis (2024)

All constructs had Cronbach's alpha values above the acceptable threshold of 0.70, indicating good internal consistency and reliability of the survey instrument [31].

4.3 Classical Assumption Test

In multiple linear regression, the classical assumption test needs to be carried out to ensure that the regression model fulfils the assumptions needed to produce valid and reliable estimates.

1. Normality Test

The normality test is conducted to ensure that the residuals of the regression model are normally distributed, which is an important assumption in linear regression so that the analysis results are reliable. The methods used include the Kolmogorov-Smirnov statistical test and the Normal Probability Plot (P-P Plot). If the residual distribution follows the diagonal line on the P-P Plot or the p-value > 0.05 on the Kolmogorov-Smirnov test, the residuals are considered normally distributed. The analysis results show that the residual points follow the diagonal line on the P-P Plot, and the Kolmogorov-Smirnov test produces a p-value = 0.154, which is greater than 0.05. Thus, it can be concluded that the residuals of the regression model are normally distributed.

2. Multicollinearity Test

The multicollinearity test checks for high correlation between independent variables, which can destabilize regression results. It uses Variance Inflation Factor (VIF) and Tolerance values, with VIF below 10 and Tolerance above 0.1 indicating no multicollinearity [31]. Based on the VIF results, all variables meet these criteria, confirming no multicollinearity in the model.

Table 3. Multicollinearity Test Results

Variable	Tolerance	VIF
Market Demand	0.612	1.633
Cultivation Technology	0.594	1.684
Environmental Conditions	0.617	1.623

Source: Results of Data Analysis (2024)

All VIF values < 10 and tolerance values > 0.1, so it can be concluded that there is no multicollinearity problem in this model.

5. Heteroscedasticity Test

The heteroscedasticity test ensures that the residual variance remains constant across different values of the independent variable, as required in linear regression. Using the Glejser Test and scatterplot analysis, no specific pattern in residual points was found, and the p-value for all independent variables was greater than 0.05, indicating no heteroscedasticity [31].

Table 4. Glejser Test Results

Variable	p-value
Market Demand	0.262
Cultivation Technology	0.154
Environmental Conditions	0.223

Source: Results of Data Analysis (2024)

Since all p-values > 0.05, it can be concluded that there is no heteroscedasticity in this regression model.

4.4 Multiple Regression Analysis

To further explore the influence of market demand, cultivation technology, and environmental conditions on economic feasibility, a multiple regression analysis was conducted. The results of the regression analysis are presented in Table 5.

Table 5. Multiple Regression Analysis

Variables	Unstandardized Coefficients (B)	Standard Error (SE)	Standardized Coefficients (Beta)	t-value	p-value
(Constant)	1.105	0.321		3.443	0.001
Market Demand	0.452	0.105	0.491	4.314	0.000**
Cultivation Technology	0.317	0.109	0.362	2.916	0.004**
Environmental Conditions	0.284	0.102	0.335	2.781	0.007**

Source: Results of Data Analysis (2024)

The regression model explains 68% of the variance in economic feasibility ($R^2 = 0.68$), indicating a strong model fit. All three independent variables—market demand (Beta = 0.491, $p < 0.01$), cultivation technology (Beta = 0.362, $p < 0.01$), and environmental conditions (Beta = 0.335, $p < 0.01$)—significantly contribute to the economic feasibility of snail farming in Indonesia.

Market demand is the most influential factor, with the highest standardized beta coefficient (0.491), suggesting that increasing demand for snail products has the largest positive impact on economic feasibility. Cultivation technology and environmental conditions also play important roles, with positive beta values indicating that advancements in farming technology and favorable environmental conditions enhance the profitability and sustainability of snail farming.

Discussion

The findings of this study provide important insights into the factors that influence the economic feasibility of snail cultivation in Indonesia. By using quantitative analysis, the study examined the roles of market demand, cultivation technology, and environmental conditions, revealing that all three factors have a significant impact on the viability of snail farming. The results show that market demand is the most influential factor in determining the economic feasibility of snail cultivation. Regression analysis revealed that market demand has the strongest positive effect on economic feasibility, indicating that increased demand leads to greater profitability and sustainability for snail farmers. This finding aligns with existing research, which highlights the critical role of consumer demand in the success of agricultural enterprises. [32]–[34] emphasized that niche markets, such as those for snail products, depend heavily on consumer awareness and interest. In Indonesia, demand for snail products is underdeveloped compared to other regions, largely due to limited consumer awareness about their nutritional and cosmetic benefits. To promote industry growth, strategies to boost demand are essential, including marketing campaigns that emphasize the health and environmental advantages of consuming snails. Furthermore, positioning snail farming as a sustainable practice could appeal to environmentally conscious consumers, thereby increasing demand and improving the industry's economic viability.

Cultivation technology plays a crucial role in enhancing the economic feasibility of snail farming in Indonesia, with results showing a positive and significant relationship between technology adoption and economic viability. The adoption of modern farming technologies, such as automated feeding systems, climate control, and improved breeding practices, can significantly boost productivity, lower costs, and increase profitability. This aligns with studies by [35] and [36], which found that technological advancements in aquaculture and livestock farming enhance production efficiency and profitability. However, in Indonesia, the adoption of modern technologies in snail farming remains limited, especially in rural areas where traditional practices dominate. [17] noted that barriers such as limited access to technology, insufficient training, and high initial costs hinder technology adoption in Indonesian agriculture. To address these challenges, investment in farmer education and training programs is essential. Providing affordable technologies and technical support, along with government subsidies or financial incentives, can help farmers transition to more efficient, technology-driven practices, thereby improving the economic feasibility of snail farming on a larger scale.

Environmental conditions have a significant positive impact on the economic feasibility of snail farming, highlighting the importance of maintaining suitable conditions like climate, soil quality, and water availability for successful cultivation. Previous studies by [37] and [38]emphasized that snails are highly sensitive to environmental factors, with any changes in temperature, humidity, or soil conditions potentially harming their growth and reproduction. In Indonesia, the tropical climate generally supports snail farming, but environmental challenges such as climate change, deforestation, and pollution pose significant threats to sustainability. [39] noted that climate change has led to extreme weather conditions that can negatively affect agricultural yields, including snail production. To mitigate these risks, sustainable farming practices should be promoted, including organic farming and eco-friendly pest management to maintain the ecological balance necessary for snail farming. Farmers should also adopt climate-resilient practices, such as controlled environments for breeding and production, to improve both environmental sustainability and the economic viability of snail farming by reducing risks from environmental fluctuations.

The study's findings on the economic feasibility of agricultural enterprises align with previous research, emphasizing the importance of market demand, cultivation technology, and environmental conditions. Market demand is a critical factor, as highlighted by [40], and is supported by the integration of market insights into agricultural strategies, which enhances sustainability and economic viability. The role of consumer demand is further explored through econometric models that predict demand based on various economic indicators [41], [42]. Cultivation technology significantly impacts profitability, with technological innovations improving productivity, as noted by [43]. This is echoed in the use of advanced technologies like precision farming to optimize production processes. Environmental conditions are crucial, as sustainable practices are necessary to mitigate the sensitivity of agricultural products to environmental factors, aligning with [44]. However, this study provides new insights into the specific challenges and opportunities for snail farming in Indonesia, particularly in relation to the country's unique environmental and market conditions

5. CONCLUSION

This study demonstrates that snail cultivation in Indonesia holds significant potential as a sustainable and profitable agricultural venture. The analysis reveals that market demand is the key driver of economic feasibility, emphasizing the importance of expanding local and international markets for snail products. Additionally, the adoption of modern cultivation technologies enhances productivity and profitability, while favorable environmental conditions further support the industry's viability. To fully realize this potential, policymakers and investors should focus on raising consumer awareness, improving access to advanced technologies, and promoting sustainable farming practices that align with Indonesia's environmental policies. This study lays a strong foundation for future research and strategies to boost the snail farming industry, offering opportunities for economic growth and sustainable agricultural development. Further research should explore additional factors such as financing options, government support, and market access to provide a more comprehensive understanding of the industry.

The findings of this study suggest important actions for policymakers, investors, and farmers to develop snail farming in Indonesia. First, increasing market demand through marketing campaigns, consumer education, and expanding market access is key to improving profitability. Second, adopting modern cultivation technologies can enhance efficiency and productivity, with access to affordable technologies and training being essential, especially in rural areas. Government support through financial incentives could further encourage investment. Finally, aligning farming practices with environmental sustainability and promoting climate-resilient methods is crucial for the industry's long-term success.

While this study offers valuable insights into the economic feasibility of snail cultivation in Indonesia, several areas warrant future research. First, exploring additional factors such as government policies, access to financing, and supply chain management could provide a more comprehensive understanding of the industry's challenges and opportunities. Second, a mixed-methods approach combining quantitative and qualitative data would offer deeper insights into the experiences of snail farmers, with interviews and focus groups providing valuable qualitative data. Lastly, future research could examine how snail farming contributes to Indonesia's broader goals of sustainable agricultural development and poverty alleviation by assessing its socio-economic impact on rural communities and potential for scaling to benefit more farmers, enhance food security, and boost economic growth.

REFERENCES

[1] K. Apostolou, D. Klaoudatos, A. Staikou, S. Sotiraki, and M. Hatziioannou, "Evaluation of production performance between two heliciculture farming systems," *Molluscan Res.*, vol. 43, no. 3–4, pp. 211–221, 2023.

[2] I. S. Danilova, "Heliceculture as a new promising direction of agriculture in Ukraine," *Sci. Messenger LNU Vet. Med. Biotechnol. Ser. Agric. Sci.*, vol. 24, no. 97, pp. 44–47, 2022.

[3] A. Yatsun, "Instrumentation of regulation in the aspect of snail breeding in Spain and its impact on the country's economy," *Econ. Bus. Manag.*, vol. 1, no. 14, pp. 90–108, 2023.

[4] G. N. Munywoki, "Snail farming (Heliciculture): Benefits, economic viability, challenges and prospects," *Int. J. Res. Agron.*, vol. 5, no. 1, pp. 9–11, 2022.

[5] V. V Golembovskii, L. A. Pashkova, A. I. Surov, and S. A. Talalaev, "A new product from Helix pomatia and the method of its production," in *E3S Web of Conferences*, EDP Sciences, 2023, p. 1017.

[6] Y. Popoola, A. Idowu, I. Omodewu, O. Ajayi, S. Ajayi, and A. deboy. Omole, "Effects and Cost-Benefit of Low and High Protein Levels in Snail Diets with Constant Levels of Energy and Calcium," *Asian J. Res. Agric. For.*, vol. 9, pp. 36–41, May 2023, doi: 10.9734/ajraf/2023/v9i3204.

[7] I. L. Sari, "Sustainability of sucking snail (Cerithidea obtusa) in Tanah Merah, Indragiri Hilir Regency, Riau Province based on ecological and economic dimensions," *Econ. Manag. Soc. Sci. J.*, vol. 1, no. 3, pp. 81–90, 2022.

[8] J. Pratiwi *et al.*, "Feeding behavior and preferences of Hemiplecta humphreysiana and Lissachatina fulica (Gastropoda) to support heliciculture in Indonesia," *J. Biodjati*, vol. 7, no. 2, pp. 163–176, 2022.

[9] V. K. Dewi, R. Ramdhani, T. Suganda, L. T. Puspasari, and R. Meliansyah, "Kepadatan Populasi dan Pola Distribusi Keong Mas (Pomaceae canaliculta L.) pada Ekosistem Sawah di Kecamatan Jatinangor," *Soilrens*, vol. 20, no. 2, pp. 103–111, 2022.

[10] P. A. Nurhayati, A. S. Nurinsiyah, T. Atmowidi, and W. Priawandiputra, "Land snail assemblages along altitudinal gradients on Mount Semeru, the highest montane forest in Java, Indonesia," *J. Molluscan Stud.*, vol. 90, no. 3, 2024.

[11] A. Dhamira and H. Anggrasari, "Indonesian Climatic Factors and Its Effect on Cocoa Productivity," *West Sci. Interdiscip. Stud.*, vol. 2, no. 05, pp. 963–974, 2024.

[12] P. Hidayat, N. B. Adilah, and N. Maryana, "Review of species, host plants, and distribution of fruit flies (Diptera: Tephritidae) in Indonesia," in *IOP Conference Series: Earth and Environmental Science*, IOP Publishing, 2023, p. 12018.

[13] J. Widjaja, A. N. Widawati, A. Nursafingi, A. Kurniawan, and H. U. Pangaribuan, "The Impact of Snail Control on Intestinal Schistosomiasis Endemic Areas in Indonesia," *J. Commun. Dis. (E-ISSN 2581-351X P-ISSN 0019-5138)*, vol. 55, no. 3 B, pp. 14–20, 2023.

[14] S. A. P. Pradina and P. C. Makatipu, "Spawning and seed production of the green snail (Turbo marmoratus L.) in Indonesia," *Secr. Pacific Community Trochus Inf. Bull.*, vol. 7, pp. 9–13, 2001.

[15] W. Wiratno, M. Rizal, and I. W. Laba, "Potensi ekstrak tanaman obat dan aromatik sebagai pengendali keong mas," *Bul. Penelit. Tanam. Rempah dan Obat*, vol. 22, no. 1, 2015.

[16] P. Rahayu, N. Istiqomah, and F. Adriani, "Uji Efektivitas Alih Fungsi Perangkap Ikan Model Bubu Menjadi Perangkap Hama Keong Mas (Pomacea canaliculata L.) dengan Berbagai Atraktan Biologi," *Rawa Sains J. Sains STIPER Amuntai*, vol. 8, no. 2, pp. 98–103, 2018.

[17] Y. Perehuda, "Assessment of the competitiveness of manufacturing products of snail and fish farms through the prism of import and export indicators," *Ukr. J. Appl. Econ. Technol.*, vol. 8, pp. 125–130, Aug. 2023, doi: 10.36887/2415-8453-2023-3-18.

[18] E. Raji, T. I. Ijomah, and O. G. Eyieyien, "Integrating technology, market strategies, and strategic management in agricultural economics for enhanced productivity," *Int. J. Manag. Entrep. Res.*, vol. 6, no. 7, pp. 2112–2124, 2024.

[19] A. S. Modjo, G. Hidayat, A. Manardi, F. Muhammad, and D. Fitriani, "Harnessing Technology for Agricultural Sustainability: Case Studies and Future Directions," *Join J. Soc. Sci.*, vol. 1, no. 3, pp. 270–280, 2024.

[20] R. C. Bunkar *et al.*, "A Review on Levering Technology for Sustainable Development in Agricultural Extension Program," *Arch. Curr. Res. Int.*, vol. 24, no. 5, pp. 543–556, 2024.

[21] V. Sharma, S. Rajawat, A. Kumar, V. Kumar, Y. Parihar, and S. Jaat, "A Review On: Advancing Sustainable and Smart Farming Practices, A Comprehensive Exploration of IoT and Sensor Technologies in Agriculture," *Int. J. Adv. Res. Sci. Commun. Technol.*, pp. 407–412, Jul. 2024, doi: 10.48175/IJARSCT-19152.

[22] W. M. Anthony, "Innovations in Aquaculture Technology and Market Access in Sub-Saharan Africa," *Iaa J. Art Humanit.*, vol. 11, no. 2, pp. 49–52, 2024, doi: 10.59298/iaajah/2024/11.4952.33.

[23] D. Jimenez and R. del Pilar, "Manejo controlado de la temperatura y humedad en caracoles de tierra de la especie Helix aspersa en el municipio de Fusagasugá (Cundinamarca)," 2007.

[24] P. Koperski, E. Dumnicka, and J. Galas, "Abiotic parameters determining fauna composition in karstic springs," *Polish J. Ecol.*, vol. 59, no. 1, pp. 153–163, 2011.

[25] M. Ilman *et al.*, "Impact of soil and water quality on the sustainable management of mangrove-compatible brackishwater aquaculture practices in Indonesia," *Environ. Res. Commun.*, vol. 6, no. 8, p. 85013, 2024.

[26] M. Riftiarrasyid and B. Soewito, "Monitoring water quality parameters impacted by Indonesia's weather using internet of things," *Indones. J. Electr. Eng. Comput. Sci.*, vol. 35, p. 1426, Sep. 2024, doi: 10.11591/ijeecs.v35.i3.pp1426-1436.

[27] Y. M. Xu and S. Q. Zhang, "The influence of environmental factors on snail growth and distribution," *Int J Medi Parasit Dis*, vol. 38, pp. 218–222, 2011.

[28] Z. Pramudia *et al.*, "Profitability Analysis and Sensitivity Level of White Shrimp (Litopenaeus vannamei) Cultivation Using the Millennial Shrimp Farming (MSF) System," *ECSOFiM (Economic Soc. Fish. Mar. Journal)*, vol. 11, no. 2, pp. 155–165, 2024.

[29] M. M. Beg, S. M. Roy, S. Moulick, B. Mandal, T. Kim, and B. C. Mal, "Economic feasibility study of organic and conventional fish farming systems of Indian major carps," *Sci. Rep.*, vol. 14, no. 1, p. 7001, 2024.

[30] M. A. Kharoub, A. Saied Ali El Shafei, and R. El-Sayed Mohamed Morsi, "The Economic Feasibility of Establishing a laying Hens Breeding Station for the Production of Table Eggs," *Alexandria Sci. Exch. J.*, vol. 45, no. 1, pp. 115–129, 2024.

[31] I. Ghozali, "Multivariate Analysis Application with the IBM SPSS 25 Program. Semarang," *Semarang Diponegoro Univ. Publ. Agency*, 2018.

[32] T. Mulyadi and S. P. Sari, "Pemanfaatan siput gonggong sebagai bahan baku olahan sosis sebagai makanan khas Kota Batam," *J. Manaj. Kuliner*, vol. 1, no. 2, pp. 78–86, 2022.

[33] N. Ningsi *et al.*, "Pengetahuan dan Perspektif Masyarakat Lokal Terhadap Schistosomiasis di Indonesia," *J. Vektor Penyakit*, vol. 16, no. 2, pp. 153–162, 2022.

[34] N. M. Suartini and N. W. Sudatri, "Distribution, eggs number and nutrition content of pila scutata snail in rice fields of Subak Uma Desa, Duda village-Bali," *Int. J. Fauna Biol. Stud.*, vol. 9, no. 5, pp. 19–22, 2022.

[35] A. Zainudin, A. Habibullah, Y. Arfiani, and S. D. Mumpuni, "Digital Transformation on Aquaculture in Indonesia through eFishery," in *IOP Conference Series: Earth and Environmental Science*, IOP Publishing, 2023, p. 12024.

[36] I. G. W. D. S. Permadi and R. Novita, "The Role of Appropriate Technology in Enhancing Efficiency and Production in Livestock and Agriculture Sectors: A Systematic Review in Indonesia," *Indones. J. Innov. Stud.*, vol. 23, pp. 10–21070, 2023.

[37] V. A. Glavatchuk and H. M. Ogorodnichuk, "Influence of cellulolytic preparation on the productive qualities of snails of the Helix Aspersa Maxima species," *ТЕХНОЛОГІЯ ВИРОБНИЦТВА І ПЕРЕРОБКИ ПРОДУКЦІЇ ТВАРИННИЦТВА*, p. 89, 2024.

[38] L. A. Oyesola, L. A. Adejumo, M. O. Jimoh, and B. O. Solomon, "Optimization of the effects of process parameters on nutritional and microbial qualities of canned snail meat using Taguchi method," *LAUTECH J. Eng. Technol.*, pp. 65–79, 2024.

[39] S. Jaishi, R. B. Thapa, K. Kafle, U. Sapkota, and D. Khanal, "Prevalence of Snails and Farmers' Practice Towards the Management of Giant African Snail, Achatina fulica Bowdich, 1822 in Kapilvastu, Nepal," *Agric. Dev. J.*, pp. 68–77, 2024.

[40] E. Kulikova and E. Molokova, "Leveraging market insights for sustainable agricultural practices," in *BIO Web of Conferences*, EDP Sciences, 2024, p. 2011.

[41] A. Musagaliev and M. Dustova, “Fertile grounds: econometric analysis of financial support for agricultural enterprises,” in *BIO Web of Conferences*, EDP Sciences, 2023, p. 14012.
[42] V. Amrahov, F. Rahimli, N. Mirzazadeh, G. Ibrahimova, and H. Valizadeh, “Satisfying the consumer demand for agricultural products: Possibilities and its prediction,” 2023.
[43] V. Kyfyak, V. Kindzerskyi, S. Todoriuk, L. Klevchik, and O. Luste, “The role of economics and management in the development of sustainable business models of agricultural enterprises,” 2024.
[44] S. Sehgal and I. Batool, “Economic Development: A Study of the Holistic Examination of Sustainable Agriculture’s Substantial Impact on Developing Nations,” *South Asian J. Soc. Stud. Econ.*, vol. 21, pp. 241–248, Jul. 2024, doi: 10.9734/sajsse/2024/v21i7858.