ASSESSMENT OF THE FINANCIAL EFFICIENCY OF CHILI-GROWING FARMERS IN TRA VINH PROVINCE, VIETNAM DURING THE PERIOD 2022–2023

Son Thi Thanh Nga[1*], Ngo Thanh Trac[2], Pham Thi Phuong Thuy[3], Nguyen Hong Ung[4], Tran Thi Thao Dang[5], Cao Thi Nhu[6], Thai Thi Thanh Tron[7]

Abstract – *This study aims to evaluate the financial efficiency of chili pepper production among 95 farming households in three districts of Tra Vinh Province from 2022 to 2023, involving Duyen Hai, Tra Cu, and Cau Ngang. The research employed rapid rural appraisal methods, SWOT analysis, and multiple linear regression to identify the key determinants of farmers' profitability. The results indicated that yield and selling price are positively and significantly correlated with net profit, explaining 98.4% of the variation in financial performance. On average, chili cultivation generates a profit of VND 139.76 million per hectare per year, with a capital efficiency ratio of 1 and a material efficiency ratio of 4, reflecting high economic viability. The SWOT analysis revealed both opportunities, such as improved technology transfer, production linkages, and the promotion of organic-oriented farming and challenges, including limited market access, labor shortages, and price instability. Moreover, the findings underscored the potential of chili pepper cultivation to enhance household income and resilience against climate change, particularly among Khmer ethnic farmers constituting more than 80% of participants. This study provided empirical evidence supporting local agricultural policies aimed at crop restructuring toward sustainable, high-value, and climate-resilient production systems. To strengthen the competitiveness and sustainability of chili farming in Tra Vinh Province, future research should focus on developing value chain integration, digital market access, and risk management strategies.*

I. INTRODUCTION

Tra Vinh Province, which has been part of Vinh Long Province since July 1, 2025, with its low-lying terrain, especially in the eastern coastal area, is vulnerable to sea-level rise, sailing, flooding, and related impacts that significantly affect land use and livelihoods [1]. The province's socio-economic development strategy and crops and livestock restructuring orientation always focus on the livelihoods of poor households, near-poor households, and ethnic minorities. Chili is a high-value spice crop that has been selected by many localities in Tra Vinh Province as a key crop for economic restructuring and poverty reduction. The Mekong Delta, before the rearrangement and reorganization of administrative units at all levels on 2025 July, comprising provinces such as Dong Thap, An Giang, Tien Giang, Soc Trang, Vinh Long, and Tra Vinh, has a total chili cultivation area of over 7,000 hectares, with an annual production of approximately 100,000 tons [2]. Chili is grown on different types of soil. With proper management, it can achieve high yields and economic efficiency on fertile soil, compared to other vegetables and industrial crops. Therefore, expanding chili cultivation makes effective use of various soil types, contributes to soil improvement under a suitable crop rotation regime, and takes advantage of local labor to develop agriculture comprehensively. The average profit from chili

[1,3,4,5,6,7]Tra Vinh University, Vietnam
[2]Tra Vinh Vocational College, Vietnam
*Corresponding author: sonthanhnga@tvu.edu.vn

farming reaches 158 million VND per hectare, with a financial efficiency characterized by a profit margin on revenue of 30.8% and a profit margin on total cost of 135%. For these reasons, many localities consider chili a highly profitable crop and include it in rotation or farming model conversion programs [3]. Although studies on chili have been widely conducted, research analyzing the financial efficiency of chili growers in Tra Vinh Province remains unexplored. This article, therefore, examines economic efficiency and affecting factors, and proposes solutions to improve farmers' financial outcomes.

II.   LITERATURE REVIEW

Chili pepper (*Capsicum frutescens* L.) belongs to the Solanaceae family and is a commonly used spice vegetable in Vietnam and worldwide. In 2023, the country's chili exports reached USD 71,673 thousand [4]. In a 2015 survey, Vo Thi Thanh Loc et al. [5] studied the current situation and value chain of chili in Dong Thap Province using the GTZ Eschborn chain linkage method. They found that the chili market in the research area mainly depends on China. A survey on the financial efficiency of chili-growing households in Dong Thap Province and Tien Giang Province by Nguyen Thi Thu An et al. (2017) identified five factors that affect economic efficiency [3]. The study by Ngo Thanh Trac et al. (2019) showed that most farmers grow the GS 888 Gold variety because of its good growth performance, which suits the soil conditions of Tra Vinh Province [6]. Chili is also an important raw material in the food industry, providing high economic value [7]. In Vietnam, chili has been cultivated for a long time and is suitable for various types of land, allowing a large potential for area expansion [8]. Although the effectiveness of chili production models in the Southwest of Vietnam has been examined [6], limited attention has been devoted to the financial factors affecting chili-growing households. In practice, farmers' participation in chili production is influenced by objective and subjective factors. Hossen [9] identified several independent variables influencing

chili pepper revenue in Bangladesh, including selling price, production technology status, production costs, and the number of chili pepper buyers. The study revealed that approximately 80% of the variations in chili yield could be explained by these independent variables [9].

Similarly, Miranda et al. (2021) surveyed the financial efficiency of households engaged in red chili pepper farming during the rainy and dry seasons in Indonesia [10]. Their findings indicated that red chili cultivation was profitable in both seasons. Particularly, the rainy season exhibited a capital efficiency roughly 0.61 times higher than that of the dry season. Moreover, income analysis demonstrated that farmers cultivating chili in the dry season achieved higher income per unit area than in the rainy season. However, this study did not examine the specific factors influencing profitability across the two seasonal production models.

Indrasti et al. (2021) studied the economic efficiency and policies related to farmers growing red chili in the districts of East Java Province of Indonesia [11]. The results revealed that there is economic efficiency in growing red chili in the study area, especially the basic factor that brings profit for farmers with extensive experience in chili farming.

In Nigeria, Lawal et al. (2021) conducted a study of chili marketing in Kano State and found that the marketing of chili products was mostly male, accounting for 96%, aged 3–40 years, with varying educational backgrounds and less than 10 years of experience in the field [12].

More recently, Mahdalena et al. (2024) examined the income of chili farmers [13]. The study analyzed the income of Tiung chili farmers in 3B Batu Balian village, Simpang Empat, and Banjar District, South Kalimantan Province of Indonesia. The result found that most chili farmers were profitable; however, their profits varied significantly due to several factors, including their ability to create favorable conditions for good plant growth and manage risks arising from chili plants to reduce production costs. Based on the previous studies, the chili pepper production model in this

study is expected to achieve high and sustainable economic efficiency. This model also provides a scientific basis for relevant departments and sectors to make decisions and develop policies that improve the economic efficiency of chili pepper production and increase farmers' incomes.

III.   RESEARCH METHODS

A. *Research location*

The survey was conducted in three districts with the largest chili pepper-growing area in Tra Vinh Province from August 2022 to June 2023, including Duyen Hai (now Ngu Lac commune), Tra Cu (now Long Hiep commune), and Cau Ngang (now Nhi Truong commune).

B. *Sampling method and sample size*

Sample selection method

To facilitate the study, a convenient stratified sample selection method was employed, complemented by direct interviews with farmers involved in the production of chili peppers. In practice, various sampling methods are commonly used in research, and the selection of an appropriate technique depends on the specific circumstances encountered during the research process. In addition, a survey of knowledgeable individuals at the commune and district levels was conducted from August 2022 to June 2023 to analyze aspects related to the production model of chili peppers, such as the effectiveness of the model, potential for future development, and developmental orientations of the model in the locality in the future. Therefore, to facilitate the research, the sample size was determined based on the large number [5].

Sample size

According to the large sample method, a minimum of 40 observations is required to ensure reliability [5]. For multivariate regression analysis, Habing [14] suggested that the sample size should be at least four or five times the number of independent variables, while Hair et al. [15] recommended a minimum of 50 observations or a ratio of 5:1 between observations and independent variables. In practice, agricultural studies in

Tra Vinh Province have often employed smaller samples; for instance, Son Thi Thanh Nga et al. [16] surveyed 31 households, and Pham et al. [17] surveyed 67 households. Based on both theoretical recommendations and practical evidence, this study determined a sample size of 95, which meets the requirements for multivariate regression analysis and ensures representativeness (Table 1).

Table 1: Tools used in the study and distribution of the survey sample of chili pepper growing households

No.	Tools name	The information source	Number of households
1	Household survey	Chili-growing farmers (Duyen Hai: 35 households, Tra Cu: 30 households, and Cau Ngang: 30 households)	95
2	PRA	Agriculture departments of the districts	3
3	PRA	Local agricultural offices	3

C. *Data collection and processing methods*

To assess financial efficiency, primary data was obtained through direct interviews with 95 households engaged in chili pepper production in Tra Vinh Province from 2022 to 2023, using a structured questionnaire that covered all relevant information. Secondary data were collected from various sources, including statistical reports, publications of the Department of Agriculture, reports of the Department of Agriculture and Rural Development, the Statistical Yearbook, and other related documents [2, 18].

The collected data were coded and analyzed according to the method proposed by Vo Van Tai et al. [18] and processed by using Microsoft Excel and SPSS Statistics 26 software. Descriptive statistical methods are used to calculate the average value, maximum value, minimum value, frequency, and percentage of technical indicators. Besides, the cost-benefit analysis method is used to calculate material costs, labor costs, total income, profit, and capital efficiency [19].

The study used a multivariable linear regression model with the Stepwise method to incorpo-

rate significant variables into the model to find the most optimal variables, thereby determining the factors affecting the profits of farmers participating in the chili pepper production model in the survey area [20]. Then, the multivariable regression analysis method is employed to assess the influence of factors on the efficiency of chili pepper cultivation, as well as the correlation between independent and dependent variables, and the influence of independent variables on each other. Independent variables such as production experience (years), planting area (ha), and age of chili pepper growing households (years) all certainly influence the profits of producing households [21]. In the case of the production model of Tra Vinh Province, besides investment costs and selling prices, planting density (trees/ha) and productivity (tons/ha) have significant impacts on the profits of the cultivation model.

The multivariable regression model is constructed as Formula (1).

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + ... + b_nX_n \quad (1)$$

In which:

Y is the dependent variable representing profit of chili pepper growing households (1,000 VND/hecta/year) and changes in profit of chili pepper growing model; a is a constant, indicating the value of variable Y when variables X_1, X_2, X_3,...X_n are equal to 0; X_1, X_2, X_3,..., X_n are independent variables; b_1, b_2, b_3, b_4,...b_n depict regression coefficients corresponding to independent variable:

X_1: Chili pepper growing experience of households [16]

X_2: Planting area [16]

X_3: Age of chili pepper growing households [16]

X_4: Yield [19]

X_5: Selling price [19, 21]

X_6: Chili planting density [16]

SWOT matrix analysis: is used to analyze internal factors of strengths (S), weaknesses (W) affecting the profits of chili-producing households, as well as external factors of opportunities (O), and threats (T) from policy institutions, organizations, risks/limitations in the process of organizing production and consumption of chili. From the issues analyzed in the chili cultivation model, a strategic analysis was conducted, and the results of the SWOT analysis established four basic strategies: SO (strengths combined with opportunities), strategies based on advantages to take advantage of market opportunities; WO (weaknesses combined with opportunities), strategies based on the ability to overcome internal weaknesses to leverage external opportunities; ST (strengths combined with threats), strategies based on internal strengths to avoid external risks; WT (weaknesses combined with threats), strategies based on the ability to overcome or minimize internal weaknesses to avoid external risks.

IV. EMPIRICAL RESULTS AND DISCUSSION

A. Demographic and socioeconomic characteristics of chili-growing households

The analysis results in Table 2 show that the average age of chili-growing households is about 43.7 years old, ranging from 27 to 60 years, showing that chili-growing households are all in the age range with sufficient strength and mental competence to participate in the model. The age of chili-growing households is 2.7 years older than that of coconut-growing households collecting nectar [16] and 6.3 years younger than the average age of traditional shrimp–price farming households in Thanh Phu District, Ben Tre Province in 2021 [19].

In addition to age, the education level of chili-growing households is also an important factor that helps households easily access and apply scientific and technical advances in production and consumption markets. The average education level of chili growers is at the seventh-grade level, indicating that most are literate and capable of acquiring new knowledge and adapting it to enhance their farming practices [3].

Production experience plays a vital role in enabling farmers to manage pests and respond to natural disasters. The analysis results of the

average number of years of production experience reached 4.7 years, ranging from 1 to 12 years. Nguyen Thi Thu An et al. [3] reported that chili farmers in the Mekong Delta had an average of 10 years of experience, with a range from 5 to 44 years. These findings suggest that chili is a relatively new crop in the study area, and farmers remain receptive to adopting new cultivation techniques. In addition, Vo Minh Hai et al. (2020) found that the average experience of perennial crop producers in Tra Vinh Province was about 15 years [22]. A similar survey on the experience of rice farmers in An Giang Province by La Nguyen Thuy Dung et al. (2015) revealed the farmers' experience of about 20 years [23].

Table 2: Information on chili pepper-growing households in the survey area

Content (N = 95)	Average	Range of variation	Standard deviation
The age of chili farmers (years old)	43.7	27–60	±6.7
Farmer's education level (grade)	7	1–12	±1.1
Chili-growing experience (years)	4.7	2–10	±0.9

B. Household size and labor participation in chili cultivation models

Table 3 shows that the average number of people is 4.3, ranging from 2 to 7 people. This result is consistent with a 2023 study on the economic efficiency of growing coconut for nectar collection in Tra Vinh Province, which revealed an average household size of 4.83 people [16]. This is an advantage for chili-growing households because it will solve the problem of labor shortage in the production process.

Table 3: Number of family members involved in chili cultivation in the survey area

Content (N = 95)	Average	Range of variation	Standard deviation
Demographics	4.3	2–7	±0.16
Laborers participating in the model	2.2	1–3	±0.76

C. Ethnic groups

Tra Vinh Province is mainly inhabited by three ethnic groups: Kinh, Khmer, and Hoa. All three ethnic groups live in all 13 provinces of the Southwest region [24]. Through a survey of 95 chili-growing households in the survey area, the research team recorded that the Khmer ethnic group accounted for 81% (77 households), followed by the Kinh ethnic group, accounting for 19% (18 households) (Figure 1). This result indicates that the chili-growing model attracts the Khmer ethnic group. In addition, the chili production model has also received great attention from relevant departments and companies operating in the agricultural sector.
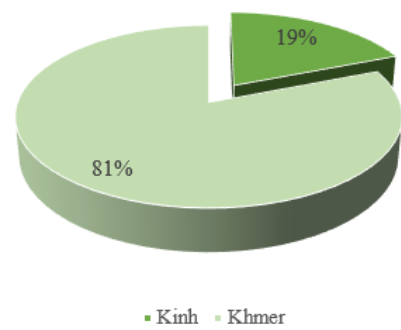

Fig. 1: Ethnic groups of chili-growing household heads from 2022 to 2023

D. Land size

The area of production land is a basic factor for agricultural households to generate income for the family. In this study, the cultivated area is based on the total agricultural land area (Table 4). The analysis results show that the average area of households in the survey area is 8.2 ha. Of which, there are 21 households with a total area of 0.1–0.5 ha (accounting for 46.2%); 17 households with a total area of 0.5–1.0 ha (accounting for 37.4%); 7 households with a total area of over 1.0 ha (accounting for 16.4%).

Table 4: Cultivated area of chili-growing households in the survey area

Content (N = 95)	Average	Range of variation	Standard deviation
Cultivated area (ha)	0.82	0.2–2.5	±0.09
Chili area (ha)	0.47	1–2.0	±0.03

E. Situation of the farmers participating in technical training in production

According to the data in Figure 2, the rate of farmers participating in technical training accounts for 80%, while the remaining 20% have not participated. When participating in technical training in production, chili pepper-growing households will have various opportunities to access scientific and technical advances and apply these techniques in production.
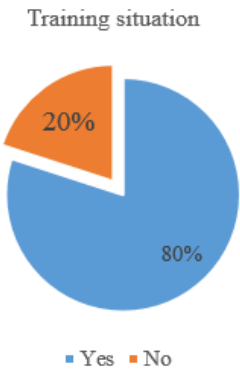

Fig. 2: Participating in training on production techniques for farmers

F. Bank credit

The survey results (Figure 3) show that 44% of households have family capital for production, 42% of households feel that the loan procedures are very complicated, 11% of farmers don't have collateral, and the remaining 4% have other reasons. From there, it shows that chili farming households rarely have access to low-interest loans from banks. The majority of chili farming households have their capital to buy input materials (fertilizer, lime, pesticides) from agricultural supply agents, with payment typically deferred until the end of the season.
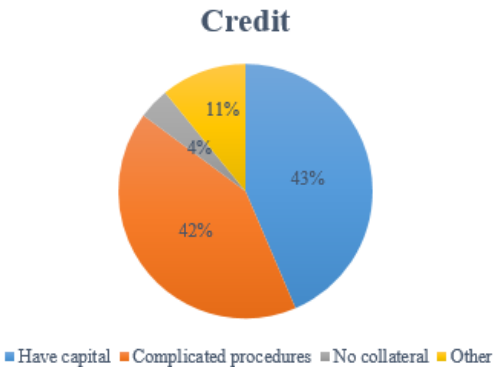

Fig. 3: Credit of chili growers from 2022 to 2023

G. Analysis of the economic efficiency of chili farming households in Tra Vinh Province

In the process of producing chili farming, the cost to produce commercial chili farming includes such as seed, cost, material cost, pesticide cost, family labor cost (fertilizing, spraying, watering, weeding); labor costs (plowing, making beds, planting, fertilizing, spraying, harvesting) and other costs (film covering electricity, water, depreciation of machinery and equipment).

Table 5 shows that the average yield (mean) of households is 13.9 tons/ha. With this yield, farmers have the same season and good prices, whereas during the survey period, the average price was about 21.2 thousand VND/kg.

According to the survey results, households growing chili peppers have high and relatively stable revenue, specifically: in the model, the total revenue is 295 million VND/ha/year. The reason for such a high total revenue is that the chili-growing model produces high productivity, and the selling price is high at 21,208 VND/kg. In terms of profit, the revenue of the model in the research area is 139.76 million VND/ha/year. The profit is much higher than that of growing rice and other crops in the same area.

Table 5: Costs and profits of the chili pepper growing model in Tra Vinh Province from 2022 to 2023

Indicators	Average (million VND/ha/year)	Standard deviation
Material costs (million VND/ha/year)	35,847,232	±54,186
Labor costs (million VND/ha/year)	114,931,362	±599,058
Other costs (million VND/ha/year)	4,463,158	±18,257
Total costs (million VND/ha/year)	155,241,751	±606,405
Selling price (million VND/kg)	21,208	±2,972
Productivity (tons/ha)	13.9	±1.194
Total revenue (million VND/ha/year)	295,003,280	±2,562,527
Profit (million VND/ha/year)	139,761,492	±1,968,248
Total income (million VND/ha/year)	254,692,853	±2,556,313
Capital efficiency	1	±0.04
Material efficiency	4	±0.05

The capital efficiency (profit/total cost) of chili pepper-producing households in Tra Vinh Province is 1. This means that when chili pepper-producing households invest 1 VND in production costs, chili pepper-producing households will receive an average of 1 VND in profit. Meanwhile, the material efficiency (profit/total cost) of chili pepper-producing households in Tra Vinh Province is 4, indicating that when chili pepper producing households invest 1 VND in production costs, chili pepper-producing households will receive an average of 4 VND in material efficiency.

H. Factors affecting chili pepper economic efficiency of households in Tra Vinh Province from 2022 to 2023

The results of the regression model analysis show that the correlation coefficient R = 99.2% means that the profit of chili pepper growing households is closely related to two factors: selling price and productivity. The coefficient of determination R2 shows that 98.4% of the change in chili farming profits is affected by yield and selling price factors, while 1.6% is affected by other factors not included in the model. The variance inflation factor (VIF) coefficients of the

independent variables are all less than 2, indicating that the variables included in the model are not multicollinear (Table 6).

Table 6: Results of the regression model of chili farming profits of households in Tra Vinh Province from 2022 to 2023

Influencing factors	Unit (VND)	Standardized regression coefficients	Significance level	VIF coefficient
Constant		18,681,297.183	0.00	
Yield	kg	0.98	0.00	1,000
Selling price	1,000	0.115	0.00	1,000
Correlation coefficient R		99.2		
Coefficient of determination R^2		98.4		
Model significance		0.00		

The standardized regression coefficients for productivity and selling price are 0.98 and 0.115, indicating a positive correlation between productivity and selling price and the profits of chili farmers. In recent years, the level of adoption of scientific and technical advances applied in cultivation and the stable selling price of chili have encouraged farmers to shift toward the chili-growing model.

I. SWOT analysis of the model

The SWOT analysis of the chili cultivation model highlights four components, including strengths (S), weaknesses (W), opportunities (O), and threats (T). In terms of strengths (S), Lots of experience (S_1), sufficient capital for production (S_2), and lots of land for production (S_3), which support efficient chili farming. However, the model also presents several weaknesses (W), such as lack of market information (W_1), lack of labor (W_2), and the use of a lot of fertilizer (W_3). Regarding opportunities (O), receive technical support and product information from the state (O_1), receive investment in new technology (O_2). Nonetheless, the model also faces serious threats (T), including poor soil quality (T_1), natural disasters (T_2), and unstable prices (T_3). The matrix is detailed in Table 7.

Table 7: SWOT matrix table on the production and consumption situation of the coconut nectar collection model in the study area

SWOT	Opportunities (O)	Threats (T)
	O_1: Receive technical support and product information from the state O_2: Receive investment in new technology	T_1: Poor soil quality T_2: Natural disasters T_3: Unstable prices
Strength	**Match S with O**	**Match S with T**
S_1: Lots of experience S_2: Sufficient capital for production S_3: Lots of land for production	$S_1S_2S_3 + O_1O_2$: Expand the area of chili pepper cultivation on the model to achieve the best efficiency and increase production profits.	$S_1S_2S_3 + T_1T_2T_3$: Expand the area, recommend the use of new technology, and increase organic fertilizer application to increase soil fertility. Proactively prevent and control pests appearing on chili.
Weakness	**Match W with O**	**Match W with T**
W_1: Lack of market information W_2: Lack of labor W_3: Use of a lot of fertilizer	$W_1 + O_1$: Link in production, establish or enhance operational capacity in promotion and consumption. $W_2 + O_1$: Proactively approach new technology to automate the production process to reduce labor.	$W_1W_2W_3 + T_1T_2T_3$: Actively update market information and new production technologies through various channels. Encourage farmers to grow chili organically.

J. Proposed solutions

Based on SWOT analysis, the research proposes solutions to enhance the effectiveness and profitability of chili cultivation. First, expanding the area of chili cultivation and increasing technical training on the model are suggested to achieve the best efficiency and increase production profits. Next, instead of using excessive chemical fertilizers, it is recommended to adopt new technology and increase organic fertilizer applications to improve soil fertility. At the same time, households proactively prevent and control pests that appear on chili. Strengthening production linkages is essential in establishing or enhancing the ability to operate in promotion and consumption. Furthermore, farmers should proactively access new technology to automate the production process to reduce labor costs. Regularly updating market information and production techniques through diverse channels is also essential. Lastly, farmers should be encouraged to adopt organic farming practices to meet growing consumer demand and ensure agricultural sustainability.

V. CONCLUSION

This study was conducted to assess the status of chili pepper cultivation in Tra Vinh Province during the period 2022–2023 and propose solutions for developing the chili pepper cultivation model in the future. The financial analysis of indicators showed that the chili pepper production model in Tra Vinh Province brings high economic efficiency. The regression model results revealed a capital efficiency ratio of 1 and a material efficiency ratio of 4, indicating highly effective resource utilization. The model supports households in shifting household production toward more suitable crops, thereby sustainably enhancing economic efficiency. To further develop chili cultivation, the study proposes solutions to continue developing the chili pepper cultivation model in Tra Vinh Province, which include increasing technical transfer efforts and sharing experiences to improve pest management and increase crop yields; applying new technologies in production; and organizing production linkages, developing products for future organic development. The results provide a new perspective and orientation for the local community and households who are using the chili pepper cultivation model. By leveraging the value of chili pepper, this enhances economic efficiency and contributes to providing scientific data as a basis for further research. Additional studies are needed to evaluate the financial effectiveness of the chili cultivation model in areas outside the targeted region to provide additional necessary data for relevant parties to reference.

REFERENCES

[1] Tran HP, Hoang PP, Nguyen TH, Duong BM, Danh M, Dang HV, et al. Assessment of changes in the structure land use in Tra Vinh Province under the scenarios of climate change and sea level rise. *Vietnam Journal of Science and Technology*. 2020;58(1): 70–83. https://doi.org/10.15625/2525-2518/58/1/13982.

[2] Ngoc Ngan. *In the first ten months of 2024, Vietnam's chili exports increased in volume and value [10 tháng năm 2024, xuất khẩu ớt của Việt Nam tăng về lượng và kim ngạch]*. https://kinhte.congthuong.vn/10-thang-nam-2024-xuat-khau-ot-cua-viet-nam-tang-ve-luong-va-kim-ngach-359251.html [Accessed 30 November 2024].

[3] Nguyen Thi Thu An, Vo Thi Thanh Loc. Financial efficiency of chili farmers in the Mekong Delta [Phân tích hiệu quả tài chính của nông hộ trồng ớt vùng Đồng bằng sông Cửu Long]. *Can Tho University Journal of Science [Tạp chí Khoa học Trường Đại học Cần Thơ]*. 2017;48: 87–95. https://doi.org/10.22144/ctu.jvn.2017.633.

[4] Truong Thu Hien. *Vietnam import and export report 2023 [Báo cáo xuất nhập khẩu Việt Nam 2023]*. Hanoi, Vietnam: Industry and Trade Publishing House; 2024. p.19.

[5] Vo Thi Thanh Loc, Huynh Huu Tho. Sampling method [Phương pháp chọn mẫu]. *Textbook of scientific research methods and writing outlines (application in the field of economics - society) [Giáo trình Phương pháp nghiên cứu khoa học và viết đề cương (ứng dụng trong lĩnh vực kinh tế - xã hội)]*. Can Tho, Vietnam: Can Tho University Publishing House; 2015. p.180.

[6] Ngo Thanh Trac, Son Thi Thanh Nga, Duong Ngoc Thanh. Assessing the production efficiency of chili farmers in Tra Vinh Province [Đánh giá hiệu quả sản xuất ớt chỉ thiên của nông hộ tại tỉnh Trà Vinh]. *Tra Vinh University Journal of Science [Tạp chí Khoa học Trường Đại học Trà Vinh]*. 2019;36: 51–63. https://doi.org/10.35382/18594816.1.36.2019.316.

[7] Tran Thi Ba, Vo Thi Bich Thuy. *Vegetable plant textbook [Giáo trình Cây rau]*. Can Tho, Vietnam: Can Tho University Publishing House; 2019.

[8] Dang Diep Hoa, Nguyen Thi Lien Huong, Ngo Thi Ha. Effect of planting time and planting space on yield and yield component of hot pepper variety GL1-20 [Ảnh hưởng của thời vụ và khoảng cách trồng đến năng suất và chất lượng thương phẩm giống ớt lai chỉ thiên GL1-20]. *Journal of Agriculture and Rural Development [Tạp chí Nông nghiệp và Phát triển nông thôn]*. 2020;3: 131–136.

[9] Hossen SM. A statistical analysis on production of chili and its' prospect in Bangladesh. *Global Disclosure of Economics and Business*. 2015;4(1): 55–62.

[10] Miranda I, Widyastuti DE, Mazwan MZ. Feasibility analysis of large red chili (*Capsicum annuum* L.) farming in Tawangargo, Karangploso, Malang, Indonesia, across wet and dry seasons. *Agriecobis: Journal of Agricultural Socioeconomics and Business*. 2023;6(2): 129–137.

[11] Indrasti R, Rawung JBM, Sudolar NR, Andri KB, SahramTan SS. Farmer institutional and economic feasibility study on red chilli pepper farming in Kepung District, Kediri Regency, East Java Province. *IOP Conference Series: Earth and Environmental Science*. 2021;807: 022018.

[12] Lawal AT, Gaya AY, Alhassan A, Suleiman I, Abdulwahab FS, Umar H. Marketing analysis of chilli pepper in Kano State markets, Nigeria. *FUDMA Journal of Sciences*. 2021;5(4): 38–43. https://doi.org/10.33003/fjs-2021-0504-778.

[13] Mahdalena Z, Aziz MR. Analysis of income in Tiung Chili Farming (*Capsicum frutescens* L.) in 3B Batu Balian Village, Simpang Empat District, Banjar Regency. *International Journal of Research and Review*. 2024;11(6): 244–250. https://doi.org/10.52403/ijrr.20240628.

[14] Habing B. *Exploratory factor analysis*. https://people.stat.sc.edu/habing/courses/530efa.pdf [Accessed 17 July 2025].

[15] Hair JFJ, Black WC, Babin BJ, Anderson RE, Tatham RL. *Multivariate data analysis*. 9th ed. New Jersey: Pearson Prentice Hall; 2006.

[16] Son Thi Thanh Nga, Ngo Thanh Trac, Pham Thi Phuong Thuy, Nguyen Hong Ung, Phan Chi Hieu, Tran Thi Thao Dang. Evaluation of economic efficiency of growing coconut for nectar collection in Tra Vinh Province [Đánh giá hiệu quả kinh tế trồng dừa thu mật hoa trên địa bàn tỉnh Trà Vinh]. *Journal of Vietnam Agricultural Science and Technology [Tạp chí Khoa học và Công nghệ Nông nghiệp Việt Nam]*. 2023;7(149): 88–97.

[17] Pham TPT, Vo MH, Nguyen BT, Le DN, Nguyen QT, Nguyen HXT, et al. Economic models related to sap coconut production and marketing in Vietnam. *International Journal of Engineering Sciences & Research Technology*. 2020;9(6): 126–141. https://doi.org/10.29121/IJESRT.V9.I6.2020.20.

[18] Vo Van Tai, Tran Phuoc Loc. *Textbook of statistical processing [Giáo trình Xử lý thống kê]*. Can Tho, Vietnam: Can Tho University Publishing House; 2016.

[19] Son Thi Thanh Nga, Pham Thi Phuong Thuy, Nguyen Hong Ung, Ngo Thanh Trac, Tran Thi Thao Dang. Comparison of economic efficiency of traditional rice farming and organic rice farming models in the shrimp – rice system in Thanh Phu district, Ben Tre [So sánh hiệu quả kinh tế của mô hình sản xuất lúa truyền thống và mô hình sản xuất lúa hữu cơ trong hệ thống tôm – lúa tại huyện Thạnh Phú, tỉnh Bến Tre]. *Journal of Vietnam Agricultural Science and Technology [Tạp chí Khoa học và Công nghệ Nông nghiệp Việt Nam]*. 2021;128: 86–93.

[20] Hoang Trong, Chu Nguyen Mong Ngoc. *Analyzing research data with SPSS – Volume 1 [Phân tích dữ liệu nghiên cứu với SPSS – Tập 1]*. Ho Chi Minh City, Vietnam: Hong Duc Publishing House; 2008].

[21] Tran Thi Thao Dang. *Evaluation of financial efficiency of embryo-cultured wax coconut and normal wax coconut models in Tra Vinh Province [Đánh giá hiệu quả tài chính của mô hình dừa sáp cấy phôi và dừa sáp thường trên địa bàn tỉnh Trà Vinh]*. Master's thesis. Tra Vinh, Vietnam: Tra Vinh University; 2020.

[22] Vo Minh Hai, Pham Thi Phuong Thuy, Le Duy Cuong, Le Vinh Thuc, Nguyen Bao Toan. Economic efficiency of sap coconut and normal coconut in Cau Ke District, Tra Vinh Province [Hiệu quả tài chính trồng dừa sáp và dừa thường trên địa bàn huyện Cầu

Kè, tỉnh Trà Vinh]. *HUAF Journal of Agricultural Science & Technology [Tạp chí Khoa học và Công nghệ Nông nghiệp, Trường Đại học Nông Lâm Huế]*. 2020;4(2): 1897–1906. https://doi.org/10.46826/huaf-jasat.v4n2y2020.326.

[23] La Nguyen Thuy Dung, Mai Van Nam. Analysis of the financial performance of rice producing house-holds in the model associated with the enterprise in An Giang Province [Phân tích hiệu quả tài chính của hộ sản xuất lúa theo mô hình liên kết với doanh nghiệp ở tỉnh An Giang]. *Can Tho University Journal of Science [Tạp chí Khoa học Trường Đại học Cần Thơ]*. 2015;36: 92–100.

[24] Nguyen Thi Thuy Loan, Diep Thanh Tung. Culture and regional development in relation to household economic development in the Southwest region [Văn hoá và phát triển vùng trong mối quan hệ với phát triển kinh tế của hộ ở vùng Tây Nam Bộ]. *Tra Vinh University Journal of Science [Tạp chí Khoa học Trường Đại học Trà Vinh]*. 2020;39: 2–24.