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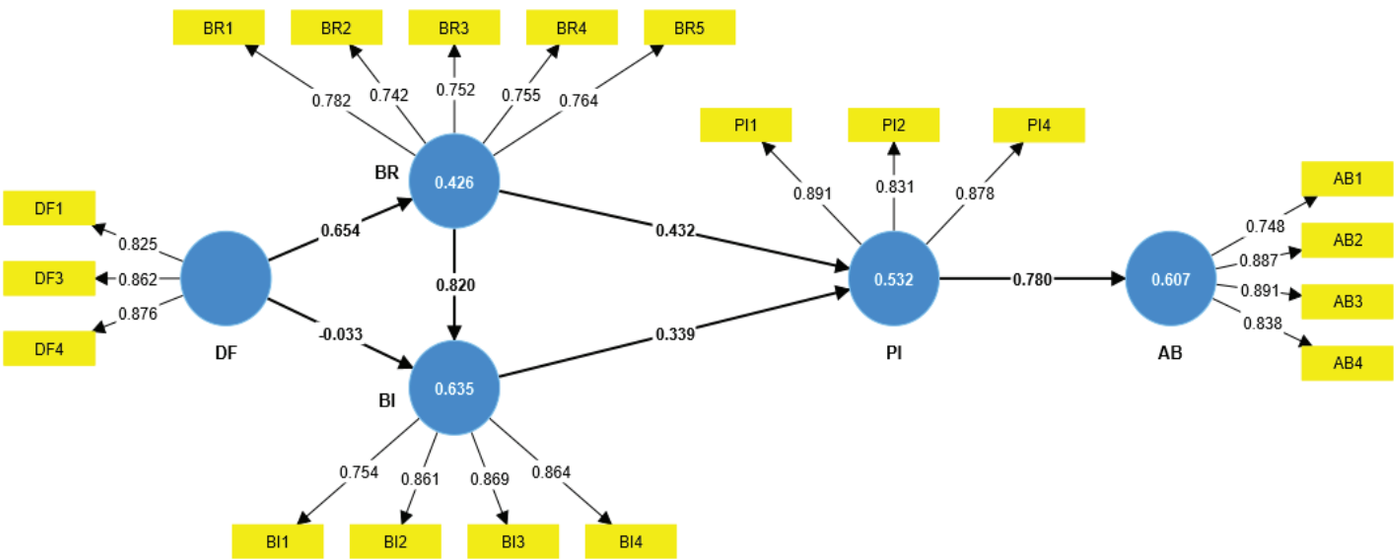

ECONOMICS AND BUSINESS

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Impact of ownership structure on bank performance: Evidence from an emerging economy

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Abstract:

This article analyses the impact of ownership structure on the performance of Vietnamese commercial banks. The research data comprises 27 commercial banks over the period from 2012 to 2021. Pooled Ordinary Least Squares (OLS), Fixed Effects Model (FEM), Random Effects Model (REM), and Feasible Generalised Least Squares (FGLS) panel data regression models were employed for the analysis. The variables representing the ownership structure of commercial banks in Vietnam include private ownership and foreign ownership. The private ownership variable is measured by the ratio of shares owned by private investors to total shares; the foreign ownership variable is measured by the ratio of shares owned by foreign investors to total shares. The dependent variables representing bank performance are return on assets (ROA) and return on equity (ROE). After employing the FGLS estimation method to address potential model deficiencies, the results indicate that both private and foreign ownership negatively impact bank performance. Control variables such as bank size, bank capital, inflation, and GDP growth also affect bank performance in Vietnam.

Keywords: **bank performance, emerging economy, ownership structure, Vietnam.**

Classification numbers: **2.1, 2.2**

1. Introduction

Commercial banks play a crucial role in financial markets and are regarded as the driving force behind economic development in many countries [1]. Developments or recessions in the banking industry significantly influence national economies and attract the attention of scholars and policymakers [2]. The banking sector is a key focus when studying any economic system, as it is often viewed as the lifeblood of the economy. To maintain a robust banking system, banks must achieve operational efficiency and safety. The performance of commercial banks is closely tied to their governance, as a bank's competitiveness largely depends on the managerial capabilities of its leadership [3]. Moreover, ownership structure is considered a critical factor influencing the performance of commercial banks, as different ownership groups may have varying objectives, which in turn affects how banks are operated [4, 5]. Shareholder groups - such as large shareholders, state shareholders, private shareholders, and foreign shareholders - may pursue divergent goals. While each group may have distinct priorities, all shareholders generally seek to maximise benefits while minimising risks. Therefore, ownership structure can significantly impact a bank's performance, highlighting the need for further empirical research on this topic.

Various theoretical frameworks offer differing and sometimes conflicting views on the role of ownership structure within corporations. According to agency theory [6], fragmented ownership structures may exacerbate agency problems, increasing agency costs and the associated risks for firms. In contrast, more centralised ownership can mitigate these issues by reducing the separation between ownership and control, thereby lowering risk and enhancing operational efficiency. Major shareholders, with dominant power, are better positioned to regulate and manage the business, reducing agency problems and improving performance [6]. Moreover, major shareholders may

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benefit from state support through favourable policies. According to the "helping hand" theory, government involvement can foster business development or manage risks through policy interventions. However, the "grabbing hand" theory suggests that excessive dependence on government decisions may hinder business operations.

Empirical research on the relationship between ownership structure and firm performance has garnered considerable attention. A.A. Berle, et al. (1932) [7] are credited with pioneering this line of inquiry, suggesting that dispersed ownership negatively affects firm performance, as divergent shareholder interests can impair corporate governance. Research on the impact of ownership structure on bank performance can be categorised into three primary areas. The first area investigates the effect of concentrated ownership on bank performance [2, 8-10]. The second focuses on state ownership's impact [4, 5, 11-15]. The third area examines the influence of foreign and family ownership [16-18]. Although these studies provide a broad overview of the relationship between ownership structure and bank performance, their findings are inconsistent and often controversial, raising further questions about this topic.

Several studies in Vietnam have addressed related issues, such as K.D. Duong, et al. (2023a) [19], who explored the impact of foreign ownership on credit growth in Vietnamese commercial banks between 2012 and 2020. Their findings indicate that foreign ownership negatively affects credit growth in these banks. K.D. Duong, et al. (2023b) [20] also investigated the effects of Employee Stock Ownership Plans (ESOPs) and ownership structure on bank performance, concluding that ESOPs improve ROA by 57% compared to banks without such plans, while state and domestic ownership negatively impact bank performance. T.T.K. Oanh, et al. (2023) [21] further observed that financial leverage and liquidity affect the performance of Vietnamese commercial banks.

This study aims to assess the impact of ownership structure on bank performance in Vietnam, given the relative novelty of this research area and the limited existing literature. Vietnam's commercial banking system exhibits certain distinct characteristics compared to other countries. For instance, some Vietnamese banks have political objectives alongside their economic goals. Additionally, individual investors in Vietnam tend to act more on emotion than discipline, which contrasts with institutional investors. As such, individual ownership plays a significant role in the operations of Vietnamese commercial banks. The ownership structure in Vietnam also differs from that of more developed markets due to the immaturity of its stock market, where private investors hold substantial influence. Currently, no research in Vietnam has specifically evaluated the impact of private ownership on bank performance. Therefore, this study introduces private ownership as a variable in the research model, offering a novel contribution to the literature on ownership structure and bank performance.

2. Literature review and hypothesis development

2.1. Agency theory

Agency theory [6] posits that when ownership and control rights are separated in a company, conflicts may arise between the owner and the agent regarding their respective interests. The agent is authorised to act on the owner's behalf to undertake activities that benefit the company, primarily through increasing the share price and thus enhancing the company's value for the owner. However, in practice, agents may seek personal gains in the form of salary, bonuses, and allowances, which may conflict with the owner's interests. Additionally, agency costs may increase, thereby reducing the owner's profit. In other words, fragmented ownership structures tend to increase agency costs, which can adversely impact corporate performance. M.C. Jensen, et al. (1976) [6] suggest that large shareholders can mitigate agency costs due to their greater incentive to safeguard their assets through effective control mechanisms. E.F. Fama, et al. (1983) [22] further argue that conflicts stem not only from differing asset values but also from information asymmetry, as agents may exploit their entrusted position to seek additional personal benefits.

2.2. Private ownership

According to agency theory [6], dispersed ownership elevates agency costs and, consequently, reduces firm performance. In developing economies, private investors constitute a significant shareholder group in joint-stock companies [4, 23]. In Vietnam, private investors are the dominant shareholders in banks and joint-stock companies, as individual investors often

invest independently rather than through investment funds. Additionally, Vietnam's stock market remains relatively nascent, and the investment behaviour of individual investors tends to be spontaneous rather than professional. Lacking the experience and in-depth knowledge of institutional and foreign investors, private investors in Vietnam frequently pursue high-risk banks for short-term gains. Consequently, private investors often focus on underperforming banks with limited long-term prospects. They are likely to exert less pressure on bank management compared to institutional investors, resulting in potentially lower operational efficiency. Furthermore, private investors may be passive in monitoring corporate activities [24]. Accordingly, the following hypothesis is proposed:

Hypothesis H1: Private ownership has a negative impact on bank performance.

Empirical studies reveal varying impacts of foreign ownership on bank performance. The first perspective suggests that foreign ownership negatively affects bank performance [4]. The second perspective indicates that foreign ownership positively influences bank performance [5, 17]. Foreign shareholders generally face less political pressure and are better positioned to supervise banking operations. Moreover, foreign shareholders can enhance commercial banks' operations due to their extensive experience, abundant capital, and advanced technologies. Consequently, they can support banks with expertise in experience, capital, and technology. As foreign investors often engage in similar ventures across different countries, they can implement standards that effectively improve business performance. Foreign investors may also join the Board of Directors of commercial banks to safeguard their interests, thereby contributing diverse perspectives and specialised knowledge to strategic meetings. This can enhance the overall efficiency of banks. Thus, the following hypothesis is proposed:

Hypothesis H2: Foreign ownership has a positive impact on bank performance.

3. Research models and methods

3.1. Research data

The data set for this study consists of audited consolidated financial statements and annual reports from 27 Vietnamese commercial banks over the period from 2012 to 2021. Banks lacking sufficient data were excluded. Macro variables were sourced from the World Bank and the General Statistics Office of Vietnam.

3.2. Research models and methods

Building on the studies by E. Mamatzakis, et al. (2017) [4], N. Gupta, et al. (2022) [2], and N.P. Kirimi, et al. (2022) [5], the following research model is proposed:

$$ROA_{i,t} = \propto_0 + \propto_1 POWN_{i,t} + \propto_2 FOWN_{i,t} + \propto_3 SIZE_{i,t} + \propto_4 LOAN_{i,t} + \propto_5 CAP_{i,t} + \propto_6 INF_t + \propto_7 GGDP_t + \varepsilon_{i,t}$$

$$ROE_{i,t} = \beta_0 + \beta_1 POWN_{i,t} + \beta_2 FOWN_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 LOAN_{i,t} + \beta_5 CAP_{i,t} + \beta_6 INF_t + \beta_7 GGDP_t + u_{i,t}$$

where, the dependent variables are the ROA and ROE, the independent variables are private ownership (POWN) and foreign ownership (FOWN), the control variables are bank size (SIZE), bank loans (LOAN), bank capital (CAP), inflation (INF), and economic growth rate (GGDP). Here, i, t represent the bank and the survey year, respectively, $\propto_0$ and β_0 are constants, and ε, u are the residuals of the model.

This study utilises unbalanced panel data. For panel data analysis, three widely used regression methods are employed: Pooled OLS, FEM, and REM. An F-test is conducted to determine whether Pooled OLS or FEM is more appropriate. Similarly, a Hausman test is used to decide between FEM and REM. Upon selecting the appropriate model, tests for autocorrelation and heteroscedasticity are performed. If these issues are present, the study applies the FGLS method to address them.

Pooled OLS is a basic regression approach that minimises the sum of squared errors to estimate the coefficients of a linear model; however, it can be inefficient in the presence of heteroscedasticity or autocorrelation. FEM and REM are designed for panel data, with FEM controlling for unobserved fixed factors using dummy variables, while REM assumes that unobserved factors are random and unrelated to the explanatory variables. FGLS is preferable to Pooled OLS, FEM, and REM, as it can address model deficiencies such as autocorrelation and heteroscedasticity (Tables 1, 2).

Table 1. Description of variables.

Var.		Symbol	Previous studies	Expected results	Description
Dependent Var.	Bank performance	ROA	[2, 4, 5]		Net profit / Total assets
		ROE			Net profit / Equity
Independent Var.	Ownership structure	POWN	[4, 24]	-	The percentage of shares held by private investors
		FOWN	[4, 5, 17]	+	The percentage of shares held by foreign investors

Table 2. Control variables.

SIZE	The logarithm of total assets
LOAN	Total loans to total assets
CAP	Bank capital to total assets
GGDP	Annual GDP growth rate

4. Data analysis

4.1. Descriptive statistics

Table 3 indicates that, over the period from 2012 to 2021, the average ROA and ROE for the 27 Vietnamese banks analysed were 0.74 and 8.71%, respectively. The standard deviation for ROA is 0.61%, and for ROE, it is 6.68%. The minimum and maximum values observed for ROA are 0.1 and 3.23%, respectively, while for ROE, they are 1.31 and 26.4%.

Table 3. Descriptive statistics.

Var.	N	Mean	S.D.	Min.	Max.
Performance variables					
ROA	287	0.0074	0.0061	0.0001	0.0323
ROE	286	0.0871	0.0668	0.0131	0.2640
Ownership variables					
POWN	280	0.6786	0.3163	0	1.0000
FOWN	280	0.1287	0.1152	0	0.3000
Control variables					
SIZE	260	32.2824	3.2090	19.1315	35.8595
LOAN	284	0.5693	0.1136	0.0216	0.7880
CAP	285	0.0934	0.0618	0.0262	0.6140
INF	287	0.0376	0.0226	0.0060	0.0910
GGDP	287	0.0584	0.0168	0.0260	0.0750

In terms of ownership structure, the average private ownership is 67.86%, and foreign ownership is 12.87%, suggesting that most Vietnamese commercial banks have a predominantly private ownership structure.

The control variables show mean values as follows: SIZE is 32.28, LOAN is 56.93%, CAP is 9.34%, INF is 3.76%, and GGDP is 5.84%.

4.2. Correlation analysis

The correlation coefficient matrix is used to measure the strength of the correlation between various pairs of variables. According to D.R. Cooper, et al. (2013) [25], absolute correlation values exceeding 0.8 between variable pairs indicate potential multicollinearity, which should be addressed to maintain model integrity. The results of the correlation matrix for this study, shown in Table 4, reveal that all absolute values between variable pairs are below 0.8. Thus, it can be concluded that the model does not exhibit serious multicollinearity.

Table 4. Correlation matrix.

	ROA	ROE	POWN	FOWN	SIZE	LOAN	CAP	INF	GGDP
ROA	1.0000								
ROE	0.8213*	1.0000							
POWN	-0.0438	-0.1351	1.0000						
FOWN	0.3756*	0.3248*	-0.0167	1.0000					
SIZE	0.4080**	0.1451	0.1793	-0.1860	1.0000				
LOAN	0.1935*	0.2134*	-0.2534*	0.0649	-0.6149	1.0000			
CAP	0.2489*	-0.1307*	-0.1408	0.0102	0.6028*	-0.0849	1.0000		
INF	-0.0093	-0.1136*	0.0980	-0.0294	0.0303	-0.2972*	0.2405*	1.0000	
GGDP	-0.2243*	-0.2058*	0.1093	-0.0265	0.0365	0.5191	0.2654	-0.0223	1.0000

*Significance of the 10% level. Source: Results from Stata software.

4.3. Discussion of results

Tables 5 and 6 present the regression results using Pooled OLS, FEM, and REM methods. The F-test results show that Prob>F=0.000<5% across all regression models, indicating that FEM is more suitable than Pooled OLS. Next, the Hausman test is conducted to choose between FEM and REM. The Hausman test results show Prob>Chi2>10% in all models, suggesting that REM is more appropriate than FEM.

Table 5. Results using the pooled OLS regression.

	ROA	ROE
POWN	0.0241** (0.0109)	-0.2128** (0.0812)
FOWN	-0.0173* (0.0043)	-0.1809** (0.0689)
SIZE	0.0098*** (0.0025)	0.0740*** (0.0189)
LOAN	0.0071 (0.0068)	0.0435 (0.0509)
CAP	0.2297*** (0.0506)	1.4947*** (0.4104)
INF	0.0414* (0.0243)	0.2403 (0.1797)
GGDP	-0.0315 (0.0293)	-0.0315 (0.0293)
_cons	-0.3435*** (0.0875)	-2.3341*** (0.5943)

Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Table 6. Results from using FEM and REM regression.

	FEM regression		REM regression	
	ROA	ROE	ROA	ROE
POWN	-0.0068 (0.0043)	-0.3194** (0.0319)	-0.2418** (0.0109)	-0.2128*** (0.0811)
FOWN	-0.0173* (0.0020)	-0.0223* (0.0051)	-0.0173** (0.0093)	-0.1809*** (0.0689)
SIZE	0.0098*** (0.0025)	0.0740*** (0.0189)	0.0098*** (0.0025)	0.0740*** (0.0416)
LOAN	0.0071 (0.0068)	0.0463 (0.0509)	0.0071 (0.0668)	0.0435 (0.0653)
CAP	0.2297*** (0.0506)	1.4947*** (0.4104)	0.2297*** (0.0556)	1.2540*** (0.2234)
INF	0.0414 (0.0243)	0.0141* (0.0176)	0.0414* (0.0243)	0.4647 (0.1985)
GGDP	-0.0315 (0.0293)	-0.0315 (0.0293)	-0.0315** (0.0293)	-0.4154** (0.2168)
_cons	-0.3333*** (0.0849)	-0.0144*** (0.0041)	-0.3194*** (0.0805)	-2.3341*** (0.5943)

Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Further tests are conducted to check for model issues, such as autocorrelation and heteroscedasticity. The Wooldridge test results across all models indicate that Prob>F=0.000<5%, confirming the presence of autocorrelation. The Breusch and Pagan LM test results, with Prob>chibar2=0.0000<0.05, indicate heteroscedasticity in the models. To address these issues, the FGLS method is applied to improve model robustness.

Table 7 presents the regression results using the FGLS method. The results show that the independent variables impacting bank performance are POWN and FOWN.

Table 7. Results from using FGLS regression.

	ROA	ROE
POWN	-0.0241*** (0.0081)	-0.2128*** (0.0604)
FOWN	-0.0173** (0.0069)	-0.1809*** (0.0514)
SIZE	0.0098*** (0.0019)	0.0740*** (0.0141)
LOAN	0.0071 (0.0051)	0.0435 (0.0379)
CAP	0.2297*** (0.0414)	1.4947*** (0.3058)
INF	0.0414** (0.0181)	0.2403* (0.1340)
GGDP	-0.0315 (0.0218)	-0.4754*** (0.1615)
_cons	-0.3194*** (0.0060)	-2.3441*** (0.4430)

Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. *Source: Results from Stata software.*

Private ownership (POWN) negatively affects bank performance in Vietnam. A 1% increase in private ownership corresponds to decreases in ROA and ROE of Vietnamese commercial banks by 0.0241 and 0.2128%, respectively. In Vietnam, private investors often have limited financial resources compared to large financial institutions or corporate investors, potentially constraining banks' capital mobilisation and investment expansion, thereby hindering business development. Additionally, private investors may struggle to provide continuous long-term capital, affecting banks' ability to raise funds and maintain financial stability. Private investors typically have a short-term profit focus, which can pressure Vietnamese banks to prioritise immediate gains over sustainable, long-term strategies, potentially undermining stable growth. A bank with high levels of private ownership may also face transparency and control challenges, heightening risks of corruption or interest misalignment and thereby reducing performance. These findings align with agency theory, the research hypothesis, and T.T.T. Tram, et al. (2020) [24] but contrast with E. Mamatzakis, et al. (2017) [4].

Foreign ownership (FOWN) also has a negative impact on bank performance in Vietnam. A 1% increase in foreign ownership results in reductions in ROA and ROE of Vietnamese commercial banks by 0.0173 and 0.1809%, respectively. Foreign investors' capital

participation in Vietnamese banks has not significantly enhanced business performance. Rapid capital expansion without a corresponding rise in profitability and increased operational costs may contribute to declining efficiency. Additionally, foreign ownership may introduce international governance processes and standards, which can be challenging for banks to adapt to, potentially reducing short-term operational efficiency. The growing presence of foreign investors can also heighten competition among banks, which may reduce profit margins and lending interest rates. These findings contradict the research hypothesis and studies by L. Jarbou, et al. (2018) [17] and N.P. Kirimi, et al. (2022) [5].

Bank size (SIZE) positively influences bank performance in Vietnam. As banks grow, their capacity to reach customers, provide services, and extend credit increases, thus positively affecting performance.

Bank capital (CAP) also has a positive impact on bank performance in Vietnamese banks. Greater capital allows banks to invest in technology, reduce operational costs, and increase profits. Higher capital levels also enhance banks' lending capacity and risk tolerance, thereby supporting improved performance.

Regarding macroeconomic variables, INF positively influences bank performance. Rising inflation typically drives an increase in loan demand, boosting banks' profits. Conversely, GGDP negatively affects bank performance, as higher economic growth can lead banks to ease lending standards, increasing the likelihood of non-performing loans and thereby reducing profits.

5. Conclusions and policy suggestions

This study examines the relationship between ownership structure and the performance of commercial banks in Vietnam, using data from 27 banks from 2012 to 2021. Employing Pooled OLS, FEM, REM, and FGLS regression methods, the findings indicate that private and foreign ownership negatively impact bank performance. Based on these results, the following policy suggestions are proposed:

Private ownership: Private ownership negatively impacts bank performance in Vietnam. Therefore, Vietnamese banks with substantial private ownership should consider increasing the involvement of large institutional and foreign investors to attract greater capital, management expertise, and modern technology, which could enhance efficiency and stability in banking operations.

Foreign ownership: Foreign ownership also negatively impacts bank performance in Vietnam. The Vietnamese government should carefully manage foreign integration in the banking sector, balancing the benefits to domestic banks and implementing policies that effectively leverage foreign investment. Foreign ownership may present risks, such as reduced control over certain bank operations or potential conflicts with Vietnamese government policy decisions. Thus, the government should carefully weigh these factors to ensure that the advantages of expanding the banking sector to foreign investors outweigh the potential drawbacks.

This study's limitation is its focus solely on private and foreign ownership's effects on bank performance in Vietnam. Ownership in Vietnamese banks is diverse, including management and employee ownership. Additionally, net interest margin (NIM) is another indicator of bank performance. Future research should consider additional variables representing ownership structure and bank performance in Vietnamese commercial banks.

CRediT author statement

Pham Hai Nam: Literature review, Methodology, Data collection and analysis, Writing, Revision; Pham Thi Hong Nhung: Data collection, Data analysis; Nguyen Minh Nhat: Literature review.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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Life insurance purchase intention from attitude to behaviour: Research in Khoai Chau district, Hung Yen province, Vietnam

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Abstract:

The study focused on identifying factors influencing customers' intention to purchase life insurance in Khoai Chau district, Hung Yen province, Vietnam. The study conducted a survey by questionnaire combined with in-depth interviews with 160 life insurance customers in Khoai Chau district, Hung Yen province, Vietnam. The exploratory factor analysis method combined with the linear regression model was applied to estimate the influence of factors. It is indicated that, alongside demographic factors that significantly impact customers' purchase intention, several key factors were analysed, including customers' attitudes, quality of products and services, barriers, and life insurance distribution channels. The results demonstrate that both customers' attitudes and the quality of products and services have statistically significant impacts on customers' satisfaction and purchase intention. While gender, income, and age significantly influence purchase intention, barriers negatively affect the buying decision. The study proposes essential solutions to enhance customers' purchasing decisions in Khoai Chau district and other areas in Hung Yen province, Vietnam, by improving satisfaction, targeting diverse income groups, segmenting customers by gender and age, and reducing barriers to purchasing life insurance.

Keywords: **behaviour factors, life insurance, purchase intention.**

Classification numbers: **2.1, 2.2**

1. Introduction

Life insurance plays a crucial role for individuals. Beyond providing financial protection, it facilitates savings, contributes to national economic development, and holds significant material and spiritual value for families. The primary purpose of insurance is to protect against unforeseen risks; it also integrates savings and investment elements [1]. In 2022, 19 insurance companies operated in Vietnam, with new insurance policies reaching 3,414,561 contracts. The total premium revenue from these contracts amounted to VND 45,622 billion, a 2.41% increase from 2021 [2]. Prominent life insurance companies in Vietnam include Bao Viet, Manulife, Prudential, AIA, Chubb, FWD, Daiichi, Hanwha, Aviva, Generali, Sunlife, Phu Hung Life, and MB Ageas [3]. The government aims to have 15% of the population purchase life insurance by 2025 [4], highlighting Vietnam's life insurance industry potential for growth.

According to the Law on Insurance Business No. 08/2022/QH15 dated 16 June 2022, effective 1 January 2023, life insurance is defined as: "Life insurance is a type of insurance in case the insured lives or dies". As explained by N.V. Dinh (2020) [5], life insurance represents a contract in which the insurer commits to paying a specified sum upon predetermined events, such as death, permanent total disability, or reaching a specified age. The insured must pay premiums in full and on time.

In today's insurance industry, life insurance offers financial protection against losses from unexpected events like death, injury, or incapacity while providing

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opportunities for savings and investments. Insurance ensures financial security for individuals and their families, making it a popular tool for future financial planning.

Khoai Chau district, Hung Yen province, has witnessed robust economic growth, improved living standards, and rapid urbanisation. This makes it a promising market for the insurance industry, helping to mitigate risks for its residents. Insurance companies such as Bao Viet, Manulife, FWD, AIA, and Prudential dominate the agency channels in Khoai Chau. Additionally, local banks like Vietcombank, Vietinbank, and Techcombank distribute insurance products, often bundled with credit transactions, thus enhancing social security amid rising business risks, epidemics, and accidents. However, despite the companies' efforts, public awareness of life insurance remains limited. Analysing factors affecting local residents' intention to purchase life insurance is crucial to help insurance firms develop effective strategies, contributing to Vietnam's life insurance market growth.

Khoai Chau's proximity to Hanoi and its transition from an agricultural economy to industry and services, accompanied by a rising urbanisation rate, underline its economic potential. In 2022, the district's average per capita income reached VND 85 million [6]. However, this income level remains moderate. Additionally, the district's health insurance coverage rate of 92.3% only addresses basic healthcare needs [6]. Many residents work in agriculture and rural development sectors such as construction, carpentry, and small-scale mechanics, which are often associated with unstable and risky incomes. Thus, promoting life insurance alongside healthcare packages aligns well with the district's future needs, providing long-term financial security and risk mitigation.

Given that Khoai Chau district shares socio-economic characteristics with many rural areas undergoing industrial and urban development in Vietnam, the research findings here may be applicable to similar regions. While the district presents significant potential for the insurance market, challenges persist, particularly in raising public awareness of insurance benefits. The study identifies factors influencing insurance purchase decisions, aiding companies in designing targeted strategies and public education campaigns. This contributes to the life insurance market's growth in Khoai Chau district and provides tangible benefits to residents, enhancing social security in the region.

This research evaluates factors affecting life insurance purchasing behaviour in Khoai Chau district, Hung Yen province, and proposes solutions to encourage customer participation. It highlights how behavioural, service, product, and barrier factors, alongside distribution channels, influence customer satisfaction and increase purchase intention for life insurance products.

2. Literature review

From an overarching perspective, several previous studies have evaluated factors influencing the satisfaction of life insurance product buyers. As life insurance is not compulsory, the theoretical framework for understanding these factors is rooted in behavioural economic theory [7].

2.1. Satisfaction

Customers' satisfaction reflects the extent to which a product or service meets the expectations of life insurance buyers [8]. When customers receive exemplary service from their agents, coupled with a strong corporate image, their post-purchase satisfaction increases. This, in turn, fosters loyalty and enhances the likelihood of purchasing additional insurance products. Satisfaction serves as an intermediate variable between factors that influence expected value and customers' confidence in their decision to purchase life insurance [9].

2.2. Purchase intention

The insurance purchasing process begins with customers contemplating their intention to buy, facilitated by comprehensive and transparent information about the insurance product or service [10]. A strong intention to purchase insurance can drive sales, reduce costs, and support market expansion efforts [8, 11]. However, purchase intention is not the ultimate outcome of the decision-making process; it

results from weighing various factors and selecting a suitable insurance product [12]. In the insurance market, the decision to purchase life insurance often involves assessing long-term needs, financial capacity, and the benefits offered by the product [13].

2.3. Attitude towards life insurance

Perceived value represents a customer's holistic assessment of a product or service, considering the balance between perceived benefits and costs [14]. Two critical components influencing purchase intention are benefit awareness and risk awareness [10]. If customers perceive that participating in life insurance offers value, they are more likely to purchase it [15-17].

2.4. Products and services

Insurance companies cater to their customers by offering diverse products tailored to individual needs, backed by strong branding and high-quality consultancy services [10]. Expected benefits, ease of access when required, and brand strength significantly impact insurance purchasing decisions [16, 17]. Insurance consultants (ICS) play a pivotal role as intermediaries between insurers and customers, addressing customers concerns, fostering relationships, and ultimately strengthening the bond between customers and the company [11].

2.5. Barriers to buying life insurance

When companies provide comprehensive information, customers gain a clearer understanding of products and services, which can enhance their purchasing decisions [12, 18]. However, certain barriers - such as limited income, long-term commitment requirements, and various fees (e.g., risk fees, initial fees, contract management fees, and early termination fees) - deter customers from buying insurance [15, 16, 19].

2.6. Distribution channel factors

Traditional distribution channels, including direct and agent-based approaches, remain prevalent in the insurance industry. However, alternative channels, such as bancassurance and brokerage, are increasingly gaining traction. Furthermore, the emergence of digital platforms has facilitated the provision of online insurance products, offering customers greater convenience and accessibility [20].

2.7. Demographic factors

Previous research has demonstrated that demographic variables, such as age, occupation, gender, education level, and income, significantly influence customers' decisions to purchase life insurance [1, 21] (Table 1).

Table 1. Related studies.

Author	Research content	Influencing factors	Research planting range
L.Q. Hieu (2022) [17]	Factors affecting the decision to buy life insurance for individual customers in Thanh Hoa province	Value perception, buying motivations, barriers to buying, company brand, consultants, buying benefits, peer support	Satisfaction has not been assessed; purchase intention has not been assessed
N.T.B. Minh, et al. (2021) [16]	Factors influencing the decision to buy life insurance for individual customers in Ho Chi Minh city	Perception of values, barriers to buying life insurance, motivations for buying insurance, consultants, brands	Satisfaction has not been assessed; purchase intention has not been assessed
H.T. Nguyen, et al. (2018) [19]	Determinants of customer satisfaction and loyalty in Vietnamese life-insurance setting	Brand image, service quality, and price affect satisfaction, and loyalty	No mention of purchase decisions, and purchase intention
P.T. Loan, et al. (2016) [15]	Factors influencing the decision to buy Manulife life insurance in Khanh Hoa province	Personal characteristics, product value perception, company brand, customer service, previous insurance buying experience, relatives' opinions	Research on purchase decisions has not yet mentioned purchase intentions and satisfaction

In summary, while numerous international studies have explored insurance purchasing decisions and behaviours, research within the Vietnamese context remains limited. Although some studies have begun to examine the relationship between customers' satisfaction and purchase decisions, few have delved into the interplay between satisfaction and purchase intention. Thus, this study seeks to evaluate customers' intention to purchase insurance through the lens of satisfaction and behaviour.

Drawing from the theoretical basis of factors affecting the decision to buy life insurance, this study is proposed according to the research model below (Fig. 1):

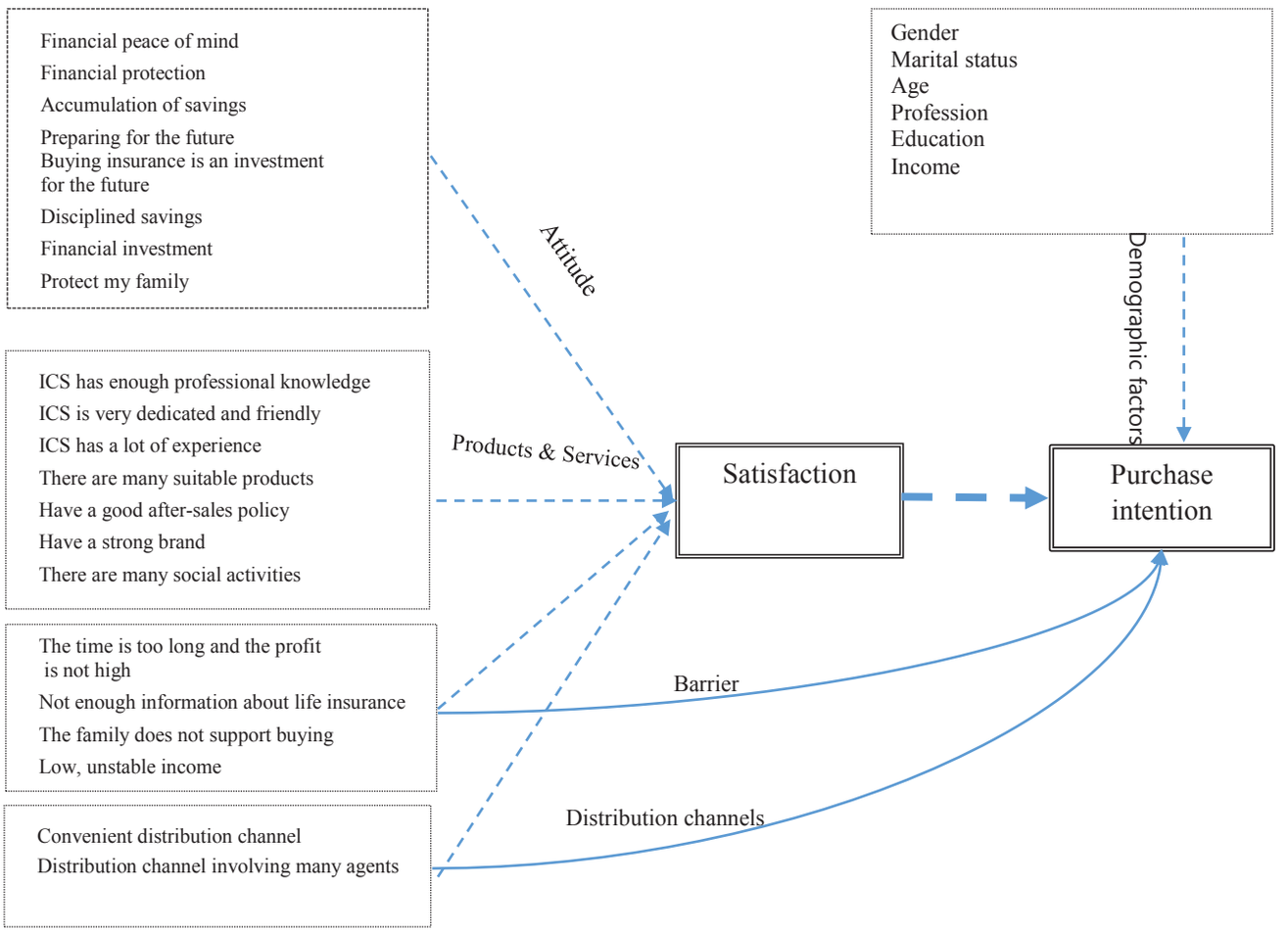

Fig. 1. Model of factors influencing the decision to buy insurance. Source: Synthesised by the authors.

3. Research methodology

3.1. Data collection method

3.1.1. Secondary data: Secondary data were collected from reports and research articles on the insurance market, published by the Insurance Supervision Administration and reputable journals.

3.1.2. Primary data: The author conducted 10 in-depth interviews: five with insurance customers representing different brands (Manulife, FWD, AIA, Bao Viet, and Chubb Life Vietnam) and five with experts, including two managers from FWD and Manulife, and three financial advisors from FWD, Manulife, and AIA. These interviews were conducted face-to-face. The interview questions explored factors influencing life insurance purchasing decisions, customer perceptions of the product, and barriers to purchasing life insurance. Additionally, expert advice formed the foundation for proposing solutions in the research project.

A large-scale survey was conducted to gather information from customers regarding their current life insurance situation and purchasing decisions. The sample was selected using a convenience sampling method, a non-probability sampling technique. The sample size was determined based on the requirements for Exploratory Factor Analysis (EFA) and multivariate regression. For EFA, with 22 observed variables, a minimum of 5 samples per variable was needed, amounting to 22×5=110 observations [22]. For regression analysis, a minimum sample size of 10 observations per variable was required. With 12 observational variables envisaged, the minimum number of samples was 160 [23].

The questionnaire survey was used to collect information from customers consulted by companies

in Khoai Chau district, Hung Yen province. Online questionnaires were distributed via Google Forms and shared through Zalo and Facebook. Financial advisors were also requested to share the survey links with their clients. This process yielded 160 valid responses. The data collection period spanned from February 2023 to April 2023.

3.1.3. Scale design: The questionnaire employed a 5-point Likert scale, with response options ranging from (1) strongly disagree to (5) strongly agree (Table 2).

Table 2. Encoding scales and observational variables of research models.

Point	1	2	3	4	5
Degree	Strongly disagree	Disagree	Consider carefully	Agree	Strongly agree
	Do not buy	Unlikely to buy	Consider carefully	Buy	Definitely buy
	Very dissatisfied	Dissatisfied	Consider carefully	Satisfied	Very satisfied

Code	Target (N=160)	Scale
TD1	Buying insurance gives me financial peace of mind	Likert 5 levels
TD2	Financial protection for families	Likert 5 levels
TD3	Buy insurance to accumulate savings	Likert 5 levels
TD4	Preparing for life in the future	Likert 5 levels
TD5	Buying insurance is an investment for the future	Likert 5 levels
TD6	Buying insurance helps me practice disciplined saving	Likert 5 levels
TD7	Financial investment	Likert 5 levels
TD8	Insurance helps protect my family	Likert 5 levels
DV1	Consultants had enough expertise to answer my questions	Likert 5 levels
DV2	Consultants are very dedicated and friendly	Likert 5 levels
DV3	Consultants have a lot of experience and professional mastery	Likert 5 levels
DV4	I choose to buy insurance at a company that has many products to suit my needs	Likert 5 levels
DV5	I choose to buy insurance from a company with a good after-sales policy	Likert 5 levels
DV6	I choose to buy insurance from a company with a strong brand	Likert 5 levels
DV7	I choose to buy insurance from a company with many social activities	Likert 5 levels
RC1	Buying insurance for too long and the profit is not high	Likert 5 levels
RC2	I don't have enough information about insurance	Likert 5 levels
RC3	My family and relatives do not support me in buying insurance	Likert 5 levels
RC4	My income is low, unstable	Likert 5 levels
KP3	Convenient distribution channel	Likert 5 levels
KP4	Diversified distribution channels	Likert 5 levels

Source: Synthesised by the authors (2023).

3.2. Data processing method

The collected data were encoded and analysed using SPSS 22 software. Descriptive statistics were used to analyse the data. The reliability of the scales was assessed using Cronbach's Alpha, while EFA and multivariate regression were conducted to examine the factors influencing satisfaction and purchasing decisions in life insurance (Table 3).

Model 1: Linear regression estimating factors affecting customers' satisfaction:

$$Y=\propto_0+\propto_1 X_1+\propto_2 X_2+\cdots+\propto_n X_n$$

where, Y: customers' satisfaction - dependent variables have the following values (1=very dissatisfied, 2=dissatisfied, 3=considered, 4=satisfied, 5=very satisfied); X_i is the independent variable used in the model; $\propto$ is the correlation coefficient of independent variables; $\propto_o$ is the constant of the model.

Model 2: Linear regression model of factors influencing purchase intention:

$$Y'=\beta_0+\beta_1 X'_1+\beta_2 X'_2+\cdots.+\beta_n X'_n$$

where, Y' is the dependent variable of the purchase intention and has the following values (1=definitely will not participate, 2=does not participate, 3=consider, 4=participate, 5=firmly participate); X'_i are independent variables used in the model; β_i is the correlation coefficient of independent variables; β_o is the constant of the model.

Table 3. Variables in model.

Code	Explanation	Scale
GT	Gender	0=female, 1=male
MS	Marital status	1= unmarried, 2=married, 3=married, with children
AI	Average income/month	1=less than 10 million VND; 2=10-20 million VND; 3=20-30 million VND; 4=over 30 million VND.
EL	Client education level	1=intermediate or below; 2=college; 3=undergraduate, 4=postgraduate
Age	Client age	1=20-30 years old; 2=31-40 years old; 3=41-50 years old; 4=over 50 years old
OC1	Occupation of civil servant/office	1=profession of office civil servant; 0=none
OC2	Homemaker career	1=homemaker; 0=none
CS	Customers' satisfaction	5-level Likert scale
ATT	Attitude	EFA variables
PS	Products & services	EFA variables
BA	Barrier	EFA variables
DC	Distribution channels	EFA variables

Source: Synthesised by the authors (2023).

4. Results

4.1. General of life insurance in Khoai Chau district, Hung Yen province

In Khoai Chau district, the life insurance products currently available in the market are predominantly investment-linked products, focusing primarily on jointly linked products (Table 4). These products combine protection with investment features. Most participants in life insurance opt for Universal Life Insurance, which includes a single investment fund (the Universal Fund) formed from the premiums paid for insurance policies. A smaller proportion of customers participate in Unit-Linked Insurance, which includes at least two investment funds. This type of product requires sellers and buyers to possess a good understanding of investment funds, the stock market, and risk management, which limits its adoption among customers in Khoai Chau district.

Table 4. Popular life insurance products in the Khoai Chau district.

No.	Company Name	Product	Age of participation	Coverage period	Fee payment period	Insurance benefits
1	Manulife	Manulife - the journey of happiness - the basic plan	From 1 month to 65 years old	Up to 99 years old	Mandatory for the first 3 years of the contract; Flexible payment from the 4th year	- Medical assistance - Death - Posthumous fulfilment
2	FWD	Stay ahead of change 3.0	From 30 days old to 69 years old	Up to 80 years old	Mandatory for the first 3 years of the contract; Flexible payment from the 4th year	- Later stage cancer - Death - Permanent total disability
4	AIA	Preeminent lifelong blessing	30 days old to 65 years old	Up to 100 years old	Mandatory for the first 4 years of the contract; Flexible payment from the 5th year	- Death - Permanent total disability - Insured with cancer
5	Baoviet	Happiness - basic program	From 0 years old to 65 years old	Lifetime or up to 90 years old	Mandatory for the first 4 years of the contract; Flexible payment from the 5th year	- Death - Serious accidental injury - Terminal critical illness
6	Prudential	Active life	From 30 days old to 65 years old	Up to 99 years old	Mandatory for the first 5 years of the contract; Flexible payment from the 6th year	- Death - Permanent total disability

Source: Results of expert interviews by the authors.

The survey results (Table 5) showed that 71.9% of the respondents were female, indicating a higher interest in life insurance among women. The majority of respondents (84.4%) were married with children. In terms of income, most respondents reported monthly incomes below VND 20 million, with 39.4% earning less than VND 10 million and 45.6% earning between VND 10 million and VND 20 million. The educational background of the respondents was predominantly tertiary, with 61.9% holding a university degree and 24.4% holding a postgraduate qualification. Most respondents were aged between 20 and 40 years.

Table 5. Survey sample characteristics.

Content		Amount	Rate (%)
Gender	Female	115	71.9
	South	45	28.1
Marriage	Unmarried	21	13.1
	Married, no children	4	2.5
	Already have children	135	84.4
Income	Under VND 10 million	63	39.4
	From 10 to 20 million VND	73	45.6
	From 20 to 30 million VND	16	10.0
	Over 30 million VND	8	5.0
Education	High school	15	9.4
	Intermediate College	7	4.4
	University	99	61.9
	Postgraduate	39	24.4
Age	From 20 to 30 years old	38	23.8
	From 31 to 40 years old	86	53.8
	From 41 to 50 years old	31	19.4
	Over 50 years old	5	3.1
Profession	Unskilled labour	46	28.8
	Domestic	5	3.1
	Civil servants, offices	109	68.1
	Total	160	100.0

Source: Compiled by the authors (2023).

4.2. Attitudes and views of customers about life insurance

The results of Cronbach's Alpha analysis revealed an Alpha coefficient >0.6 and a total variable correlation coefficient >0.5, confirming the reliability of the scale. The EFA results indicated a variance extraction rate >50%, KMO>0.5, loading factor >0.5, eigenvalue >1, and a significant Bartlett's test result (<0.05). Based on the EFA, 22 observed variables were grouped into

four main factors: attitudes, products and services, barriers, and distribution channels (Table 6).

Table 6. Factor rotation matrix.

No.	Exploratory factor analysis	Code	Components			
			1	*2*	*3*	*4*
1	Attitude	TD1	0.847			
		TD2	0.842			
		TD3	0.834			
		TD4	0.833			
		TD5	0.827			
		TD6	0.810			
		TD7	0.777			
		TD8	0.628			
2	Products & Services	DV1		0.839		
		DV2		0.812		
		DV3		0.808		
		DV4		0.805		
		DV5		0.760		
		DV6		0.722		
		DV7		0.627		
3	Barrier	RC1			0.877	
		RC2			0.847	
		RC3			0.824	
		RC4			0.566	
4	Distribution channels	KP3				0.821
		KP4				0.806

Source: Compiled by the authors (2023).

For the criteria evaluating customers' attitudes towards insurance, the aspects of insurance as a means to invest in the future, promote disciplined saving, and protect family received the highest ratings, with average scores ranging from 3.9/5 to 4.0/5 on the rating scale. Financial investment criteria were rated with the lowest average score, a 3.4/5. According to most customers, the essence of insurance is to financially protect against health and life risks as those who buy insurance are usually responsible for their families and relatives. Therefore, the criterion representing protection of relatives is most appreciated. However, purchasing life insurance is not only a protection but also a disciplined investment for the future. With strict terms of an insurance policy, customers must comply with rules such as premium due dates or else the contract will lapse. Satisfactory compliance ensures customers will be entitled to amounts such as accrued dividends, end-of-contract dividends, or interest from common and unit-linked funds. Therefore, paying fees in full and on time will help customers maintain a financial investment.

The low score implies that the financial investment aspect of insurance is not a major consideration for most customers. The profitability rate of insurance products tends to be lower than that of other investment channels, owing to various fees, including initial fees, risk fees, and contract and portfolio management fees. Moreover, under the Law on Insurance Business, insurance companies primarily invest in government bonds, which offer relatively low returns.

For the product and service group criteria, the average scores ranged from 3.8/5 to 4.0/5. Notably, the criteria related to the quality of consultants and product diversity received the highest scores, both averaging above 4/5. Consultants play a pivotal role in clients' decisions to purchase insurance by offering expert knowledge and personalised advice. They help clients understand specific insurance products and design tailored financial solutions. Trust is built when consultants exhibit professionalism, honesty, and dedication. Their ability to address client concerns and provide ongoing support post-purchase enhances customer confidence, facilitating decision-making and ensuring a positive insurance experience.

Product diversity significantly impacts customers' purchase intentions. Each customer has unique needs, and a wide range of insurance products allows them to select options that best meet their specific requirements. For example, customers can choose policies aimed at life and health protection, creating education funds for their children, or building comfortable retirement funds. Besides benefits, customers also focus on fees, premium payment terms, and coverage periods. In response, insurance companies have developed a variety of products with flexible benefits, payment schedules, and contract terms. This flexibility empowers customers to manage their financial resources effectively while providing optimal protection for their families.

Additionally, customers tend to prefer well-known insurance brands. Recognisable brands often inspire trust and are perceived as more reliable. Established brands typically have a long history in the industry, a strong reputation for quality service, and the financial stability to guarantee benefit payments and customer support. These attributes make customers more comfortable purchasing insurance from reputable companies, as they believe such companies are committed to maintaining long-term customer relationships and honouring their commitments.

The barrier criteria reveal that long-term commitment and low returns associated with life insurance were rated the highest, with an average score of 3.8/5. The second most significant barrier was the lack of family and relative support for purchasing insurance, with a score of 3.4/5. Low income was another critical barrier, scoring 3.3/5.

Life insurance often requires long-term financial commitments before policyholders can access its benefits. The product's inflexible nature makes many hesitant to participate, especially since the returns are generally lower than those from other financial investment options. This limitation makes life insurance less appealing to individuals seeking high-yield investments.

Additionally, purchasing life insurance often involves consulting family members or relatives. Sometimes, these consultations result in disagreements, as relatives may have different financial perspectives or limited knowledge of insurance. Misinformation or negative perceptions about insurance, often spread through social networks, can also lead to disapproval.

Finally, customers with low or unstable incomes often worry about their ability to make long-term premium payments. According to contractual terms, failure to maintain timely and complete payments could result in a surrender value that is significantly lower than the total premiums paid, further deterring participation (Table 7).

Table 7. Statistics describing variables used in the model.

Code	Target (N=160)	Minimum	Maximum	Mean	Std. deviation
TD1	Buying insurance gives me financial peace of mind	1.00	5.00	3.862	0.820
TD2	Financial protection for families	1.00	5.00	3.825	0.835
TD3	Buy insurance to accumulate savings	1.00	5.00	3.562	0.887
TD4	Preparing for life in the future	1.00	5.00	3.775	0.853
TD5	Buying insurance is an investment for the future	1.00	5.00	3.937	0.798
TD6	Buying insurance helps me save disciplined	1.00	5.00	3.956	0.738
TD7	Financial investment	1.00	5.00	3.468	0.977
TD8	Insurance helps protect my loved ones	1.00	5.00	4.081	0.735
DV1	The counsellor had enough expertise to answer my questions	1.00	5.00	3.975	0.768
DV2	The counsellor is very dedicated and friendly	1.00	5.00	4.006	0.713
DV3	Consultants have a lot of experience and professional mastery	1.00	5.00	4.006	0.731
DV4	I choose to buy insurance at a company that has many products to suit my needs	1.00	5.00	4.093	0.689
DV5	I choose to buy insurance from a company with a good after-sales policy	2.00	5.00	3.993	0.695
DV6	I choose to buy insurance from a company with a strong brand	1.00	5.00	3.943	0.762
DV7	I choose to buy insurance from a company with many social activities	2.00	5.00	3.800	0.759
RC1	Buying insurance for too long and the profit is not high	1.00	5.00	3.312	1.059
RC2	I don't have enough information about insurance	1.00	5.00	2.993	1.006
RC3	My family and relatives do not support me in buying insurance	1.00	5.00	3.468	0.977
RC4	My income is low, unstable	1.00	5.00	3.356	0.927
KP3	Convenient distribution channel	1.00	5.00	3.250	1.021
KP4	Diversified distribution channels	1.00	5.00	3.268	1.020

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalisation. Eigenvalue>1. Source: Compiled by the authors (2023).

4.3. Factors affecting satisfaction and decision to buy life insurance

4.3.1. Factors affecting satisfaction

The results indicate that the adjusted R-Square value of the model is 0.621, signifying that 62.1% of the variance in the dependent variable (customer satisfaction) is explained by the independent variables. The test results confirm no multicollinearity issues within the model. The model is statistically significant at the 1% level, making it suitable for evaluating the factors influencing customer satisfaction.

The linear regression analysis reveals that two groups, Attitude and Products & Services, significantly impact customers' satisfaction, with correlation coefficients significant at the 1% level. The analysis finds no statistically significant correlation between Barriers or Distribution Channels and customer satisfaction with insurance services.

Customer attitude and the quality of products and services play pivotal roles in driving satisfaction in life insurance purchases. A positive attitude fosters trust and peace of mind, contributing to favourable perceptions of the products. Insurance products must ensure that customer interests are reliably protected by clearly outlining policy terms and providing reasonable premiums that meet clients' financial needs. Transparency is crucial for instilling confidence in purchasing decisions.

Professional and friendly customer support is essential for addressing queries and ensuring comprehensive post-purchase assistance. Providing complete and accurate information helps customers understand the product's benefits, fostering strong relationships and enhancing satisfaction with life insurance (Table 8).

4.3.2. Factors influencing buying decisions

The results reveal that the adjusted R-Square value of the model is 0.427, indicating that 42.7% of the variance in the dependent variable (customer buying decision) is explained by the independent variables. The model is statistically significant at the 1% level, making it appropriate for assessing the factors impacting insurance purchase decisions.

The variables GT (Gender), AI (Average Income), Age, CS (Customer Satisfaction), and BA (Barriers) demonstrate statistically significant correlations with purchase intention. This suggests that customer satisfaction, gender, income, age, and barriers influence life insurance purchase decisions.

Women are more likely than men to buy life insurance for several reasons. They often find counsellors more accessible and tend to be more cautious about financial risks, placing greater emphasis on securing family protection. Additionally, women often bear more significant family responsibilities, such as caring for children and relatives, making life insurance a crucial safeguard for their families.

Higher-income individuals are more inclined to purchase life insurance as they can more comfortably afford premium payments without significantly affecting their financial plans. In the Hung Yen area, the average life insurance contract size ranges from VND 15 to 20 million, making it accessible to individuals with monthly incomes of VND 20 to 30 million.

Table 8. Estimation results of factors affecting customer satisfaction.

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.	Collinearity statistics	
		B	*Std. error*	*Beta*			*Tolerance*	*VIF*
1	(Constant)	3.925	0.036		107.748	0.000		
	Attitude	0.276***	0.037	0.368	7.542	0.000	1.000	1.000
	Products & Services	0.522***	0.037	0.698	14.293	0.000	1.000	1.000
	Barrier	0.057	0.037	0.076	1.547	0.124	1.000	1.000
	Distribution channels	0.038	0.037	0.051	1.048	0.296	1.000	1.000

Note: Double and triple asterisks (*) denote statistical significance at the 5 and 1% levels, respectively. Source: Compiled by the authors (2023).

Most customers with purchase intentions are married individuals aged 31-40, a financially stable demographic with growing family responsibilities, particularly for children. This age group typically enjoys good health, making them eligible for health insurance plans with higher coverage and lower premiums. Early participation in life insurance enables customers to secure higher sums insured at more favourable rates (Table 9).

Table 9. Estimation results of factors affecting customers' decision to buy life insurance.

Model		Unstandardised coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	*Std. error*	*Beta*			*Tolerance*	*VIF*
2	(Constant)	0.598	0.495		1.209	0.228		
	GT	-0.273**	0.137	-0.136	-1.990	0.048	0.766	1.305
	MS	-0.144	0.098	-0.109	-1.473	0.143	0.655	1.527
	AI	0.205***	0.072	0.185	2.855	0.005	0.859	1.164
	EL	-0.005	0.076	-0.005	-0.067	0.947	0.760	1.316
	Age	0.205**	0.086	0.170	2.387	0.018	0.710	1.409
	OC1	0.162	0.143	0.081	1.134	0.259	0.699	1.431
	OC2	-0.345	0.318	-0.067	-1.086	0.279	0.954	1.049
	CS	0.704***	0.074	0.584	9.485	0.000	0.952	1.050
	BA	-0.168***	0.055	-0.186	-3.025	0.003	0.957	1.045
	DC	-0.068	0.056	-0.075	-1.205	0.230	0.928	1.077
a. Dependent variable: QD								

Note: Double and triple asterisks (*) denote statistical significance at the 5 and 1% levels, respectively. Source: Compiled by the authors (2023).

5. Solutions to improve satisfaction and decision to buy life insurance

5.1. Product solutions

Develop a diverse range of life insurance packages tailored to customers' specific needs, including options for personal and family financial protection, savings accumulation, and financial investment. Create products that combine insurance with investment, enabling customers to fulfil both protection and financial accumulation goals, with transparent benefit structures.

5.2. Consulting and support solutions

Implement ongoing training programmes for consultants to ensure mastery of product knowledge, contract details, and skills in sales and customer care. Advisors should adhere to professional ethics, providing advice aligned with customers' needs and financial capacities while offering attentive customer care.

5.3. Brand and policy solutions

Design targeted advertising and promotional campaigns to foster customer trust and highlight benefits. In the context of the Fourth Industrial Revolution, insurance companies must prioritise digital transformation to enhance customer experiences during policy enrolment, contract execution, and brand interaction on e-commerce platforms. Moreover, robust after-sales services, including post-purchase customer care, are essential to ensure continuous support and satisfaction.

5.4. Income group solutions

To target specific income groups, companies should conduct market research to understand the unique needs of each group. Develop life insurance products tailored to the fees, benefits, and conditions applicable to different income levels. Select appropriate distribution channels for each group, such as insurance agents, online platforms, banking partnerships, event marketing, or collaborations with related partners. Customise outreach content to suit the targeted audience, and establish partnerships with organisations such as banks, financial institutions, or social organisations to access potential customers.

5.5. Age- and gender-specific solutions

Host events tailored to different age and gender demographics. For example, sporting events, healthcare consultation sessions featuring reputable medical experts, and collaborations with medical facilities for free health check-ups can effectively attract diverse customer segments. During these events, companies can introduce insurance products that meet the specific needs of attendees.

5.6. Solutions to reducing barriers

To mitigate barriers to life insurance participation, companies should refine their consultation processes and equip consultants with advanced skills in handling objections. Advisors must possess deep professional knowledge and be adept at addressing customer concerns effectively. New consultants should receive mentorship and managerial support during consultations to improve their skills.

6. Conclusions

Khoai Chau district, Hung Yen province, represents a promising market for life insurance development, offering significant financial and social security benefits to the community. Statistical analysis of customer attitudes toward life insurance in Khoai Chau reveals limited awareness of the product's benefits\the effect of the product has not been fully identified. At the same time, in Khoai Chau, there are still many potential customers with insufficient recognition of its value. Furthermore, barriers such as a lack of information and support from relatives and family members hinder purchase intentions. The research identifies a strong correlation between attitudes, product quality, and services with customer satisfaction. Additionally, a reciprocal relationship exists between satisfaction and purchase intention, while barriers negatively impact buying decisions. Key solutions include improving customer attitudes toward life insurance, enhancing product and service offerings, targeting diverse income, age, and gender groups, and reducing barriers to purchasing life insurance to boost buying decisions.

7. Limitations of the study

Due to resource constraints, this study focused on a single district and relied on a limited sample size. Moreover, only a subset of factors influencing satisfaction and purchase intention was explored. Future research should involve large-scale studies to comprehensively analyse the various subjective and objective factors affecting life insurance purchase intentions.

CRediT author statement

Le Thanh Ha: Conceptualisation, Methodology, Formal analysis, Investigation, Writing - Original draft preparation, Writing - Reviewing and Editing, Validation; Le Thi Hong Quyen: Writing - Reviewing, Validation, Resources; Le Thi Thu Thao: Conceptualisation, Formal analysis; Do Quang Giam: Reviewing and Editing, Validation and Supervision.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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Why do clients switch? An empirical study on third-party logistics service providers' loyalty in Vietnam

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Abstract:

The logistics industry significantly contributes to global supply chain and e-commerce growth. This study investigates the overall service quality (OSQ), leading to customer satisfaction (CS) and switching intention (SW) within Vietnam's logistics industry. Additionally, it examines the role of digital transformation (DT) as a moderating factor in the relationship between OSQ and CS. Employing partial least square structural equation modelling (PLS-SEM), we analysed factors impacting overall logistics service quality, satisfaction, and loyalty among 229 companies within Vietnam's economy. Our findings suggest that reliability, responsiveness, empathy, and order discrepancy handling positively influence OSQ. Customers with higher satisfaction and perceived service quality are less likely to switch logistics service providers. Contrarily, DT does not significantly moderate the relationship between OSQ and CS within the surveyed data. Therefore, logistics service providers should enhance aspects such as reliability and responsiveness to improve service quality. This study contributes to understanding the links among OSQ, CS (moderated by DT), and SW in the Vietnam logistics industry, providing practical implications for operational excellence.

Keywords: **intention to switch, loyalty, service quality, third-party logistics provider, Vietnam.**

Classification numbers: **2.1, 2.2**

1. Introduction

In recent decades, the logistics industry has played a crucial role in the global supply chain and e-commerce, enabling the transportation of goods and commodities across nations and creating value for the global economy. Indeed, the World Bank reported that the logistics industry accounted for 13% of the global economy, valued at $5.2 trillion, and employed a workforce of over 60 million people worldwide in 2018 [1]. This industry has sustained growth over the past decade, with a compound annual growth rate of 3.9% between 2010 and 2018 [1]. However, the global supply chain faced disruptions due to the COVID-19 pandemic, leading to signs of a global economic slowdown. The global supply chain has gradually become more resilient and rebounded in the years following the COVID-19 outbreak [2].

Vietnam, as an emerging economy, has proactively participated in international business activities with over 30 years of radical economic reform (the Doi Moi movement). Notably, Vietnam's accession to the World Trade Organization in 2007 marked a turning point for its participation in the global economy, underscored by significant agreements such as The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the EU-Vietnam Free Trade Agreement (EVFTA) [3]. Along with external opportunities, Vietnam's favourable

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geographic position has established it as a regional hub for transshipment and production in Southeast Asia. Over the last decades, Vietnam has become an attractive destination for international investors and manufacturers (e.g., Intel, Samsung…), leading to rapid evolution in the Vietnam logistics industry. As a result, Vietnam performed outstandingly in the logistics performance index among emerging economies and was ranked 39th out of 160 countries in 2018 [1]. Moreover, Vietnam was ranked 10th in the 2023 agility emerging markets logistics index, based on domestic and international logistics opportunities, business fundamentals, and digital readiness among the world's 50 emerging countries [4].

To achieve these performances, Vietnam leveraged its geographic advantages and made substantial internal efforts to fortify the national logistics system [5]. Vietnam's border stretches more than 3,260 km along the coastline with deep seaport systems from the North to the South. Seaports play a pivotal role in multi-modal transportation, where maritime transport, railroads, inland waterways, and air transportation converge. Additionally, public and private investments in infrastructure development accounted for 5.7% of GDP in recent years, ranking second after China (6.8% of GDP) among Asian countries [6]. These investments have supported the maintenance and expansion of 34 seaports, 22 airports, 19,000 km of inland waterways, 3,143 km of railroads, and 1,822 km of highways from the North to the South. Vietnam has a master plan to improve its infrastructure by 2030 [6].

Furthermore, Vietnam has enacted an institutional framework to drive the logistics industry. The promulgation of Decree No. 96/2022/ND-CP illustrates the state management of logistics services under The Ministry of Industry and Trade (MoIT). Additionally, Resolution No. 163/2022/NQ-CP promotes the fulfilment of business activities to gain competitiveness and develop logistics services in Vietnam. Among other initiatives, several decrees, circulars, and guidelines in roads, airways, inland waterways, railroads, maritime routes, and logistics have been promoted to support the Vietnam logistics industry. Approximately 3,000 enterprises function as 3PL providers in Vietnam, of which 95% are small and medium enterprises [7]. Given the fierce competition in providing 3PL services, enhancing the quality of logistics services to satisfy customers is a main focus for providers to retain ongoing customers and attract new clients within the competitive Vietnam logistics industry. Otherwise, customers may seek alternatives. Therefore, a study on logistics service quality and satisfaction is critically necessary among 3PL providers in Vietnam.

Several studies have discussed the quality of logistics services in the literature. Early research on transportation service quality in the U.S. context was found in empirical studies by S.A. Hopkins, et al. (1993) [8] and E.A. Morash, et al. (1994) [9]. Additionally, C.C. Bienstock, et al. (1997) [10] assessed physical distribution service quality (PDSQ) measurement. Others have studied port service quality dimensions from passenger perceptions [11] and their empirical association with customer satisfaction in Singapore [12], Korea [13], and Vietnam [14, 15]. Significantly, J.T. Mentzer, et al. (2001) [16] developed the logistics service quality (LSQ) scale concerning processes across customer segments. Some researchers extended this scale in specific cases, such as Danang city [17] and Haiphong city [18] in Vietnam. To the best of our knowledge, a study on 3PL service quality in Vietnam is still scant.

Most studies on service quality are grounded on the SERVQUAL model [19], and some use the LSQ model [16]. However, few empirical studies combine these two models. Moreover, alongside the rapid technological advancements of the Industry 4.0 era, logistics has embraced DT to boost the productivity and efficiency of operational business activities across logistics functions. However, numerous barriers to DT still exist in the Vietnam logistics industry. More than

90% of 3PL providers are still at the initial stage of digitalisation, though they are aware of the critical importance of DT in the logistics business [6].

Accordingly, this study explores factors of logistics service quality of 3PL providers associated with CS and loyalty in the context of the Vietnam logistics industry. This study contributes to the literature in the theoretical framework by combining the SERVQUAL model and LSQ in studying OSQ and the role of DT in the association between OSQ and CS. We examined this study in four main gateways of import-export businesses in Vietnam, including Hanoi and Haiphong city in the North, Danang city in the Central, and Ho Chi Minh city in the South. By doing so, we addressed three research questions:

1. Which factors significantly influence CS with 3PL providers in Vietnam?

2. How does digital transformation moderate the relationship between OSQ and CS regarding the context of 3PL in the Vietnam market?

3. How can 3PL providers in Vietnam reduce customers' switching intentions to others?

2. Literature review

2.1. The service quality and logistics service quality model

The service quality (SERVQUAL) model, introduced by A. Parasuraman, et al. (1988) [19], is an initial and widely used tool for assessing service quality. SERVQUAL identifies the gap between customers' expectations of a service provided and their perceptions of the actual service delivered [19]. Addressing this gap is crucial for enhancing service quality. SERVQUAL has been applied across various sectors, including hospitality, retail, healthcare, education, and telecommunication. In the logistics sector, for example, S.A. Hopkins, et al. (1993) [8] adapted SERVQUAL to the U.S. transportation industry to measure the service gap between shippers and carriers, and C.C. Bienstock, et al. (1997) [10] explored physical distribution and formulated PDSQ dimensions.

J.T. Mentzer, et al. (1999) [20] conducted a comprehensive revision and validation of the PDSQ model, proposing a multidimensional model with an integrated logistics focus, termed LSQ. This model was further supported by J.T. Mentzer, et al. (2001) [16], confirming its robustness. LSQ comprises two complementary elements: marketing customer service and physical distribution service, which result in nine related logistics service quality components [16]. These include personnel contact quality, order release quantities, information quality, ordering procedures, order accuracy, order condition, order quality, order discrepancy handling, and timeliness as a process. By examining the SERVQUAL and LSQ models, we proposed five dimensions reflecting the OSQ of Vietnam's logistics services, predicting CS and behavioural intentions [21].

2.2. Customer satisfaction

Customer satisfaction has become a prominent topic within the service industry. Satisfaction is the emotional response experienced by an individual when a product's performance matches or exceeds their expectations. R.A. Westbrook, et al. (1991) [22] characterised satisfaction as the positive feelings experienced after consuming a product or service. In e-commerce logistics, S. Akil, et al. (2022) [23] described CS as an indicator of customers' happiness with a company's offerings, while G.T. Yeo, et al. (2015) [13] demonstrated consumers' positive feelings about service quality outcomes. Studies suggest that satisfied customers contribute to profitability by attracting new customers through referrals and fostering repeat business [24], making CS essential for competitive business strategies.

2.3. Digital transformation

In the digital era, the advancement of new technologies has radically changed competitive strategies, particularly in the logistics service industry. Providers must harness technologies such as artificial intelligence (AI), the Internet of Things (IoT), blockchain, and cloud computing to gain competitive edges. M. Cichosz, et al. (2020) [25] noted that smart logistics utilising AI, IoT, and blockchain provide competitive advantages by automating processes, optimising routes, and facilitating real-time tracking. G. Schuh, et al. (2017) [26] outlined 6 stages of DT in Industry 4.0: computerisation, connectivity, visibility, transparency, predictive capacity, and adaptability. Among other functional areas such as development, production, services, marketing, and sales, logistics can achieve competitive advantages through digital transformation.

In Vietnam, DT could enable 3PL providers to enhance customer experience (CX) by improving traceability and transparency. Additionally, DT can enhance productivity, boost business performance, increase connectivity among functional departments (thereby avoiding the silo phenomenon), and reduce carbon emissions through the optimisation of routes using AI, thereby supporting sustainable development [6, 25].

2.4. Switching intention

Customer switching intention is defined as "the customer's self-reported likelihood of terminating a current service relationship" [27]. Originally, the concept of customer switching was grounded in the brand switching model, which introduced the term "potential switcher" to describe customers who are not loyal within a specific market [28]. These customers can be influenced by various factors that may prompt them to switch. S.M. Keaveney (1995) [29] identified eight factors driving switching behaviour in the service industry: pricing, inconvenience, core service failure, service encounter failure, responses to service failure, competition, ethical problems, and involuntary switching. Empirical studies have consistently identified dissatisfaction as a primary factor driving customers to churn [27-30].

2.5. Hypothesis development

Tangibles refer to the appearance of facilities, equipment, staff uniforms, items, and materials used for performing services [19]. For service delivery firms, tangibles significantly strengthen positive customer relationships and create a moment in CX by utilising firms' unique assets [16, 31]. Some studies, such as [14, 32, 33], have indicated that the tangible dimension significantly impacts overall service quality (OSQ). Hence, we raise the hypothesis:

H1: Tangibles are positively associated with overall service quality.

Reliability delineates the ability to deliver timely and consistent services [19]. In the logistics context, reliability refers to the ability of service providers to consistently deliver services as promised, meet customer expectations, and provide reliable transportation and delivery of goods. It means that reliable providers perform the promised service accurately [32]. Reliability is critical to OSQ [14, 31-33]. Thus, we assume that:

H2: Reliability is positively associated with overall service quality.

Responsiveness refers to the eagerness to help customers and quickly resolve problems in errors or unexpected cases [19]. This dimension is particularly relevant to the logistics industry, where timely and efficient responses are crucial in meeting customer expectations and maintaining logistics operational excellence [14, 32, 33]. C. Ugboma, et al. (2004) [33] found that a higher level of responsiveness was associated with increased customer satisfaction and trust, suggesting that the quicker logistics service providers respond, the higher the overall quality of logistics service is. Hence, we propose the hypothesis:

H3: Responsiveness is positively associated with overall service quality.

Empathy expresses employees' service style through attention, care, and the capability to understand customer needs and provide a sense of security and safety [19]. Staff can stand in the customers' perspectives and provide personalised services properly and safely. The significance of empathy in driving positive business outcomes is widely recognised [14, 32-34]. Therefore, empathy could be an essential component of service quality across various businesses:

H4: Empathy is positively associated with overall service quality.

Order discrepancy handling refers to how logistics firms address differences in orders after receiving customers' orders [19]. Logistics errors such as wrong items and poor quality harm customers' perception of service quality. When customers notify a logistics provider about incorrect or defective products, providers must address these complaints effectively. Although these activities are time-consuming and costly, service providers must resolve these issues [16, 23]. Therefore, order discrepancy handling becomes a predominant component of service quality:

H5: Order discrepancy handling is positively associated with overall service quality.

Overall service quality and customer satisfaction. CS is commonly understood as a result of service quality. It implies that the level of CS increases in tandem with the perceived quality of the product or service. Generally, several empirical studies have found a positive association between service quality and CS [21, 29, 31]. Specifically in the logistics industry, the same association was observed in M.S. Farooq, et al. (2018) [24], D.N. Le, et al. (2020) [14], N.A.A. Roslan, et al. (2015) [32], S. Huma, et al. (2019) [35], and M.F. Sorkun, et al. (2020) [36]. In this study, we propose:

H6: Overall service quality is positively associated with customer satisfaction.

The moderating role of digital transformation. By virtue of DT, the logistics industry can enhance operational efficiency, optimise supply chain processes, and improve CX [25]. The logistics industry is highly reliant on providing efficient and reliable services. By fostering DT initiatives, service providers can track real-time shipments, manage inventory efficiently, and process orders faster than ever. Advanced technologies such as AI, IoT, and blockchain in smart devices can facilitate the track and traceability of goods and products among supply chain partners in logistics 4.0 [37, 38]; for example, agri-food products in Vietnam have applied blockchain technology [39]. We assume that the more DT is integrated into service provision, the stronger the association between OSQ and CS is. Thus, we suggest:

H7: Digital transformation moderates the relationship between overall service quality and customer satisfaction.

Overall service quality and switching intention. Despite extensive research on service quality and its impact on various customer-related outcomes, the relationship between OSQ and switching behaviour still needs exploration, particularly in logistics. While the negative relationship between service quality and customer switching behaviour is statistically significant in the mobile phone service sector [40], it does not find significance in the telecommunication industry [29]. J.S.C. Hsu (2014) [41] found that perceived switching value and benefits generate switching intention. Increasing service quality could retain customers and mitigate the risk of customers churning among service providers:

H8: Overall service quality is negatively associated with switching intention.

Customer satisfaction and switching intention. The link between CS and the intention to switch providers

is critical for customer retention. Customers are likely to switch to others if they perceive less satisfaction with 3PL service providers. In other words, satisfied customers tend to stay loyal to their current service providers [23, 35]. By juxtaposing switching benefits and costs, customers decide whether to continue or maintain their current service providers [41]. Some argue that satisfied customers are unlikely to change to other service providers [27, 29]. Therefore, we propose:

H9: Customer satisfaction is negatively associated with switching intention.

The mediating role of CS between OSQ and switch intention. Research consistently shows that logistics service quality positively influences customer satisfaction and behavioural intentions in the 3PL industry [14, 23, 32, 35]. Multiple studies have identified the OSQ with various SERVQUAL dimensions impacting CS, which in turn mediates the relationship between OSQ and customer loyalty [14, 23]. Particularly, customer behaviour in our study is the switch intention of clients. The relationship of SERVQUAL-satisfaction-loyalty is quite common in the corpus of literature. However, we highlight the mediating role of satisfaction between SERVQUAL and loyalty by posing the following hypothesis:

H10: Customer satisfaction mediates the relationship between overall service quality and switching intention.

3. Research methods

3.1. Sample and data collection

We tested the research model using data collected from customers utilising 3PL services of a leading trading and delivery goods company headquartered in Ho Chi Minh city, with branches in Hanoi, Haiphong city, and Danang city - the four main cities in Vietnam. This company is a significant player in the Vietnamese freight forwarding market, providing inland transportation, air freight, and sea freight services in both domestic and international markets. The structured questionnaire comprised two sections: the first collected general information about the customers surveyed, such as business type and size, location, experience, transportation mode, frequency of service usage, and primary type of shipment; the second section contained questions about service quality, customer satisfaction, digital transformation, and switching choices. Before disseminating the survey, we asked four experts - two academic researchers and two industry practitioners - to review and validate the content of the study. Following some amendments, the final version of the survey was rendered more transparent and valid. For data collection, we employed a non-probability convenience sampling method. The survey was conducted in August 2023.

The final questionnaire was distributed directly to 270 participants using the company's logistics services via an online platform. A total of 229 respondents returned completed questionnaires, resulting in a response rate of 84.8%. These 229 samples were then available for further analysis.

3.2. Measurement scale

This study utilised variable measures grounded in the literature, employing a five-point Likert scale ranging from 1 to 5, where 1 represents 'strongly disagree' and 5 represents 'strongly agree'. For service quality, the variables of tangibles (TAN), reliability (REL), and responsiveness (RES) comprised four items each and were adopted from A. Parasuraman, et al. (1988) [19] and D.N. Le, et al. (2020) [14]. Empathy (EMP) also includes four items adopted from the same sources [14, 19]. Order discrepancy handling (ODH) with three items was adopted from J.T. Mentzer, et al. (2001) [16], while OSQ was measured by three items from D.N. Le, et al. (2020) [14]. DT included four items suggested by J.K. Nwankpa, et al. (2016) [42]. Three items measuring CS were taken from G.T. Yeo, et al. (2015) [13]. Finally, SW uses binary choices (0 not to switch and 1 to switch) as detailed in Table 1.

Table 1. Measurement items for constructs.

Items	Mean	S.D.	Outer loading	VIF
Tangible *(Cronbach's alpha=0.750; C.R.=0.842, AVE=0.573)*				
TAN1. The working offices of my 3PL provider are spacious.	4.288	.927	0.718	1.407
TAN2. The staff members of my 3PL provider are well-dressed and wear neat uniforms.	4.231	.991	0.816	1.754
TAN3. My 3PL provider has enough modern facilities and equipment to ensure customer service needs.	4.205	1.018	0.793	1.722
TAN4. My 3PL provider has appropriate and effective equipment for protecting goods and avoiding damage during transport.	4.148	.932	0.695	1.300
Reliability *(Cronbach's alpha=0.814; C.R.=0.878, AVE=0.643)*				
REL1. My 3PL provider delivers services on time as committed.	4.279	.976	0.826	2.742
REL2. My 3PL provider always performs the right committed services (cargo clearance, loading and unloading containers, etc.).	4.131	.949	0.733	1.665
REL3. My 3PL provider accurately issues an invoice (delivery order), a receipt, and a purchase order document.	4.105	.938	0.794	1.808
REL4. My 3PL provider can deliver goods without flaws or damage while providing services.	4.236	.928	0.850	2.848
Responsiveness *(Cronbach's alpha=0.825; C.R.=0.883, AVE=0.654)*				
RES1. My 3PL provider can quickly respond to any unexpected or urgent order.	4.153	1.109	0.877	2.133
RES2. The staff members of my 3PL provider are always willing to help customers with logistics services.	4.148	.987	0.825	1.870
RES3. The staff members of my 3PL provider are always available at my request when cargoes face trouble at port.	4.057	1.033	0.740	1.644
RES4. My 3PL provider is fully supportive in addressing emergency problems and situations encountered.	4.135	1.083	0.787	1.759
Empathy *(Cronbach's alpha=0.828; C.R.=0.879, AVE=0.593)*				
EMP1. My 3PL provider understands my company's unique needs related to the transportation of cargo (warehousing, storage, handling fee, etc.).	4.118	1.032	0.808	2.133
EMP2. My 3PL provider pays attention to the issues my company is most concerned about (cut-off time, clearance time, container position, etc.).	4.201	.968	0.771	1.870
EMP3. My 3PL provider demonstrates understanding of customer interests.	4.205	1.039	0.832	1.644
EMP4. When my company uses services from my 3PL provider, we gain a gratifying sense of security.	4.157	1.087	0.748	1.759
EMP5. My 3PL provider will put themselves in a position to solve problems for my company when addressing problems.	4.183	1.007	0.680	2.133
Order discrepancy handling *(Cronbach's alpha=0.638; C.R.=0.801, AVE=0.578)*				
ODH1. Correction of delivered quality discrepancies is satisfactory.	4.245	1.012	0.821	1.302
ODH 2. The process of reporting discrepancy process is adequate.	4.140	1.010	0.608	1.174
ODH 3. The response to order discrepancies is satisfactory.	4.048	1.095	0.830	1.398
Digital transformation *(Cronbach's alpha=0.757; C.R.=0.860, AVE=0.672)*				
DT1. My 3PL provider is driving new business processes built on technologies.	4.162	1.064	0.820	1.493
DT2. My 3PL provider is integrating digital technologies.	4.057	.921	0.815	1.601
DT3. My 3PL provider is shifting toward use of digital technologies.	4.057	1.029	0.824	1.496
Overall service quality *(Cronbach's alpha=0.785; C.R.=0.874, AVE=0.699)*				
OSQ1. Overall, the quality of logistics services provided by my 3PL provider is superior to those of other logistics providers.	4.249	.964	0.843	1.789
OSQ2. Overall, the quality of logistics services provided by my 3PL provider is of high standards in the logistics industry.	4.144	.972	0.837	1.673
OSQ3. Overall, the quality of logistics services provided by my 3PL provider meets my company's expectations of service quality.	4.162	.978	0.827	1.524
Customer satisfaction *(Cronbach's alpha=0.807; C.R.=0.886, AVE=0.722)*				
CS1. My company is satisfied with the services provided by my 3PL provider.	4.109	1.086	0.846	1.747
CS2. My company will continue to use services offered by this 3PL provider.	3.917	1.056	0.850	1.754
CS3. My company is willing to recommend this 3PL provider to our business partners.	4.052	1.056	0.853	1.750
Switching intention *(Cronbach's alpha=1.00; C.R.=1.00)*				
SW. Up to now, does your company intend to switch to another logistics provider?	28 (Yes)	201 (No)		1.000

3.3. Data analysis

This study employed second-generation statistical methods for multivariate analysis, specifically PLS-SEM, using the SmartPLS 4.0 software package. According to J.F. Hair, et al. (2022) [43], PLS-SEM is predominantly used to develop theories in exploratory research. Our research model, which links variables among OSQ, CS, and SW, is underexplored in existing literature. Therefore, the PLS-SEM algorithm is particularly well-suited for our study.

4. Results and discussion

4.1. Descriptive statistics

The clients, serving as business partners in the surveyed sample, are primarily large trading enterprises (46.7%), manufacturing plants (33.2%), transportation service providers (14%), and other types of businesses (6.1%) (Table 2). This distribution underscores the significant role that freight forwarders play in moving goods and commodities across trading partners. The business size distribution among micro, small, medium, and large categories is 8.3, 23.1, 45.0, and 23.6%, respectively, indicating that one-fourth of the enterprises are large, while nearly 80% are micro, small, and medium-sized companies. The geographical dispersion of businesses across the northern (24.0%), central (34.5%), and southern (41.5%) regions demonstrates that this company maintains a customer network on a national scale, enabling it to establish a resilient and interconnected logistics network. This network utilises competitive advantages due to its scale, reducing transportation times, optimising routes, and enhancing overall operational efficiency. The demographic data in Table 2 also details the years of establishment and the number of years of partnership of the business partners. The prevalence of sea freight (48%) and air freight (38.4%) over other modes like trucking as the primary modes of transportation among surveyed businesses highlights a focus on international rather than domestic services.

The frequency of service usage reflects the operational dynamics and inherent demands of the customers. Those using services less than twice per month account for 22.7%, while those using services more than four times per month represent 20.5%. Notably, a significant proportion of businesses (56.8%) use logistics services between three and four times monthly. Regarding the main types of shipment, full-container load (FCL) shipments (46.3%) cater to businesses with consistent cargo volumes, while less-than-container load (LCL) shipments (33.6%) serve the needs of companies with smaller consignments. The combination of both FCL and LCL shipments (20.1%) highlights the importance of versatile and customisable logistics options to meet the unique requirements of each business.

Table 2. Demographic characteristics of respondents (n=229).

Characteristics	Categories	Frequency	Valid percent
Type of business	Transport service enterprise	32	14.0%
	Trading enterprise	107	46.7%
	Manufacturing enterprise	76	33.2%
	Others	14	6.1%
Size of business	Micro-sized business (x≤50 people)	19	8.3%
	Small-sized business (50<x≤150 people)	53	23.1%
	Medium-sized business (150<x≤ 300 people)	103	45.0%
	Large-sized business (x>300 people)	54	23.6%
Location of business	Northern region	55	24.0%
	Central region	79	34.5%
	Southern region	95	41.5%
Company establishment	Under 5 years	17	7.4%
	5 years - under 10 years	61	26.6%
	10 years - under 20 years	120	52.4%
	Over 20 years	31	13.5%
Number of years of partnership	Under 5 years	44	19.2%
	5 years - under 10 years	162	70.7%
	10 years - under 20 years	23	10%
Main mode of transportation	Sea freight	110	48%
	Air freight	88	38.4%
	Others	31	13.5%
Frequency of service usage	Less than 2 times/month	52	22.7%
	From 2 to 4 times/month	130	56.8%
	More than 4 times/month	47	20.5%
Main types of shipment	Full-container load	106	46.3%
	Less-than-container load	77	33.6%
	Both full-container load and less-than-container load	46	20.1%

4.2. Measurement model

To ensure the reliability or internal consistency of the measurement scales, J.F. Hair, et al. (2022) [43] recommended using Cronbach's alpha and Composite Reliability (CR) indices. Cronbach's alpha requires a minimum acceptance value of 0.6 and is preferably over 0.7 [44]. In Table 1, the reliability of the studied variables ranged from 0.638 to 0.828, exceeding the minimum threshold of 0.6, indicating that the latent variables are internally consistent. Furthermore, CR values from 0.801 to 0.886 meet the acceptable threshold of 0.7 to 0.9, as suggested by J.C. Nunnally, et al. (1994) [45]. Table 1 also presents the outer loading for all reflective measurements in our research model. Items with outer loading below 0.7, including TAN4 and EMP5, were eliminated to maintain the explanatory power of indicators towards endogenous constructs.

For the convergent validity of the measurement scale, the average variance extracted (AVE) index assesses the correlations among items and their underlying construct. A measurement scale achieves convergence when AVE reaches 0.5 or higher, indicating that the latent construct explains at least 50% of the variance in each observed variable [39]. In our study, the AVE ranged from 0.573 to 0.722, exceeding the suggested minimum (Table 1). Therefore, the reliability and validity of this measurement model are considered satisfactory according to the criteria suggested by [39, 41].

For discriminant validity - a construct should be empirically distinct from other constructs - we utilised the C. Fornell, et al. (1981) [46] criterion and the Heterotrait-Monotrait (HTMT) ratios for assessment. According to C. Fornell, et al. (1981) [46], discriminant validity is achieved when the square root of the AVE is greater than its inner construct correlation coefficients. Table 3 shows that the square roots of each AVE value are greater than the off-diagonal elements, indicating satisfactory discriminant validity among variables. Furthermore, J.F. Hair, et al. (2022) [43] suggested an HTMT threshold value of 0.90 for conceptually similar constructs and 0.85 for conceptually different constructs. Table 3 reveals that all components in this study have HTMT values below the necessary threshold of 0.85, except for the components of EMP and DTxOSQ, which are acceptable at a value of 0.900. Thus, the discriminant validity of this study has been achieved. Additionally, this study evaluated all variance inflation factor (VIF) values below the cut-off value of 5. Our analysis shows that the VIF values are less than 3, indicating no critical levels of collinearity.

Table 3. C. Fornell, et al.'s criterion and Heterotrait-Monotrait ratio [46].

	CS	DT	EMP	ODH	OSQ	REL	RES	SW	TAN
CS	0.849								
DT	0.580	0.820							
EMP	0.564	0.725	0.770						
ODH	0.460	0.571	0.627	0.760					
OSQ	0.517	0.631	0.679	0.606	0.836				
REL	0.511	0.602	0.665	0.587	0.706	0.802			
RES	0.574	0.565	0.634	0.520	0.617	0.576	0.809		
SW	-0.722	-0.667	-0.676	-0.548	-0.685	-0.639	-0.611	1.000	
TAN	0.320	0.542	0.637	0.558	0.548	0.603	0.478	-0.446	0.757
Heterotrait-Monotrait ratio (HTMT)									
CS									
DT	0.738								
EMP	0.689	0.900							
ODH	0.626	0.799	0.829						
OSQ	0.647	0.811	0.823	0.826					
REL	0.631	0.763	0.795	0.814	0.877				
RES	0.697	0.704	0.753	0.676	0.743	0.688			
SW	0.804	0.766	0.729	0.667	0.769	0.706	0.665		
TAN	0.407	0.716	0.781	0.784	0.707	0.771	0.610	0.510	
DTxOSQ	0.435	0.705	0.724	0.706	0.900	0.782	0.563	0.653	0.692

CS - customer satisfaction; DT - digital transformation; EMP - empathy; ODH - order discrepancy handling; OSQ - overall service quality; REL - reliability; RES - responsiveness; SW - switching intention; TAN - Tangible.

Finally, the research model should be subject to a goodness-of-fit test after evaluating the constructs' reliability and validity. The standardised root mean square residual (SRMR) delineates the discrepancy between the correlations explained by the research model and those observed in the data. J.F. Hair, et al. (2022) [43] suggest that an SRMR should be lower than 0.080. Our empirical findings show that the SRMR in this study is 0.071, which is beneath the threshold. Consequently, the measurement model meets the criteria for satisfactory reliability, validity, and goodness-of-fit, enabling further data analysis in the structural equation model.

4.3. Structural equation modelling

The fitness of the structural model is evaluated through the coefficient of determination R^2 and effect size (f^2). The R^2 values, as shown in Fig. 1, for OSQ (0.615) and SW (0.654) can be considered moderate, whereas the R^2 value for CS (0.388) is relatively weak, according to the rules of thumb by J.F. Hair, et al. (2022) [43]. These results indicate that our research model provides acceptable explanations of the variances in the inner model for OSQ, SW, and CS, respectively. Regarding the f^2 effect size, this metric illuminates the effectiveness of the impact of each independent variable on the dependent variable. The cut-off values of f^2 at 0.02, 0.015 and 0.035 interpret small, medium, and large effects, respectively. For example, our empirical evidence shows that the effect size for CS→SI (f^2 = 0.534) and OSQ→SI (f^2=0.382) are significant, while TAN→OSQ (f^2=0.001) shows a small effect. Overall, these effect size values express the varying degrees of influence that different exogenous variables exert on the endogenous variables.

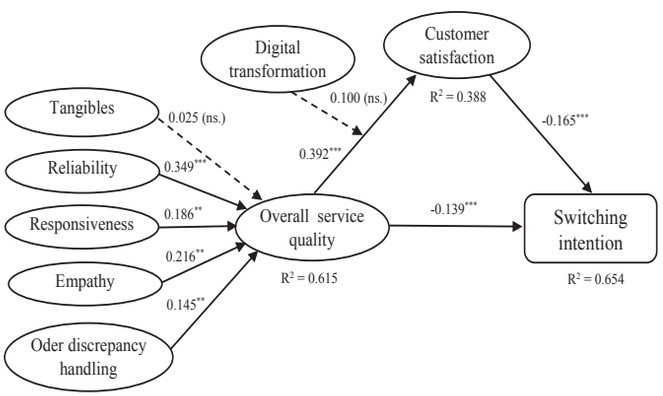

Fig. 1. Results of inner structural model. Note: *,**,*** significant level at 0.10, 0.05, and 0.01, respectively; ns. - not significance.

For the structural model (Fig. 1), seven out of the ten associations proposed in this study were statistically significant (Table 4). Among the SERVQUAL dimensions, no statistically significant relationship was found between Tangibles and OSQ (H1 is not supported). In contrast, the associations between RES, EMP and ODH with OSQ are statistically significant at the 0.05 level, with coefficients of 0.186, 0.216, and 0.154, respectively (H3, H4, and H5 are supported). Among these dimensions, REL has the most substantial statistical impact on OSQ at the 0.01 level with a coefficient of 0.349 (H2 is supported). Furthermore, OSQ was found to have a positive relationship with CS (β=0.392, p<0.05), supporting H6, indicating that higher overall service quality correlates with increased customer satisfaction.

Table 4. Results of hypothesis testing.

Hypothesis		Path coefficient	t-value	p-value	Significance at 0.05
H1	Tangibles→OSQ	0.025	0.309	0.757	No
H2	Reliability→OSQ	0.349	3.816	0.000	Yes
H3	Responsiveness→OSQ	0.186	2.329	0.020	Yes
H4	Empathy→OSQ	0.216	2.394	0.017	Yes
H5	ODH→OSQ	0.154	2.021	0.043	Yes
H6	OSQ→CS	0.392	3.229	0.001	Yes
H7	DTxOSQ→CS	0.100	1.162	0.245	No
H8	OSQ→SW	-0.139	4.365	0.000	Yes
H9	CS→SW	-0.165	5.387	0.000	Yes
H10	OSQ→CS→SW	-0.203	2.826	0.005	Yes

OSQ - overall service quality; ODH - order discrepancy handling; CS - customer satisfaction; SW - switching intention.

The relationship between OSQ and SW was negatively significant (β=-0.139, p<0.01) (H8 is supported), suggesting that customers perceiving high service quality tend to remain loyal and are less likely to switch to other service providers. Furthermore, H9 demonstrates a negative association between CS and SW (β=-0.165, p<0.01), indicating that higher customer satisfaction reduces the intention to switch. This result confirms that the relationships among OSQ, CS, and SW function as complementary partial mediation with the total effect of SW at a correlation coefficient of -0.203 (H10 is supported). However, the moderating effect of DT does not strengthen or attenuate the relationship between OSQ and CS (H7 is not supported), suggesting that efforts in DT in the logistics business have been ineffective. Control variables (Table 2) such as the scope of business partners, the age of the business partners (dating back to the initial establishment), the period partnering with 3PL service providers, and the frequency of service use do not influence the exogenous variables in our study.

The dependent variables dictate a single dichotomous (switching and not switching) indicator. We conducted a logistic regression analysis (Table 5) to assess the impact of OSQ and CS on SW. The logistic regression model, consisting of OSQ and CS as predictors, is presented in Table 6. We found that both OSQ (β=-2.090, p<0.001) and CS (β=-2.887, p<0.001) were negatively associated with switching intention. The R^2 for the intention construct was 0.789, reflecting that the model provides robust explanations of the variance in switching intention. In summary, the results strongly suggest that when customers have a higher level of CS and service quality, they are inclined to remain loyal to their current 3PL providers (Table 6 and Fig. 2).

Table 5. Summary of logistic regression results.

SWITCHING	OSQ mean	OSQ S.D.	CS mean	CS S.D.	N
Not_switch (0)	4.391	0.476	4.270	0.596	201
Switch (1)	2.702	1.121	2.273	0.811	28

OSQ - overall service quality; CS - customer satisfaction.

Table 6. Results of logistic regression analysis.

	Chi-square	*d.f.*	Sig.	
Model	134.34	2	.000	
-2Log Likelihood (L)				-17.888
Variable	B	S.E	Sig.	R^2
OSQ	-2.090	0.500	0.000	0.789
CS	-2.887	0.631	0.000	
Constant term	15.201	3.18	0.000	

OSQ - overall service quality; CS - customer satisfaction.

4.4. Digital transformation intervention

This study further tested the moderating effect of DT on the relationship between OSQ and CS. Table 7 shows no statistically significant moderation (p=0.245>0.05), suggesting that DT does not play a moderated role in this association (H9 was not accepted). However, DT significantly impacts CS (β=0.459, p<0.001), proposing that DT activities satisfy customers more.

Table 7. Path coefficients for moderating effects.

Hypothesis	Path coefficient	t-value	p-value
DT→CS	0.459	5.190	0.000
OSQ→CS	0.392	3.229	0.001
DTxCS→SW	0.100	1.162	0.245

CS - customer satisfaction; DT - digital transformation; OSQ - overall service quality; SW - switching intention.

5. Conclusions and implications

This study explores the associations among OSQ, CS, and SW within Vietnam's logistics industry. Despite initial assumptions, DT does not moderate the relationship between OSQ and CS. However, CS effectively mediates the relationship between OSQ and itself. Our findings demonstrate that reliability, responsiveness, empathy, and order discrepancy handling positively influence OSQ, aligning with prior studies [14, 23, 32, 33]. These factors significantly enhance customer satisfaction and reduce switching

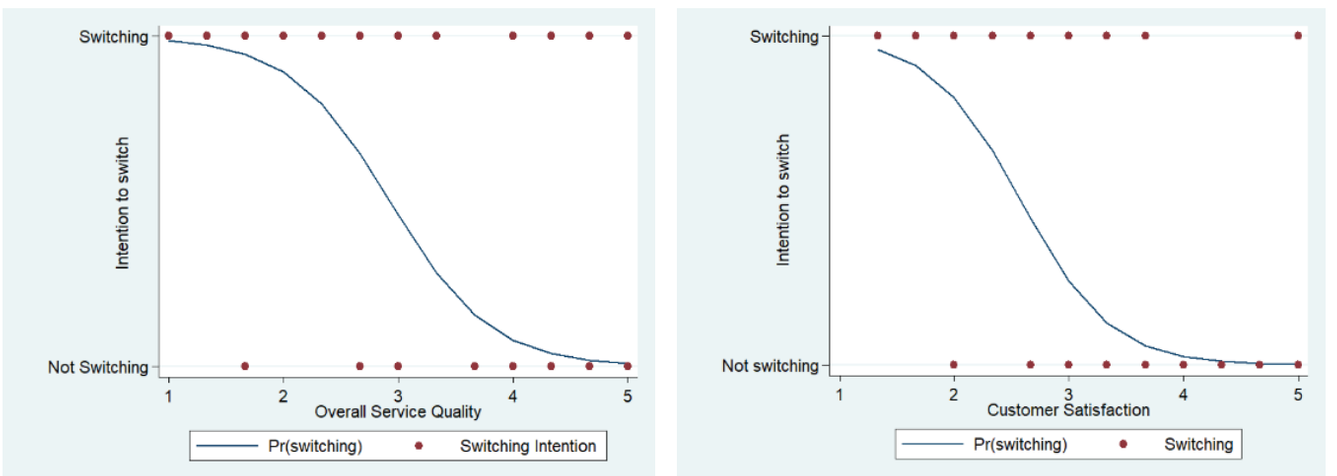

Fig. 2. Logistic regression results on overall service quality and customer satisfaction.

intention [23, 35, 36, 41]. Despite the influence of these factors, DT does not significantly impact the interaction between OSQ and CS. This study contributes notably to the literature by highlighting several key points:

5.1. Theoretical implications

This study enhances the existing conceptual framework by detailing the impacts of SERVQUAL dimensions on OSQ and examining the interconnections among OSQ, CS, and SW within Vietnam's logistics sector. Firstly, we proposed the role of DT as a moderator in the mediating relationship among OSQ, CS, and SW. This aspect is notably underrepresented in the logistics service industry literature. The empirical findings from our study reveal a strong positive association between OSQ and CS, suggesting that customers perceiving high-quality logistics services are likely to experience increased satisfaction. This result aligns with the findings of S. Huma, et al. (2019) [35] and M.F. Sorkun, et al. (2020) [36], thus advocating for 3PL providers to significantly enhance their logistics services. Secondly, we introduced the construct of order discrepancy handling into the SERVQUAL model, which is commonly explored within sectors such as hospitality, retailing, healthcare, education, and telecommunications. We recommend that future researchers consider the role of order discrepancy handling in their studies. Our findings underscore that 3PL providers should focus on improving reliability, responsiveness, empathy, and order discrepancy handling within their service offerings. Among these factors, reliability is identified as being the most influential. Finally, the study finds that customers who perceive a higher level of service quality and are satisfied with the service provided are less likely to switch to other competitors. The third theoretical contribution is an intention to switch to other competitors as devised in our research model. This introduces a new dimension to the traditional discussions around customer loyalty, often elaborated on by other scholars [23, 35], by incorporating the use of logistic regression models to assess switching intentions.

5.2. Practical implications

In the fiercely competitive market of Vietnam, the retention of current clients is of paramount importance for any 3PL provider. To achieve this, providers should strive to enhance reliability by building stronger customer trust through consistent on-time delivery, accurately fulfilled orders, and minimising service flaws and damages [35]. Additionally, 3PL providers need to optimise logistics processes to minimise delays and maintain the dependability of their operations [16]. They should also consider expanding their partnerships with a wider array of shipping lines to offer customers more flexibility and choice. Responsiveness is crucial as it reflects the provider's ability to quickly and effectively assist customers with inquiries, concerns, and unexpected situations [13, 14]. Establishing clear communication channels and protocols for swiftly addressing customer issues ensures that customers perceive value in the services provided. Moreover, 3PL providers should encourage their staff to deliver personalised attention and empathetic support to enhance the customer experience. Given the international scope of logistics, particular emphasis should be placed on improving the foreign language skills of employees [6]. Furthermore, 3PL providers should devise a reasonable reward system aligning with staff performance. Fourth, to handle order discrepancies effectively, providers should invest in comprehensive training and develop robust processes that enable prompt resolution of issues, thus enhancing overall customer satisfaction [25]. A well-managed approach to handling order discrepancies can transform potential challenges into positive customer experiences [16, 23, 25]. 3PL providers can demonstrate their commitment to customer-centric service by addressing discrepancies promptly and professionally.

Our findings indicate that DT does not moderate the relationship between OSQ and CS. This observation aligns with the current digitalisation levels in Vietnam, where more than 90% of logistics companies operate primarily at basic digitalisation levels - level 1 (computerisation) at 73.5% and level 2 (connectivity)

at 17.0%. Remarkably, 97.8% of logistics companies utilise software like Microsoft Excel and Google Sheets for daily operations, and 94.8% employ electronic custom services, specifically VNACCS [6]. However, the application of digital technologies in other activities, such as freight forwarding, customer relationships, transportation management, warehouse management, order management, and terminal operating systems, remains limited. This suggests that logistics providers need to intensify their efforts to embark on more comprehensive DT initiatives by utilising advanced technologies such as AI, IoT, and blockchain to track and trace goods and commodities in real-time, especially in the e-commerce market [37]. The necessity for digital transformation with intelligently connected tracking and tracing devices is particularly crucial in Logistics 4.0 [38]. For instance, blockchain technology, such as Agridential, has been implemented in some agricultural food sectors in Vietnam in recent years [39].

It is imperative that logistics providers standardise operational processes, strengthen leadership commitment to DT, and continuously develop feasible technological solutions [25, 37, 38]. Additionally, they should formulate a compatible roadmap for DT that aligns with their company's vision and mission, considering the constraints of human and financial resources. This study also reasserts the mediating role of customer satisfaction between service quality and behavioural intention, as previously explored [14, 23]. Ultimately, enhancing customer satisfaction and overall service quality can significantly reduce the churn rate among customers.

5.3. Limitations and future research

This study has limitations due to its focus on a leading 3PL service provider, which may not generalise to all logistics companies in Vietnam. We recommend future research that replicates this study across various companies in Vietnam and internationally. Additionally, while this study selected five process-related logistics service quality factors as antecedents of OSQ, further research might explore alternative sets of factors and delve deeper into examining their interrelationships. Moreover, by expanding the scope to include a business-to-business framework and comparing various industries, future studies could reaffirm unique logistics service factors from multiple perspectives.

CRediT author statement

Co Huynh Thi My: Conceptualisation, Methodology, Literature review, Data analysis; Thang Luong Minh: Data analysis; Uyen Phan Nguyen Thuy: Conceptualisation, Methodology, Literature review; Thien-Vu Tran: Reviewing and Editing.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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The influence of discount framing on purchase intention and actual behaviour of e-customers through brand values on Shopee Vietnam

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Abstract:

Discounting is one of the most effective types of promotion to attract customers and help businesses improve their brand value, while also increasing their revenues. Due to the rapid growth of e-commerce, revenue from online platforms is increasingly contributing an important part to firms' business results. Therefore, it is crucial to study factors influencing online customers' shopping intention and behaviour, in order to help firms increase their online revenue. Only a few researches concentrate on the relation among discount framing (DF), brand reputation (BR), brand image (BI), and none of them has been conducted in Vietnam. Hence, the research team conducted a quantitative study with 251 valid samples from respondents in Hanoi who have been using Shopee, an e-commerce platform commonly used in Vietnam, using the theory of reasoned action (TRA). The results show that DF has an effect on BR, while both BI and BR influence purchase intention (PI), which was also found to affect final actual behaviour (AB) of online clients.

Keywords: **actual behaviour, brand values, discount framing, e-commerce, purchase intention, theory of reasoned action**.

Classification numbers: **2.1, 2.2, 4.1**

1. Introduction

In a rapidly competitive and turbulent business landscape that requires continuous improvements and top performance, process innovation has been identified as an essential competitiveness source. As Internet information technology is flourishing, retail sales via online platforms have witnessed explosive growth in the past few years. This trend is beneficial for retailers as it enables them to expand their businesses via online platforms [1]. A commonly implemented strategy to increase sales is offering discounts and this strategy is also found to be effective in the case of online purchasing. However, the impact of DF on PIs can be moderated by BR and BI. In the digital marketing and consumer behaviour literature point of view, BI and BR were mentioned as the antecedents of PI as well as AB [2].

Price discounts can dramatically increase sales volume in social e-commerce due to the interaction of online consumers [3]. On top of that, different ways of framing discounts result in different PIs. About the relation between BR and BI, it is suggested that BR has a direct positive impact on BI [4]. For example, damage to BR will cause a bad impression on the brand, thus discouraging customers from making purchases. However, only a little research has factored in DF, BR, BI, PI and AB all at once. Other studies suggested that BR and BI are influential in PI, however, they did not involve DF as an important factor. Moreover, conflicts exist between the results of different studies.

We noticed that there were limitations in the range of products in those conflicted studies. Besides, many studies got data only from a particular mall or supermarket. Those factors might render the result less reliable due to the lack of diversity. Meanwhile, on e-commerce platforms, consumers usually have a plethora of choices. Yet again, there are only a few studies about the impact of DF on PI and AB through BR and BI, in the context of e-commerce.

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Since 2016, the e-commerce industry in Vietnam has witnessed significant growth, even during the time of the global pandemic. The most prevalent online shopping platform is Shopee. To increase sales, Shopee applies promotional strategies, usually discounts. Consumers usually come across discounted products while browsing this site. However, there were only a few Vietnamese studies about the impact of promotions on consumers' behaviours, especially on online sites. Therefore, it's urgent for our team to conduct a study on Shopee, to see whether Shopee's DF affects its users' perception of brands, hence stimulating their purchase decisions and their purchase behaviours.

Examining how to properly frame a price promotion is crucial to give retailers an insight into the relationship between these factors and help them make the most suitable decision, especially in terms of pricing strategies.

We created a model which includes different factors that are interdependent on each other, to examine the impact of one factor on another that is related to it, specifically:

1. Examine whether there is an impact of DF through brand values - BI and BR - on PI and AB, and if so, is the effect in each case significant or insignificant?

2. Examine the influence of PI on customers' AB.

3. From the research results, we propose solutions to improve sales for businesses that have their stores on Shopee to attract more young customers in Hanoi, as they are the customer segment that accounts for a high proportion of businesses' online revenue.

This study applies Smart PLS 4.0 to examine the effect of DF on PI and AB through BR and BI. It consists of six parts. Part two provides the theoretical background of TRA, overview of e-commerce, DF, BR, BI, PI and AB of online customers. Part three offers the methodology including research design and data analysis techniques. Part four shows the results. Part five provides findings and implications. Part six presents conclusions.

2. Literature review

Following the strong emergence of e-commerce business, especially after the COVID-19 pandemic which transformed the population's shopping habits, studying customers' behaviour on online sites has been capturing the attention of researchers. Among studies regarding this topic, TRA is a widely used theory to find out factors impacting the intention and the behaviours of consumers when shopping online.

The TRA was developed by M. Fishbein, et al. (1975) [5], being the premise for many studies about the consumers' intention and behaviours. TRA suggests that intention leads to behaviours and is dictated by personal attitudes towards behaviours. TRA relates to consumers' behaviours, which are determined by their intentions and Subjective Norms. The theory predicts the attention to perform a behaviour by the consumer's attitudes towards that behaviour rather than their attitudes towards the product or service. Online PI is the likelihood of a consumer purchasing online [6].

The research team employed TRA in our study with the purpose of examining the impact of DF towards the perception of BR and image, and eventually the intention and final purchasing decision of customers in the particular context of the online shopping platform Shopee Vietnam.

2.1. Discount framing

Discount framing is defined as a method to frame a promotional price within a given offer [7]. DF can also be the method in which the price of a particular product is offered to influence consumer response. Most stores use discount brackets to offer bundled products. When a consumer sees a certain discount that represents the nominal price crossed out and the new price lower as its comparison, the consumer thinks of a cost-saving opportunity [8]. Thus, creating a discount framework can increase a consumer's intention to purchase the product. Previous research shows that consumers don't really feel guilty about buying a product with a discount [8]. As a result, framing discounts can increase a product's sales.

2.2. Brand reputation

Brand reputation is defined as the consumer's perception of product quality in relation to the

brand name. Good reputation could lead to positive expectations and bad reputation could lead to negative expectations [9].

Therefore, BR is important. The value of a brand lies in what consumers have experienced and learned about the brand. Consumers want to enhance their social self-actualisation by connecting with a brand that has a high reputation. Some research stated that consumers purchase images, not products. When they choose brands with high reputation, other people will perceive their high life status. The research found that consumers who purchase from reputable brands are consumers who want to show their social status. When consumers buy any product, they think about the reputation of the brand. They see a smaller risk for well-known brands. Therefore, it can stimulate purchasing decisions.

2.3. Brand image

The definition of BI is unstable and varies between authors. The American Marketing Association (AMA) defines BI as "the perception of a brand in people's minds. It's what people believe about a brand - their thoughts, feelings, expectations" (AMA). BIs are the numerous perceptions that customers have in their minds about brand induced from introducing brand to the market.

Nowadays, organisations are aware that customers' positive notion about branding creates strategic asset and competitive advantage. BI is regarded as an important factor in determining purchaser's behaviour.

When consumers buy a product, they are also buying an image of that product. Earlier research has shown that the desired BI can lead to brand loyalty [10], brand equity [11], purchase behaviour [12]. Hence, a positive BI exceeds customer expectations. A positive BI enhances the goodwill and brand value of an organisation.

2.4. Purchase intention

Intention expresses the probability to implement behaviours of an individual in the future. Intention can be defined as a willingness to do a specific behaviour of an individual [13].

Purchase intention is often related to consumer behaviour, perception and attitude. PI is defined as a tool for predicting the buying process. PI can be changed under the influence of price, or perceived quality and value. In addition, consumers are influenced by internal or external motivations in the purchasing process. Customers tend to think that buying something with a low cost, simple packaging and low-profile is a high risk because the quality of these products is not reliable.

2.5. Actual behaviour

AB is defined as consumer behaviour that is influenced by their intention to act and influenced by their attitudes [14]. Furthermore, AB refers to how people make decisions in spending their time, money, and effort in terms of consuming a product or service [14]. Realistic behaviour is related to the TRA which explains how people's perceptions of others' opinions are influenced by people's intentions and attitudes [5]. The primary purpose of TRA is to determine consumer behaviour to engage or opt out of their intentions. Behavioural humanity is determined by behaviour and prior intentions such as attitudes towards subjective and normative behaviour. Because of these three determinants, this study uses this theory.

2.6. Research hypotheses

This section presents the hypothesised development based on earlier studies' findings. They are tested through quantitative analysis. From there, the results of the quantitative analysis will answer the research question raised in the introduction.

It is concluded that while consumers show direct responses to price promotions, the effectiveness of the promotion itself is also influenced by sellers' reputation [15]. Although there are several studies about the impact of BR on consumers' purchasing intention, surprisingly, most of them did not examine how BR influences their promotions.

In the case of never-before-purchased goods, consumers will consider the promotional price based on other external cues such as BR to form their reviews on products [16].

We assume that consumers make inferences based on BR and respond more positively to promotions from those same brands. Therefore, we propose the first hypothesis (Fig. 1):

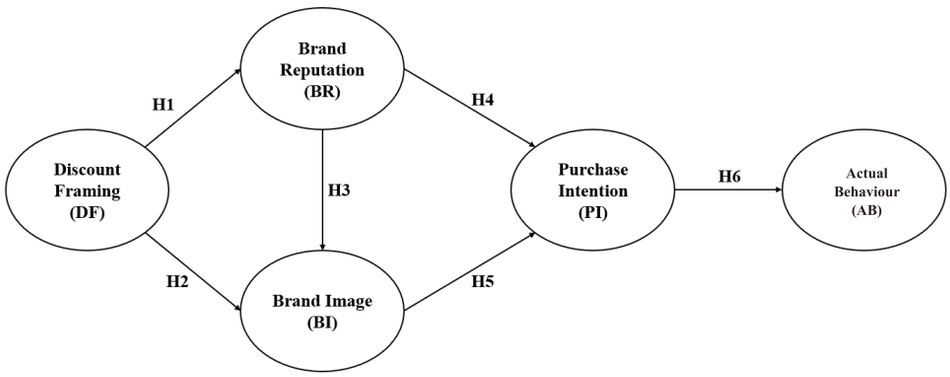

Fig. 1. Research model.

- H1: DF has an impact on BR.

Consumer perceptions of price promotions have been linked empirically to a brand's price image. For example, a low-priced luxury brand product may affect the perceived quality and image of that brand because the lower price is often associated with a lower quality [4]. When customers have to compare the quality of two different brands based on price, they will rate the higher priced product as having higher quality.

It was also found that frequent promotions have an effect on customers' evaluation of BI [17].

However, in a study conducted with 307 people in the Greater Jakarta Area, Indonesia in 2017, DF was found to have no effect on BI [8].

From the aforementioned disagreements between those studies, we propose the second hypothesis:

- H2: DF has an impact on BI.

BR and BI can be linked. Industries that are highly competitive, such as the culinary industry, should have high BR to create consumer trust as well as to reduce uncertainty [18]. When making a purchase, the customer wants to see if the product has enough credibility and reputation. A number of people prefer to purchase reputable brands' product to increase their pride [18]. A well-established brand will lead to customers' loyalty [10]. Hence, customers' perception regarding the brand, or BI, is improved. If a reputation crisis befalls a brand, it is important for managers, marketers and brand owners to manage the crisis as quickly and effectively as possible. However, due to the limited number of studies on the influence of reputation on BI, we propose the third hypothesis:

- H3: BR has a positive impact on BI.

When making a purchase, the customer wants to see if the product has enough credibility and reputation. If someone has positive feelings about buying a product from a certain brand, or a member of their family, friend or colleague recommends the product, that further reinforces PI. Therefore, they are more likely to make purchasing decisions. BR has been proven to have a positive and significant relationship with customers' PI [19].

On the contrary, in another research, the hypothesis that BR has an effect on PI is rejected [8]. Therefore, to examine the relationship between BR and online PI more clearly, we propose the fourth hypothesis:

- H4: BR has an impact on PI.

Understanding the influence of BI on customer purchase is one of the core issues in current brand management research. BI is considered an important indicator in the purchasing decision process, in which positive brand information affects perceived quality, perceived value, and willingness to buy a product [16]. Consumers tend to prefer products with a more positive BI. According to research done in the US and Europe, a popular store tends to have a larger profit margin because the BI can make consumers feel like buying or not buying. Therefore, this study suggests that BI has an influence on customers' purchasing decisions. From the above discussion, we propose the fifth hypothesis:

- H5: BR has an impact on PI.

In earlier studies, behavioural intentions have been found to be immediate predictors of ABs [20]. Moreover, in the green product industry, some research concludes that consumers' attention to the environment and green products will affect their purchase decisions. As for sustainable clothing, PI for

sustainable clothes has a positive impact on actual purchase behaviour. Overall, since PI ultimately leads to purchase behaviour, it has been suggested as a key predictive component. Interestingly, however, the relationship between PI and AB can vary depending on culture.

As can be seen, earlier results are not in complete consensus. Therefore, we propose the sixth hypothesis:

- H6: PI has an impact on AB.

Figure 1 shows the research model for this study.

3. Data and methodology

3.1. Research design

The questionnaire consisted of 22 items, not including the participants' demographics section. The respondents were asked to choose one of five levels on a 5-point Likert scale, from 1 (totally disagree) to 5 (totally agree). The construction of the questionnaire was based on the consideration of research concepts, combined with qualitative research through collecting opinions from selected experts and teachers. The questionnaire was designed with clear, easy-to-understand questions so that participants could answer in accordance with their thoughts and ensure acceptable reliability. The questionnaire was then sent directly or online via Google Forms to survey subjects between 21 December 2022 to 21 February 2023.

Data for the research was primary data which were responses from young people, whether college students, graduates or people who have already got a job, in the city of Hanoi. Observations must satisfy specific criteria; the respondents age must be under 29 and have made any purchase via Shopee. Each respondent is allowed to fill in the form once only.

3.2. Data analysis techniques

To analyse the collected data set, the research team used PLS-SEM, which is currently one of the most widely applied approaches to analysing data in various research models and contexts, using SmartPLS 4.0 software.

The PLS-SEM method works efficiently with small sample sizes and complex models, makes no distributional assumptions and can easily handle reflective and formative measurement models, as well as single-item constructs, with no identification problems. Moreover, PLS-SEM also has greater statistical power in comparison to CB-SEM. Therefore, PLS-SEM is an appropriate method considering the model as well as the aim of the research.

There are two main steps in PLS-SEM: measurement model evaluation and structural model evaluation. The factors were coded as follows: DF=DF; BR=BR; BI=BI; PI=PI; AB=AB.

4. Results

4.1. Demographic distribution

The research team managed to collect 266 responses. The responses were then entered into a spreadsheet for cleaning and validating. After being checked, 15 biased observations were eliminated, leaving 251 valid responses that can be used for research analysis. These valid responses were then entered into the SPSS and SmartPLS software for data analysis.

Table 1 summarises the demographic distribution of the respondents.

Table 1. Descriptive statistics of participants' demographics.

Variables	N	%
Gender		
Male	88	35.1
Female	163	64.9
Income		
<2 million VND/month	121	48.1
2-5 million VND/month	60	23.9
5-10 million VND/month	30	12.0
10-15 million VND/month	17	6.8
>15 million VND/month	23	9.2
Shopping frequency on Shopee		
Sometimes (<3 times/month)	158	62.9
Often (3-5 times/month)	76	30.3
Very often (>= 6 times/month)		

Source: Author's calculation.

4.2. T-test

The results of the t-test and Levene's test indicate a difference in actual buying decisions (AB) between the two groups of surveyed subjects by gender as shown in Tables 2 and 3 below.

With p=0.000<0.05, the results indicate that there is a difference in online purchase decision between the two gender groups of male and female.

Table 2. Summary of t-test and Levene's test results.

	Gender	N	Mean	Std. Deviation	Std. Error Mean
AB	Male	88	3.3932	.87754	.09355
	Female	163	3.8528	.68198	.05342

Source: Author's calculation.

Table 3. Summary of t-test and Levene's test results.

F		Levene's Test for Equality of Variances		t-test for Equality of Means		
		Sig.	t	df	Sig. (2-tailed)	
AB	Equal variances assumed	7.150	.008	-4.595	249	.000
	Equal variances not assumed			-4.266	144.723	.000

Source: Author's calculation

4.3. Measurement proposed research model assessment

There are four constructs in the model, namely: DF, BR, BI and PI.

First, the collected data set was evaluated for their outer loadings to assess the quality of the observations. Based on the algorithm index, three indicators were found to be invalid as their outer loadings index were below the threshold of 0.7: DF2 (outer loadings=0.217), PI3 (outer loadings=0.539) and AB5 (outer loadings=0.642). As a result, these three observed variables were excluded from the model. The re-evaluation after the invalid indicators were eliminated indicated that all the remaining variables were satisfactory as their index of outer loadings (Table 4).

Table 4. Outer loadings.

	AB	BI	BR	DF	PI
AB1	0.748				
AB2	0.887				
AB3	0.891				
AB4	0.838				
BI1		0.754			
BI2		0.861			
BI3		0.869			
BI4		0.864			
BR1			0.782		
BR2			0.742		
BR3			0.752		
BR4			0.755		
BR5			0.764		
DF1				0.825	
DF3				0.862	
DF4				0.876	
PI1					0.891
PI2					0.831
PI4					0.878

Source: Author's calculation.

The index of composite reliability (rho_a and rho_c), and average variance extracted (AVE)'s result were demonstrated in Table 5.

Table 5. Cronbach's alpha and composite reliability.

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
AB	0.862	0.866	0.907	0.711
BI	0.858	0.861	0.904	0.703
BR	0.819	0.827	0.872	0.576
DF	0.816	0.822	0.890	0.730
PI	0.835	0.840	0.901	0.752

Source: Author's calculation.

The Discriminant validity was tested using Fornell - Lacker Criterion, the results of which are shown in Table 6. This result indicates that each construct in the model explains better the variance of its own indicator than the variance of other constructs.

Table 6. Fornell - Lacker Criterion.

	AB	BI	BR	DF	PI
AB	0.843				
BI	0.634	0.838			
BR	0.681	0.798	0.759		
DF	0.576	0.503	0.654	0.855	
PI	0.780	0.684	0.703	0.624	0.867

Source: Author's calculation.

Next, the structural model is assessed. The Collinearity Statistics (VIF) was checked in order to ensure that there is no multicollinearity among the variables in the research model. The results shown in Table 7 indicate that latent variable in the research model may not be collinear as all Collinearity Statistics indices are lower than 3.

Table 7. The Collinearity Statistics.

	AB	BI	BR	DF	PI
AB					
BI					2.757
BR		1.749			2.757
DF		1.749	1.000		
PI	1.000				

Source: Author's calculation.

The higher R^2 means the better explanatory power of the model. The results for this index are shown in Table 8 and Fig. 2.

Table 8. R-Square and R-Square adjusted.

	R-square	R-square adjusted
AB	0.609	0.607
BI	0.638	0.635
BR	0.428	0.426
PI	0.535	0.532

Source: Author's calculation.

4.4. Testing research hypotheses

The study performed Bootstrap analysis with N=5000 to test the significance of the effects in order to draw conclusions about the hypotheses, the results are shown in Table 9.

Table 9. Bootstrapping analysis.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/ STDEV|)	P values
BI -> PI	0.339	0.344	0.078	4.335	0.000
BR -> BI	0.820	0.822	0.047	17.429	0.000
BR -> PI	0.432	0.425	0.081	5.320	0.000
DF -> BI	-0.033	-0.036	0.056	0.587	0.557
DF -> BR	0.654	0.657	0.040	16.251	0.000
PI -> AB	0.780	0.780	0.033	23.770	0.000

Source: Author's calculation.

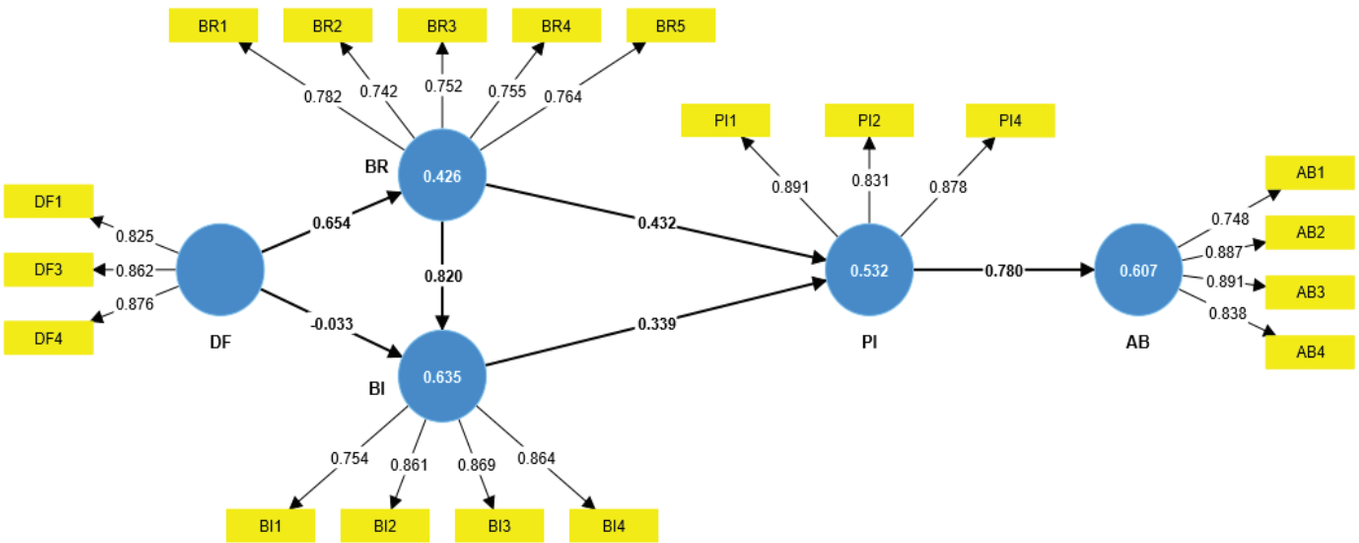

Fig. 2. Confirmatory factor analysis results.

It can be seen from the bootstrapping results that DF (p=0.000<0.05) has a significant effect on BR; BR has a significant relationship with both BI and PI (p=0.000<0.05 in both cases); BI displayed significant relationship with PI (p=0.000<0.05) and PI was proven to have a significant relationship with AB. Therefore, five out of six hypotheses were accepted. However, DF shows no direct impact on BI (p=0.557>0.05), thus Hypothesis 2 was rejected.

The effect size of DF on BR, BR on BI and PI on AB (f^2=0.749, 1.062, 1.555, respectively) signified large effects as they all exceeded 0.35. The indices for the effect of BR on PI were 0.145, which indicates that the effect size is medium (0.15≤f^2<0.35). The effect was small in the case of BI's impact on PI (f^2=0.090). Finally, the effect size of discount on BI (f^2=0.002<0.02) suggested that there is almost no effect between these two variables. The calculations of f^2 are shown in Table 10 as follows.

Table 10. Effect size.

	AB	BI	BR	DF	PI
AB					
BI					0.090
BR		1.062			0.145
DF		0.002	0.749		
PI	1.555				

Source: Author's calculation.

5. Conclusions and discussion

The main purpose of this study is to utilise the TRA to examine the effect of DF towards e-customers' PI via the factors of BI and BR. From the data analysis result above, the following conclusions can be made:

Firstly, DF has a significant impact on BR, which indicates that discount programs have positive effects on the reputation of e-commerce platforms, in this case Shopee Vietnam. This also means that offering discount programs to consumers may result in an enhanced position of a certain brand in customers' perception. However, other previous studies have found different results. S.A.S Wowling, et al. (2022) [21] found that the price has no effect on BR. S.E. Ali (2008) [22] suggested that a BR gives an image of superior quality and added value, which justifies a premium price, and some consumers may choose a brand just because it has the highest perceived price inferring that it is of high quality.

Secondly, DF is found to have no influence on BI, which appears to contradict several previous studies. As mentioned above, price promotion can affect various aspects of a brand, including perceived image and quality [4]. However, it is concluded that discounts have a negative impact on a brand's image, especially discounts of more than 20% [4]. Researchers also pointed out that frequent price promotion leads to a more conservative estimation of the quality of products as well as BI since they often correlate low price with low quality [17].

Thirdly, there exists a significant relationship between BR and BI. The uses of corporate reputation were proved to be somewhat significantly associated with BI strategy [23]. D. Grewal, et al. (1998) [15] accepted the hypothesis that the more positive the reputation associated with the store, the more positive the buyers' perceptions of store image.

Fourthly, BR shows a positive effect at a medium level in its relationship with PI. Several previous researches have found similar results. All of these researches indicated that BR positively influenced customer's intention of purchasing certain products and thus increased the likelihood of them actually deciding to buy the merchandise. Another study also supports this by stating that "Well-known products were of the strongest preference to customers when they were considering which e-commerce products to buy in the future" [24]. However, it is possible that in stark contrast, BR has no influence on customers' PI [8].

Fifthly, BI does have an impact towards PI although the influence appears to be minimal. Meanwhile, other authors also suggested a positive, but significant relationship between BI and PI or in other words, a decent BI can increase the probability of customer purchasing the products [25]. In addition, if the brand has a good image, customers will be more susceptible to information in advertisements, which may induce their purchase desires [26].

Finally, a significant relationship between PI and AB exists. Other research has found similar results [27]. It is also suggested that actual purchase behaviour is remarkably affected by the prior intention of customers [18].

Based on the aforementioned results, it can be concluded that DF shows effects on PI and through PI influences buyers' final decision to purchase any product on Shopee's platform.

The research questions are answered as follows: First, DF has a significant and positive impact on BR. Second, DF was unrelated to BI. Third, BR displays a significant and positive impact on BI. Fourth, BR shows an insignificant but positive impact on PI. Fifth, BI has a positive but marginal relationship with PI. Finally, PI and AB have a close and remarkable relationship with each other.

About the contribution of the research, firstly, the research contributes to the literature in the field of marketing, customer behaviour and e-commerce. Secondly, another contribution of this research is to help online sellers and entrepreneurs come up with strategies to improve their business by providing a deeper insight into the influence of DF towards customers' perception and behaviour. Online retailers should offer discounts on their products to stimulate consumer demand and increase customers' PI and AB. Moreover, to improve BR, e-commerce platforms can either independently implement or collaborate with their retailers to execute special discount programs. Finally, there is a difference in online purchase decision between the two gender groups. Therefore, e-commerce platforms and online sellers need to have an understanding of the needs and preferences of each gender group in order to offer suitable promotions for their products.

Nonetheless, there are limitations to this study. Firstly, the respondents are young people aged 18 to less than 29 in the city of Hanoi, which means that this study hasn't considered other age groups as well as people from regions other than Hanoi city. In addition, both BR and image are customers' perception of Shopee. The research team hasn't considered other online shopping websites in Vietnam such as Lazada, Sendo or Tiki, though each of them has its own distinct features. At the same time, the research team has not studied the brand perception of the product. Finally, discounts come in many different forms including discount by a percentage of original price or cut down a specific amount of money and each type of discount may have different effects on BR and image. These suggest new research directions for future studies.

CRediT author statement

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COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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Economic valuation of mangrove forest: The case of Kim Son district, Ninh Binh province using contingent valuation method

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Abstract:

Contingent valuation method (CVM) is used to estimate the value of an environmental good and service. By applying the CVM method, this study estimates the value of mangrove forests in Kim Son district through the willingness to pay (WTP) of residents in the coastal area for two mangrove protection and development funds, for both present and future purposes. Data were collected from a survey in May 2023 using questionnaires with 90 farming households living in the coastal area of Kim Son district, employing a convenience sampling method. Benefits from mangrove forests recognised and appreciated by Kim Son coastal residents include the ability to block waves, protect dykes, block wind, limit soil erosion, limit human and economic risks caused by storms, improve air quality, filter water, provide breeding grounds for organisms, form soil, and provide food. Payment Card technology was used to determine WTP levels for mangrove protection and development in Kim Son district. According to calculations, the value of Kim Son mangrove forests is equal to 741 million VND/year, with WTP levels depending mainly on the gender of the respondent.

Keywords: **contingent valuation method, mangrove forest, valuation of mangrove forest.**

Classification numbers: **2.1, 4.1**

1. Introduction

Resource and environmental valuation is an applied field of environmental economics that developed in the 1980s to serve the decision-making process of resource and environmental management. Thus, resource and environmental management agencies can evaluate the value of resources and effectively implement exploitation policies.

CVM is a method that allows the estimation of the value of an environmental good and service. The method's name derives from the contingent response to a valuation question based on describing a hypothetical market to the respondent. CVM was first introduced by Davis in 1963 to estimate the benefits of outdoor recreation R.K. Davis (1963) [1]. Applying CVM to consider the WTP for the use of public goods or services has been studied in several countries such as Italy [2]; Indonesia [3, 4]; and the Philippines [5]. WTP can be used as a basis for determining ticket prices and improving the quality of bus services or choosing high-speed mass transit systems, including streetcars or subways. CVM is used to estimate economic values for all types of ecosystems and environmental services, which can be used to estimate both use and non-use values.

In Vietnam, numerous studies have applied the CVM method to value environmental services. For instance, N.T. Hai (2000) [6] used CVM to ascertain the WTP level of tourists for improvements in roads and protected areas for wildlife at Cuc Phuong

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National Park. T.V.H. Son, et al. (2002) [7] investigated the WTP for establishing a protected sea area in Nha Trang bay, Hon Mun island. N.T. Ha (2009) [8] used the random assessment method to determine the community's WTP to preserve the cultural space at the gate of Mong Phu village, Duong Lam, Son Tay, Hanoi, targeting both tourists and locals. N.V. Song, et al. (2011) [9] determined the WTP of farming households for domestic solid waste collection management and treatment services in Gia Lam district, Hanoi. L.T.D. Hien, et al. (2014) [10] estimated the WTP for tourism needs of Can Tho city residents. All studies consider factors that affect willingness to pay, and the main factors identified include distance, age, gender, marital status, monthly income, family background, educational status, and religion.

Mangrove forests are considered one of the ecosystems with the highest biological productivity [11], thus playing an important role in local socio-economic development. Mangrove forests are valuable ecological and economic resources, providing essential services such as food and fuel; nurseries for many animal species; filtering pollutants, absorbing carbon and other elements; and protecting against coastal erosion caused by tsunamis and tropical storms [11]. This study aims to estimate the value of mangrove forests in Kim Son district through the assessment of people living, working, and benefiting directly from mangrove forests as a basis for effective exploitation and use of natural resources.

2. Research area and methods

2.1. Research area

Kim Son district's coastal mangrove forests are formed in the delta of the Day and Can rivers. This area, along with the entire land south of the 20th parallel of Ninh Binh province, is recognised by UNESCO as the buffer and transition zone of the Red River Delta Biosphere Reserve, with a total area of 10,088 hectares, accounting for 14.2% of the entire biosphere reserve (Ninh Binh Provincial People's Committee, 2021) [12]. Kim Son mangrove forests have been planted by the Vietnamese government, the Japanese government, and the Ninh Binh Protection Forest Management Board since 1995, mainly on coastal mudflats. The total area of forests and forestry land is 1,558.9 hectares, of which the planted forest area is 633.25 hectares; the area of vacant land is 955.65 hectares. The entire forest area is currently protected by forest owners signing contracts with households according to the provisions of Decree No. 168/2016/ND-CP of the government. Forest protection is carried out very strictly. Kim Son mangrove forest is shown in Fig. 1.

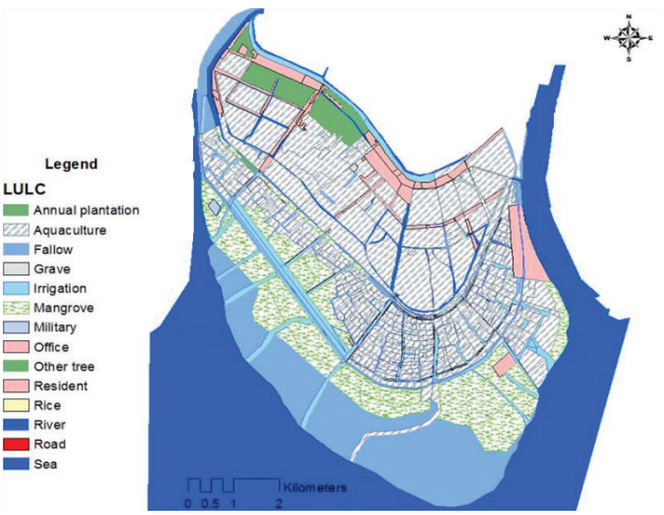

Fig. 1. Map of mangroves in Kim Son district, Ninh Binh province [13].

2.2. Research methods

2.2.1. Sociological investigation methods

The present study used a questionnaire survey with 90 households using a convenience sampling method. The convenience sampling method has several advantages, such as being easy to implement and time-saving, making it suitable for studies with limited resources. The disadvantage of this method is that the representativeness of the sample is not guaranteed due to non-compliance with the rules of random sampling. To overcome this drawback, the authors selected subjects living and working in the coastal alluvial area of Kim Son district whose main livelihood is extensive coastal aquaculture. These are the subjects who directly benefit from coastal mangrove forests and most clearly identify the benefits of mangrove forests, thereby making the decision to

be willing to pay for the mangrove protection fund. At the same time, these subjects were selected to be as diverse as possible in terms of their age, education level, and income. Information was collected based on a previously designed questionnaire.

The survey sampling formula can be applied if the population is known [14]:

$$n = \frac{N}{1+N*e^2}$$

where *n* is number of samples to be determined, *N* is overall quantity, and *e* is allowable error.

In 2022, the number of extensive aquaculture households in 3 coastal communes (Kim Hai, Kim Trung, Kim Dong) was 1,427 households (N = 1,427). Taking the error e = 0.1, the number of samples to be determined is n = 93.43 households. Due to the rate of unanswered or incompletely answered questions due to the complexity of the questionnaire, the total number of people interviewed was 90 households.

2.2.2. Mangrove forest value quantification method using contingent valuation

The CVM is used to evaluate goods and environmental quality by building a virtual market through people's WTP or willingness to accept (WTA) posed in a hypothetical situation. CVM is applied to many environmental factors such as air quality, landscape value, and wildlife conservation.

Some techniques to determine WTP levels from interviewees used in surveys are:

• Open question: Allows each person to freely state their willingness to pay. This can lead to intentional bias.

• Bidding game: The interviewer offers increasingly higher prices to respondents until they reach their maximum willingness to pay.

• Payment card: Shows a series of prices written on the card, and the respondent is asked to choose a price.

• Close-ended referendum (dichotomous choice): The answer is Yes or No.

In this study on WTP levels for mangrove protection and development in Kim Son district, payment card technology was used to present a series of prices that respondents are willing to pay in a year, ranging from 10,000 VND to 200,000 VND, for one person to choose. There are 2 funds to protect and develop mangrove forests for current and future purposes. The average price given by the group of respondents will be the average WTP and is calculated according to equation (1):

$$\overline{wtp} = \frac{\sum_{k=1}^{i} wtp_k n_k}{\sum_{k=1}^{i} n_k} \quad (1)$$

Source: Author's summary.

where $\overline{wtp}$ is the average WTP for the mangrove protection and development fund of coastal people in the Kim Son district, *k* is the index of WTP levels, wtp_k is the WTP at level *k*, and n_k is the number of people willing to pay the *k* willingness level.

Next, based on the total population in the coastal area of Kim Son district (three coastal communes) directly benefiting from Kim Son mangrove ecosystem services, we calculate the total WTP according to the equation (2):

$$WTP_{total} = WTP_{avg} * N \quad (2)$$

where: *N* is the total number of households in the area; WTP_{total} is the total WTP of all people in the study area; WTP_{avg} is the average amount a person is willing to pay.

3. Results and discussion

3.1. General information about the interviewee

To conduct this research, the authors interviewed 90 people living and working in 3 coastal communes of Kim Son district: Kim Hai, Kim Trung, and Kim Dong communes. Their livelihood is extensive aquaculture. These are the direct beneficiaries of the coastal mangrove forests of Kim Son district. Therefore, these subjects will most clearly identify the benefits from mangrove forests and thereby make the decision to be willing to pay for the mangrove protection fund. Information of the interviewees is shown in Fig. 2.

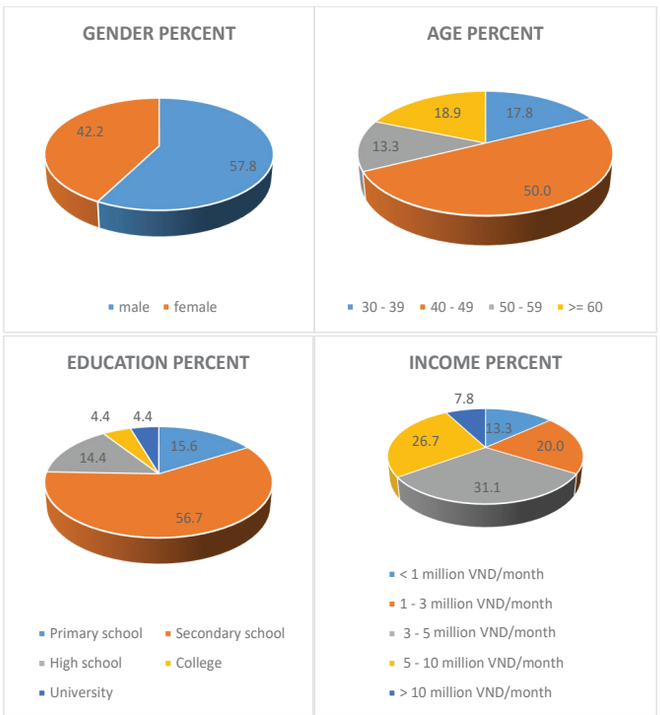

Fig. 2. General information about the interviewees. Source: Author's research results.

Of the respondents, 42.2% were female and 57.8% were male; 50% were aged 40-49, 18.9% were older than 60 years old, 17.3% were aged 30-39, and the remaining were aged 50-59 (13.3%). The education level of the respondents (86/90 responses) was mainly secondary school (56.7%), followed by primary education (15.6%), high school degrees (14.4%), while the remaining respondents had intermediate college and university degrees (8.8%). The income of the households questioned (89/90 responses) was mainly 3-5 million VND/month (31.1%), 5-10 million VND/month (26.7%).

3.2. People's recognition of the benefits from Kim Son district's mangrove forests

From a theoretical basis on the role and benefits of mangrove forests combined with practical surveys, we offer some perspectives on mangrove forests. Through questionnaire interviews, people's assessments of the contribution of the benefits of Kim Son mangrove forest were obtained as shown in Table 1. The level of contribution is expressed on a scale of 1-5; where: 1 - don't care/don't know; 2 - not important; 3 - less important; 4 - important; 5 - very important. Local people's assessment is shown in Table 1.

Table 1. Local people's assessment of benefits from mangrove forests.

	N	Minimum	Maximum	Mean	Std. Deviation
Contribution of mangrove forests to the local economy.	81	2.00	5.00	4.5	0.82
Mangrove forests provide exploited food.	81	2.00	5.00	4.2	0.84
Mangrove forests provide pollen to raise bees for honey.	83	1.00	5.00	3.5	1.09
Mangrove forests provide wood and firewood.	83	1.00	5.00	2.7	1.24
Mangrove forests help store and replenish groundwater sources.	79	1.00	5.00	3.2	1.53
Mangrove forests have the ability to filter water and improve water quality.	81	1.00	5.00	4.0	1.22
Mangrove forests improve air quality by removing dust particles and emissions from the environment.	81	1.00	5.00	4.5	0.88
Mangrove forests store water and regulate it during heavy rains.	85	3.00	5.00	4.5	0.73
Mangrove forests have the ability to block wind.	82	4.00	5.00	4.9	0.36
Mangrove forests absorb large amounts of carbon dioxide, helping to regulate the climate and reduce the greenhouse effect.	89	3.00	5.00	4.7	0.50
Mangrove forests limit soil erosion caused by wind or storms.	87	4.00	5.00	4.9	0.27
Mangrove forests limit human and economic risks caused by storms.	89	4.00	5.00	4.9	0.29
Mangrove forests have the ability to block waves and protect sea dikes.	83	4.00	5.00	5.0	0.22
Mangrove forests provide habitat for wild plants and animals.	87	3.00	5.00	4.6	0.51
Mangrove forests provide breeding grounds for wild plants and animals.	88	3.00	5.00	4.6	0.56
Mangrove forests contribute to sedimentation and soil formation.	87	4.00	5.00	4.7	0.44

Source: Author's research results.

Survey data indicates that the benefits from mangrove forests most recognised and appreciated by Kim Son coastal people are the ability to block waves and protect sea dykes, with an average rating of 5.0 - very important, with high agreement among local residents shown by a standard deviation of 0.22. According to residents, the dyke is better protected from the impact of ocean waves if it is shielded by mangrove forests.

Near the very important rating are the roles of wind protection, limiting soil erosion, and limiting human and economic risks due to storms (4.9), with a standard deviation below 0.5. Next are the roles of improving air quality, regulating water, providing habitat, providing breeding grounds for wild animals and plants, and soil formation, evaluated at levels 4.5-4.7 with standard deviations ranging from 0.44 to 0.88.

The ability to provide food for exploitation is assessed at 4.2, with a standard deviation of 0.84. According to local people, about 50 individuals exploit aquatic products in the mangrove forests manually as a secondary livelihood for these households. Additionally, there are about 72 fishing and trawling boats in coastal estuaries and shallow coastal waters. The contribution from exploited food supply is therefore assessed as slightly above the level of importance.

The ability to filter and improve water is rated at 4.0, and the ability to store and replenish groundwater is rated at 3.5 because many people do not know about this role of mangroves. The role of providing pollen to raise honeybees is rated at 3.5 (less important) because this benefit of mangrove forests only supports a small number (about 10 households) in the Kim Son coastal area.

Rated lowest is the ability to provide wood and firewood from mangrove forests, with an average of 2.7 points, almost unimportant. According to the Kim Son district Statistical Yearbook (2022), the amount of firewood exploited has gradually decreased from 240 ster of firewood in 2018 to 162 ster in 2021 and 130 ster in 2022. However, in reality, protection forests are strictly protected, and people are not allowed to harvest firewood, so this role of mangrove forests is underestimated.

On average, mangrove forests with their many roles and benefits are rated by people at 4.5 (between important and very important) in contributing to local economic development.

3.3. Valuing mangrove forests based on people's willingness to pay

3.3.1. Optional value

To determine the optional value that mangroves bring, the research team assumed the formation of a fund to protect and develop mangroves for current uses. As a result, out of 90 interview participants, 87.8% of people were willing to pay for this fund, with the most chosen WTP being 100,000 VND, with a rate of 8.9%. The amount and WTP for the mangrove protection and development fund for current use are shown in Table 2.

Table 2. The willingness to use mangrove protection and development current funds.

WTP (VND/person/year)	Number of people	Percentage (%)
0	11	12.2
10000	42	46.7
20000	8	8.9
30000	6	6.7
40000	6	6.7
50000	3	3.3
60000	2	2.2
90000	4	4.4
100000	8	8.9
Total	90	100

Source: Survey data in 2023.

Applying equation (1), we calculate the average WTP of coastal people in Kim Son district:

$\overline{wtp}$ = 27,000 VND/person/year

According to the 2022 Statistical Yearbook of Kim Son district, the population of the 3 coastal communes of Kim Son district is: Kim Hai (4,095 people), Kim Trung (4,668 people), and Kim Dong (5,080 people) for a total of 13,843 people [15].

Applying equation (2):

WTP = $\overline{wtp}$ * N

we can calculate the option value in the study area as follows:

WTP_1 = 27,000 * 13,843 = 373,761,000 (VND/year).

3.3.2. Existence value

For residual value, the research team assumed the formation of a fund to preserve and develop mangrove forests for future use. The results recorded that out of 90 interview participants, 76 people (equivalent to 84.4%) were willing to pay for this fund. The most chosen WTP is 10,000 VND, with a rate of 36.7%. The amount and WTP for the mangrove protection and development fund for future use are shown in Table 3.

Table 3. Willingness to use the mangrove protection and development funds in the future.

WTP (VND/person/year)	Number of people	Percentage (%)
0	14	15.6
10000	33	36.7
20000	15	16.7
30000	6	6.7
40000	7	7.8
50000	4	4.4
100000	11	12.2
Total	90	100.0

Source: Survey data in 2023.

Applying equation (1), we calculate the average WTP of coastal people in the Kim Son district:

$\overline{wtp}$ = 26,550 VND/person/year

According to the 2022 Statistical Yearbook of Kim Son district, the population of the 3 coastal communes of Kim Son district is: Kim Hai (4,095 people), Kim Trung (4,668 people), and Kim Dong (5,080 people) for a total of 13,843 people.

Applying equation (2):

WTP = $\overline{wtp}$ * N

We can calculate the option value in the study area as follows:

WTP_2 = 26,550 * 13,843 = 367,531,650 (VND/year).

Thus, the total value of mangrove forests through people's WTP is as follows:

WTP = WTP_1 + WTP_2 = 373,761,000 + 367,531,650 = 741,292,650 (VND/year).

(equal 741 million VND/year)

3.4. The influence of factors on people's willingness to pay

After correlation and regression analysis using SPSS 22.0 software, the results show that people's WTP for two mangrove protection and development funds for the present and future depends on gender (sig coefficient = 0.04<0.05) (Fig. 3). The regression model is defined as follows:

WTP = - 0.319GEN + ε

where GEN is the gender variable and ε is the random element.

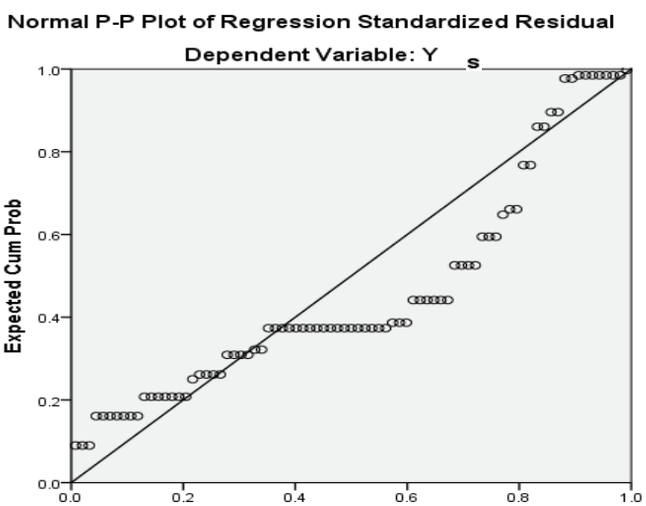

Fig. 3. P-P plot of normal distribution of the dependent variable WTP.

In the research area, people's WTP depends mainly on the gender of the respondent. Women tend to be willing to pay at a lower level than men. Also, related to income, when considering the correlation between the level of WTP for forest environmental services, P.T. Thuy, et al. (2020) [16] found a positive correlation between the payer's income, profit, and WTP to protect

mangrove forests; fishermen with larger boats tend to pay more for forest protection.

Analysing the survey data, the authors obtained a correlation matrix between gender and other factors, as shown in Table 4.

Table 4. Correlation matrix table between gender and other factors.

		Gender	Income	Education	Age
Gender	Pearson correlation	1	-.460**	-.110	.077
	Sig. (2-tailed)		.000	.312	.472
	N	90	89	86	90
Income	Pearson correlation	-.460**	1	.251*	-.196
	Sig. (2-tailed)	.000		.020	.065
	N	89	89	85	89
Education	Pearson correlation	-.110	.251*	1	-.244*
	Sig. (2-tailed)	.312	.020		.024
	N	86	85	86	86
Age	Pearson correlation	.077	-.196	-.244*	1
	Sig. (2-tailed)	.472	.065	.024	
	N	90	89	86	90

According to Table 4, the gender factor is only correlated with the income factor, as the coefficient sig=0.000<0.05. Moreover, Pearson correlation=-0.460 demonstrates that gender is negatively correlated with income, indicating that women have lower income than men. This also explains why women's WTP is lower than men's.

3.5. Discussion

L.A. Kiet (2018) [17] used the CVM method to estimate the value of the nipa palm ecosystem in Binh Phuoc commune, Binh Son district, Quang Ngai province. The author also assumed the formation of two funds to preserve and protect the nipa palm ecosystem, serving current and future uses. The total value willing to pay for nipa palm ecosystem conservation funds is 101,893,230 VND. Thus, it can be seen that the value of Kim Son mangrove forest estimated by the CVM method is higher than the value of the nipa palm ecosystem. The reason is that only 59.62% of people in Binh Phuoc commune are willing to pay for the fund to maintain the nipa ecosystem for current use, and 66.03% of people are willing to pay for the fund to maintain the nipa palm ecosystem for future use, whereas in Kim Son mangrove forest, this number is 87.8% and 84.4%, respectively. Another reason why the value of Kim Son mangrove forest is higher than the nipa ecosystem in Binh Phuoc commune is that Le Anh Kiet calculated only 2,097 households in Binh Phuoc commune would benefit, while with mangrove forests in Kim Son, the authors calculated for 13,843 people in all three coastal communes of Kim Son district.

In fact, wetland ecosystems in general provide many important values for a region, even nationally and internationally, so the number of beneficiaries estimated only in a small widespread area of wetlands is an incomplete count of those willing to pay for the conservation of these ecosystems. T.T.T. Ha (2022) [18], when calculating the WTP for Can Gio mangrove forests, also assumed that many people living outside Can Gio district (for example, people living in other districts of Ho Chi Minh city or people living in the southern coastal area of Vietnam) are willing to pay for the long-term survival of Can Gio mangrove forests. However, that research also calculated the WTP for all households in Can Gio district (18,250 households) and obtained the result that the existence value of the Can Gio mangrove ecosystem is 4.26 billion VND/year.

Another explanation can be considered in T.H. Tuan, et al. (2015) [19]'s study estimating the level of WTP for the economic value of preserving and restoring Thi Nai mangrove forests. When using the non-parametric estimation method to estimate the total economic value of mangrove forests, the total willingness of households at the research site is 14,633,320 VND. If we apply the parameter estimation method, the total WTP for the total number of households in the study area is 15,694,439,000 VND/year, much higher than the WTP for flooded forests, Kim Son saltwater, Can Gio mangrove forest, and Binh Phuoc commune nipa ecosystem. This is consistent with the theory of stochastic pricing since the non-parametric method uses the lower bound of the bids.

Through the above studies, it can be seen that the advantage of the CVM is that it can easily collect the WTP of different individuals for the same environmental goods and services. However, respondents are willing to offer hypothetical payment levels that are not influenced by the rules of the real market, so they can offer very high or very low prices. In addition, during the investigation process, the interviewer's guidance can cause errors in the results. To overcome these disadvantages, it is necessary to select direct beneficiaries of these goods. Moreover, the interviewer needs to be objective and use testing and filtering questions to evaluate the appropriateness of the answer.

Finally, although this study uses a convenience sampling method, there is a focus on the main beneficiaries of mangrove forests. In addition, during the investigation process, the authors always try to diversify interview subjects in terms of age, gender, income, and education level to ensure representativeness of the research area. However, it cannot be denied that expanding the investigation with a larger sample size will help make the research results more reliable.

4. Conclusions

The CVM is used to evaluate goods and environmental quality by building a virtual market through people's WTP or WTA posed in a hypothetical situation. CVM is applied to many environmental factors such as air quality, landscape value, and wildlife conservation. The study uses the CVM combined with sociological surveys to examine local people's assessments of the role and benefits of mangrove forests in local economic development. According to the people's assessment, the most important benefits of Kim Son mangrove forests include the ability to block waves, protect sea dykes, block wind, limit soil erosion, limit human and economic risks caused by storms, improve air quality, regulate water, provide habitat, provide breeding grounds for wildlife, contribute to soil formation, provide food for exploitation, filter water, and improve water storage capacity and groundwater replenishment of mangrove forests. However, many people do not know about the role of mangrove forests. Mangrove ecosystem services that contribute little include providing pollen to raise honeybees and providing firewood.

Through two mangrove protection funds for current and future purposes, the study determines the optional values and residual values of mangrove forests. The total value of mangrove forests through people's WTP reached 741 million VND/year, and the factor affecting WTP depends mainly on the gender of the respondent. In the research area, people's WTP depends mainly on the gender of the respondent. Women tend to be willing to pay at a lower level than men. This can be explained by the fact that women's income is lower than men's income (according to the survey results), while women often manage expenses, thus creating a cautious mentality in public service contributions.

CRediT author statement

Ha Thi Thu Nguyen: Conceptualisation, Methodology, Data collection, Data analysis, Writing, Validation; Anh The Luu: Data collection, Methodology, Writing; Thu Tuyet Thi Tran: Data collection, Writing.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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The registration of non-traditional trademarks from a British perspective

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Abstract:

One of the main goals of the registration process is to specify which signs are protected in which commercial domains. This reduces the likelihood of disputes and provides trademark owners with greater certainty [1]. **With the continuous development of marketing tactics, unique scents, shapes, colours, and even smells associated with products are increasingly used in marketing campaigns to distinctively represent products. This reality has sparked many debates on what could be considered a trademark and the development path for the registration system. From a doctrinal viewpoint in the United Kingdom (UK), this paper delves into the issues facing different types of non-traditional marks, including smell marks, sound marks, colour marks, and taste marks, by examining the relevant legal provisions and related cases for each type of mark. In conclusion, although the allowances for the registration of such trademarks can be problematic, mainly due to the requirements for representation and distinctiveness, there is hope that non-traditional marks could be accepted in the near future. This is due to contemporary developments in methods of representation, such as the internationally recognised Pantone colour system, and recent changes to the representation requirement brought about by the EU Directive 2015/2436.**

Keywords: **distinctiveness, intellectual property, non-traditional trademarks, representation methods, United Kingdom perspective.**

Classification numbers: **2.2, 5.2, 6**

1. One aim for the registration of trademarks is to ensure that the authorities, competitors and the public know what is being claimed as a mark

It should come as no surprise that the main goal of the registration process is to specify which signs are protected and in which commercial domains. This not only verifies what is being claimed as a mark but also fosters consumer confidence and prevents confusion by removing any doubt regarding the origin of goods sold under a trademark [2].

With the rapid development of marketing tactics and the persistent need for companies to continually advance the quality of their products, businesses today do not rely solely on traditional types of trademarks like fanciful, suggestive, or descriptive trademarks for the identification of their products and services. Nowadays, unique characteristics associated with products are increasingly used in marketing campaigns and sales to distinctively represent products, setting them apart from competitors. To some, the need for using non-traditional trademarks arises because market-savvy companies want to design and advertise their products in a manner that appeals to the consumer's aesthetic sense [2]. In a future legal system where non-traditional trademarks are registrable and widely accepted, is it still true that the aim of trademark registration is to ensure society knows what is being claimed as a mark?

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In response, yes, the registration of non-traditional trademarks is consistent with this aim of trademark registration in general. However, this is not entirely true, as the allowances for the registration of such trademarks can be problematic, particularly concerning the requirements of representation and distinctiveness. For some non-traditional trademarks, like taste and odour marks, it is nearly impossible to find a representation that can accurately and completely capture the full experience of the marks for the majority of the public, even with the changes to the representation requirement brought about by the EU Directive 2015/2436, as each person's experience with these kinds of marks is subjective in nature. Discussion regarding this legal instrument will be addressed below.

Certain non-traditional marks, like colour or sound, might not be as obvious or immediately recognisable. This could make it difficult to notify other parties about the precise elements being claimed in a clear and noticeable way. For instance, in a case involving an attempt to register the use of the colours blue and yellow together on packaging[1]. The Court of Justice of the European Union ruled that although a colour might be a sign, it is not always so; in many cases, colour is just an attribute or feature of an object. According to the Court, an applicant for a colour mark must demonstrate that the colour in question is regarded as a "sign" by consumers, to prevent trademark law from being used by one trader to gain an unfair advantage over competitors. The approval for the registration of colour trademarks is likely to provoke debates over fairness, as colours, especially basic ones, are limited, and the number of companies using colours to identify their products or services is limitless, as this occurs in almost every existing company today in Europe and worldwide. The matter can be more serious as trademark protection can be renewed every ten years; in other words, protection can last indefinitely. Some may argue that with the internationally recognised Pantone colour system, which consists of 2,161 colours, the number of combinations that could be derived from them would be almost indefinite. However, even though the colour system offers many colours, the author must consider that not all are recognisable as different to the average consumer.

Furthermore, if a non-traditional mark deviates from accepted verbal or visual representations, it might require more effort to prove its distinctiveness. More thorough evidence, such as customer surveys, may be needed to establish and preserve the uniqueness of non-traditional marks and demonstrate the connection between the mark and the providers of goods or services.

2. What are non-traditional trademarks?

Previously, under the EU Trade Mark Regulations 2009, a sign had to be capable of being presented graphically, and it had to be clear, precise, self-contained, easily accessible, intelligible, durable, objective, distinctive, and not deprive the trade or the public of signs that the directive or regulation implies should be free to all[2]. In 2015, the introduction of Directive (EU) 2015/2436 removed the requirement for graphical representation, allowing for 'non-traditional' marks such as sound marks, three-dimensional shapes, or colours to be more easily registered. The requirement of being 'graphically presentable' was replaced with broader wording, permitting signs to be registered "in any appropriate form using generally available technology".

[1]Heidelberger Bauchemie (Case C-49/02) (2004), ECR I-6152.

[2]Council Regulation (EC) No. 40/94 of 20 December 1993 on the Community Trade Mark [1993] OJ L 11/1.

Paragraph 10 of the Directive nonetheless retains requirements on precision by stating that the representation "must be clear, precise, self-contained, easily accessible, intelligible, durable and objective".

In the UK, the Trade Marks Act 1994 liberalised the definition of marks, opening the floodgates for non-traditional marks to be considered for registration, such as sounds, shapes, colours, holograms, and gestures [1]. Since graphical representation was more problematic, the requirement has shifted to 'represented in a manner which enables the registrar and other competent authorities and the public to determine the clear and precise subject matter of the protection afforded to the proprietor', in harmonisation with Directive 2015/2436.

Specifically, the UK Trade Marks Act (as amended) in section 1(1) defines trademarks as 'Any sign which is capable: (a) of being represented in the register in a manner which enables the registrar and other competent authorities and the public to determine the clear and precise subject matter of the protection afforded to the proprietor, and (b) of distinguishing goods or services of one undertaking from those of other undertakings. With the wording of section 1, Trade Mark Act 1994 (as amended), non-traditional trademarks can include an endless list of any signs that fit into the prescription of section 1. However, sound, colours, odours, shapes, and taste marks stand out as the most common types of trademarks referred to [2].

3. The registration of trademarks and the Sieckmann criteria

The issue of trademark registrability is not new; throughout Europe, scholarly publications from the 19th century have consistently discussed whether single colours and three-dimensional shapes should be protected as trademarks. Court rulings pertaining to three-dimensional shapes and the colour blue on envelopes date back to the same period in European history [3].

In the history of the formation of international Intellectual Property treaties, a clear definition of trademarks is also absent. During the debate following the adoption of the Paris Convention, the parties were unable to reach a consensus on the definition of a trademark. Additionally, the International Association for the Protection of Intellectual Property concluded in 1957 that it was not appropriate to include a definition of trademarks in the Union convention given the circumstances at the time, in response to the Congress of Washington's discussion revising the Paris Convention. This was not the first time the subject had been considered, as it had also been on the agenda for the 1952 Vienna summit. Even for the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 1994, the provision of Article 15(1) is broad regarding the nature of signs that can constitute a trademark[3] [3].

Given such circumstances, it is fair to say that even though non-traditional trademarks such as sound, odour, or colour marks have never been officially accepted by any jurisdictions, there is room for them in the legal systems of the world. To be legally regarded as a trademark, the subjects only need to satisfy the requirements that could constitute a mark in general.

In England today, according to section 32 of the Trade Mark Act 1994, an application for a trademark must contain:

[3]TRIPS: Agreement on Trade-Related Aspects of Intellectual Property Rights 1994, Art 15(1).

(1) A request for registration, including the name and address of the applicant;

(2) A statement of the goods or services for which the mark is to be registered;

(3) A representation of the mark 1994;

(4) A declaration that the mark is being used or that there is a bona fide intention to use the mark.

To obtain a filing date, requirements (1) through (3) must be met, which means that an adequate representation of the mark is required. This demonstrates that the idea of "representative registration" serves as the foundation for the trademark system [4].

In the well-known case regarding 'representation' of *Sieckmann*[4], what was then 'graphical representations', was required to be 'clear, precise, self-contained, easily accessible, intelligible, durable, and objective', this is also only referred to as the 'Sieckmann criteria'.

Nowadays, while 'graphical' is no longer the only mode of representation, the Sieckmann criteria were incorporated into the Directive 2015/2436 and continue to be relevant when assessing other modes of representation [1].

3.1. Smell marks

On the *Sieckmann*[5] case, the European Court of Justice (ECJ), while examining whether a 'balsamically fruity smell with a slight hint of cinnamon' was registrable, concluded that, at the time in 2002, odours could not be represented graphically in accordance with legal requirements, and thus could not be considered trademarks under Article 2. The ECJ also expressed scepticism about the accuracy of the description provided in identifying the smell's unique characteristics. It also stated that a chemical formula or the deposit of a sample would frequently not be sufficient for registration, nor would a simple description of the smell.

A basic question that arises when discussing cases involving odour marks is whether a certain smell is consistently the same at all times and if an average person can distinguish between the differences in smell under varying circumstances. Natural elements such as wind, humidity, and temperature can all contribute to increasing or decreasing a scent's potency. In the case of *Dyson Ltd v. Registrar of Trade Marks*[6], the Court's reasoning suggests that subject matter will not constitute a sign when it is (i) an impermissible abstraction, as a mental concept capable of manifesting in different ways; and (ii) the concept has a purpose (in this case, technical) such that recognising exclusive rights through trademark law will bestow an unfair competitive advantage upon the applicant. It is evident that the first of these rationales overlaps with the *Sieckmann* representation requirements, emphasising clarity and precision[7].

However, the argument that all sensory perceptions are subjective, including sound, taste, and colour, is rather arbitrary, as the statement itself is subjective in nature. This presses the inquiry of how far apart individuals can experience the outer world and what is the universal way to describe a certain subjective feeling. Thus, for all practical purposes, it is almost impossible to register olfactory marks in Europe as of now until further advances are made in technology to graphically represent smells.

[4]Ralf Sieckmann v. Deutsches Patent-und Markenamt (Case C-273/00) (2002), ECR I-11754, EUR-Lex - 62000CJ0273 - EN - EUR-Lex (europa.eu).

[5]Ralf Sieckmann v. Deutsches Patent-und Markenamt (Case C-273/00) (2002), ECR I-11754, EUR-Lex - 62000CJ0273 - EN - EUR-Lex (europa.eu).

[6]Dyson Ltd v. Registrar of Trade Marks (Case C-321/03) (2007), EUR-Lex - 62003CJ0321 - EN - EUR-Lex (europa.eu).

[7]Ibid; Trade Marks Act 1994, s 1(1)(a).

Considering that most scents are not separate chemical compounds but mixtures that are so complex, accurate analysis of their components is not only very expensive but also hardly possible at the current level of scientific development.

Generally speaking, the ability to analyse human tastes stops at sour, spicy, salty, and sweet. In special cases, such as when the taste of MSG, which is used as a flavour enhancer through a combination of sour, spicy, salty, sweet, and smells of various food sources, is considered, it would be incredibly difficult to determine whether such marks are registrable. Further, proving that consumers perceive a particular scent as a source-indicating trademark rather than merely an appealing feature of the goods or services is a difficult task [5].

In the case of *R v John Lewis*[8], the UK Court refused an application for 'the smell, aroma or essence of cinnamon' as a trademark for furniture, as the verbal description of a smell was not enough to make a graphical representation. However, the case might have been different if this had been done with reference to certain standards.

Thanks to the liberalisation of the law, starting from 2015, regarding the way trademarks are to be represented, the door of possibility has been opened, though not fully, for more odour marks to be considered registrable in the future.

In the long history of the trademark registration system, successful cases of odour trademarks are very limited in number. Only two cases have been recorded in the UK [6], regarding a 'strong smell of bitter beer applied to flights for darts' and 'a floral fragrance that is reminiscent of roses applied to road vehicle tyres'. In the EU, the 'smell of fresh cut grass' for tennis balls [7] has been a trademark.

Internationally, neither TRIPS nor EC Directives address protection for scent marks. Some countries like Australia, France, and Germany do not prevent such kinds of registration, leaving the options open. However, in other jurisdictions like Mexico, South Korea, Brazil, Japan, India, etc., scent marks are neither registrable nor have the courts considered protection of scent marks under the intellectual property rights regime [8]. This can pose many challenges for businesses seeking international protection for their odour trademarks.

3.2. Sound marks

Sound marks can be considered to be composed of unique sounds, for example a piece of classical music, and common sounds, such as a cockcrow.

Before the liberalisation of the law, in the *Shield Mark*[9] case in 2003, the ECJ determined that while sound marks could be registered, they needed to meet certain requirements, including graphical representation and distinctiveness. It stated that musical notation, onomatopoeia, and written descriptions of sounds were insufficient. However, in this particular case, the Court did not specify suitable modes of representation for the sound of a cockcrow or any other sound, leaving it to nations to determine their specific requirements. Whatever the form of representation, the Court made it clear that it must be objective, self-contained, comprehensible, clear, durable, and easily accessible.

According to the EUIPO guidelines in part B [9], section 2, chapter 9(3)(7), a sound mark is defined as a trademark consisting exclusively of a sound or combination of sounds. Therefore, trademarks

[8]R v John Lewis (1857), 169 E.R. 1026, R v John Lewis - Case Law - VLEX 805636977.

[9]Shield Mark BV v Joost Kist (Case C-283/01) (1857), CURIA - List of results (europa.eu).

combining sounds with, for example, movement do not qualify as sound marks per se and should be applied for as multimedia marks. A sound mark must be represented by submitting either an audio file reproducing the sound or an accurate representation of the sound in musical notation. The audio file must be in MP3 format and its size cannot exceed two megabytes. Office requirements do not allow the sound to stream or loop. Audio files are currently not considered acceptable mark representations under the International Trademarks System, or the Madrid System. Musical notations may be submitted in one single JPEG file or on one single A4 sheet. 'Accurate musical notation' means that the representation must include all the elements necessary for interpreting the melody, that is to say, pitch, tempo, lyrics (if any), etc.

The 1994 UK Trade Marks Act in Section 103(2) does not expressly list sound marks as registrable trademarks or exclude them as non-registrable. The existence of sound marks is made possible because the Act permits a trademark to be represented in ways other than through graphical representation. Thus, the burden of proof to establish the registrability of a specific sound mark rests fully with the applicant.

3.3. Colour marks

It is not problematic to recognise a combination of colours as marks because it has been clearly acknowledged as unique on its own in legislations and cases[10]. The subject matter is however still exclusively limited and debatable to cases involving the use of a single colour.

In the *Libertel* case[11], the ECJ discussed this matter. Even though the Court rejected the deposition of a single sample of a colour, it did state that in some situations, a verbal description might be sufficient. For the first time, the Pantone code, as an internationally recognised colour identification system, was acknowledged by the Court in this case.

Furthermore, a requirement for prior use emerged since the Court established the requirement of distinctiveness for colour marks. It follows that three criteria must be met for a colour to qualify as a trademark: functionality, source indication, and distinctiveness [5].

3.4. Taste marks

In comparison, regarding the experiences that one might have on the mark, taste marks are rather similar to odour marks. It could be said, in many cases, the tastes of edibles are concentrated experiences of smelling their odours. In other words, to a certain degree, taste marks belong to another form of marks, a more concentrated form of odour marks.

Functionality is a significant barrier to the enforcement of flavour marks because it must be accessible to all competitors. Because various manufacturers use the same flavours frequently, they may also be considered generic. Only flavours that are greatly unusual, like peanut butter or caramel added to a toothbrush, would be more likely to be protected than doing the same thing for food such as cookies or bread [5]. In *Eli Lilly's*[12] case, the Board discussed and ultimately came to no decision regarding the representation of taste marks.

[10]Smith Kline and French Laboratories Ltd v Sterling Winthrop Group (1975), 2 All E R 578, Smith, Kline & French v. Sterling Winthrop, 1975.

[11]Libertel Groep BV v Benelux-Merkenbureau (Case C-104/01) (2003), ECR I-3822, CURIA - List of results (europa.eu).

[12]Eli Lilly and Company v Actavis UK Limited and others (2017), UKSC 48, https://www.supremecourt.uk/cases/uksc-2015-0181.html.

According to the EUIPO guidelines [9] in part B, section 4, chapter 2(9)(3), it is currently not possible to represent a taste in compliance with Article 4 EUTMR[13] as Article 3(9) EUTMIR[14] specifically excludes the filing of samples and the subject matter of protection cannot be determined with clarity and precision with generally available technology.

There have been arguments that technological developments regarding representative methods of taste, such as taste profiles and spider diagrams [10], which allow flavours to be presented more objectively and precisely, have paved the way for a future where taste trademarks are a reality.

4. Recommendations for Vietnam

Through discussions and examinations of relevant legal provisions on the issues facing different types of non-traditional marks, including smell marks, sound marks, colour marks, and taste, the Author has found that there is significant potential for Vietnamese IP Law to reference and develop.

With the abolishment of the requirement for graphical representation, the law could take the next step in recognising non-traditional trademarks, even though such recognition could prove problematic, even in the UK and Europe. Nevertheless, the issue for Vietnamese IP Law does not lie in whether non-traditional marks are legally recognised, but rather whether non-traditional marks and modes of recognition for them are being researched. In other words, it is the pace of legal research that should be examined, as applicable research on this topic in Vietnam is currently rather scarce.

It is arguable that the recognition of non-traditional trademarks would increase the level of protection for trademarks, potentially negatively impacting the economy of Vietnam, as overprotection for IP could harm developing nations. However, it is the alterations of Vietnamese law that are under discussion, not those of more developed foreign Western nations. Hence, apart from increasing the level of protection for Vietnamese products, which is greatly beneficial for the Vietnamese economy, such alterations that could bring us closer to the recognition of non-traditional trademarks would not restrict the free use of foreign trademarks by Vietnamese companies. Therefore, if this cutting-edge issue of trademarks could be further explored, provided that research papers propose more practical solutions, such research could prove to bring Vietnam more benefits than drawbacks.

5. Conclusions

In conclusion, it is appropriate to consider that the primary aim of the registration system is to notify society of what is being claimed as a trademark. This aim can be true, but perhaps not absolute, for the registration of non-traditional trademarks, as it could prove problematic concerning the requirement of representation and distinctiveness.

Internationally, the world is on the path of opening up to the registration of non-traditional trademarks, as the only international agreement which directly excluded the protection of non-traditional trademarks is the Trademark Law Treaty 1994. As indicated in Article (2)(1)(b): “This Treaty shall not apply to hologram marks and to marks not consisting of visible signs, in particular, sound marks and olfactory marks”.

In the UK and the EU, thanks to the introduction of the Directive (EU) 2015/2436, the greatest hindrance to the application of non-traditional

[13]Council Regulation (EC) No 207/2009 of 26 February 2009, Art 4.

[14]Commission Implementing Regulation (EU) 2018/626 of 5 March 2018, Art 3(9).

trademarks, namely the requirement of graphical representation, was removed. Even though the floodgate is still not entirely open, and there are still numerous challenges facing the registration of non-traditional trademarks, it is fairly safe to expect that there will be more non-traditional marks entering the market and being recognised as registrable trademarks in the UK and the EU. The European Courts have adopted a strict test for trademark representation, despite attempts to broaden the scope of trademark types. This is due to the *Sieckmann*[15] approach. Although this is very helpful in preventing disputes regarding the registrability of non-traditional trademarks, it may exclude cases where the expansion of the consumer base and business competition utilises such marks [11].

COMPETING INTERESTS

The author declares that there is no conflict of interest regarding the publication of this article.

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The current practices of utilising forms, methods, and assessment strategies for self-study learning activities among students at Can Tho University

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Abstract:

Self-study is a crucial component of higher education, playing a significant role in enhancing students' academic success and lifelong learning abilities. This study examines the current practices of self-study at Can Tho University, focusing on forms, methods, and assessment strategies. A mixed-methods approach was adopted, involving 919 participants, including administrators, lecturers, and students. Quantitative data were analysed using SPSS, while qualitative insights were extracted through thematic coding. The findings reveal that self-study with direct guidance from lecturers is considered the most effective, emphasising the critical role of timely instructor support in improving learning outcomes. Interactive methods, such as group discussions and online exploration, were highly rated by students, while autonomous methods like mind mapping posed challenges due to insufficient self-management skills. Differences in perceptions between students and lecturers regarding the effectiveness of self-study methods and assessment strategies were also noted, particularly in the preference for flexible forms and prompt feedback. These results highlight the need for enhanced guidance, improved assessment systems, and tailored support tools to foster effective self-study habits. This study provides valuable insights into optimising self-study practices and improving the quality of higher education in Vietnam.

Keywords: **evaluation and assessment, form, method, self-study, students.**

Classification numbers: **3.1, 3.2**

1. Introduction

Self-study is a crucial component of higher education, significantly influencing students' academic performance and lifelong learning abilities [1]. Diverse self-study methods and effective assessment techniques play a key role in developing students' independent learning skills [2]. However, many universities face challenges in implementing effective self-study methods, leading to inconsistent academic outcomes [3, 4]. Understanding the specific challenges and successes at Can Tho University is essential for developing appropriate measures to enhance educational quality and student autonomy.

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In previous studies on self-study, most of the studies focused on developed countries, where cultural factors, educational policies and available resources are very different from those in Vietnam [1, 2]. This study aims to fill this gap by exploring the forms and methods of self-study at Can Tho University, a unique educational environment, thereby contributing to improving the quality of higher education in the Vietnamese context.

This study conducted a comprehensive survey involving administrators, lecturers, and students, aiming to provide a detailed analysis of the current situation and the impact of self-study activities on students' academic performance. These findings will offer valuable insights to improve self-study activities and contribute to the broader discourse on fostering self-directed learning in higher education.

2. Literature review

2.1. Forms of self-study

Self-study is a crucial aspect of the educational process, helping students develop autonomy, critical thinking, and problem-solving skills. The forms of self-study can be classified into three main types: self-study with instructor guidance, self-study with remote instructor guidance, and self-study without instructor guidance [5].

Self-study with instructor guidance: This form involves students receiving direct support from lecturers or academic advisors and usually takes place in traditional classrooms or small group discussions. The guidance from instructors helps students grasp knowledge, clarify doubts, and receive timely feedback [2].

Self-study with remote instructor guidance: In this form, students receive support from instructors through various media such as email, video calls, or online learning platforms. If implemented correctly, self-study with remote instructor guidance can be as effective as traditional learning. The flexibility in time and space is a significant advantage of this form, allowing students to be more proactive in managing their time and study plans [6]. However, this form requires students to have strong self-management and discipline skills.

Self-study without instructor guidance: In this form, students are entirely responsible for their learning process without direct support from instructors. They must find resources, plan their study schedules, and self-assess their learning outcomes. According to D.P. Lan (2021) [7], self-study without instructor guidance helps students develop autonomy, self-management, and lifelong learning skills. However, this form also presents many challenges, particularly for students who lack experience or self-management skills.

Each form of self-study has its own advantages and challenges. A flexible combination of these forms can create an effective learning environment suited to different student groups [8]. The choice of an appropriate self-study form depends not only on the nature of the subject but also on the individual characteristics and actual conditions of the students.

2.2. Self-study methods

Self-study methods are a key element in higher education, helping students develop autonomy, critical thinking, and problem-solving skills [9]. Self-study is not limited to reading books or completing assignments but also includes searching for information, analysing data, and applying knowledge in practice [10]. Self-directed learners need to evaluate information from various sources, make judgments based on evidence and logical reasoning, and be ready to adjust their viewpoints when new evidence emerges [11].

Self-study methods are crucial in helping students develop autonomy, critical thinking, and problem-solving skills [12]. Self-study not only enables students to master knowledge but also to cultivate essential skills for academic and life success. Combining self-assessment with support from lecturers creates a comprehensive and effective learning system.

2.3. Evaluation and assessment of students' self-study activities

The evaluation and assessment of students' self-study activities are crucial in higher education, helping to determine the effectiveness of learning methods and ensuring that students develop the necessary self-study skills for academic and career success [13, 14]. This evaluation encompasses two main aspects: self-assessment by students and assessment by lecturers.

Self-assessment: Self-assessment involves students' self-awareness, self-analysis, and self-judgment about their learning processes [15]. This is an indispensable part of developing self-study skills, allowing students to adjust and improve their learning methods.

Lecturer assessment: Lecturer assessment involves instructors using various methods and tools to evaluate students' self-study activities. This process ensures that students achieve their learning objectives and develop self-study skills. According to Y. Kainarbayev, et al. (2024) [15]'s research, the assessment of students' self-study activities must ensure transparency, fairness, and a close connection to learning objectives. This allows lecturers not only to evaluate students' progress but also to identify areas for improvement in teaching methods and student support [14].

The evaluation and assessment of students' self-study activities are complex but necessary processes to ensure students' development in the right direction. Self-assessment helps students become aware of and improve their learning methods, while lecturer assessment ensures that students achieve their learning objectives and develop self-study skills. The combination of self-assessment and lecturer assessment creates a comprehensive and effective evaluation system.

Although previous studies have discussed various self-study methods, few have evaluated the differences in perceptions between lecturers and students regarding these methods. This gap leads to the formation of the key research questions for this study, which include:

Question 1: *Which forms, methods, and assessment strategies for self-directed learning are perceived as most effective by students and lecturers at Can Tho University?*

Question 2: *Are there significant differences between the perceptions of students and lecturers regarding the effectiveness of self-study methods?*

Question 3: *How can the effectiveness of self-study methods be improved in the context of higher education at Can Tho University?*

3. Research methodology

The study surveyed administrators, lecturers, and students from 10 training units and 5 functional departments related to self-study activities. After the survey period, a total of 919 responses were collected, including 39 from administrators at various schools, faculty, and department levels, 73 from lecturers, and 807 from students. Specific information about the research subjects is shown in Tables 1-4.

Table 1. Number of survey respondents at Can Tho University units.

No.	Unit surveyed	Management and lecturers	%	Students	%
1	College of Engineering	15	13.4	185	22.9
2	College of Information and Communication Technology	15	13.4	78	9.7
3	College of Aquaculture & Fisheries	10	8.9	48	5.9
4	College of Natural Sciences	6	5.4	70	8.7
5	College of Environment & Natural Resources	13	11.6	59	7.3
6	College of Agriculture	9	8.0	114	14.1
7	School of Social Sciences and Humanities	5	4.5	46	5.7
8	School of Political Science	5	4.5	50	6.2
9	College of Economics	8	7.1	102	12.6
10	College of Education	10	8.9	55	6.8
11	Department of Student Assistance	3	2.7	-	-
12	Department of Academic Affairs	3	2.7	-	-
13	Learning Resource Center	5	4.5	-	-
14	Center for Students Consultance, Assistance and Start-up	2	1.8	-	-
15	Department of Scientific Research Affairs	3	2.7	-	-
Total		**112**	**100.0**	**807**	**100**

Table 2. Statistics on management staff information.

Survey information	Category	Number	Percentage (%)
Gender	Male	24	54.2
	Female	15	45.8
Years of experience in management	Less than 5 years	2	3.4
	5 to 10 years	17	45.8
	Over 10 years	20	50.9
Academic qualification	Master's Degree	18	46.2
	Doctoral Degree	14	35.9
	Associate Professor	7	17.9

Table 3. Statistics on lecturer information.

Survey information	Category	Number	Percentage (%)
Gender	Male	46	63
	Female	27	37
Years of teaching experience	Less than 5 years	7	11.3
	5 to 10 years	19	26.4
	Over 10 years	47	62.3
Academic qualification	Master's degree	43	58.9
	Doctoral degree	25	34.2
	Associate Professor	5	6.9

Table 4. Statistics on student information.

Survey information	Category	Number	Percentage (%)
Gender	Male	438	54.3
	Female	369	45.7
Student year	1st Year	206	25.6
	2nd Year	280	34.7
	3rd Year	167	20.7
	4th Year	143	17.7
	5th Year	11	1.4
Accumulated results	Excellent	82	10.8
	Very good	276	35.5
	Good	355	40.0
	Average	94	14.3

This study employs a mixed-methods approach, incorporating both quantitative and qualitative methods to gain a comprehensive understanding of self-study practices at Can Tho University. This research design leverages the strengths of both approaches, allowing for the collection of broad quantitative data from a large number of participants, while also delving into personal insights and experiences through open-ended questions.

3.1. Quantitative method

A survey using a 5-point Likert scale was employed to assess factors related to self-study methods, forms, and the effectiveness of self-directed learning activities. The quantitative data provides insights into the prevalence and perceived effectiveness of these methods from the perspectives of different respondent groups, including students, lecturers, and management staff.

3.2. Qualitative method

Open-ended questions were used to gather deeper opinions, perspectives, and feedback from students and lecturers regarding the challenges and opportunities associated with self-study. The qualitative data was analysed using thematic coding to identify key themes related to both the difficulties and successes encountered during the self-study process.

This mixed-methods approach ensures that both the breadth of quantitative data and the depth of qualitative insights are captured, leading to a well-rounded understanding of self-study practices.

A survey using a 5-point Likert scale was utilised to assess the effectiveness as perceived by administrators, lecturers, and students regarding the use of methods, forms, and techniques for evaluating self-study activities at Can Tho University. The scale was defined as follows: 1.00-1.80 = Completely ineffective; 1.81-2.60 = Ineffective; 2.61-3.40 = Average; 3.41-4.20 = Quite effective; 4.21-5.00 = Very effective.

SPSS software version 20.0 was used to encode and process the data, employing calculations of means and standard deviations. The reliability of the Cronbach's alpha coefficient was tested, with a target of 0.8 or higher.

4. Results and discussion

4.1. Current status of self-study forms by students at Can Tho University

The results from Table 5 show that, for self-study forms with direct guidance from lecturers, paying attention to lectures received the highest

Table 5. Evaluation of the use of self-study forms by management staff, lecturers, and students at Can Tho University.

No.	Method	Average score by students	Average score by management staff and lecturers	Overall average	Standard deviation	Rank
	Self-study with direct guidance from the teacher					
1	Paying attention in class	3.89	3.78	3.84	0.749	1
2	Taking notes during lectures	3.93	3.63	3.78	0.764	2
3	Participating in class discussions	3.86	3.63	3.75	0.793	3
	Self-study with remote guidance					
4	Reviewing class notes	3.83	3.59	3.71	0.751	5
5	Completing homework assignments given by the teacher	3.86	3.57	3.72	0.792	4
6	Self-study through scientific research	3.78	3.54	3.66	0.836	6
	Self-study without teacher's guidance					
7	Studying according to personal interest	3.84	3.43	3.64	0.815	7
8	Studying related to academic tasks	3.81	3.38	3.60	0.778	8
	Overall average	**3.79**	**3.54**	**3.71**	**0.784**	

rating with an average score of 3.84 and the lowest standard deviation (0.749), indicating consistency in perception between students and teaching staff. Note-taking during lectures ranked second with an average score of 3.78. This form also shows a relatively low standard deviation (0.764), indicating widespread acceptance. The presence of lecturers and direct interaction creates a supportive learning environment where students receive immediate feedback and explanations. This consistency may stem from students feeling more assured and confident with the lecturers' guidance during their studies.

For self-study forms with remote guidance from lecturers, self-study through lecture notes received an average score of 3.71, indicating that students use this form, but slightly less than those with direct guidance. Self-study of assigned exercises had an average score of 3.72, showing a higher preference compared to self-study of lecture notes. Self-study through scientific research received an average score of 3.66, evaluated as less utilised, possibly due to the high standard deviation (0.836) reflecting diverse opinions from management staff, lecturers, and students.

For self-study forms without lecturer guidance, self-study related to academic tasks received the lowest average score of 3.60 among all forms, falling into the 'average' category according to the Likert scale., with a standard deviation of 0.778, indicating that students pay less attention to this form. The lower average scores indicate that these forms are considered less utilised compared to those with direct guidance from lecturers. The lack of specific guidance and immediate feedback may pose difficulties for students in self-regulating their studies, potentially leading to confusion or loss of motivation. Qualitative research reveals that many students face challenges in time management and organising study materials when there is no direct support from instructors. Some students reported that this method often leads to a loss of motivation and lacks interaction, which makes it difficult to address questions in a timely manner.

The results of the study indicate that lecturers and students have differing evaluations regarding the effectiveness of self-study forms. Students rated self-study with direct guidance from lecturers higher than lecturers did. The reason is because:

- Different expectations: Students may have higher expectations for support and guidance from lecturers to feel confident in their learning. In contrast, lecturers might assume that students are sufficiently equipped with knowledge and skills to learn effectively without continuous guidance.

- Familiarity with the learning environment: Students at Can Tho University are often accustomed to a structured educational model, where lecturer support is essential, leading them to value guided self-study forms more than those without guidance.

The study results show that self-study with direct guidance from lecturers was rated the most effective by both students and lecturers at Can Tho University. This finding is consistent with Babu's conclusion, who indicated that direct support and timely feedback from lecturers help students deepen their understanding of learning content and achieve better learning outcomes in self-directed learning environments [2].

However, this study extends previous findings by revealing that students at Can Tho University are more dependent on direct guidance compared to findings from international studies. For example,

Hauge's research shows that students in developed countries can engage in self-study effectively without much support from lecturers. This reflects the differences in educational culture, where Vietnamese students are more accustomed to structured learning environments with regular guidance from lecturers [1].

To improve the effectiveness of self-study forms without lecturer guidance, Can Tho University should provide additional structural support tools such as detailed guides, reference materials, and online and offline consultation sessions. Courses on self-study skills and time management could also help students develop self-study skills and become more confident when there is no direct guidance from lecturers.

4.2. Current status of assessing self-study methods by students at Can Tho University

The results from Table 6 show that highly interactive self-study methods, such as group discussions and online exploration, were rated highly by students, with average scores of 3.68 and 3.68, respectively, falling into the 'quite effective' category on the Likert scale. These methods displayed strong agreement between students and lecturers, particularly group discussions, which had the lowest standard deviation (0.825). This indicates that group discussions are a widely adopted and highly regarded self-study method for practical learning.

Conversely, the method of mind mapping received the lowest average score (3.45), categorised as 'average,' with the highest standard deviation (0.900). This suggests significant variability in perceptions among respondents, likely due to the fact that mind mapping requires more independent thinking skills, which many students may not yet have fully developed.

Qualitative research provides additional insights into the self-study methods evaluated in Table 6.

Specifically, open-ended interviews reveal that students highly value interactive self-study methods, such as group discussions and online exploration, as these not only help them grasp knowledge but also develop communication and teamwork skills. One student shared:

"Group discussions help me gain a deeper understanding of the subject matter and learn from

Table 6. Evaluation of self-study methods by management staff, lecturers, and students at Can Tho University.

No.	Method	Average score by students	Average score by management staff and lecturers	Overall average	Standard deviation	Rank
1	Self-study through information search	3.66	3.67	3.67	0.829	3
2	Self-study through group discussions	3.65	3.71	3.68	0.825	1
3	Self-study by solving problems	3.60	3.49	3.55	0.795	4
4	Self-study through online exploration	3.60	3.75	3.68	0.847	2
5	Self-study using mind maps	3.67	3.23	3.45	0.900	5
	Overall average	**3.64**	**3.57**	**3.60**	**0.839**	

my peers' perspectives, while online exploration offers a wealth of information from diverse sources."

However, when discussing mind mapping, many students expressed difficulties in organising and structuring information effectively due to a lack of analytical and systematisation skills. Another student explained:

"Mind mapping can be useful, but I struggle to create clear and logical maps on my own. I think I would do better with more guidance or examples from instructors".

Regarding self-study methods, lecturers tend to rate traditional methods higher, while students prefer interactive learning methods, such as group discussions and online searches. The reason originates from:

- Differences in educational perspectives: Lecturers may prioritise methods that have been proven effective in delivering knowledge, while students might feel that these methods do not meet their learning needs. Students could find that interactive methods enhance their engagement and practical application of knowledge.

- Practical experience: Lecturers might evaluate based on their teaching experience and methods they have observed to be effective in the past, whereas students are seeking learning forms that better align with their learning styles, creating a discrepancy in evaluation.

The study reveals that group discussions and online information searches are highly rated by students as effective self-study methods. This aligns with the findings of J. Yang, et al. (2022) [3], who emphasised that interactive learning methods, such as group discussions, help students not only master knowledge but also develop the necessary professional skills during self-study.

Overall, group discussion and online exploration are the most effective self-study methods, highlighting the importance of interaction and access to diverse information. Methods requiring individual effort, such as mind mapping and problem-solving, are less effective, possibly due to a lack of immediate feedback and support. Students need specific guidance on self-study methods to effectively utilise various approaches across different courses and achieve the best self-study outcomes.

4.3. Current status of assessing the extent of using methods to test and evaluate self-study activities by students at Can Tho University

Results depicted in Table 7 illustrate the implementation level of assessment methods in students' self-study activities.

The results from Table 7 show that lecturer assessment methods, such as using various types of tests (average score 3.83) and timely publication of results (average score 3.78), were rated highly, falling into the 'quite effective' category on the Likert scale. This reflects agreement between lecturers and students on the importance of applying flexible assessment forms and providing timely feedback to support students' self-study. Lower average scores (3.55-3.56) related to students' self-assessment methods, such as evaluating self-study goals and content, suggest that students find it more challenging to assess their own learning progress without external guidance.

Qualitative data analysis reveals that students often face difficulties in self-assessing their self-study activities, especially when it comes to determining goals and learning content. Many

Table 7. Evaluation of self-study assessment methods by management staff, lecturers, and students at Can Tho University.

No.	Assessment method	Average score by students	Average score by management staff and lecturers	Overall average	Standard deviation	Rank
	Students' self-assessment of their self-study activities					
1	Assessing self-study goals	3.81	3.30	3.56	0.751	4
2	Assessing self-study content	3.77	3.34	3.56	0.809	5
3	Assessing self-study methods	3.72	3.32	3.52	0.821	8
4	Assessing self-study tools	3.75	3.38	3.56	0.825	6
5	Assessing self-study time and location	3.71	3.34	3.55	0.836	7
6	Assessing self-study formats	3.70	3.36	3.52	0.870	9
	Lecturers' assessment of students' self-study activities					
7	Using various assessment methods: objective tests, essays	3.75	3.91	3.83	0.762	1
8	Using reasoning tests to enhance students' creativity	3.73	3.74	3.74	0.764	3
9	Timely publication of assessment results to encourage students	3.77	3.79	3.78	0.775	2
	Overall average	**3.73**	**3.50**	**3.62**	**0.801**	

students expressed uncertainty about how to effectively evaluate their learning progress due to a lack of clarity in assessment criteria and self-awareness skills.

One student shared: *"I find it difficult to assess whether I have achieved my learning goals. Without guidance from lecturers, sometimes I'm unsure if I'm on the right track".*

In contrast, lecturers highly value the use of diverse testing methods, which is also supported by students. They feel that such tests not only help evaluate knowledge but also provide timely feedback for improving self-study methods. Another student explained: *"The tests help me realise my weaknesses, and the lecturers clearly explain how I can improve".*

These qualitative insights highlight the role of lecturer assessments in helping students gain a clearer understanding of their self-study abilities. They also show that students need further guidance in self-assessment to improve their ability to self-manage and monitor their learning progress independently.

When it comes to assessment methods, students favour flexible assessment forms, while lecturers prefer traditional assessment methods, such as regular exams. The reason can be traced back to:

- Expectations and perceptions: Students often seek flexibility and prompt feedback from assessment forms, while lecturers may view traditional assessment methods as providing more

accuracy and reliability. Students feel that more flexible assessments allow them to demonstrate their knowledge more naturally and easily.

- Pressure in learning: Students may feel pressured when faced with traditional exams, while lecturers may see these exams as a way to ensure that all students meet learning standards. This leads to differences in evaluation approaches and expectations from both parties.

The study found that students highly value transparent and clear assessment tools, which is consistent with the conclusions of Y. Kainarbayev, et al. (2024) [15]'s who emphasised that timely and fair feedback is critical to enhancing students' self-study skills. Specifically, group projects and assignments were rated as effective in evaluating knowledge and promoting self-directed learning skills.

An additional finding from this study is that while lecturers favour traditional assessment methods such as regular tests, students tend to prefer more flexible forms of assessment with prompt feedback. This highlights a difference in perspectives on self-study assessment methods between students and lecturers, and further research is needed to improve the alignment of assessment tools with student needs.

Lecturer evaluations were rated higher than students' self-assessments, indicating that implementing external assessment methods is perceived as more effective. Utilising diverse assessment methods and providing timely feedback are crucial in supporting effective self-study. Therefore, the university should develop solutions to assess and provide feedback on students' self-study activities to enhance self-study effectiveness and educational quality at Can Tho University.

5. Conclusions and recommendations

5.1. Conclusions

This study has clarified the role of forms, methods, and assessment strategies in enhancing the effectiveness of self-directed learning among students at Can Tho University. The results indicate that self-study with direct guidance from lecturers is rated as the most effective, aligning with the previously stated hypotheses regarding the importance of lecturer support in improving learning outcomes. The research confirms that students are highly dependent on guidance from lecturers, reflecting the unique characteristics of the Vietnamese educational context.

Furthermore, the findings demonstrate that students highly value interactive learning methods, such as group discussions and online information searches. This confirms that these learning methods not only help students acquire knowledge but also develop essential professional skills. However, the study also highlights that students face difficulties in unguided self-study, indicating a gap in their self-management skills that needs improvement.

Additionally, the research emphasises the need for clear and transparent assessment tools. The results reveal a discrepancy between students' preference for flexible assessment forms and lecturers' perspectives on traditional assessment methods. This gap warrants further investigation to adjust assessment tools to better align with the actual needs of students.

These findings not only provide valuable insights into the current state of self-directed learning at Can Tho University but also open new avenues for research in developing supportive programs

for student self-study. Recommendations include enhancing the role of lecturers in guidance and feedback, integrating supportive learning tools, and adjusting assessment methods to better meet student needs.

However, this study also has limitations, including the restricted sample size and geographic context, which may affect the generalisability of the results. Future research should consider expanding the sample size and applying the research methodology at other universities to test the consistency of the findings. Future studies should focus on evaluating the effectiveness of these programs and exploring further the differences in perceptions between students and lecturers regarding self-study methods.

This conclusion clearly links the research findings back to the research questions posed, thereby reinforcing the study's contribution to the academic discourse on self-directed learning in higher education in Vietnam.

5.2. Recommendations

The research proposes the following solutions to effectively address the identified issues:

5.2.1. Enhance direct guidance from instructors

The research shows that direct support from instructors significantly enhances the effectiveness of students' self-study. The university should implement the following measures to provide timely support, effectively address students' questions, and ensure learning progress:

- Instructors should allocate more time for direct guidance in class and outside of class through discussions and consultations. Instructors should dedicate at least two sessions per week to direct guidance both during and outside of class hours. Encourage the organisation of discussion sessions and small group exercises, allowing students to ask questions and interact directly with instructors after each class.

- Establish fixed weekly hours for students to ask questions, seek advice, and receive direct guidance. The university should set up a fixed schedule for consultation sessions, with each instructor having at least two hours per week to support students directly or online. Students can register in advance through the university's learning management system.

- Use online tools such as Zoom and Microsoft teams to organise online guidance sessions, making it easier for students to access support.

These activities can create an interactive learning environment and help students gain a deeper understanding of the material. Additionally, they promote student autonomy and responsibility in learning.

5.2.2. Promote interactive learning methods

Group learning methods are evaluated as the most effective in self-study activities. Therefore, Can Tho University should implement several methods to enhance the effectiveness of interactive learning:

- Form study groups among students: Encourage students to form small study groups based on interests and majors to discuss lectures, solve problems, and support each other. The university should direct the Student Affairs Office and Youth Union to oversee this activity.

- Integrate project-based learning into the curriculum: Each course should include at least one major group project. Students are required to form groups of 3-5 members and work together

to complete the project. Instructors should apply effective group learning methods such as peer instruction and jigsaw to achieve better results.

- Organise monthly thematic discussions: Invite experts from the fields taught at Can Tho University to share their experiences and knowledge, creating opportunities for students to exchange and share knowledge and experiences.

These activities will stimulate creative thinking, cooperation, and the development of soft skills among students, enhancing their motivation and engagement in learning.

5.2.3. Improve assessment and feedback methods

Assessment is crucial for students to recognise their strengths and weaknesses during their studies. Instructors play a key role in helping students identify their competencies and adjust their self-study activities through the following measures:

- Diversify assessment methods: Instructors should combine various assessment forms such as multiple-choice tests, essays, presentations, and group projects to comprehensively evaluate students' skills. Develop clear, specific, and appropriate evaluation criteria for each course, and make the scoring rubrics and evaluation criteria available before assessments.

- Provide timely and detailed feedback: Instructors should offer detailed and prompt feedback after each exam and assignment, helping students improve their skills and knowledge. Analyse students' strengths and weaknesses in each test and assignment and suggest suitable learning methods to address weaknesses and enhance strengths.

- Use online tools to automate grading and feedback: Utilise online learning management systems to organise multiple-choice and essay tests. The university should widely implement the LMS software. Instructors can use tools like Turnitin to grade essays and provide detailed feedback. Multiple-choice tests should be graded automatically, with results immediately sent to students.

Enhancing the effectiveness of self-study for students at Can Tho University requires a combination of several factors, from direct guidance from instructors and interactive learning methods to improved assessment and feedback methods. Implementing these measures comprehensively will create an effective and well-rounded learning environment, helping students develop both knowledge and skills.

CRediT author statement

Thi Kieu My Doan: Data collection and Writing; Thi Tham Tran, Doan Trinh Nguyen: Providing research guidance.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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Exploring Vietnamese English as a foreign language learners' interaction in grammar learning via educational games: Benefits and drawbacks

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Abstract:

Because there is frequent insufficiently understandable input for the acquisition of second languages, grammar is crucial in the context of English as a foreign language (EFL) education and different teaching strategies should be used for grammar courses in order to suit the demands of the students and to encourage their enthusiasm in learning. Among the alternative teaching methods for grammar lessons, using educational games is reported as being a useful replacement for the typical teaching procedure following guidance and practice from course books. Educational games can foster connection, engagement, and cooperation in language learning. The study participants include 42 non-English major students at Binh Duong University's - Ca Mau Campus. The study applied a mixed-method research design to investigate the potential benefits and drawbacks of using educational games to teach grammar, as well as how much interaction learners are likely to experience from these resources. Quantitative findings from descriptive statistics of a 10-item questionnaire revealed that the opportunities to interact with a teacher, friends in group collaboration, competition, and discussion are highly evaluated by the participants. Meanwhile, qualitative findings firstly indicated similar learners' perception of the use of educational games as the means to enhance classroom interaction; however, the main challenge for using educational games is the imbalance in learners' proficiency level and the lack of teachers' control. The study's teaching implications are associated with learning styles, cultural context, and learning preferences as three potential contributors to the extent to which educational games could improve the level of interaction between students and grammar instructions for EFL learners.

Keywords: **educational games, English as a foreign language learners, grammar, interaction, motivation.**

Classification numbers: **3.1, 3.2, 9.1**

1. Introduction

Learning grammar was considered as the most challenging aspect of learning English and understanding its principles helps language learners develop their communicative abilities [1]. However, acquiring grammatical rules could seem like a trade-off effect in terms of comprehension and production [2] and this could result in the relative poor learning achievement for non-native English learners. Many researchers have investigated the causes of poor learning achievement, identifying key factors such as teachers' and students' attitudes as well as issues with textbooks, syllabi, and curriculum design.

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In the Vietnamese teaching context, students often learn passively in the classroom as they must follow whatever the teachers tell them to do [3]. Many students claim to find grammar lectures boring and do not want to invest the time necessary to learn them because they feel that they do not have enough opportunities to exchange ideas with their peers or to be ready to respond to inquiries from the teachers. Due to the old-fashioned viewpoint on teaching and learning languages, teachers pay less attention to the quality of teaching and consider that grade their students acquire to pass accurately reflect their ability in teaching [3]. Therefore, it can be concluded that Vietnamese students may receive the best test scores, but they fall short of demonstrating their greatness in real-world performance [4]. This reason calls for numerous attempts to turn teaching grammar into a fun, creative, engaging and beneficial learning activity and this study will place the focus on using educational games as the main teaching method to arouse Vietnamese EFL learners' interest in grammar learning.

2. Research objectives

The study has two concrete objectives as follows:

- To discover Vietnamese EFL learners' interaction level towards the use of educational games in learning English grammar.

- To investigate possible drawbacks of using educational games in grammar learning for Vietnamese EFL learners.

3. Literature review

3.1. Games in grammar learning

Learning languages through games is an engaging retreat from a monotonous grammar lesson which promotes accuracy and makes use of the variety of grammatical expressions available in English. As highlighted by M. Briewin, et al. (2013) [5], when context is given to teach certain grammatical points, games can arouse students' interest and help them to acquire knowledge of locations, people and events as well as simplify circumstances which would otherwise be abstract and challenging to convey in words.

J. Hadfield (1998) [6] distinguished two categories of language games: (1) linguistic games that emphasise correctness and (2) communicative games that involve information exchange or spotting discrepancies between two or more images. R.G. Jones (2014) [7] claimed that games can provide an immersive setting where the target language is used extensively. When participating in language games, learners would take turns and play parts so that they are able to build up their self-confidence and to broaden their perspectives on learning English. Considered to be a productive technique in the language class, the use of games will improve learners' interaction with the subject at hand, and this subsequently increases the acquisition of grammar.

3.2. Purposes of games

Combined with a relaxing atmosphere in the classroom, games help shy students express themselves in a comfortable way and even the more introverted students prefer playing games to participating in traditional activities because games promote a comfortable and stress-free environment [8]. Furthermore, when games are used, they lessen learners' anxiety about learning grammar structures of the language [9] while increasing the level of enjoyment [10] and engagement level in language acquisition [11]. The use of games in grammar instruction also links with the mental state that learners experience when they perform difficult learning tasks such as difficult grammatical concepts; therefore, learners should try to work out the grammar issues in order to finish the games and compete with their peers in the class [12].

Using games in grammar teaching is also an interactive alternative method of teaching and sharing language information. Linguistic researchers supposed that the combination of games provides a friendly and cooperative environment among learners in mastering grammatical concepts. Offering learners such options will stimulate them to comprehend grammar mastery and build foundational grammar skills [13, 14] believed that teaching grammar through games is a successful and effective approach because during the participation in games, learners concentrate more on the concepts of the target language and subconsciously acquire the grammatical rules.

3.3. Previous studies

This section reviews previous research on the use of grammar in teaching and learning grammar. S.S.M. Siska (2016) [15] investigated the use of games under the implementation of the CLT (communicative language teaching) approach in teaching grammar. The research was completed in the grammar classroom that consisted of 20 students from STKIP PGRI West Sumatera institution as main participants of the research. The researcher used observations and interviews as the research instruments to get all the supported information or data related to the research. The findings of the research confirmed that games are among the best ways to increase learner's motivation, interaction, and language acquisition so that students can consciously acquire grammar in a fun and supportive learning environment.

Another research conducted by H. Hashim, et al. (2019) [16] examined the usefulness of employing online games to improve Malaysian EFL learners' grammar. The sample of the students included 30 students at a secondary school. A quasi-experimental design and pre and post-test were applied as research instruments for the study. The intervention used various online language games such as: *Powerpoint Challenge Game, Socrative* and *Kahoot*. The findings revealed that gamified learning was successful in terms of grammatical mastery as learners performed better when they used language oriented games to learn grammar. The research also pointed out that motivation and interaction were two elements that contributed to successful learning.

In the context of high school, J.M. Al-Jarrah, et al. (2019) [17] conducted a research to measure the value of using educational games in improving English grammar proficiency among eleventh-grade students at a high school in East Jerusalem. The participants of the research were divided into experimental group as those learning grammar via games during two months and a control group as those learning via traditional classroom methods. The findings demonstrated that playing games gave students an authentic environment to study and practice grammar in.

Furthermore, C. Lien, et al. (2017) [18] conducted a study to measure the advantages of using games in teaching English grammar for first-year students who are English majors at Dong Nai Technology University. The participants of the study included 25 first-year university students who attended grammar classes twice a week. The study used both quantitative and qualitative methods to collect data. The findings indicated that students have a favourable attitude towards grammar lessons.

Additionally, N.H. Ngoc (2021) [19] completed a research to find out the effectiveness of utilising games in teaching English grammar to students at Dong Nai Technology University. The participants of the study were 30 first-year English language students. The results after analysing data showed that learner's attitudes in learning English grammar was positive after teachers utilised games in class. Since the level of learning motivation was also enhanced, as they became more active in self-study and in classroom activities.

4. Research methodology

4.1. Research design and questions

A mixed-methods design was employed in the present study. This approach involved collecting both qualitative and quantitative data sets to obtain a more holistic understanding of the research problem than either method alone [20]. The researcher used a questionnaire to examine the participants' interaction regarding the use of games to enhance their grammar knowledge. To further explore the learners' interaction in depth, 10 students were selected for the next stage. The semi-structured interviews enabled the researcher to tailor their questions based on the participants' answers and to fully grasp the participants' views [21].

Based on the stated research objectives in section 2, two research questions are formulated as follows:

RQ1: How do Vietnamese EFL learners evaluate the interaction level after the intervention of learning grammar with educational games?

RQ2: What are possible disadvantages of learning grammar with educational games as identified by Vietnamese EFL learners?

4.2. Research site and participants

This research was conducted at Binh Duong University's - Ca Mau Campus (BDU-CM) where 42 Vietnamese EFL students were recruited as participants using convenience sampling. This sampling method was suitable for the research context and due to accessibility of the research site. The participants were non-English majors in their second year of university, ranging from 18 to 20 years old. They had different academic backgrounds in fields such as Information Technology, Economic Law, Civil Engineering. They also had a similar level of English proficiency with 6 to 10 years of learning experience. The rationale for the criteria was that the participants were expected to have adequate grammatical knowledge and learning experience to engage in educational games (Table 1).

Table 1. Demographic information of participants.

Information		Number	%
Gender	Male	23	54.8
	Female	19	45.2
Age	18-20	35	83.3
	21-25	7	16.7
	25+	0	0
Time spent learning English	1-5 years	0	0
	6-10 years	31	74.0
	More than 10 years	11	26.0
Major	Information Technology	22	52,3
	Economic Law	11	26,1
	Construction Engineering	9	21,6

4.3. Research scope and instruments

In this study, the scope of educational games is understood as the practice of using games which assist learning activities in a specific sequence as designed in a lesson plan. Both quantitative and qualitative methods were implemented to answer the two stated RQs through the use of a questionnaire and an interview.

This section explains the questionnaire that was used in this study to see how learners interacted with games for learning grammar. The questionnaire had two main parts. The first part was a short introduction of the research goals, background information, and English learning experience. It asked the participants about their age, gender, level of education, and how long they had been learning English. It also explained the purpose and procedure of the study and assured the participants of confidentiality and anonymity. The second part was 10 questions about the grammar topics covered in the training program. The questions were designed to measure the participants' attitudes, preferences, and perceptions of using games for learning grammar. The questions were on a 5-point Likert-scale design categorised from 1 to 5, namely, strong disagree (1), disagree (2), neutral (3), agree (4)

and strongly agree (5). The questionnaire content was based on and modified from the following source H.Y. Phuong, et al. (2017) [22], H. Hashim, et al. (2019) [16], L.C. Cuesta (2020) [23]. The researcher chose to adapt these existing questionnaires because of time constraints and because previous studies had shown valid and reliable results of using games to enhance students' interaction in the classroom. After the stage of data collection, the raw data collected from participants was coded and organised prior to the stage of running statistical tests using SPSS Statistics version 22.0. Two main statistical values to be used for data analysis in the present study included the value of means (M) and standard deviation (SD), which were known as the average results from the participants' responses and the variation between the observed values and the mean value respectively. The value of means scores (M) in each survey item was interpreted as follows:

Five-point Likert-scale of extent:

+ M= 1.00 - 1.80: Never true = Very low

+ M= 1.81 - 2.60: Rarely true = Low

+ M= 2.61 - 3.40: Sometimes true = Average

+ M= 3:41 - 4.20: Often true = High

+ M= 4.21 - 5.00: Always true = Very high

Five-point Likert-scale of agreement:

M= 1.00 - 1.80: Strongly disagree

M= 1.81 - 2.60: Disagree

M=2.61- 3.40: Neutral

3.41 - 4.20: Agree

M= 4.21 - 5.00: Strongly agree

Meanwhile, there were 10 participants who volunteered to be in the interview stage. The interview was used as a mean to specify learners' perspectives on learning grammar through games, and to note the advantages and disadvantages of the intervention. All questions were formulated both in English and their mother tongue so participants could express their opinions more freely and accurately. The interview stage involved 10 participants who had volunteered to participate in this phase of the study. The purpose of the interview was to elicit the learners' views on the effectiveness of using games to learn grammar and to identify the strengths and weaknesses of the intervention. The interview questions are presented in detail in Appendix B: Interview questions for students.

4.4. Validity and reliability

The test of reliability was conducted using Cronbach's alpha value as the measurement for consistency and equivalence across participants' responses. The results of reliability test showed that Cronbach's alpha coefficients for ten items were 0.942, indicating that the items have relatively high internal consistency.

For the validity of the instruments to be used, the researcher consults with five experienced EFL teachers who are also working at BDU-CM to check its suitability and the pertinent topics. They were asked to evaluate each item on the instrument in light of its suitability and relevance to the study's overall objectives. They gave advice and suggestions about organisation and variety of questions in both the questionnaire and interview. Their comments and suggestions were considered and led to the reformulation of some items for the sake of coherence and conciseness.

5. Results

5.1. The interaction level of learners after the intervention

Considering the scope of RQ1, this section will only report quantitative findings from the responses of 42 participants in the experimental group. Data in Table 2 reflects the descriptive statistics of learner's perspectives towards their interaction with educational games in grammar class:

Table 2. Descriptive statistics of learners' interactions.

No.	Items	N=42	
		M	*SD*
1	Grammar games provide me with extra opportunities to interact with my classmates.	4.36	.879
2	I believe that employing games in English grammar lessons improves group collaboration.	4.26	.912
3	When we play games, my friends and I can help each other correct grammar mistakes.	3.93	.677
4	Through games, the teacher assists students in studying grammar more efficiently.	3.93	.894
5	When I'm learning English grammar, I prefer to compete with my friends by playing games.	4.02	.897
6	I enjoy discussing English grammar rules with my friends while playing language games.	4.02	.975
7	I find the contents of the English grammar class are quite simple after playing games.	3.95	.882
8	Learning English through games allows me to communicate more with my teacher.	4.21	.898
9	I am more engaged by the grammar materials when I play language games.	3.90	.790
10	During grammar class, teacher often praises our responses using games.	3.88	.889
	Total	4.04	0.87

The highest mean score in the questionnaire is for participants' expression that grammar games provide them with extra opportunities to interact with their classmates (item 21: M=4.36, SD=.879), to be followed by the belief in employing games in English grammar lessons to improve group collaboration (item 22: M=4.26; SD=.912). Data from the interview also addressed similar findings where one student (S2) assumed that language games allow students to interact and work together and that the expected outcome of engaging in competition is that they can compare and share knowledge in a relaxed environment. Another student (S5) expressed the benefits of games in individual or group activities especially when interacting with classmates or at least with those sitting close by (S5).

A great number of participants reported that when playing games, learners can help each other correct grammar mistakes (item 3: M=3.93; SD=.645). Similarly, the respondents agreed with the idea that through games, the teacher assists students in studying grammar more efficiently (item 4: M=3.93; SD=.894). In accordance with the questionnaire, one participant also mentioned that:

"Absolutely! Grammar games allowed me to communicate freely with my teacher without feeling embarrassed. I can ask questions about the topics at hand or discuss any problems that I was facing in learning grammar" (S2).

Additionally, the overwhelming majority thought that when they were learning English grammar, they preferred to compete with their friends by playing games (item 5: M=4.02; SD=.897). With regard to item 6, most respondents admitted that they enjoy discussing English grammar rules with their friends while playing language games (M=4.02; SD=.975). Two students (S9, S10) also expressed their opinions:

"Definitely, games can help students to develop collaboration skills. I have to think really quickly and compete against my classmates. And I also can learn different learning styles from my friends, one might learn by this way, and another might learn another way" (S9).

"I think games help improve the relationship between classmates and make it more comfortable towards each other; the teacher usually mixed the groups' members, so I can interact with more people from the other side of the room" (S10).

It can be found that the majority of the students generally agreed with the statement that they found the content learning of English grammar is at ease after playing games (item 7: M=3.95; SD=.882). Similarly, the same number of students perceived that learning English through games allows them to communicate more with the teacher (item 8: M=4.21; SD=.898) as how one student (S1) indicated:

"Learning grammar through games, I feel that the atmosphere is quite comfortable, so then the studying is enjoyable. I feel the distance between the teacher and students is shortened as I can communicate with her naturally" (S1).

The result of the two last questionnaire items revealed most of the students manifested their agreement that they were more engaged by the grammar materials when they played language games (item 9:M=3.88; SD=.790) and they also concurred with the statement that teachers often praise their responses using games during grammar class (item 10: M=3.88; SD=.889). Here are two obvious opinions of the students in the interview (S1, S2):

"I was quite interested in the grammar topics when I learn them via games, the teacher can explain the materials in an understandable method, then I can understand the lesson very quickly" (S1).

"Through games, I can learn knowledge out of book. It makes learning enjoyable rather than just tedious, thus in my opinion, it is really appropriate" (S2).

The data from the above questionnaire showed that games make learners have full interactions both within group work and within the whole class. As a result, the learners more became active to participate in pair work or group discussion to find the best solution to the issues they were encountering. In addition, the responses from the learners also emphasised that teacher-student interactions are positively built when the learners are involved in the learning process. Consequently, learners have a more advantageous platform through those kinds of interactions which causes them to have a useful and meaningful learning process so that they engage more with the grammatical materials to acquire grammatical competence.

5.2. Drawbacks when using educational games in class

Using games to teach grammar also imposes certain drawbacks. Because of the various levels of proficiency, sometimes the instructions may be misunderstood by the learners and this leads to chaos and time waste in the classroom. It is similar to how S2 mentioned in the interview data:

"The disadvantage of language games, in my opinion, is that not all students always understand the rules of how to play. This could disrupt the class and waste time by causing confusion, inappropriate behaviour, loudness, and disruption" (S2).

On the other hand, teachers would lose control of the class if there was chaos in the classroom, making it impossible for them to monitor classroom. Some students could be overly aggressive competitors who disturb other classmates much like how one student (S4) reflects an opinion on the drawbacks of bringing games to the class:

"I believe that grammar games bring many benefits for students. However, it is undeniable that the games we use to teach grammar could work well in one class but not in another. Due to the different levels of students, some of them may be troubled by their weaknesses, and they may also find the game to be uninteresting" (S4).

Finally, since "some students may be more receptive to learning from games than others due to the different learning styles among them" (S10), this supports the idea that not all types of games can work for all pedagogical purposes. Furthermore, the effectiveness of games also depends on the teaching situations and learning styles.

6. Discussion

6.1. EFL learners' interaction in grammar learning through educational games

The study's findings provided compelling evidence for the use of educational games in English language instruction to raise EFL students' proficiency in the target language. The information from both questionnaire and interview illustrated that most learners in this

study had positive opinions about the use of games for teaching grammar. With the aid of grammar games, the classroom atmosphere becomes lively as students can take part in the games as well as contribute to the lessons. Language games tend to positively inspire learners to participate in grammar lessons as they are being supported by their enthusiasm for the games. During the use of educational games, every student moves around to exercise their brains and stimulate their memory centres, which encourages them to absorb and retain the information. At that time, shy students participated in joyful activities and forgot their shyness and fear. It is obvious that games have the power to captivate interest and engagement of the learners. In the same way, confidence is enhanced by the ability to use grammar correctly in context. Therefore, grammar should not be taught separately and teachers should implement teaching techniques which can engage EFL students with practice and usage of grammatical items.

Secondly, educational games encouraged greater classroom interaction and promoted enthusiasm among learners. These findings corroborated those of C. Riedel (2008) [24] who demonstrated the benefits of games in raising learner achievement through peer interaction and the assistance of games to help learners participate actively in the learning process. Such positive relationships are reflected in the learners' ability to build level goals and an ability to achieve success in each of these levels, which makes them feel self-satisfied. R.E. Slavan (1983) [25] found that in the absence of group incentives, group members would have no incentive to support one another's efforts to improve team members' learning. The participants in the present study seem able to build positive relationships among learning groups individuals through grammar games, which contributed to the academic growth in English learning. In the setting of educational games, the students with higher ability levels in teams made an effort to support the lower ability members of their teams in order to improve their team's performance in grammar learning. Furthermore, the implementation of educational games also gives students a meaningful setting for communicative grammar practice and enhances the permanence and pleasure of grammar acquisition.

The responses from the questionnaire also stated that using games may increase interaction with their teachers through which the interaction comprised by the nature of classroom pedagogy and classroom behaviour is enhanced. By using games complementary to textbooks, students are more motivated to learn grammar since they see games as an engaging and practical teaching tool. Furthermore, findings in the present study are also consistent with a large number of studies that have indicated the effectiveness of games in the development of various learning outcomes. In particular, the findings of this study suggested that educational games could improve students' interaction to learn English grammar, which concurred with the findings of similar studies by M.H. Hamzah, et al. (2010) [26] and G. Yolageldili, et al. (2011) [27]. As a result, the employment of games in the classroom will not only alter the teaching atmosphere of the lecture, but will also energise the students and improve learning.

6.2. Difficulties and suggested solutions when applying educational games in class

The identified difficulties when using educational games in teaching grammar shared similar concerns with previous research. According to T.T. Hue (2020) [28], game activities cannot be successful if the instructions of games are not clear enough and make students become embarrassed because they do not understand the rules and procedures of the game. Moreover, there is not enough space in the classroom to reconfigure desks for students to sit or to move around in the class for practice and the teacher cannot

move around to control students. Depending on the circumstances, the teacher must be adaptable in order to correctly set up the class and maintain class management. Furthermore, the selection of a suitable teaching program and curriculum as well as the implementation of an integrative teaching approach and interactive grammar assessment should be further taken into consideration of maximising learning benefits of educational games in the classroom teaching context [29].

Due to varying learning styles of learners, teachers should maintain good classroom discipline and place students in appropriate positions for pair or group work because some game activities will cause excitement and noise [30]. This can assist the teachers to control the activity, limit noise and make sure that students use the target language to complete the communicative task. The teachers should make sure to designate a specified time and set a rule for the players as well as a specific code of discipline for the learners. Teachers should encourage learners to use English in class, to promote self-correction for errors, and to offer assistance when necessary.

The selection of appropriate gamified platforms is also another factor to enhance the effectiveness of educational games in grammar teaching. The platforms such as Wordwall.net [31], Educaplay games in Canvas platforms [23] and Quizizz [32] are designed with colourful backgrounds, interesting templates, music which results in the maximisation of learning motivation extrinsically and intrinsically for learners while acquiring grammatical knowledge. Furthermore, the selection of appropriate educational games is also important so that the learners can improve their learning performance. For instance, in the study of L.C. Cuesta (2020) [23], it was claimed that matching games and crossword puzzles facilitated learner's performance in using modals, gerunds, and infinitives as well as vocabulary topics of jobs and education.

7. Conclusions

Overall, findings from the present study support the view that educational games offer a more engaging and successful method of teaching grammar. The main reason is that the implementation of games in grammar teaching often comes from the teacher's consideration to find replacements for the traditional ways of teaching grammar. The replacement is often integrated with the contextual game-based learning approach in grammar course within the expected outcomes of assisting learners in their development of language systems for the construction of ideas and experiences in their learning context [33]. Another supportive reason to use educational games in grammar course is the positive attitude that Generation Z learners would gain in grammar learning, considering the current challenges in engaging students into the acquisition of grammatical knowledge [34]. Through the integration of educational games in grammar instructions, teachers can establish a more captivating and delightful learning atmosphere to maintain learners' attention and engagement.

Educational games offer learning motivation and self-efficacy. They also enhance grammar learning and can improve learner's interaction and overall learning achievement. Games foster communicative competence and integrate the acquisition of language skills into a meaningful setting. Findings from the present study also imply that adding interactive activities to the teaching curriculum can improve learners' perspective toward their teachers. Learners would gain more positive feelings when they observe how their teachers make efforts to vary teaching methods and learning activities that are pertinent to the specific course objectives and to the dynamic learning environment. Although there are certain drawbacks in teaching grammar using games, they can be more effective than the traditional drill and memory techniques when they are used wisely and properly.

Although the present study was carefully designed, there still remained some unavoidable limitations. One of them was the small sample size during one semester, which might have prevented the researcher from obtaining more reliable results. Another one was the focus on a semester program, which required the researcher to use language games intensively in the teaching process. Therefore, it is suggested that future research should involve a larger sample from different schools or institutions and a longer duration, allowing the students to adapt to the new technique and produce a more conclusive outcome. Moreover, to fully examine the effect of game-based activities on students' attitudes towards grammar learning and their language skills development, more comprehensive research with more participants and diverse methods are needed.

APPENDICES

Appendix 1: Questionnaire for students

This survey questionnaire is designed for the study "Vietnamese EFL Learners' Interaction towards the Use of Educational Games in Grammar Learning: Benefits and Drawbacks". Your assistance in answering the following questions will be extremely valuable and helpful. The questions in this section are designed to collect information on education, and your answers will be treated with complete confidentiality. Please accept my sincere gratitude for your time and efforts.

Part 1: Personal information

Tick (√) the option that is suitable with you

1. In what age group are you? Under 20 20-25 25 +

2. Your gender: Male Female

How long have you learned English?

1-5 years 6-10 years More than 10 years

What is your major?

Information technology

Constructing engineering

Economic law

Other:

.....

Part 2: Learners' interaction level towards the use of games in learning grammar

Please tick the number for each statement to indicate the extent to which you agree or disagree with that statement.

	Statements	(1)	(2)	(3)	(4)	(5)
1	Grammar games provide me with extra opportunities to interact with my classmates.					
2	I believe that employing games in English grammar lessons improves group collaboration.					
3	When we play games, my friends and I can help each other correct grammar mistakes.					
4	Through games, the teacher assists students in studying grammar more efficiently.					
5	When I'm learning English grammar, I prefer to compete with my friends by playing games.					
6	I enjoy discussing English grammar rules with my friends while playing language games.					
7	I find the contents of the English grammar class are quite simple after playing games.					
8	Learning English through games allows me to communicate more with my teacher.					
9	I am more engaged by the grammar materials when I play language games.					
10	During grammar class, teacher often praises our responses using games.					

1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

Appendix 2: Interview questions for students

Date: ……

Location: ……

What's your name? And what's your major?

Have you ever thought that learning English grammar might make students feel anxious? Please tell me what do you feel when you complete the grammar task through games?

Do you have any opportunities to use English in real context when joining language games? Please describe what situations are typically like?

Will you be able to interact more with your friends while playing games to learn grammar? If yes, how and which cases?

Do you have more chances to communicate with the teacher through grammar games? If yes, how did it help? If no, why not?

In your opinion, what are some drawbacks of studying English grammar through games?

Thank you for your cooperation!

CRediT author statement

Thi Khac Phung Nguyen: Literature review, Data analysis, Writing, Editing; Ngoc Thanh Trinh: Revision, Editing.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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Investigating climate change-related perceptions that hinder stakeholders' willingness to protect the ocean

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Abstract:

While community and stakeholder support for marine and coastal ecosystem conservation policies is important, there is a shortage of multinational studies examining how perceptions of climate change impact stakeholders' willingness to protect the ocean. Therefore, this study, employing Mindsponge theory and Bayesian Mindsponge Framework analytics, examines which climate change-related perceptions can hinder the willingness to support marine protection efforts, addressing a gap in existing literature. Our findings reveal that perceived high socio-economic costs for climate change mitigation (i.e., society is doing too much to address climate change and responses to climate change can damage the country's economy) and high potential of technologies in addressing climate change (i.e., new technologies can solve climate change) can hinder stakeholders' willingness to support ocean protection actions. Based on these results, we suggest a comprehensive strategy supporting climate change mitigation, marine conservation, and socio-economic growth simultaneously. The study also highlights the danger of exceptionalism, which refers to the risky tendency of relying too heavily on technology to solve environmental challenges, posing a significant risk to both climate change mitigation and marine protection efforts. We propose fostering collaborative partnerships, incorporating indigenous knowledge, and promoting ecocentrism to ensure globally informed, locally relevant, and impactful marine conservation.

Keywords: **Bayesian Mindsponge Framework analysis framework, environmental policy, exceptionalism, marine and coastal ecosystem, Mindsponge theory, stakeholder support.**

Classification numbers: **4.1, 7**

1. Introduction

The unsustainable exploitation of marine resources, driven by population growth, has raised significant concerns about biodiversity and the overall health of marine ecosystems. These ecosystems, which have been important for human progress throughout history, are now facing unprecedented threats. Millions of people rely on marine resources for their livelihoods, as the sea is considered a rich source of food and contributes significantly to global food security [1]. However, overfishing, habitat loss, pollution, and the impacts of climate change are among the numerous challenges threatening the marine environment [2]. For instance, the disturbance caused by local human activities leading to the loss of seagrass beds can result in altered sediment surfaces and the degradation of biogeochemical environments, exacerbating the impacts of climate change on coastal areas [3]. These impacts include ocean acidification, temperature fluctuations, and rising sea levels.

Over recent years, research attention has increasingly focused on public support for coastal and marine conservation. This highlights the critical role of diverse stakeholders, such as local communities,

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businesses, governments, NGOs, and scientists [4, 5]. Studies emphasise understanding various factors that shape community awareness and consciousness, thereby influencing support for marine and coastal conservation [2]. These factors include economic interests, cultural values, social norms, and personal experiences with the marine environment. Additionally, demographic characteristics such as age, education, and income significantly influence environmental attitudes, with younger and more educated individuals typically showing greater support for conservation initiatives [6]. Moreover, cultural and social influences, including traditions and community practices, play important roles in shaping attitudes towards marine conservation [7].

Recently, researchers have also hinted at the impacts of stakeholders' climate change-related perceptions on their support for marine conservation efforts. M.H. Nguyen, et al. (2023a) [8] showed that stakeholders who understood the benefits of preserving marine and coastal ecosystems for human well-being, climate, and weather were more likely to support policies focused on marine protection. Research conducted in Sciacca, Italy, indicated that individuals' perceptions of climate change, their increased involvement in addressing the issue, and their heightened concerns about its potential impacts on marine fish resources are correlated with a greater willingness to financially support efforts aimed at mitigating climate change's effects on fish resources [9]. A. Galati, et al. (2021) [10] confirm a similar trend - coastal community members who demonstrate more positive attitudes towards climate change are more likely to financially support the protection of fish resources and the marine ecosystem. Additionally, the interactions between stakeholders' perceptions of the benefits of aquatic ecosystems, their knowledge, and their emotions about climate change also influence their support for marine protection initiatives [11].

However, limited research has focused on the specific negative impact of climate change-related perceptions on attitudes toward marine conservation. As socio-economic perceptions have been found to affect people's attitudes toward marine protection, it is expected that certain socio-economic perceptions related to climate change could hinder willingness to support marine protection. Additionally, technology-related perceptions can also be a potential factor hindering stakeholders' willingness to support marine protection. In today's rapidly advancing technological context, there is a prevailing perception that innovation and technological solutions can adequately address environmental challenges [12]. This perspective is reinforced by the development of various green technologies, such as renewable energy sources, energy-efficient devices, and sustainable materials [13]. However, this perspective often overlooks the interconnected nature of environmental issues, where actions in one area can have widespread consequences in others [14]. Climate change presents a significant challenge that demands multifaceted solutions. While creativity, science, and technology are valuable tools in addressing climate change, they cannot be solely relied upon [15].

Protecting the ocean and its ecosystems is crucial because it plays a significant role in regulating the Earth's climate, absorbing carbon dioxide, and providing essential resources and services to humanity [16]. Acknowledging the ocean's crucial role not only enables the development of more effective strategies to combat climate change but also extends beyond reducing emissions and transitioning to renewable energy sources. This includes the conservation of marine habitats, addressing ocean acidification, and promoting sustainable fishing practices.

Failure to prioritise the protection of the ocean could have severe consequences, not only for marine life but also for the stability of the entire planet's climate system [17]. This highlights the need to examine whether the perception that technological innovation can address climate change can hinder stakeholders' willingness to support marine protection.

Although there has been an increase in research on public support for marine protection policies, some major research gaps still require attention. The impact of contextual factors on public support for coastal and marine conservation varies significantly across countries [18, 19]. Contextual differences encompass social, cultural, political, economic, and historical factors [20, 21]. If scientific results can be generalised to countries with different contexts, it could help make policies more effective and reduce research costs. Therefore, a cross-national study that identifies trends generalisable to countries with different contextual factors is needed [22]. Even when common trends cannot be found, multinational research efforts can assist in identifying contextual factors that may have differential effects across countries, thereby guiding

future research efforts. Understanding these factors allows policymakers and decision-makers to design more effective and targeted strategies that resonate with various stakeholder groups. This, in turn, can strengthen support and cultivate a stronger sense of connection and responsibility towards marine preservation To address the gaps mentioned above, the current study aims to use the Mindsponge theory, which describes how people perceive and process information [23, 24], to address the following research questions:

Question 1: Does the perception of technology's benefits in addressing climate change (e.g., developing technology to help address climate change) reduce stakeholders' willingness to protect the ocean?

Question 2: Do perceptions of the socio-economic costs associated with combating climate change (e.g., the belief that responding to climate change will harm economies and societies already actively addressing the issue) reduce stakeholders' willingness to protect the ocean?

The research article is presented according to the following structure. First, the introduction clearly states the importance of the research problem in protecting ocean and coastal ecosystems and the research questions. Details of the Bayesian Mindsponge Framework analysis method, statistical model, and data specifics for 42 countries are described in Section 2. The results discussion and conclusions are then presented in sections 3, 4, and 5.

2. Research methodology

2.1. Theoretical basis and hypotheses

The Mindsponge theory is a psychological and social theory of the mind developed from mindsponge mechanisms and the most recent findings in biology, ecology, and neuroscience [23, 25]. This theory is based on an information-processing approach to studying the human mind. This approach views information as the foundation on which practice is constructed, allowing for the investigation of complex phenomena requiring multidisciplinary knowledge. Various studies have used this theory as a theoretical foundation to study social psychological phenomena, including environmental and conservation psychology [8, 26-31].

Mindsponge theory was chosen as the theoretical framework for this study because it can clarify the interconnected components of our complex topic. Mindsponge theory provides a new information processing perspective that complements and clarifies existing theories and conceptual frameworks in psychology and sociology, e.g., The theory of planned behaviour [32]. In the context of this study, Mindsponge theory helps explain the factors that hinder stakeholders' willingness to protect the ocean.

Specifically, this theory views the mind and the environment as two main domains. The mind is considered an information-gathering and -processing system. At the same time, the environment is conceptually a larger and more encompassing information-processing system (e.g., Earth system, social system, etc.) that contains the human mind. The main goal of the mind is to prolong the system's existence in one way or another, such as through survival, growth, and reproduction. The mind consists of three main parts: mindset, a buffer zone (or comfort zone), and a multi-filtering system (Fig. 1). The mindset is defined as the collection of highly reliable information or core values in the human mind; the buffer zone is the conceptual space where information is temporarily stored before being reviewed and evaluated by the multi-filtering system.

Information integration and discrimination are two main functions of the multi-filter system. When sensory systems absorb information from the environment into the mind, the information is processed in two different ways. Absorbed information will be synthesised and absorbed into the mindset if it is consistent with core values (or highly reliable information) contained in the recipient's thinking. However, suppose the new information differs significantly from the core values or trusted information. In that case, the new information must undergo a rigorous review and evaluation process to determine the costs and benefits of accepting or rejecting the emerging information (or replacing the existing information with new information).

In general, in cases where new information is considered potentially beneficial, it will be accepted into the core of the mind and influence thinking, thereby further influencing filtering processes, thoughts, and subsequent behaviour. In cases where it is deemed inappropriate or costly, the information will be discarded. In cases where the perceived cost and benefit do not have a clear difference, it will be stored in a buffer and used for later evaluation when there is enough necessary information [24].

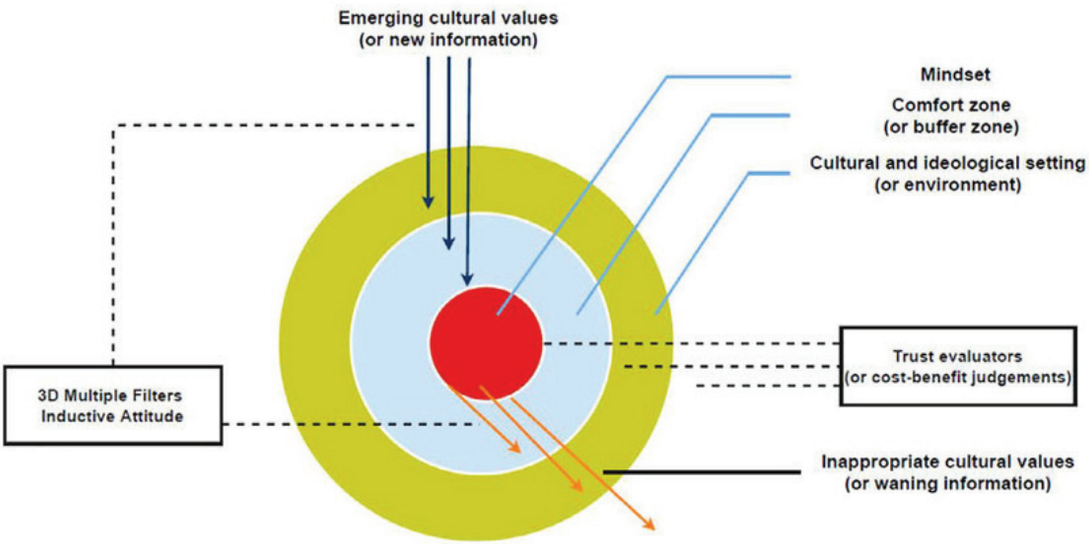

Fig. 1. Conceptual diagram of the mindsponge mechanism. Retrieved from M.H. Nguyen, et al. (2021) [33] under CC BY-SA 3.0.

Based on the information processing principles of Mindsponge theory, we assume that for individuals to be willing to protect the ocean, information related to marine protection must be absorbed into their mindset. However, for this information to be absorbed into the mindset, it must be evaluated by the mind as beneficial. If the mind, based on the information already present, deems the protection of the sea as costly, the relevant information may be limited in the absorption process or even eliminated from the mind.

To address the issue of climate change, nature conservation, including marine conservation, is considered one of the significant solutions, alongside technological development (e.g., clean energy, carbon capture technology, electrification, etc.). Therefore, if an individual's mind contains information that technological development will help solve the problem of climate change, other methods might be deemed less beneficial for addressing climate change. Therefore, they may be less inclined to seek and absorb information related to other solutions for climate change, including marine protection. Hence, we made the first hypothesis (H):

H1: Individuals who think new technology can be developed to solve adverse environmental changes will be less willing to protect the ocean.

In addition, protecting the ocean demands a great amount of time, effort, and resources (including money), but an individual's time, effort, and resources are finite. Therefore, even if individuals know the importance of combating climate change, they can only allocate a portion of their time, effort, and resources to combat it. Suppose an individual's mind contains information that society is already making significant efforts to address the impacts of climate change. In that case, it will tend not to absorb and may eliminate information related to solutions to combat climate change, including marine protection, to save time, effort, and resources. Based on this, we made the second hypothesis:

H2: Individuals who believe that society is doing much to address the impacts of climate change will be less willing to protect the ocean.

Along with this logic, if individuals feel that actions to combat climate change require sacrificing or reducing current benefits (including economic benefits), their minds will tend to eliminate information related to solutions to combat climate change, including marine protection. Based on this, we made the third hypothesis:

H3: Individuals who believe that responses to climate change will harm the country's economy will be less willing to protect the ocean.

2.2. Model building

2.2.1. Variable selection and theoretical basis

The dataset used in the present study was a product of the MaCoBioS project (Biodiversity and Coastal Ecosystem Services in a Changing World), funded by the European Commission H2020. Data were collected through an online survey accessible on the Qualtrics internet platform from 16 November 2021,

to 16 February 2022. The questionnaire is available in English, French, Spanish, and Italian. The survey interface was adapted to the device used. The final dataset has a total of 709 respondents and is stored on Mendeley Data as "Survey_Fonsecaetal_07122022.xlsx" [34].

The survey was designed for public stakeholders interested in marine and coastal ecosystems, climate change, and ecosystem management. The questionnaire included questions about attitudes, responses to climate change, socio-demographic information, and the importance of and threats to coasts, oceans, and animals. It was initially tested on a sample of 20 people. Most questions require a response, while demographic questions offer a "prefer not to answer" option. Participation was optional, and respondents were allowed to exit the survey and return later to complete it. Participant information is kept confidential, ensuring respondents' IP addresses, location data, or contact information are not recorded.

Snowball sampling was applied to find a suitable target group for the survey due to the difficulty of accessing population groups related to marine and coastal ecosystems, climate change, and ecosystem management [35]. Specifically, the survey was widely shared on MaCoBioS's social media pages (i.e., Twitter and Instagram). Furthermore, the surveyors also contacted 105 organisations involved in conservation, tourism/recreation, and fishing/seafood in multiple countries (e.g., UK, Norway, Ireland, France, Italy, Spain, Bonaire, Martinique, and Barbados) to ask them to share the survey with their members.

Furthermore, because the project aims to conduct a cross-national survey of coastal and marine communities' perceptions of climate change, human impacts, and the values and management of marine and coastal ecosystems, it is not feasible to conduct other types of sampling (e.g., stratified or random sampling) due to the high costs involved [36]. Therefore, the sample collected is not representative but only has a reference value.

In the present study, we used four variables to build the model (one outcome variable and three predictor variables). The outcome variable is *ProtectOceans*, representing respondents' willingness to protect the ocean. The three predictor variables represent factors that potentially hinder support for coastal and marine ecosystem conservation: *TooMuchSocialEffort*, *TechasEnvironSolution*, and *NegativeImpactonEconomy*. A detailed description of these variables is presented in Table 1.

Table 1. Description of variables.

Variables	Description	Variable type	Variable level
TooMuchSocialEffort	Society is doing too much to address the impacts of climate change	Numerical	1. Strongly disagree 2. Disagree 3. Average 4. Agree 5. Strongly agree
TechasEnvironSolution	People do not need to worry about climate change as new technologies will be developed to help address adverse environmental changes	Numerical	1. Strongly disagree 2. Disagree 3. Average 4. Agree 5. Strongly agree
NegativeImpactonEconomy	Actions to respond to climate change will damage my country's economy	Numerical	1. Strongly disagree 2. Disagree 3. Average 4. Agree 5. Strongly agree
ProtectOceans	I am willing to support actions to protect the ocean, even if it requires consuming less seafood and paying a higher price for it	Numerical	1. Strongly disagree 2. Disagree 3. Average 4. Agree 5. Strongly agree

2.2.2. Statistical model

To test our hypotheses about social, technical, and economic factors constraining stakeholders' willingness to protect the ocean, we built the model as follows:

$$\text{ProtectOceans} \sim \text{normal}(\mu,\sigma) \quad (1.1)$$

$$\mu_i=\beta_0+\beta_1*\text{TooMuchSocialEffort}_i+\beta_2*\text{TechasEnvironSolution}_i+\beta_3*\text{NegativeImpactonEconomy}_i \quad (1.2)$$

$$\beta \sim \text{normal}(M,S) \quad (1.3)$$

The probability around the mean value μ is represented by a normal distribution, whose width is determined by the standard deviation σ. μ_i is the willingness level of stakeholder i to protect the ocean; $\text{TooMuchSocialEffort}_i$ is stakeholder i's agreement

level that society is doing too much to address climate change; TechasEnvironSolution$_i$ is i's agreement level that new technologies will be developed to help address adverse environmental changes; and NegativeImpactonEconomy$_i$ is stakeholder i's agreement level that taking action to respond to climate change will cause damage to the country's economy.

Model 1 has five parameters: the intercept β_0, the coefficients β_1-β_3, and the standard deviation of "noise", σ. The coefficients of the predictor variables are distributed as a normal distribution around the mean denoted M with the standard deviation denoted S.

2.2.3. Analysis and validation

This research paper uses the Bayesian Mindsponge Framework method to analyse and test the proposed hypothesis based on the Mindsponge theory [24, 37]. The Bayesian Mindsponge Framework method is used for several reasons.

First, the method combines the theoretical reasoning power of Mindsponge theory and the inferential advantages of Bayesian analysis because both are highly compatible in nature [37].

Second, Bayesian inference evaluates all values probabilistically, allowing for reliable predictions with parsimonious models [38].

Third, Bayesian inference has several advantages over the frequentist approach; for example, it allows users to use credible intervals to interpret results instead of *p*-values. The reproducibility crisis is related to the variability of *p*-values [39].

Due to the exploratory nature of this study, uninformative priors were used to provide as little information as possible before estimation. Once the model was estimated, we used the Pareto smoothed importance sampling leave-one-out (PSIS-LOO) diagnosis to test the model's fit to the data [40, 41]. Specifically, the *k*-Pareto value in PSIS-LOO diagnosis is used to evaluate the model's fitness. Typically, a model is considered to fit the data when the *k* value is less than 0.5.

Before interpreting the estimated results, the convergence of the Markov chains must be checked. The convergence of the Markov chains can be tested using statistical values, such as the effective sample size (*n_eff*) and the Gelman-Rubin coefficient (*Rhat*), and diagnostic plots, such as the trace plots. The *n_eff* value represents the number of non-autocorrelated iterative samples generated during the stochastic simulation. If the *n_eff* value is greater than 1000, we can consider the Markov chain to be convergent, and the effective samples are enough to support reliable inference [42]. The *Rhat* value-often called the potential scale reduction factor or the Gelman-Rubin shrinkage factor-is used to evaluate the convergence of a Markov chain [43]. If the *Rhat* value exceeds 1.1, the model does not converge. Typically, the model is considered convergent if *Rhat*=1.

The Bayesian analysis in this study was performed using the bayesvl package on R software. This package is chosen for its user-friendly interface, ease of use, and capacity to generate visually appealing and intuitive graphics [24, 44]. For the sake of research transparency and reducing research and reproducibility costs, we have stored all data and computer code on OSF.

3. Results

A detailed description of the surveyed respondents' characteristics is presented in Table 2.

Table 2. Socio-demographic description.

	Value	Frequency	Percentage(%)
Age	18-30 years old	216	30.47
	31-40 years old	185	26.1
	41-50 years old	133	18.76
	51-60 years old	105	14.81
	>60 years old	62	8.74
Gender	Female	360	50.78
	Male	336	47.39
Educational level	High/secondary school or equivalent	66	9.31
	Bachelor's degree (e.g., BA, BSc)	153	21.58
	Master's degree (e.g., MA, MSc, MRes, MEd)	291	41.05
	Doctorate (e.g., PhD)	172	24.26
Country's income level	Low income	5	0.71
	Low middle income	14	1.97
	Upper middle income	30	4.23
	High income	659	92.95

The participants surveyed, as detailed in Table 2, come from diverse backgrounds and engage in various activities such as tourism, recreation, conservation, management, scientific research, and food production, including fishing and seafood production. Their diversity encompasses multiple countries and cultural contexts, enriching the dataset by incorporating a wide range of perspectives and offering valuable insights into the multifaceted perspectives and

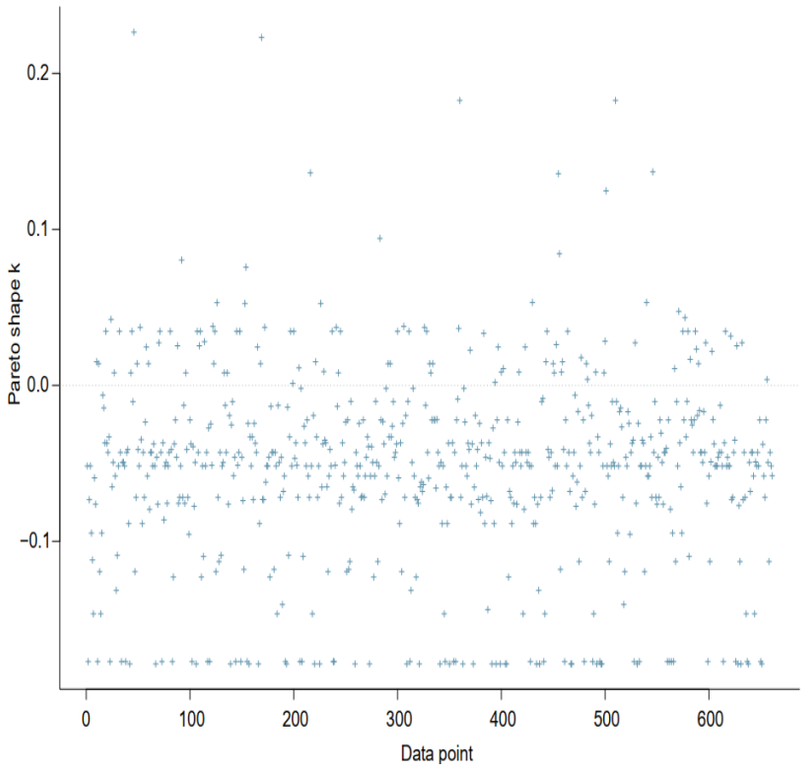

Fig. 2. Model 1's PSIS-LOO test.

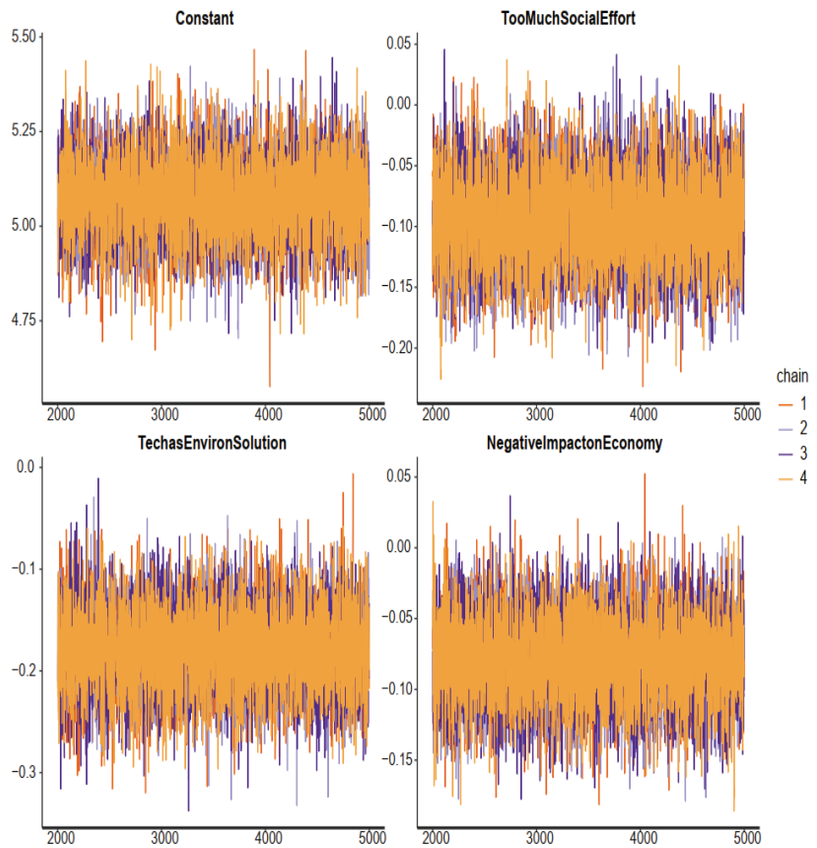

Fig. 3. Model 1's trace plot.

priorities concerning marine protection efforts. Out of the 709 stakeholders who participated in the survey, the majority (92.95%) were from high-income countries, followed by stakeholders from upper-middle-income, lower-middle-income, and low-income countries, representing 4.23, 1.97, and 0.71%, respectively. Additionally, the age distribution among respondents includes a diverse range, with significant representation from younger demographics. Over 56% of respondents fell between the ages of 18 and 40, while 33.57% were aged between 41 and 60, and those older than 60 made up 8.74%. This diversity enables a thorough examination of generational attitudes towards marine conservation. Furthermore, the survey demonstrates gender balance, with substantial involvement from both men and women, ensuring inclusivity and comprehensive representation in data analysis. Specifically, females comprise 50.78%, while males account for 47.39%. Moreover, the educational attainment of respondents was notably high, with approximately two-thirds holding at least a master's degree. Only 9.31% of respondents reported having the highest level of education as high/secondary school or equivalent. This breadth of expertise is valuable for addressing marine conservation issues effectively.

Building on the detailed participant description, the results section continues with an assessment of Model 1's goodness of fit using the PSIS-LOO plot (Fig. 2), indicating a favourable fit between the model and the data, with all *k* values below 0.5.

The estimated results of Model 1 are shown in Table 2. The effective sample size (*n_eff* >1000) and Gelman-Rubin shrinkage factor (*Rhat*=1) confirm the convergence of the Markov chain, enabling the interpretation of simulated posterior distributions of the model coefficients. Additionally, the healthy mixing of the Markov chain around the central equilibrium point, as illustrated in Fig. 3, also confirms the convergence.

Table 3. Estimated results of model 1.

Parameters	Mean	Standard deviation	*n_eff*	*Rhat*
Constant	5.07	0.10	6986	1
TooMuchSocialEffort	-0.09	0.04	7341	1
TechasEnvironSolution	-0.18	0.04	8639	1
NegativeImpactonEconomy	-0.08	0.03	8128	1

The estimated posterior distributions in Table 3 reveal negative associations between stakeholders' perceived high social and economic costs of addressing climate change and their willingness to support ocean protection ($M_{TooMuchSocialEffort}$= -0.09 and $S_{TooMuchSocialEffort}$=0.04; $M_{NegativeImpactonEconomy}$=-0.08 and $S_{NegativeImpactonEconomy}$=0.03). The negative association between the perceived benefits of technology in addressing climate change and the willingness to support ocean protection is also discovered ($M_{TechasEnvironSolution}$=-0.18 and $S_{TechasEnvironSolution}$=0.04). Specifically, the results imply that individuals who agree more with the statements "society is doing much to address the impacts of climate change", "new technologies will be developed to help address adverse environmental changes", and "taking action on climate change will damage my country's economy" are less willing to protect the ocean.

Figure 4 visually illustrates the posterior distributions of Model 1's coefficients, validating the reliability of the negative associations of *TooMuchSocialEffort*, *TechasEnvironSolution*, and *NegativeImpactonEconomy* with *ProtectOceans*. Specifically, the dark blue lines of each coefficient, represent the 89% highest posterior density interval, lie entirely on the negative side of the horizontal axis. These illustrations suggest that *TooMuchSocialEffort*, *TechasEnvironSolution*, and *NegativeImpactonEconomy* have at least an 89% probability of being negative.

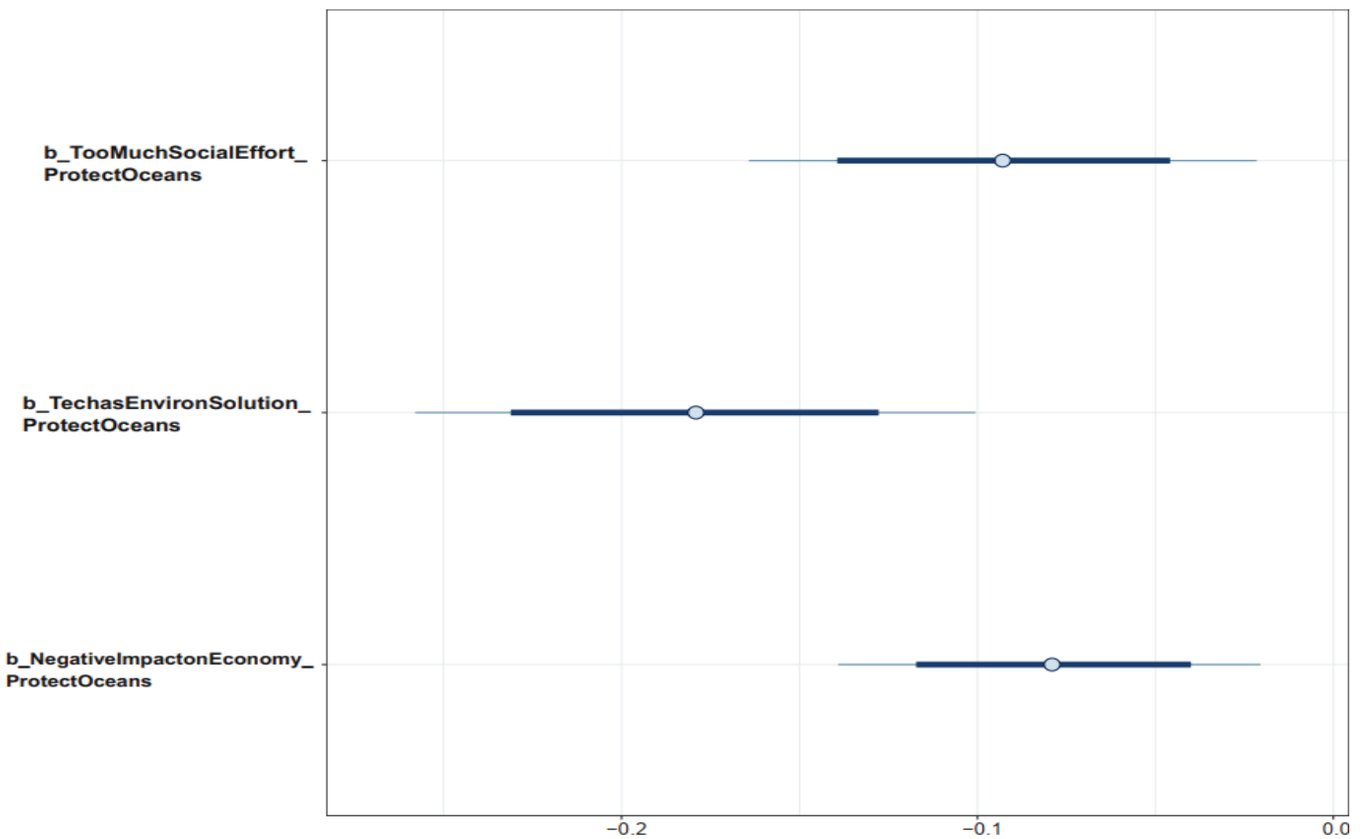

Fig. 4. Posterior distributions of model 1's coefficients.

4. Discussion

By utilising Mindsponge theory and Bayesian Mindsponge Framework analytics, this study examines the relationships between perceptions of climate change-related perceptions and willingness to support marine protection. Its results contribute to the field of environmental psychology and marine conservation. By exploring these psychological dimensions, our findings confirm that some climate change-related perceptions can significantly hinder stakeholders' willingness to support marine protection efforts. Specifically, stakeholders who perceive high socio-economic costs associated with combating climate change are less supportive of marine protection efforts. Additionally, those who perceive the benefits of technology in addressing climate change also show decreased support, thus validating our hypotheses.

The confirmation of our hypotheses has some implications, particularly for policymakers dedicated to fostering pro-environmental behaviours that protect marine environments. Firstly, our study's findings highlight the critical demand for effective marine conservation policies and their alignment with key social and economic sectors associated with marine ecosystems. Policymakers are encouraged to design measures that protect the environment, mitigate climate change, and simultaneously contribute to national social and economic goals, creating a balanced approach. Otherwise, stakeholders will be less likely to support conservation efforts due to their concerns of socio-economic trade-offs [45].

Secondly, the study brings attention to a concept called exceptionalism, which suggests that relying solely on technology can solve climate change. It highlights the significance of acknowledging and understanding perspectives that isolate humans from the ecosystems integral to existing policies, programs, and campaigns [46]. To tackle these challenges, it is essential to implement various key measures. One example is promoting multi-stakeholder collaboration, fostering partnerships among scientists, policymakers, local communities, and conservation organisations. This approach not only enhances decision-making and participation in citizen and community sciences [47] but also mitigates the narrow focus associated with an exceptionalist viewpoint, which tends to isolate humans from ecosystems. By fostering a more comprehensive and inclusive approach to environmental conservation [48], it promotes collaboration and understanding across diverse stakeholders. Additionally, recognizing and integrating indigenous knowledge will provide valuable insights into advancing sustainable living and cultivating harmonious coexistence with nature [46, 49].

Furthermore, advocating for ecocentrism is important as it recognises the value of every component within an ecosystem, thereby deepening our understanding of life's interconnectedness [50]. This approach aligns with the significance of comprehensive environmental education, which is crucial in nurturing a society with ecological consciousness. Through such education, individuals can better appreciate the intricate relationships within ecosystems and develop a greater sense of responsibility towards environmental stewardship.

To reinforce this perspective, we propose that to gain public support for marine and coastal protection, the content of disseminated environmental information should highlight the importance of marine and coastal ecosystems in improving human welfare, regulating climate and weather, and mitigating climate change [8]. At the same time, it is necessary to take advantage of different information transmission channels so that relevant parties can increase access to information about climate change, thereby raising awareness about protecting marine and coastal ecosystems and its long-term socio-economic and cultural benefits to people [51, 52]. In the long term, these perceptions will form the foundation for building an eco-surplus culture [29, 52-54].

Incorporating these suggestions into policymaking might ensure that marine conservation interventions are globally informed, locally relevant, and impactful [55]. By considering the interconnectedness between environmental, cultural, economic, and technological factors, policymakers can enhance the effectiveness of their initiatives, promoting a holistic understanding of marine conservation and fostering sustainable practices that benefit the environment, society, and economy. These efforts are crucial steps towards achieving global environmental sustainability goals, such as the EU's carbon neutrality target outlined in initiatives like the European Green Deal.

However, it is important to acknowledge several limitations of the current study for transparency and integrity [56]. Firstly, while the dataset includes respondents from 42 countries, the majority are from

Europe, particularly France and Italy, which may limit the generalisability of the findings to non-European regions. Nevertheless, this dataset represents an exploratory effort to incorporate non-European perspectives into a global approach. Secondly, potential bias may arise from the self-selection of survey respondents, as those who participate may already hold specific opinions or beliefs about environmental issues, impacting the generalisability of the findings. Awareness of these limitations is essential when interpreting the study's results and their relevance to a broader population.

5. Conclusions

In conclusion, this study explores the relationships between climate change-related perceptions and the willingness to support marine protection. It employed Mindsponge theory and Bayesian Mindsponge Framework analytics to explore the psychological dimensions of marine conservation. Our findings validated hypotheses suggesting the negative effects of perceived high social and economic costs for addressing climate change and the perception of technologies as solutions for climate change on the willingness to support ocean protection. Based on these findings, we call for a balanced approach that can simultaneously contribute to climate change mitigation, marine conservation, and socio-economic development. Additionally, the study highlights the risk of exceptionalism, which can undermine the effectiveness of climate change mitigation and marine protection due to the strong belief in the capability of technologies to solve environmental problems. Strategies such as multi-stakeholder collaboration, indigenous knowledge integration, and the promotion of ecocentrism are proposed to make marine conservation efforts globally informed, locally relevant, and impactful.

CRediT author statement

Phuong-Tri Nguyen: Conceptualisation, Writing - Original draft preparation, Project administration; Minh-Phuong Thi Duong: Formal analysis, Writing - Original draft preparation, Writing - Reviewing and Editing; Hong-Hue Thi Nguyen, Viet-Phuong La: Methodology, Software, Visualisation, Data curation; Minh-Hoang Nguyen: Conceptualisation, Formal analysis, Writing - Reviewing and Editing; Quan-Hoang Vuong: Conceptualisation, Validation, Supervision.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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The veil of secrecy regarding a protected design scope in the light of prior art

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Abstract:

The scope of industrial design protection is often determined in close relation to legal information on prior industrial designs recorded in the prosecution estoppel history and in other sources. Determining the scope of industrial design protection based on that "prior art" aims to clarify the nature of the protected design and determine whether a contested design falls into that scope or is infringing the protected design right in resolving conflicts of rights as well as adjudicating infringements of rights over the protected design. This article delved into the theoretical basis for the scope of industrial design protection in the light of prior art and practical international lessons in determining the nature of the protected design. Although it is not clearly stipulated in current legal provisions on industrial designs in Vietnam, the accessible design prior art, particularly, the public design prosecution estoppel history, should be considered as one of the indispensable grounds to determine the scope of design protection. The principles for analysing scope of design protection that should be applied in Vietnam in accordance with the common standard practice are proposed in this article as well.

Keywords: **design, industrial design, prior art, prosecution estoppel, scope of protection.**

Classification numbers: **6, 7**

1. The "black box" of the scope of design protection

The current Intellectual Property Law stipulates that an industrial design (or design) patent recognises the subject matter, the scope, and the term of protection of the design (Article 92.1). For that purpose, the scope of design protection is determined based on the scope recorded in the National Register of Industrial Property, the International Register of industrial designs, or in design patents, or in decisions on the acceptance of international industrial design protection (Article 34.1 of the Decree No. 65/2023/ND-CP dated August 23, 2023 by the Government). Furthermore, the basis for determining the infringement of industrial design rights is the scope of industrial design protection recorded in those documents (Article 76.2 of the Decree). The unique information on the scope of design protection recorded in the above mentioned documents only includes a set of photos or drawings of the protected design, the number of the design's alternatives, the international classification of the design and some other information (Article 37.2.b) (ii) and (iii) of the Circular No. 23/2023/TT-BKHCN dated November 30, 2023 of the Ministry of Science and Technology). Thus, the current laws and regulations on industrial designs do not explicitly stipulate how to determine the scope of design protection with the existence status of known industrial designs for the same products (hereinafter referred as "*prior art*"). Therefore, the research issue in this context is whether the scope of design protection should be determined in comparison with other known designs of the same products in the eyes of informed users.

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It would be understood that the scope of industrial design protection determines the nature of that design, i.e. the overall visual impression or appearance of the design characterised by the combination of its essential features (Article 23.4. of the Circular No. 23/2023/TT-BKHCN). In particular, the features of an industrial design are presented in the form of lines, shapes, colours, position or dimension proportions that, when combined with other features, create the individual character of the design. Among those features, "essential features" contribute to the overall appearance of the design, which are easy for informed users to perceive, necessary and sufficient to determine the design's nature and differentiate the design with other designs used for the same products or articles. The essential feature must meet the criteria that can be used to examine the novelty, non-obviousness and industrial applicability of a design, and to be easily "looked and felt" by the informed users in terms of significant differences of the relevant designs. In other words, the combination of those essential features of overall appearance of a design identifies the scope of that design protection.

In the practical perspective, regarding the process of industrial design prosecution as well as invalidity proceedings, the prior art even anywhere in the world would be taken into account at the time of filing date of the design application for the purpose of examining essential features of that design as well as its nature in the light of the prior art. Thus, design protection is conferred only for the combination of those essential features of overall appearance of the registered design. However, in Vietnam those who try to precisely determine the scope of an industrial design protection may not rely only on the information recorded on the design patent as provided for in the current design laws and regulations due to the lack of both the design's published prior art and disclosed prior art accessibility limitation. To contribute to a more relevant interpretation of the scope of design protection, the methodological approach used in this article is synthesis and analysis of secondary data including legal regulations and court precedents.

2. The scope of design protection in the light of prior art

Determining the scope of industrial design protection, which analyses and examines the combination of essential features based on the "prosecution estoppel history" and the prior art of the design, is a complicated issue and has long been discussed in the practical context of dispute resolution and infringement adjudication regarding industrial design rights in the world [1]. The prosecution estoppel history is the proceedings between the applicant and the Intellectual Property Office from application filing to patent issuance, which usually comes into play in the context of claim construction (for example, before a court, or in a post-grant proceeding, or in analysing the patent for freedom to operate reasons), and also of an assessment of infringement under the doctrine of equivalents. In general, the scope of industrial design protection is interpreted quite consistently in the United States, the EU, Japan, China... and is often considered during the process of the design prosecution, or invalidity proceedings and particularly in infringement litigation.

In the practice of industrial design litigation, since the late 19th century, to solve the problem of determining the scope of industrial design protection, the US courts have applied a number of legal doctrines relating the design prior art [2, 3], e.g. the "point of novelty test", the "non-trivial advanced test", and the "ordinary observer test". The courts in Japan also apply this important principle [4]*. In the EU perspective, the extent of the prior art is also considered as a key determinant for individual character of a protected design [5, 6]. Recently, the EUIPO's Guidelines for Examination of design invalidity applications (31 March 2024, para 5.7.2) stated that: "…when the contested RCD (Registered Community Design)

*Quotation from the study of Miku & Chikako (2023): "With regard to the enforcement of designs, the test for infringement is fairly similar to the US test… Further, and similar to US law in some cases, the presence of the novelty of the design as compared with the prior art may be considered".

shows more features than the earlier design (prior art), all of its features will be taken into account for the assessment of novelty and individual character. This can happen, for instance, where the contested RCD includes colours, visible effects produced by textures or any other aspects of appearance that are not visible in the earlier design" [7]. The interpretation and application of these doctrines themselves are modified over time [8, 9]. In this context, this article would like to take US viewpoints as a typical example to further illustrate the determination of the scope of industrial design protection in the light of prior art. Until recently, the courts have almost not applied the non-trivial advanced test as an independent rule, but rather integrated it into two rules on the point of novelty test and the ordinary observer test. Some courts even combine the point of novelty test and the ordinary observer test as if there is only the ordinary observer test. It seems that the litigation in practice of many countries and regions around the world considers the scope of industrial design protection as same as the invention's nature and hence the design protection titles are also called the "design patents".

The purpose of the point of novelty test and the non-trivial advanced test for industrial designs is to determine the scope of industrial design protection [2, 10]. The design owner has the right and obligation to indicate which features of the design are new and inventive. To do this, it is necessary to present a list of the known designs or the earlier published designs (prior art) that are the basis for the improvement or creation of the new designs, and to clarify the essential features that should enjoy the design right protection [11]. On the contrary, the alleged infringer defends against the infringement allegation by providing the prior art information to prove that the essential features claimed by the design owner are not new and/or inventive and therefore do not fall within the scope of design protection. The court may also issue prior art information on its own. Thus, the scope of industrial design protection depends closely on the relevant prior art information presented to the court or other competent dispute resolution authorities, especially the information recorded in the prosecution estoppel history [12]. In the context of industrial design dispute resolution and infringement adjudication, the scope of design protection may be narrowed, even considered as "zero" (i.e. the design patent is judged as invalid). This circumstance can be clarified by the *Lawman Armor Corp. v. Winner Int'l, LLC*. case in the US. In this case, the industrial design owner indicated eight essential features of the steering wheel lock that are considered as the points of new in his design patent compared to the only one known design of the prior art. The alleged infringer (defendant) argued that all eight features as indicated were not new by presenting a number of known designs of the various prior art information, in which each prior art document had several features, but not all eight, recorded in the design patent. The court accepted this defendant's argument and revoked the design patent validity in its entire scope of protection, i.e. invalidated the granted design patent [10]. What is noteworthy is that the court accepted the use of each individual design in the prior art to reject each essential feature recorded in the design patent and thus this design patent became cannot be infringed.

The ordinary observer test is also a very important rule to determine whether a particular object falls within the scope of design protection [2, 13]. As early as 1893, in the *Smith v. Whitman Saddle Co.* (148 US 674, 1893) case regarding the industrial design of the saddle, the US Supreme Court clearly expressed its stance on the scope of design protection when it decided that there was no infringement in the alleged product because the protected design has a unique new feature, a drop shape, while the accused product does not have this shape even though the other essential features are the same as the protected design. In this case, the Court stated that *"…if, therefore, this drop was material to the design, and rendered it patentable as a complete and integrated whole, there was no*

infringement". It means that if the drop shape is the essential feature of the protected design because of its important contribution to the design as a whole, the accused saddle is not infringing only because it does not have this feature. The *Smith v. Whitman Saddle* case became the rule of case law and applied to subsequent industrial design infringement lawsuits. For example, in the case of *Applied Arts Corp. v. Grand Rapids Metalcraft Corp.* (67 F.2d 428, 1933) regarding the design of an ashtray combined with an electric lighter, a district court in the US initially determined that there was infringement because in the eyes of the ordinary observer, there is not a significant difference between the accused product and the protected design. However, the Federal Court overturned the district court's decision on the grounds that *"… ordinary observer was not one who has never seen an ashtray or a cigar lighter, but one who, though not an expert, has reasonable familiarity with such objects and is capable of assessing the similarity of the patented and accused designs in light of similar objects in the prior art"*. The latest version of the ordinary observer test established by the US District Court in *Egyptian Goddess, Inc. v. Swisa, Inc.* (543 F.3d 665, Fed. Cir. 2008) case, and is now applied in many countries and regions around the world. In particular, the Federal Court requested to apply the precedent of the Litton case [10]. The Court's statement is as follows: "*Litton and predecessor cases on which it relies are more properly read as applying a version of the ordinary test in which the ordinary observer is considered to view the differences between the patented design and the accused product in the context of the prior art. When the differences between the claimed and the accused design are viewed in the light of the prior art, the attention of the hypothetical ordinary observer will be drawn to those aspects of the claimed design that differ from the prior art. And when the claimed design is so close to the prior art designs, small differences between the accused device and the claimed design are likely to be important to the eye of the hypothetical observer*" (recited by E.E. Vasallo, et al. (2009) [10]).

Thus, the literature review of theoretical and practical studies in international case laws have demonstrated that determining the scope of industrial design protection should be made in view of the relevant design prior art, at least as recorded in the prosecution estoppel history, rather than being taken to consider a particular protected design in isolation [14]. Accordingly, the scope of design protection determination based on the prosecution estoppel history is the important principle known as "three-way visual comparison". This principle firstly determines whether a particular feature of the patented design is considered as essential by comparison with the relevant prior art and secondly, evaluates whether a contested design has that essential feature or not by comparison of the contested design with both the protected design and the prior art. The comparison of two specific designs to determine the protection scope should be taken through the eyes of an "ordinary observer" who is knowledgeable about the product's sector and is aware of known similar designs in the sector, and even being informed about the new features of registered designs [15]. Therefore, to determine the scope of industrial design protection, it is prerequisite to perform a prior art search to identify the essential and non-essential design features. When determining that a feature is "similar", it is necessary to indicate a prior design in the art that contains that feature and not to make an arbitrary judgement. In specific circumstances, a known design with the overall appearance must be included in the prior art; if found, compare that design with the protected one to evaluate which feature is new, thereby determining which new feature is essential, and only then should the contested design be considered; if not found, the general features are essential characteristics without taking details into account. To prevail on a claim for design patent infringement, the patentee must establish that an ordinary observer who is familiar with the prior art designs would be deceived into believing that the accused product is the same as the patented design.

3. Some implications on determination of the scope of design protection in Vietnam

In Vietnam, studies on determining the scope of industrial design protection in view of the relevant prior art have almost not been conducted. Due to the lack of clear and complete concept of the protection scope in legal documents and in the implementation of laws and regulations on industrial designs, there have not been practical mechanisms to interpret or clarify that concept in a consistent manner. In recent years, the design right registration and enforcement practice has shown that there is an inconsistency, even contradiction, in the interpretation of the same concept regarding the scope of design protection by competent authorities and practitioners, thereby leading to situations in which the same legal provisions on the protection scope are applied in the different principles. In the context of unofficial case law application and only a few cases have been considered as "sources for developing case law" in the people's courts' database, and any authority adjudicating infringement of industrial design right can interpret that legal concept at its own discretion, so that in case of conflict in interpretation, the existence of a guiding agency to determine which interpretation is reasonable to apply consistently in other similar circumstances is really crucial. While the issue of intellectual property in general as well as industrial design rights is still relatively new to the court system, the contradiction in understanding, interpreting and applying the above legal provisions causes difficulties not only for the judges in adjudicating the case but also for other authorities to make satisfactory and predictable decisions. More seriously, it will disrupt industrial design protection activities and make it impossible to fulfil the goal of the intellectual property law system. For that reason, the unification of permissible standards on the scope of industrial design protection is firstly reasonable expectation and urgent practical requirement in the long term, not just in specific cases.

Secondly, in the invalidity proceedings as well as the process of resolving disputes and/or adjudicating industrial design right infringements, the issue of determining the protection scope plays a decisive role in evaluating acts of infringement. In many cases, when an accused design is only different from the protected design in one or a few features, determining the protection scope and assessing whether or not the accused design is within the protection scope in the light of prior art is a complicated task. In other words, within hypothetical scenarios, the following question should be reasonably answered in detail: if the design B is protected on the ground that B has a new feature "y" compared to the feature "x" of the known design A while B has the all remaining features that are similar to those of A, then should the design C be considered different (and not within the protection scope) compared to B if it has the feature "z" that is different from "y" even though C has the all remaining features the same as B? To answer this practical question, the scope of design protection should be interpreted as the combination of each and every essential features of the protected industrial design. The correct answer is "Yes" because if a product has all essential features of the protected design, regardless of whether there are any other essential features on that product, then the product is considered to fall within the scope of design protection, and the production or sale of such products is considered an infringement of the patented design right. Even if the added features are considered to meet the conditions of novelty and inventiveness and their combination with known essential features is eligible for design protection, the right of the person granted the design patent still depends on the right of the original design owner. In this interpretation, the above mentioned essential feature must be considered as the new and different characteristic compared to the relevant prior art and be used to distinguish this design as an overall visual impression from other known designs. Due to the above mentioned "black box", the relevant prior art which is any disclosure, written or oral, made available to the public anywhere before the filing date of the design application for registration should be publicly accessed in the most comfortable

manner and considered as an indispensable factor affecting the determination of the protection scope. This is because the prior art provides real-time grounds for determining which design features are essential as well as its combination building the nature of the industrial design.

In conclusion, although it is not clearly stipulated in current legal provisions on industrial designs in Vietnam, the accessible design prior art and in particular, the public design prosecution estoppel history, should be considered as one of the indispensable grounds to determine the scope of design protection. As mentioned above, there are a lot of countries or regions having developed modern intellectual property systems such as the US, the EU or Japan apply this important standard when evaluating the scope of design protection. More specifically, the scope of design protection would rather be determined by the combination of all essential features and the construction of which feature is "essential" should be applied consistently based on publicly known designs in the light of prior art. This principle provides an intuitive and effective tool for evaluating design similarities. It helps avoid the common mistake of comparing only two designs in isolation without reference to prior art. This principle has been applied for many years internationally yet, demonstrates its compatibility with the industrial design protection mechanism and therefore should be applied consistently during the process of the design prosecution, or invalidity proceedings and particularly in infringement litigation in Vietnam for the time being. Nevertheless, based on the US and the EU systems, more studies are needed to determine whether the patented design should be conceptualised as the design as applied to a specific type of product, not as a design *per se*, and therefore, may have implications for the broader policy debate over how designs should be protected by intellectual property laws.

COMPETING INTERESTS

The author declares that there is no conflict of interest regarding the publication of this article.

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Gate eyes - Unique features in decoration and belief of Hoi An ancient town XVI-XVII centuries

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Abstract:

In the sixteenth century, Hoi An flourished as a Southeast Asian trading port, attracting international ships. To this day, Hoi An retains significant elements of its traditional culture and historic architecture. Among its distinctive architectural features are the gate eyes, which are unique to Hoi An houses and reflect the spiritual and cultural identity of its inhabitants. Unfortunately, there are few existing studies on Hoi An's gate eyes, and those that do exist lack sufficient detail, making it difficult to engage in further research or discussions. This study aims to address that gap by providing information on the gate eyes and their cultural value. The study employs scientific observation, investigative techniques, and expert interviews. It explores the historical development of gate eyes, categorises their patterns in Hoi An, and situates them within a broader architectural context. The study also investigates why gate eyes are more prevalent in Hoi An than in other regions with Chinese communities. Finally, it discusses the significance of gate eyes to the local people. The preservation and promotion of this architectural feature could be leveraged to enhance Hoi An's tourism industry.

Keywords: **gate eye, Hoi An's gate eye, unique feature of Hoi An.**

Classification numbers: **8.1, 9.3, 10**

1. Introduction

Since 1999, Hoi An has been recognised as a UNESCO World Cultural Heritage site. Hoi An ancient town continues to preserve its historic value through its architectural structures, including pagodas, communal houses, chapels, ancient houses, and temples. Visitors will notice that gate eyes are a unique feature of Hoi An's architecture, regarded as a spiritual emblem and a distinctive mark of the Hoi An people.

The objective of this research is to provide a comprehensive analysis of Hoi An's gate eyes. Currently, there is a lack of in-depth studies and discussions on the subject. Existing studies tend to offer only brief insights into gate eyes within broader topics, such as the worship of Gate Gods by Hoi An's Chinese residents or the architectural uniqueness of gate eyes, without exploring their historical context in detail. However, a thorough examination of the uniqueness of gate eyes, as well as an analysis of the images associated with various types, is crucial for understanding why gate eyes are distinct to Hoi An and are not commonly found in other regions where Chinese communities have settled.

For the benefit of the Hoi An community, it is important to explain the cultural and spiritual significance of gate eyes. By conducting observations and research, this study aims to address this fundamental question.

2. Research methods

This research utilises observational methods to collect data on gate eyes. During a research trip in May 2023, I visited and studied 76 ancient houses in Hoi An, documenting the various shapes of gate eyes. In addition, the study draws on expert interviews and conversations with local residents to understand the symbolic meanings behind different types of gate eyes.

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The research also incorporates analysis and synthesis methods to explain why gate eyes are prevalent in Hoi An but are absent in district 5, Ho Chi Minh city, where many Chinese migrants reside.

3. Results

3.1. Overview of the gate eyes

3.1.1. What is gate eyes

Gate eyes are known as clips of the gate (gate clips) in Chinese culture. This is a common accessory for women that is worn as jewellery and is used to keep hair neat. The Chinese may have implied that these clips add a noble touch to the building where a distinguished family resides by referring to the gate eyes of the architectural work [1]. For that reason, gate eyes are also called gate clips. Furthermore, "people in Dongshan, Suzhou, China consider that (mendanghupair) is a common name for gate stones, and gate eyes are also called (Mendang: prospective), the rest (Hupair: well matched) is usually a pair of stones or wood, lifting the shaft beneath the gate threshold always goes together. This is an idiom presenting the meaning of two objects that fit well together..." [2]. In the context of marriage in the past, this idiom indicated that the families of each party were well matched in terms of social status when discussing marriage. Depending on the pattern and shape of the gate eyes, they have different lucky meanings. The symbolism of the gate eyes varies depending on the pattern shape. It is common to see gate eyes in Hoi An, prominently displayed on the front gates of houses throughout the ancient town. The gate eyes have a nail-like form, with a canopy that is 8 to 10 cm thick and a diameter of more than 20 cm. The front canopy is around 30 cm in length, with a rectangular shape to which the chisel cotter is affixed. Originally, the purpose of the gate eyes was to decorate and safeguard the gate set. They helped ensure smooth opening and closing of the gates without disengagement and provided security. The key part of the function is more important, "but perhaps to enhance the appearance of the house, people gradually carved it to make it look more appealing, even assigning it a value that is one step less than the wooden beam (The wooden beam is referred to as the first rank, and the gate eyes as the second)" [3].

3.1.2. The origins and development of gate eyes

Gate eyes originated from two main beliefs: animatism and faith in the worship of Gate Gods. The Hoai river, where fishermen and traders live and work, is located next to Hoi An. Therefore, people generally design two large, clear eyes at the head of the boat (Fig. 1). The idea that "a boat exists as well as a living creature" helps sea monsters recognise the boat as a moving object of the same species and thus not a threat. At the same time, the boat's eyes assist sailors in seeing far ahead, finding fish and shrimp, and predicting dangers.

Fig. 1. The belief in painting eyes for boats among Hoi An residents.

The eyes represented a prayer for a peaceful life on the river and turned the boat into a symbol of good fortune. Over time, the Cua Dai estuary in Hoi An has become increasingly narrowed by sediment, preventing large ships from accessing the harbour. As a result, the Co Co river has turned into a "dead river" after experiencing many historical changes over time. "The Quang people virtually ignore the river and the view of the boat floating down it, as well as the life attached to the river" [4]. Therefore, locals who had previously lived on boats wanted to leave that life behind and build houses on land. Moreover, the people of the area were heavily influenced by the custom of drawing eyes on boats and their belief in worshipping the Chinese Gate Gods.

Additionally, because the entrance is the first thing that visitors see when arriving at a house, "the old gate frame is often narrow, not as splendid as the gate itself, but it is still respected and carefully decorated" [5]. According to Chinese architectural traditions, the people of Hoi An adapted the clips into gate eyes with their own characteristics, making them an essential feature in every house.

3.2. The shape of gate eyes

Based on Buddhist, Confucian, and Taoist concepts, Hoi An currently has more than 20 different forms of gate eyes. The most common are the whirling chrysanthemum gate eyes, with 63 pairs. There are also 8 pairs with a circular shape, 3 pairs with square shapes, and 3 pairs with octagonal shapes. The most widely recognised gate eyes shapes are the chrysanthemum whirling and circular shapes, but other shapes include hexagonal, rectangular, and rhombus.

3.3. Size and quantity

The size of the gate eyes symbolises the homeowner's power and authority. In ordinary or wealthy homes, the number of gate eyes ranges from one to two pairs, while in Siheyuan households, there can be up to six pairs. The size of the gate eyes depends on the size of the house, indicating the owner's class and prosperity. Hoi An residents also believe that only a house with gate eyes demonstrates that the owner is a true local.

3.4. The pattern on the gate eyes

The structure of the gate eyes is divided into two parts: the rim and the centre. The rim surrounds the chrysanthemum flower with vortex petals in the shape of leaves, Bagua, Water Monster, Five Blessings, a long geometric art drawn on the shape, ancient characters or gate eyes with only one word of longevity, or creating a clew that only has ledges outside the centre.

The centre part often displays symbols such as yin, yang, five symbols, a pistil-shaped pole, or the letter of happiness, longevity, seal script, or yijing. Some gate eyes are only circular, and the front contains images of Rahu or Han characters. "According to the Chinese concept, the circle signifies the desire to give birth to heaps of descendants, which means expecting a prosperous family, someone to inherit the fire" [5]. The pattern on the gate eyes helps indicate whether the family's beliefs are aligned with Buddhism, gods, or Taoism.

3.5. The colour of gate eyes

Gate eyes are frequently gilded with gold leaf, although they can also be coloured in black, blue, or natural wood tones. Each colour holds a distinct meaning. Red symbolises wealth, renown, and good fortune. The shade of blue evokes images of bygone eras along rivers and represents one's career. White symbolises innovation and the expectation of receiving support from those in power. Yellow denotes prosperity and wealth, while blue represents health and nature.

3.6. General characteristics and significance of each type of gate eyes

Gate eyes share the common feature of being elaborately and meticulously carved. They are typically made from round wood in their original form. While the rim is more varied and flexible in its design, the inner decorations usually feature Taiji and chrysanthemums.

3.6.1 Gate eyes in the shape of 6-spiral chrysanthemums

In Hoi An, the most common gate eyes with a rim are the chrysanthemum petals shaped like the leaves of the ficus rhynchophylla (Fig. 2).

Fig. 2. Six-petal chrysanthemum gate eyes in swirling shape, gilded with gold leaf.

Yellow chrysanthemums are thought to symbolise prosperity and lavishness. "The ancients considered September to be symbolised by chrysanthemums. The pronunciation of 'save' (retained) and 'chrysanthemum'

is the same in Ju. Therefore, September means 'Jiu,' which is also a homonym for the word 'Nine,' carrying the meaning of eternity" [6]. Chrysanthemums are said to represent wishes for longevity, balance, and overall well-being.

Previously, chrysanthemums were reserved for royalty, as they were believed to bring wealth and blessings to the household and symbolise love, filial piety, and respect. The numbers 6 and 8 are highly favoured by Chinese people. According to tradition, six (growth) is a lucky number denoting abundance, wealth, and prosperity. The pair of gate eyes with six petals of chrysanthemum flowers is the crystallisation of family bonds, filial piety, a full lineage of descendants, and the homeowner's desire for fortune.

3.6.2. Gate eyes in the shape of 8-spiral chrysanthemums

"The Cantonese pronunciation of 'eight' as 'fa,' which is similar to how prosperity is pronounced, is the reason why the Chinese are fascinated by the number eight [7]". In addition to symbolising prosperity, luck, and wealth, it also represents fullness and peace. The number eight in the Bagua denotes a favourable shift in one's circumstances. The image of eight chrysanthemum petals swirling around the rim also symbolises each person's flourishing business (Fig. 3).

Fig. 3. A pair of gate eyes in the shape of 8-spiral chrysanthemums.

3.6.3. Gate eyes in Taiji diagram

The Taiji often appears in the centre of the gate eyes, which is a circle with two symmetrical 'S' halves embracing each other (Fig. 4). The concept of Taiji embodies the essence of Eastern philosophy, particularly the yin and yang theory. Black signifies yin, while white signifies yang. A yin and yang equilibrium is represented by black dots on a white background or vice versa. The outer circle symbolises infinity.

Fig. 4. A pair of gate eyes in the combined shape of the Bagua and 6-spiral chrysanthemums.

The colour of Taiji may vary depending on the views and beliefs of the host family, such as white-yellow, white-red, etc. "The symbol of Taiji represents the beginning, perfection, integrity, bringing auspiciousness and happiness, while also serving to appease demons and exorcise evil spirits" [6], with hopes of harmony and goodness in all things.

3.6.4. Gate eyes in Bagua shape

Taiji is frequently associated with the Bagua, a common cosmological symbol that is often found on the rim of the gate eyes (Fig. 5). "In the 'Yijing,' it is said that the universe has its origin in Taiji; Taiji generates heaven and earth, heaven and earth generate The Four Symbols, and The Four Symbols generate Bagua" [8]. The Bagua has two forms: the early heaven sequence and the later heaven sequence.

Fig. 5. A pair of gate eyes in the shape of the Bagua.

People apply the Bagua to the gate eyes in the hopes of attracting wealth, luck, and good health. Moreover, the Bagua symbol on the gate eyes also attracts luck for the family and wards off evil spirits and bad omens.

3.6.5. Gate eyes in the shape of two dragons attending the sun and two dragons flanking a moon

Gate eyes shaped like "two dragons fighting for the pearl", "two dragons flanking a moon" or "two dragons attending the sun" are symbolic of sovereignty and royal orders (Fig. 6). This design can be seen on the rim of the gate eyes in the harem of Fukian Assembly Hall. These "eyes" are large, blending in with the surrounding architecture. The pair of gate eyes were painstakingly carved at the Fukian Assembly Hall and gilded with gold leaf.

Fig. 6. A pair of gate eyes in the shape of two dragons attending the sun at the rear of the Fukian Assembly Hall.

"The traditional belief that "all things begin with water" portrays the dragon as a symbol of water, which is responsible for life and growth of all things" [9]. The dragon symbolises the confluence of power, development, and the dispersal of essence. The phrase "two dragons" symbolises duality-yin and yang, heaven and earth.

3.6.6. Gate eyes in Rahu shape

The "Rahu" figure in Chinese culture, also referred to as "Taotie," is depicted on the gate eyes at Quang Cong temple (24 Tran Phu, Hoi An) with a fierce visage. Rahu is believed in Chinese culture to ward off bad luck and evil spirits while safeguarding the tranquillity of the household.

3.6.7. Gate eyes in the Wǔ Fú Lín Mén (Five Blessings) shape

In Chinese culture, the expression "Five Blessings" conveys the wish for blessings and benefits to the homeowner: longevity, happiness, well-being, virtue, and goodness. In Vietnamese culture, the Five Blessings are happiness, fortune, longevity, well-being, and security. The bat is considered a symbol of the Five Blessings, as its pronunciation in Chinese, 蝙蝠 (biānfú), is homophonic with 福 (fú) in beatitude.

Fig. 7. A pair of gate eyes in the Five Blessings shape.

The rim of the gate eyes is adorned with a circular arrangement of the "Five Blessings" (Fig. 7). "Small circles, ribbons, or transformations of grass, flowers, and leaves are often prioritised for decoration alongside the bat motif" [10]. This is a symbol of the hope for good fortune, achievement, wealth, and contentment. While not everyone achieves the full Five Blessings, they have become a deeply desired aspiration for many.

3.6.8. Gate eyes in the Finger citron fruit shape

The image of the Finger Citron fruit is found at the centre of the gate eyes, surrounded by chrysanthemum petals shaped like the leaves of Ficus rhynchophylla (Fig. 8). The Finger Citron fruit, also known as Buddha's fingers, is represented in the gate eyes with inward-pointing "fingers" like flowers, as if blessing and protecting the family. The design of the Finger Citron fruit symbolises respect for ancestors and hopes that they will bless the family with success in career, fame, and well-being. Beyond its spiritual and feng shui benefits, this image reminds all family members to act with kindness, compassion, and goodwill.

Fig. 8. A pair of gate eyes in the shape of finger citron fruit.

3.7. The relationship between gate eyes and the overall architecture of ancient houses in Hoi An

When Chinese merchants migrated to Hoi An and settled there, in an effort to remember their homeland and preserve their ancestral culture, "the Chinese people built residential and spiritual structures according to Chinese architectural principles, with details constructed based on the concept of the yin-yang universe, emphasising aesthetics, symmetry, and orderliness" [11]. This concept is evident in the roof structure of houses in the ancient town, which is always covered with yin-yang tile roofing (except for houses built in the French architectural style during a later period). Gate eyes are no exception, as they are placed symmetrically, following this principle to create harmony and balance in the overall architecture.

When constructing houses, the craftsmen from Kim Bong woodworking village infused spirit into Hoi An's wooden architecture, not only through the gate eyes but also by carving decorations in many other parts of the house, such as the trusses (especially crab-shell roofs), wall panels, roof edges, and furniture. Even though, during this period, King Gia Long issued a prohibition "against painting and decorating, forbidding the use of ironwood for houses, and banning the carving of trusses... houses that were too beautifully made would be considered an excess" [12], the artisans continued to innovate and skilfully incorporate architectural details. The motifs they used primarily included Chinese characters (blessing, prosperity, longevity, delight), flowers, leaves, branches, the five fruits, the four sacred animals, bats, and carp. These carvings were predominantly located at the front of the house, in the reception area, highlighting the importance placed on the house's exterior. The motifs harmonised with the patterns of the gate eyes, all sharing the common purpose of wishing peace and prosperity for the homeowner.

3.8. Red brocade fabric as decoration for gate eyes

The gate eyes are adorned with red brocade fabric, which gives the house an opulent, old-world appearance (Fig. 9). Red fabric is a symbol of good fortune, luck, and protection against evil spirits. People typically take out the gate eyes at the end of the year to clean them and usually replace the slot of the gate eyes with a new square piece of red cashew fabric, which they use throughout the year. By doing this, they create an atmosphere for the house, ward off evil luck from the previous year, and anticipate good fortune. However, since there are now so many tourists, people tend to keep the red fabric hanging year-round instead of taking it down.

Fig. 9. An example of gate eyes adorned with a piece of red brocade fabric.

3.9. The uniqueness of Hoi An gate eyes

3.9.1. The uniqueness of Hoi An gate eyes

"Hoi An is perhaps the only city in Southeast Asia that still maintains an 18th-century lifestyle with wooden architectural structures" [10]. Largely unaffected by wars, changes in lifestyle, and trends of architectural modernisation, as well as partially restored to its original appearance, Hoi An has preserved its ancient charm. A prime example of this preservation is the gate eyes, which continue to exist in Hoi An's ancient town, contributing to its unique identity. While some gate eyes have been found in cities like Hue, Khanh Hoa, and Hung Yen, this is likely due to the spread of architectural styles throughout history [13, 14]. However, as the ethnic Chinese population has dwindled in these provinces and cities, the presence of gate eyes is less common compared to Hoi An.

In Hoi An's ancient town, gate eyes only appear on houses, temple communal houses, and assembly halls belonging to Hoi An residents of Chinese descent. In contrast, the houses of indigenous people do not have gate eyes. The design of the gate eyes is in harmony with the house, becoming an integral part of it. This image also evokes the ancient practice of drawing eyes on boats. Although gate eyes are now primarily considered decorative elements in modern architecture, they still hold significant cultural and spiritual meaning. They contribute to heritage conservation and create spaces rich in tradition, ensuring that the memories and culture of Hoi An's people remain vibrant for future generations.

3.9.2. Comparison of beliefs in house decoration of the Chinese in Hoi An and Ho Chi Minh city

When the Chinese came to Vietnam, they brought their culture and customs with them, but gate eyes only appeared in Chinese houses in Hoi An, not in Chinese houses in Ho Chi Minh city. The reason for this is that Chinese people living in Ho Chi Minh city continue to maintain their belief in the worship of Gate Gods. According to Chinese custom, they place images of the two Gods and Yulei on both sides of the gate (Fig. 10). However, since the homes of Chinese people in Ho Chi Minh city are often adjacent to production and commercial areas, close to the market, the spaces within these residences are frequently small, as they serve both as living quarters and locations for production, hosting, and performance. As a result, "they worship the Gate Gods more simply, using two iron pipes as symbols to insert incense on either side of the gate, with one placed above and one below the house" [15]. In addition to lighting incense daily, homeowners also frequently place red paper with phrases such as

Fig. 10. Examples of the worship of Gate Gods by the Chinese in Ho Chi Minh city.

"Wish you a safe journey/trip", "Five Blessings" etc., in front of the gate in hopes of attracting good fortune and peace.

For the Chinese people in Hoi An, the architecture of their ancient houses is built according to traditional principles, and the gate eyes follow feng shui guidelines. The customs of trade and business along the river, combined with spiritual beliefs, led to the creation and appearance of gate eyes in Hoi An.

3.10. The meaning of gate eyes for Hoi An

The gate eyes have become a distinctive architectural feature that visitors can only see in Hoi An. Gate eyes enhance the appearance of the owner's residence, making it more elegant, dynamic, and magnificent, while also reflecting the owner's aesthetic sensibilities. Despite this, the design remains consistent with the house's overall structure and decor.

From a spiritual perspective, the people of Hoi An place great importance on gates, "worshipping every night by placing incense sticks on both sides of the gate, showing the owner's respect for the gods" [16]. The gate eyes symbolise family and authority, as well as the homeowner's wealth and good fortune. Like the eyes of the gods, the pair of gate eyes constantly observe the thoughts and actions of each family member, serving as a reminder to act morally, avoid evil, and instil good manners in their children and grandchildren. Gate eyes serve as an amulet for the homeowner, symbolising their wish for a peaceful life free from illness, natural disasters, and evil omens.

Beyond their decorative function, gate eyes play a key role in preserving the beliefs, culture, and religious practices of the people of Hoi An. Additionally, from an educational and tourism perspective, gate eyes offer valuable insights into the history and culture of Hoi An.

They attract tourists, especially those with an interest in architecture, culture, and history, and serve as a unique cultural symbol of the town.

4. Conclusions

The gate eyes are a distinctive and unique feature of Hoi An's architecture. Every detail is not only aesthetically pleasing but also carries deep spiritual significance for the homeowner. With the frequent buying and selling of properties in Hoi An, new owners may not fully appreciate the importance of gate eyes, as they may be unfamiliar with local traditions. As historic structures gradually disappear, the concept of gate eyes risks fading from memory. However, the gate eyes reflect the aesthetics and cultural identity of the people who live in these homes.

Therefore, it is essential to research and preserve the gate eyes to prevent them from being forgotten. This can be achieved by promoting awareness and studying the relationship between Hoi An's gate eyes and the town's architecture and spiritual culture. Integrating the significance, culture, and history of gate eyes into tourism, events, and even traditional products and souvenirs, can serve not only as an educational tool but also help raise funds for the sustainable conservation and development of the ancient town. This contributes to promoting sustainable tourism and preserving the cultural heritage of Hoi An.

Each pair of gate eyes represents a part of the soul of the ancient town and forms a part of Quang Nam's broader cultural identity. Conserving and promoting their value is not just the responsibility of local residents but also of the international community. Only through a clear understanding and proper evaluation of the role of gate eyes can we ensure that memories and traditional culture are preserved and passed down to future generations.

COMPETING INTERESTS

The author declares that there is no conflict of interest regarding the publication of this article.

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Protecting peace and the ecological environment: From the story of the Coconut Religion in Ben Tre

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Abstract:

Ben Tre is known as Vietnam's coconut capital. When discussing Ben Tre, one inevitably refers to coconuts and the unique cultural phenomenon of the "Coconut Religion". While this religion no longer exists in its original form following 1975, the folk beliefs surrounding coconuts in Ben Tre continue to reflect the cultural legacy of the "Coconut Religion". One of the enduring values within this heritage is the emphasis on peace and sustainable ecological preservation, a cause championed by the religion's founder, Mr Nguyen Thanh Nam. This legacy extends beyond Vietnam, resonating with followers and researchers in Japan as well. The Coconut Religion's principles have transformed into a folk belief system that integrates religious elements and promotes peace and environmental protection globally. This collaborative research seeks to explore lessons on sustainable ecological protection inspired by the post "Coconut Religion" coconut beliefs, which offer valuable insights for environmental policy. These beliefs, which span natural and cultural ecology, contribute to the preservation of intangible cultural heritage and spiritual culture. The findings also hold potential for reviving and enhancing tourism in Ben Tre within the context of globalisation and integration.

Keywords: **Ben Tre, coconut beliefs, Coconut Religion, ecological environment.**

Classification numbers: **9.3, 10**

1. Introduction

Ben Tre, located in the Mekong delta region, covering a natural area of 2,360 km². It consists of three islets: An Hoa, Bao, and Minh, surrounded by the four branches of the Mekong river (the Tien river, Ba Lai river, Ham Luong river, and Co Chien river), along with an expansive network of over 6,000 km of canals, creating an ecosystem highly conducive to coconut cultivation. Encompassing 78,000 hectares of coconut plantations [1], Ben Tre is Vietnam's largest coconut-growing area, where the coconut tree holds a prominent place in the lives of the people.

To understand the role of the Coconut Religion in promoting ecological protection within this unique environment, we conducted a case study on coconut beliefs in Ben Tre. Our focus centred on communities of former followers in Phuoc Thanh, Huu Dinh, Tam Phuoc, and Phu An Hoa communes within the Chau Thanh district, closely associated with the figure of Mr. Dao Dua. Although the Coconut Religion no longer exists, its legacy endures as a belief system known as the Coconut Beliefs of Ben Tre, embodying the local population's faith and aspirations for a sustainable environment. This belief system holds valuable lessons for cultural managers, social organisations, and other religious communities seeking to promote ecological values.

To gather data, the authors employed document analysis and ethnographic fieldwork, including group participant observation, interviews with dignitaries from Caodaism, Buddhism, former followers of the Coconut Religion, and experienced coconut growers. Collaborators supported data collection, analysis, and evaluation to meet the research objectives.

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2. Literature review

Research on coconut beliefs has not been adequately addressed. Consequently, there are few substantial studies, theses, dissertations, projects, or scientific conferences focusing on the coconut beliefs and the Coconut Religion in Ben Tre, particularly since 1975. This lack of research was a concern for the late professor To Ngoc Thanh, former President of the Vietnam Folklore Association. Throughout his life, he consistently encouraged Ben Tre to prioritise the collection, recording, and documentation of folklore stories related to the Coconut Religion. Based on our research, discussions on the heritage of the Coconut Religion can be categorised into two main groups:

2.1. International

In the United States, Richard Boyle authored *The Flower of The Dragon: The Breakdown of The U.S. Army in Vietnam*, published by Ramparts Press in 1972 [2]. Although the entire book has not been translated into Vietnamese, we have translated a chapter that addresses the Coconut Religion at Phung islet. This chapter offers insight into life on Phung Islet from the perspective of an American soldier, illustrating how the islet served as a refuge for soldiers, both domestic and international.

Zen master Thich Nhat Hanh also wrote *The Coconut Monk*, a children's book published by Parallax Press in 2005 [3]. This well-known picture book introduces the deeds of Mr. Dao Dua during the Vietnam war. It is notable that a globally renowned Zen master, Thich Nhat Hanh, chose to introduce children to the Coconut Religion, emphasising the importance of peace.

In Japan, the magazine 太陽 (*The Sun*) featured an article by Kuwabara Shisei, with photos of Mr Dao Dua on the cover, and an article titled "The monk Dao Dua living in the Mekong river: A form of anti-war activity", spanning pages 107-118 in the 12 March 1974 [4], issue. Similar to Boyle's book [2], this article provides a glimpse into life on Phung islet, depicting the simplicity and hardship there and illustrating how Mr Dao Dua protected his followers from government interference during wartime. The article also presents Mr Dao Dua's ideals for an ideal world, highlighting his regard for President Ho Chi Minh, as symbolised by his display of the North Vietnamese flag on the day of the President's death.

2.2. Domestic

Prior to 1975, significant works included H. Minh's self-published 1964 book *20 Nam Hanh Dao Tren Dai Cao - Doi Kho Hanh - Dao Dua*, in Vietnamese *(20 Years of Religious Practice on The High Platform - Ascetic Life - Coconut Religion),* considered the most comprehensive book on the Coconut Religion to date [5]. The author, H. Minh, conducted fieldwork directly at Con Phung, the sacred site of the Coconut Religion, and, upon completing the manuscript, sent it to Mr. Dao Dua for review and confirmation. This book describes the Coconut Religion as "playing the role of a bird keeper" (p.91) while practising asceticism on That Son mountain, establishing "an ascetic who has spent 20 years pursuing the dream of peace" (p.211). Another early study is Phan Nghi Linh's master's thesis, Chua Nam Quoc Phat Kien Hoa - Dinh Tuong, defended at Saigon University's Faculty of Letters in 1971 [6-8]. This thesis, the only master's work on the Coconut Religion to date, meticulously traces the religion's development from its challenging beginnings to Mr Dao Dua's leadership at Con Phung.

Post-1975, several studies emerged. These include P.V. Luan's (2019) [6] fieldwork documents on the Coconut Religion, and Ty Kheo Thich Tinh Tri's (2018) [7] essay from Hanh Nguyen pagoda in Ho Chi Minh city, "Hieu the nao cho dung ve nha tu kho hanh Nguyen Thanh Nam, tuc goi ong Dao Dua" "Understanding the ascetic Nguyen Thanh Nam, also known as Mr. Dao Dua", which provides a monastic perspective on the Coconut Religion. Here, the author clarifies the importance of Mr Nguyen Thanh Nam's commitment to peace and interreligious harmony. In 2020, P.V. Luan's article [9], "Di san van hoa Ben Tre trong boi canh phat trien cong nghe hien dai" ("The cultural heritage of Ben Tre in the context of modern technological development"), published in the *Tap chi Van hoa va Nguon luc (Culture and Resources Journal*), highlights the heritage of the Coconut Religion as a valuable feature of Ben Tre's tourism. Another work from 2020, *Nguoi Ben Tre (People of Ben Tre)* by L.M. Quoc, includes seven pages of text and three pages of photos on the Coconut Religion, with the author noting... "The topic that I have never heard anyone mention... according to my subjective choice, is Mr Dao Dua". Also in 2020, the Ben Tre Union of Science and Technology Associations published *Ben Tre Dat Va Nguoi (Ben Tre Land and People)*, dedicating three pages (274-277) to the Coconut Religion in a section

on Phung islet, one of Ben Tre's prominent tourist islets. Most recently, in 2022, the Social Sciences Publishing House in Hanoi published *Nghi Le Ton Giao Va Thuc Hanh Nghi Le Ton Giao o Viet Nam (Religious Rituals and Practices in Vietnam)*, a collective work featuring P.V. Luan's study "Tim hieu dam gio ong 'Dao Dua' - Nguyen Thanh Nam" ("Exploring the memorial ceremony of 'Dao Dua' - Nguyen Thanh Nam"), spanning pages 430-441, which states, "the story of the memorial ceremony for Mr. Dao Dua contains religious colours and has become a folklore tale in the Southern region" [10].

Additionally, since 2016, the Ben Tre People's Committee has officially recognised Phung islet (Coconut Religion) as a cultural and historical site under Decision No. 59/QĐ-UBND, dated 11 January 2016. This designation includes the Dao Dua relic site (Phung islet) for preservation and ranking, though it excludes the current Dao Dua church.

Most research projects, published works, and theses have primarily focused on the folklore surrounding the Coconut Religion in Ben Tre. However, studies examining the Coconut Religion's insights into peace and ecological protection remain scarce, revealing a research gap. This study aims to re-evaluate the "Coconut Religion" from a contemporary perspective and develop new approaches, leading to meaningful recommendations for preserving and promoting its cultural heritage values. The study synthesises essential lessons on peace and environmental protection that are highly relevant today.

The collected materials, analysed and interpreted through the lens of peace and ecological protection, serve as a foundation for future studies, enhancing the understanding of the Coconut Religion and encouraging broader research applications within Vietnam and internationally.

3. Research methodology

The primary research methods in this study are exploratory, drawing from disciplines such as cultural studies, sociology, and cultural economics to analyse the Coconut Religion. Additionally, the author employs fieldwork techniques, including surveys, observations, and data collection through photography, note-taking, and interviews with residents of Ben Tre province. Consultations with experts, both domestically and internationally, were also conducted. Based on these methods, the study proposes solutions for preserving and promoting the values of the Coconut Religion, with a focus on fostering peace and ecological protection for sustainable development.

4. Results

4.1. Ben Tre coconut: Foundations of coconut beliefs

4.1.1. Origins of Ben Tre coconuts

The question of when coconuts first appeared in Ben Tre has yet to be adequately explored by researchers. The perception that "Ben Tre is the land of coconuts" has often overshadowed historical inquiries into the origins of coconuts in the region, resulting in limited academic attention. Our research draws on historical evidence such as findings from the Giong Noi archaeological site in Ben Tre city in 2004, an exchange between the scholar Nguyen Dinh Chieu and Truong Dinh, and coconut motifs in the unique architecture of an ancient tomb in Ben Tre. These sources offer preliminary insights into the presence of coconuts in Ben Tre and the development of coconut-related beliefs, especially following the dissolution of the Coconut Religion.

First, we consider evidence from archaeological excavation and historical records. Over 2,000 years ago, nipa palm leaf patterns were engraved on pottery shards unearthed at the Giong Noi site in Ben Tre city [11]. This finding suggests a connection between the nipa palm and the terrestrial coconut - a term locals use for coconuts planted on higher ground. In response to our inquiry on "coconut leaf motifs on artefacts at the Giong Noi site", professor Amarjiva Lochan from Delhi University commented, "The coconut tree is sacred in India, and although we have found ancient paintings of coconuts, we have yet to see depictions of coconuts in early Indian rock art. This new discovery in Vietnam warrants further research". This observation is significant, as India is one of the world's largest coconut producers, and Ben Tre holds a similar status within Vietnam. The historical ties between India and Vietnam, visible in both Hindu temple architecture and coconut cultivation, underscore this connection.

The second story, nearly 200 years old, concerns an interaction in the summer of 1862 between Truong Dinh and the scholar Nguyen Dinh Chieu. Truong Dinh, feeling frustrated, asked, "The imperial order demands that I disband my troops and surrender to the French. How should I act?" Nguyen Dinh Chieu

gestured towards a row of coconut trees and asked, “What part of the tree must be strong for it to thrive?” Truong Dinh, after a moment’s thought, replied, “The roots. A tree’s vitality comes from its roots. If the roots are strong, the tree stands firm”. Nguyen Dinh Chieu responded, “Indeed! But recognising where those roots lie is the true challenge”. Truong Dinh then exclaimed, “Here, the roots are here - among the common people in these villages. As long as the people’s will endures, so does the nation!” [12]. Although this exchange is a folk anecdote, it reflects the courage and resilience of the Southern people, symbolised by the coconut trees. This historical theme remains vibrant in Nguyen Dinh Chieu’s writings, illustrating the connection between the people’s strength and the symbolic power of coconut trees.

The third story involves the ancient tomb of District Chief Ho Phung Lam. On 11 January 2016, this tomb, known as the “Ho Family Ancient Tomb”, was officially listed in the inventory of historical and cultural sites in Ben Tre province by Decision No. 59/QĐ-UBND from the People’s Committee of Ben Tre province [13]. However, details about the tomb in the inventory were limited to a few lines.

Significant details about this famous ancient tomb were revealed during our field research on 3 August 2019, in collaboration with Sino-Nom scholar Do Van Tam (artist Tuc Tam). Our findings indicate that the tomb belonged to District Chief Ho Phung Lam, a native of Nghe An who, under Lord Nguyen Tien Hoang’s orders, moved southward to manage an extensive area encompassing seven communes. Built over 100 years ago from granite and white marble, the tomb features unique architectural and sculptural elements, including a five-fruit tray, dragon motifs, and plant ornamentation. Notably, the tomb has a marble plaque depicting a Ben Tre coconut tree and a red granite coconut placed on the offering tray. The tomb, situated in Phuoc Thanh Hamlet, Tam Phuoc commune, Chau Thanh district, Ben Tre province, was constructed in April 1918. Despite enduring exposure to wind, rain, sunlight, and bombings during the resistance wars against the French and Americans, the coconut tree carvings on the stone relief panels and the coconut on the five-fruit tray remain intact. As Sino-Nom scholar Tuc Tam, of Giong Trom town [6] exclaimed during our fieldwork, the coconut depiction is “clearly visible and exceptionally rare.”

The research findings on the history of coconuts in Ben Tre significantly supplement, deepen, and enrich our understanding of the land, people, and coconut cultivation in the region. Agricultural researcher Do Van Cong from the Department of Agriculture and Rural Development of Ben Tre [13, 14] has proposed a hypothesis regarding the origins of coconuts in Ben Tre. He suggests that people from the Central region, particularly Binh Dinh province where coconuts are prevalent might have brought coconuts with them during their migration southward. Alternatively, coconuts may have drifted from the Philippines or Indonesia to Ben Tre’s shores, eventually taking root and flourishing.

Sino-Nom scholar Tuc Tam decoding the coconut tree and five-fruit tray motifs at the Ho Family Ancient Tomb. Photo by authors.

While researchers have yet to confirm or refute these hypotheses, the historical development of Ben Tre as an island region over the past 300 years, populated by migrants from Ngu Quang (the Five Prefectures) who reclaimed and cultivated land, implies that coconuts were planted during this period of land reclamation. The most significant expansion in coconut cultivation occurred during the early 19th century migration wave. Following the conclusion of the war between the Tay Son and Nguyen Anh dynasties, people began to settle, form communities, and establish villages. By the late 19th century, Ben Tre had only 4,000 hectares of coconut plantations. During this time, dwarf coconut varieties-brought from Thailand by Father Gernot along with other fruit tree species - became known locally as Xiem coconuts [15].

By 1930, Ben Tre's coconut plantations had expanded to 6,000 hectares. Starting in 1945, farmers discovered that one hectare of coconuts generated significantly higher income than one hectare of rice, prompting a shift from rice fields to coconut groves. By 1961, Ben Tre had 20,834 hectares of coconuts [4]. Today, despite fluctuating coconut prices, coconuts are still extensively grown across Ben Tre's three islets. The nickname "land of coconuts" was given to Ben Tre because, historically and presently, no other region in Vietnam has surpassed Ben Tre in coconut cultivation.

Linguistic evidence concerning the etymology of the word *dua* ('coconut palm') is provided by H. Shorto (2006) [15]. Its corresponding forms in other Mon-Khmer languages are listed as follows [16]:

Proto Mon-Khmer	*braaw
Old Mon	*brāw* /braw/
Modern Mon	[nɔm] prɛà
Lawa Bo Luang, Lawa Umphai	phrɯa
Mae Sariang	phɯa
Central Nicobarese	oyau
Thin	blau

~ (*bnraaw>?) Vietnamese [*cay*] *dua*

This means that the word *dua* can be traced back to the stage of Proto Mon-Khmer.

The historical documentation of coconut palm usage appears in *Gia Dinh Thanh Thong chi*, edited by Trinh Hoai Duc (1765-1825) [16]. However, it lacks specific geographic details on coconut cultivation sites, other than mentioning Gia Dinh [17].

The question of when coconuts first appeared in Ben Tre may continue to intrigue researchers for generations. Nonetheless, evidence from the archaeological findings at the Giong Noi site, the historical conversation between Truong Dinh and Nguyen Dinh Chieu about the strength of the common people, and the white marble bas-relief depicting Ben Tre coconuts on a red granite offering tray at the ancient Ho Family tomb serve as "historical markers." Together, they attest to the historical, cultural, and socio-ecological importance of the Ben Tre coconut tree. Beyond its role as an economic crop, the coconut tree symbolises cultural values, human philosophy, and respect for the ancestors who reclaimed the land. For the people of Ben Tre, the coconut tree signifies both faith and livelihood, embodying the accumulated folk knowledge and beliefs passed down through generations.

4.1.2. The name Ben Tre and the sediments of coconut worship

Nearly 60 years ago, while exploring Ben Tre and visiting the holy land of the Coconut Religion, Zen master Thich Nhat Hanh expressed his awe while crossing the Rach Mieu ferry:

"I stood at the bow of the boat, watching it cut through the waves, and was mesmerised by the majestic river's powerful flow. The river is as mighty as the mountains but more lively. The river's water is so red, with so much alluvium... Ben Tre! Ben Tre! I don't see any bamboo. I only see coconuts. Yes, only coconuts... But the impression of the river's vigorous flow during the flood season remains deeply etched in my soul" [18].

It can be said that not only Zen master Thich Nhat Hanh, who hailed from Hue, but also nearly all visitors to Ben Tre, experience a similar perception-they come to Ben Tre and see only coconuts. This distinct impression has contributed to the sedimentation of Ben Tre's coconut worship, and the seemingly contradictory name "Ben Tre" reflects an aspect of this coconut worship that deserves further exploration.

In *Géographie Physique, Économique et Historique de la Cochinchine*, published by the Indochina Research Association in 1901, an explanation of the name Ben Tre is offered: "Ben Tre was formerly

called Soc Tre (land of bamboo) by the Cambodians because of the many bamboo groves scattered across the province. Later, the Vietnamese established a market there, which they called Ben Tre, and the canal flowing past this market into the Ham Luong river also took on this name" [19] now known as the Ben Tre river. In alignment with this, the *Nam Ky Luc Tinh Dia Du Chi (Geographical Dictionary of the Six Provinces of Southern Vietnam)* (1872) by Duy Minh Thi states: "Because Soc Tre had many bamboos, boats from near and far docked here to load bamboo, hence the name Ben Tre".

The *Dia Chi Ben Tre (Ben Tre Geography)* (2001) [20] also posits that "the name Ben Tre (formed by combining natural terrain with a plant species) signifies a dock with abundant bamboo growth, akin to Ben Gia, Ben Tranh, and Ben Luc".

However, considering the area dedicated to bamboo cultivation compared to other crops reveals an interesting discrepancy. In 1903, Ben Tre only had 300 hectares of bamboo, while coconut plantations covered 6,115 hectares and 26.7 acres [21]. According to a research published in the *Huong Que Journal* in the 1965s: "The total coconut planting area in the southern provinces was 43,340 hectares, with Kien Hoa province alone accounting for 20,000 hectares, half of the total coconut area in the South" [22]. Despite being the largest coconut-growing area, the name "Ben Tre" persisted, a unique phenomenon in the land of coconuts. The belief in the "land of three lush, coconut-covered islets" is indelibly linked to Ben Tre: the mention of Ben Tre inevitably brings coconuts to mind. Consequently, in folk literature, references to Ben Tre are overwhelmingly inspired by coconuts:

"… Thay dua thi nho Ben Tre (Seeing coconuts reminds me of Ben Tre), Thay bong lua dep thuong ve Hau Giang (Seeing beautiful rice flowers makes me long for Hau Giang)".

Thus, it is not surprising that most visitors to Ben Tre, like Zen master Thich Nhat Hanh, are always amazed to see only coconuts!

The layered meaning of the name "Ben Tre" within this "coconut" context inspired researcher Nguyen Van Au to propose a more in-depth exploration of the name's origin, remarking, "To this day, the name Ben Tre still requires study to clarify the matter" [23]. We believe a careful approach is needed to address this unresolved topic, as discussing coconuts is essential when visiting Ben Tre. For any region, an initial curiosity, exploration, or search often seeks to understand the origins and indigenous knowledge that constitute its unique culture and people. We approach Nguyen Van Au's question from the perspective of coconut worship-a distinct ecological-humanistic viewpoint focused on the coconut tree.

Coconut worship has helped shape Ben Tre's cultural identity, embodying a folk knowledge system that integrates both material and spiritual values created by the people of Ben Tre throughout history. This cultural heritage encompasses a broad range of folk knowledge, including religious practices, customs, literature, arts, and environmental understanding. It is uncertain when coconut trees first became associated with Ben Tre, but they have enriched people's material lives through an array of products from fruit to trunk to leaves. Beyond economic value, coconut trees also provide spiritual sustenance. Their shade enhances Ben Tre's homeland, creating a distinctive landscape. The coconut tree also serves as an enduring source of inspiration for artistic and literary expression, both past and present.

In Ben Tre's folk songs, our ancestors drew on unique elements of the coconut tree:

"Tra on ai co cay dua (Repay whoever has a coconut tree), Cho toi nghi mat doi cho nguoi thuong (Let me rest and wait for my lover)".

The symbolic significance of the coconut within the folk knowledge system of Ben Tre's coconut worship is profound. The coconut stands as a unique emblem of Ben Tre's cultural and historical identity. Talking about Ben Tre's culture naturally includes references to coconuts, which have become a defining feature of the region since ancient times. Our preliminary research indicates that the folk knowledge of coconut worship among the people of Ben Tre is passed down orally and through performance, requiring thorough exploration, documentation, and study. Many practitioners of folk art and coconut worship traditions are now elderly, making this knowledge increasingly rare.

In this context, our preliminary fieldwork and research suggest that documenting the indigenous knowledge and folk beliefs surrounding coconuts will contribute to the preservation and promotion of cultural values and the protection of the ecological environment. The Ben Tre coconut serves as a central symbol, embodying and perpetuating ancestral

lessons on ecological protection wisdom gained through generations who laboured to reclaim, cultivate, and maintain the land, coconuts, and livelihoods for current and future residents of Ben Tre.

In Ben Tre, growing coconuts is an unending profession, accompanied by significant questions: When did Ben Tre coconuts originate? Why is the land of coconuts called Ben Tre? These questions may remain unanswered, with coconut worship as the means for future generations to convey the deep meaning associated with Ben Tre coconuts.

Coconuts play an immensely important role in the lives of the people of Ben Tre. They provide raw materials for food, beverages, fuel, wood, roofing materials, and more. Recent studies show that coconuts also offer a completely clean biomass energy source and effectively absorb greenhouse gases [24], which is crucial in the context of increasingly severe climate change. Thus, coconuts are naturally regarded as symbols of green, natural vitality in Ben Tre.

Many research projects, dissertations, and theses have explored coconut varieties, cultivation techniques, and coconut candy production from a technical perspective, highlighting the central role of coconuts in the lives of Ben Tre residents. Alongside these studies, numerous articles and scientific reports published in journals and presented at forums have focused on the coconut tree. However, the spiritual aspect of coconut worship as a cultural symbol of Ben Tre and the role of coconuts in the customs and festivals of the people has yet to be thoroughly addressed. Coconuts hold a special place in the folk beliefs of Ben Tre, representing love, aspiration, and happiness across generations.

The coconut tree symbolises love, aspiration, and happiness for many generations of Ben Tre people. This idea coincides with German philosopher Hegel's notion: "A symbol is an external thing, a direct reference that speaks directly to our intuition. However, this thing is not chosen and accepted as it exists in reality for its own sake. On the contrary, it is accepted with a much broader and more general meaning; that requires us to recognise in each symbol two elements: 'meaning' and 'expression'". Meaning is the association with a symbol or an object, regardless of its specific form. Expression is a sensory existence or image (Interview with Ngot on 10 November 2020). Through initial research, we find that the symbolic meanings of the coconut come from its role and relationship with the lives of the people of Ben Tre. This close, unique, and inseparable bond between the people and the coconut is evident in objects made from coconuts that signify love connections, as well as in daily life practices.

Preliminary findings suggest that the symbolic meanings of the coconut are not fixed but are dynamic, shaped by the relationships among these meanings and the experiences of each person and generation of coconut farmers in Ben Tre. Moreover, the connection between the symbolic expressions and meanings of coconuts is organic, interwoven, and continuously evolving with traditional indigenous knowledge of the coconut land, the nation, and the times.

This article examines the coconut tree as a symbol of miraculous strength and a means of communication for the people of Ben Tre, forming a "belief" within Ben Tre culture. In this context, "Coconut Worship" allows us to approach and understand the deeper aspects of the land and people of the three islets. Decoding Ben Tre coconut worship begins with recognising the coconut as a special symbol in Ben Tre culture, encompassing concepts in religion, beliefs, history, environmental protection, and the entire social life of Ben Tre, built over generations.

The folk knowledge system on environmental protection in "Coconut Worship" is diverse and unique, enriching a land of exceptional people. The coconut in Ben Tre culture embodies traditional values, serving as lessons in culture, history, religion, beliefs, customs, cuisine, and the ecological environment. These values, accumulated over hundreds of years, have become the pride and strength of Ben Tre's cultural identity. More than half a century ago, coconuts were an identifying feature of Ben Tre's ecological environment, with stories and anecdotes related to the "Coconut Religion". This is a special aspect of coconut worship that warrants further study and development to inherit its progressive aspects, contributing to environmental protection from a cultural-spiritual-belief perspective and integrating ecological consciousness with indigenous cultural identity.

4.2. Mr. Dao Dua and the foundation of Coconut beliefs

When speaking of Ben Tre, with its ever-present image of the coconut tree, people invariably mention engineer Nguyen Thanh Nam, also known as Mr. Dao Dua (1910-1990), who hailed from Phuoc Thanh

village in An Hoa canton, Truc Giang district, Kien Hoa province (now Phuoc Thanh commune, Chau Thanh district, Ben Tre province). A young man with a Western education, Mr. Dao Dua studied in France for seven years. Upon his return, he chose not to work for the French colonial government but instead established a soap-making business using coconuts in his hometown. After the business failed, he turned to a monastic life, renouncing material pursuits to live as an ascetic. Initially following Buddhism, he later developed a new faith known to the people as Dao Dua (Coconut Religion).

Although Dao Dua existed as an organised religion for only about 30 years, centred around the sanctuary at Phung islet, it had a profound impact on people through Mr. Dao Dua's unique approach to spreading his teachings. One core element of his message was environmental protection, interwoven with spiritual values and the beauty of coconut beliefs. Mr. Dao Dua's dedication to his homeland's environment was grounded in three main pillars: peace for the country (the foremost cause of his life); economic development and improved living standards (with the architecture of Con Phung as both a place of spiritual practice and a centre for tourism, which continues to flourish); and population control, evidenced in his misunderstood "no child creation" theory, which he hoped would be evaluated objectively later in life.

Major religious ceremonies, such as Buddha's Birthday, Christmas, and the Hung King's death anniversary, were solemnly observed by Mr. Dao Dua at the pagoda. On these occasions, and as part of his daily practice, he advised followers to fast, pray, and repent to lessen the burden of sins from past lives and present life, stating: "... Everyone must fast and pray and repent to reduce their sins, all the sins of previous lives, this life and the whole life". Later, for descendants, there will be no more unjust bondholders demanding blood debt; The world ends war; Phong Dieu Vo Thuan; National prosperity and peace; Those who survive will enjoy the ancient age or die and be reborn in the pure land" [5].

Though he left no formal teachings, Mr. Dao Dua had a powerful way of mobilising people through clear messages and a hands-on approach. Beyond tangible relics and rituals, his legacy endures as a vision of peace for both the nation and the world, a spirit of religious harmony, and a dream of a self-sufficient, peaceful society. This vision of self-sufficiency closely mirrors Mahatma Gandhi's ideal for a newly independent India. Mr. Nguyen Thanh Nam encouraged his followers to sustain themselves through coconut handicrafts and farming, with coconuts as a focal point. Some even view him as the "father" of the coconut handicrafts industry [8]. He invested donations from followers to purchase 8 acres of farmland in O Long Vi commune, Chau Phu district, An Giang province, establishing communal land for his followers to use for livelihoods, a practice that continues today (In-depth interview with Ms. B.N. Khai, the person in charge of the church and Mr. Dao Dua's grave on 1 March 2019).

Mr. Dao Dua often invoked the ancient saying, "hands work then jaws can chew (No eating without working)", to encourage self-sufficiency among his followers, urging them to work for their living rather than depend on offerings. He advised visitors interested in his teachings to return home, embrace vegetarianism, do good deeds, and avoid harm to each other and the surrounding environment, an approach he equated to monastic practice. Committed to these principles, he ate only fruit he picked himself, once daily at noon, and refrained from eating in the afternoon. His commitment to peace extended beyond personal lifestyle; during the tumultuous years of war, he advocated for peace in his homeland, driven not by political motives but by a desire for a peaceful life for his people.

Beginning in 1958, Mr. Dao Dua actively campaigned to end the war and restore peace in the South, leading to his arrest and imprisonment seven times by the Saigon government. In the early 1960s, he chose a remote area of Con Phung in Tan Thach commune, Chau Thanh district, Ben Tre province, where he requested permission to establish the "Holy land of Dao Dua", hoping it would inspire peace, unity, and sustainable development for Vietnam. Between 1967 and 1968, his following grew, especially after the Tet offensive of 1968, as people sought refuge from the war and found safety in Con Phung. His vegetarian followers formed residential communities such as Truong Chay hamlet and Nam Quoc Phat pagoda. In September 1969, upon learning of President Ho Chi Minh's death, Mr. Dao Dua organised a public funeral attended by many, marking the only funeral for President Ho conducted under the Saigon government without interference.

Due to his peace campaigns, Mr. Dao Dua attracted large gatherings whenever he left Con Phung, prompting significant security concerns for the Saigon government, which eventually placed him under house arrest on the islet [5].

4.3. How Mr. Dao Dua approached people

In exploring why the community influenced by Mr. Dao Dua remains conscious of practising good environmental stewardship more than half a century later even among the descendants of his original followers we find that Mr. Dao Dua employed unique and effective methods to reach people. His approach not only incorporated popular proverbs but also drew on the oracle stories of the renowned scholar Trang Trinh Nguyen Binh Khiem to support his messages.

In 1970, after President Nguyen Van Thieu introduced the "The ploughman has the field" law, Mr. Dao Dua used an excerpt from Trang Trinh's oracles at Nam Quoc Phat pagoda to emphasise his teachings: The field is broken then appears the honourable man. No war is achieved naturally.

He prominently displayed the phrase "No war is achieved naturally" on a wall, treating it as a declaration and slogan at the "holy land" of Con Phung. According to Mr. Phan Kim Hue from Long An (depth interview with Mr. Ba Huong, who regularly cleans the shrine area and the grave of Mr. Dao Dua, on 20 April 2020), Dao Dua and his disciples explained "the field is broken" as abolishing the law of the land, that is, promulgating the law that the ploughman has the field, then a honourable man will appear, that is Nguyen Thanh Nam - "Mr. Hai Dao Dua" took Mr. Dao Dua and his followers interpreted "the field is broken" as the abolition of restrictive land laws and the introduction of the new policy granting land to farmers. They saw the phrase "an honourable man will appear" as a reference to Nguyen Thanh Nam himself known as Mr. Hai Dao Dua who advocated for a world without war. This peaceful message resonated deeply, gaining him the trust and attention of his community.

Today, the Con Phung tourist site still features the peace tower (with its nine towers), where Mr. Dao Dua would sit to preach the Dharma, share his vision, or meditate in silence. This tower remains a symbol of his dedication to the peace movement. Believing himself to have a mission for peace, he took the Buddhist name Thich Hoa Binh (meaning "peace" in Vietnam by Nguyen Thanh Nam). Alongside his peace advocacy, he established a spiritual institution at Con Phung to pray for peace. Visitors were frequently encouraged to adopt a vegetarian lifestyle, abstain from eating meat and fish, and dedicate themselves to repentance and prayers for peace. He held that true peace could only arise from harmonious relationships, beginning with harmony between people and animals, maintaining a clean and respectful environment, and abstaining from harm toward living beings.

This approach to peace and environmental harmony captured the attention of Zen master Thich Nhat Hanh, who travelled to Ben Tre over half a century ago to meet Mr. Dao Dua. Mr. Dao Dua later served as the inspiration for a children's educational comic written by Thich Nhat Hanh. In response to the book, Heidi, a reader who used it in Dharma School, noted:

"I used this book in the Dharma School to demonstrate the value of morality. This is a true story about Mr. Dao Dua, a monk who lived with a cat and a mouse during the Vietnam war. He truly embodies a virtuous life. I also used this book to illustrate the Bodhisattva" [3].

Discussing Mr. Dao Dua's anti-war efforts and his dedication to peace, the Japanese magazine 太陽 (*The Sun*) published his photograph on the cover, accompanied by an article by K. Shisei (1974) titled "Master Dao Dua lives in the Mekong river: A type of anti-war activity", spanning pages 107-118 on 12 March 1974 [4].

In 1973, author Kuwabara visited Con Phung and observed a community of approximately 1,500 young people from across southern Vietnam who had sought refuge there. He estimated that the actual number of people who avoided military service by relocating to Con Phung could have reached about 5,500. K. Shisei (1974) [4] described the lifestyle of these residents, emphasising the peaceful and communal life established by Mr. Dao Dua on the islet:

"People have to endure hardship and poverty. In addition, they must comply with the precepts: 1. Do not kill, 2. Do not have sex, 3. Do not steal, 4. Do not speak nonsense, 5. Do not drink alcohol.

"No killing" is not only a popular viewpoint in Buddhism related to vegetarianism but is also meaningful when implementing anti-war policies and opposing killing during times of war. With that anti-war atmosphere, even the fish in the Mekong river at Phung islet look healthier than elsewhere!

There are a few more precepts: 6. Don't smoke, 7. Don't listen to music, 8. Don't gamble, 9. Greet superiors, 10. Don't chase fashion. They say there are exceptions in the precepts. For young men, when they reach the age of 34, their military service ends. If peace returns, they can get married [4]".

The author conducted a direct interview with Mr. Nguyen Thanh Nam, but Mr. Nam remained silent, not uttering a single word. According to the author, this silence was itself a powerful expression of Mr. Nam's unwavering commitment to peace. Instead of speaking, Mr. Nam wrote down his responses and the author's questions on individual sheets of paper with a ballpoint pen, handing each sheet to the author one by one:

"The ideology of fighting for peace of the Coconut Religion - Nguyen Thanh Nam is not just an empty idea but also through concrete actions. Wanting to go to Hanoi to meet and discuss directly with the North, after 1965, several times the Coconut Religion - Nguyen Thanh Nam group submitted to the Saigon government a request for permission to go to the North. Each application was not accepted, and twice he was sent to prison. The desire for national unity of Coconut Religion - Nguyen Thanh Nam was so strong that he decided to illegally go to the North. In 1967, when Coconut Religion - Nguyen Thanh Nam followed the Ho Chi Minh route to the North, he was arrested at the Cambodian border for illegally leaving the country [4]".

4.4. The lessons of Coconut Religion to protect the ecological environment

The lifecycle of a coconut tree resembles that of a human; the oldest trees bear fruit for around 80-90 years before they are either cut down to make way for new growth or naturally wither and die. Presently, it is rare to find a coconut tree in Ben Tre over a hundred years old. The coconut tree has created a sustained value chain in Ben Tre, providing unique benefits throughout history and offering lessons on environmental protection from a spiritual and religious perspective, once known as the "Coconut Religion" (In Southern dialect of Vietnamese, both "dua" and "vua" are pronounced the same as [jɨə˧]). The image of the coconut tree in the name "Coconut Religion" symbolises a call for a "green lifestyle" and for coconut itself to be seen as a source of religion.

In discussions with friends and former followers of Mr. Dao Dua, we discovered that he did not refer to himself as "Dao Dua"; the community gave him this name, viewing it more as a folk title rather than a formal religious designation, for three main reasons. First, he was from Ben Tre, the land of coconuts, where these trees are most abundant in Vietnam. As part of the "religious men" movement in southern Vietnam during the latter half of the 20th century, he dedicated himself to the spiritual life. Second, the term Dao Dua also plays on the word (In-depth interview with Mr. Sau Vo Quy, the person in charge of preparing food for Mr. Dao Dua, on 20 April 2020) meaning "moderate" in the standard language, symbolising a path of practice according to the idea of religious harmony, understood in the sense of "neither excess nor deficiency", while also not judging any other religion too harshly. Third, he adhered strictly to a lifestyle centred around coconuts, using Siamese coconut water (various types of coconut for water...) to drink and dried coconut to wash food as opposed to using rain, river, or ditch water like other people (In-depth interview with Mr. Ba Huong, one of Dao Dua's close disciples on 20 April 2020). His ascetic practices, to the point that many saw him as eccentric, marked him as distinct from typical practitioners of the time. "Once a tall man, after years of rigorous practice, he had a small frame of 1.3 metres but retained piercing eyes that conveyed profound inner strength, a result of his dedicated meditation and diet based on coconut", followers recall a story that continues in folklore, with many anecdotes surrounding this real-life figure. This comment is constantly recounted by followers of the Coconut Religion and still spreads today, passed down in folklore with many different anecdotal variations about a real character.

Mr. Nguyen Thanh Nam never referred to himself as a religious leader and refused to take on disciples. He preferred to be called "Uncle Hai" rather than formal titles like teacher, patriarch, or master. This informal title, Uncle, may have also held a deeper meaning, encouraging others to seek spiritual knowledge, emphasising that anyone could achieve insights into higher truths. According to our research, the use of uncle here also has the meaning of "aunt medium, uncle medium" to encourage people to practice. With the implication that "you" can know the secrets of heaven, according to the prophecy, Trinh helped him have a profound influence in the hearts of religious people.


The author interviewing Mr. Sau Vo Quy (left) and Mr. Ba Huong (right). Photos by authors.

Today, generations of people from near and far return to commemorate Mr. Dao Dua annually on his death anniversary. This occasion allows people to visit his shrine and grave, reflecting on his vision and dream of peace for his homeland. His legacy includes his wish for the territorial integrity and sovereignty of Vietnam's seas and islands. His grave, an unusual standing burial, is encased in a model of the unified map of Vietnam, including the Paracel Islands (Hoang Sa) and Spratly Islands (Truong Sa) archipelagos, symbolising this enduring commitment. In the wake of Mr. Dao Dua's life and teachings, the community culture he fostered endures a blend of reason and emotion that nurtures a flow of spiritual exchange among former followers of the Coconut Religion and their descendants. This legacy is rooted in a harmonious relationship between people and nature, expressed through a lasting reverence for the coconut tree and the spiritual lessons it represents.

It is the "folk belief core" of Dao Dua that, despite not being an official religion, has created a cultural flow surrounding coconuts that carries broad and lasting social significance, uniting the community of "coconut people" in An Giang and other Western provinces for over half a century. This connection has also become a lifeline for "migrants" from Ben Tre who, in recent years, have sought land and livelihoods in An Giang due to drought and saltwater intrusion, which have led to crop failures. In 2020, the community associated with Dao Dua played a crucial role in bringing freshwater from upstream An Giang to quench the "thirst of saltwater drought" in Ben Tre.

Today, while Dao Dua as a movement no longer exists, Mr. Dao Dua's close followers affirm that his mission was to bring peace and national unification to Vietnam. When this wish was fulfilled, he foresaw his own departure, leaving a will and instructions for his followers to honour. In our view, Dao Dua has ceased not because it does not have its own doctrine. Due to many misunderstandings and insufficient studies, an evaluation of Dao Dua's death has not been published objectively. It is considered by the authorities' perspective, that we have reached the end of the phenomenon of Dao Dua. The issue we are concerned about is that although it is not a religion, in the past 60 years, followers continued to revere him as a figure of "Coconut Belief", rooted in the cultural and spiritual landscape of Ben Tre since Dao Dua was not an official religion with a doctrine but rather a symbolic folk belief.

The enduring value of Dao Dua lies in the teachings on peaceful coexistence and ecological stewardship, principles that generations of his followers continue to practise. Bhikkhu T.T. Tri (2018) [7], who studied Coconut Buddhism at Con Phung for seven years, noted: "His concept of practice is highly ethical, aligning with Buddhist teachings and the trends of the time". Since Mr. Nguyen Thanh Nam's passing on April 18, 1990 (lunar calendar), his followers across Ben Tre, Tien Giang, Dong Thap, An Giang, and beyond, have continued to honour him, recognising him as the embodiment of a coconut-based folk belief that

sustained and nurtured generations. In keeping with his legacy, they contribute to environmental protection and community welfare in practical ways, such as building homes, roads, and bridges, supporting the poor and elderly, and participating in charitable activities.

A particularly notable contribution from the Dao Dua community has been the campaign to plant trees and clean up rural areas, in support of the monthly "New Rural Sunday", which protects local water resources. Even into their eighties, some followers travel regularly from My Tho to the shrine to care for the grounds, clean, plant, and maintain ornamental flowers. These activities align with local policies and are visible during the peak commemorations at Mr. Dao Dua's shrine, such as his death anniversary, which draws thousands of participants. One example is the freshwater supply system installed at his shrine in Phuoc Thanh commune, Chau Thanh district, which provided much-needed drinking water during the severe drought and COVID-19 pandemic in 2020. This mobile freshwater pond, holding over 300 cubic metres, was set up along the Ba Lai river with a canvas-lined wooden frame, a filter tank, and a faucet system to enable quick, efficient access while observing social distancing guidelines.

Ben Tre, blessed with unique climate, terrain, and soil, is divided into three ecological zones: freshwater, brackish water, and saltwater. The brackish zone is particularly suited for coconut cultivation, and coconut is identified as one of Ben Tre's eight provincial value chains. With a goal to increase productivity, coconut output, and farmer income, Ben Tre has leaned on coconuts to counter the challenges of climate change, which has led to increasingly severe natural disasters and saltwater intrusion. Unlike other crops, coconuts thrive under these adverse conditions, underscoring their resilience in the face of global ecological threats.

As the earth's temperature becomes increasingly warmer and energy resources dwindle, the appeal of "Coconut Houses" constructed from coconut trunks, leaves, and shells grows. These homes align with an ecological lifestyle, showcasing a sustainable, "green" approach to living. The coconut tree's unique characteristic of providing a complete value chain from construction materials to culinary uses represents a significant ecological benefit, as coconut-based products are both energy-efficient and environmentally friendly. Coconut products not only appeal to visitors but also increase awareness of their contribution to global environmental protection.

Today's rising interest in ecological conservation and the use of organic, biodegradable products reflects the value of using coconut-based products for daily living, fostering both novelty and environmental consciousness. As food safety and health concerns grow, the demand for fresh coconut water and other coconut products has surged, further linking the coconut tree with safe, sustainable agricultural tourism and culinary practices.

While recent developments have mainly emphasised the agricultural and economic value of coconuts, there has been less attention to the cultural, spiritual, and symbolic meanings that complete the coconut tree's value chain. Understanding the folk knowledge and environmental lessons rooted in the Coconut Religion today, as an enduring aspect of Ben Tre's culture, offers insight into how peace and ecological stewardship are embedded in the lives of the people through customs, beliefs, and traditions.

5. Conclusions

Coconut trees play a vital role not only in the economy but also in the spiritual and religious life of Ben Tre's people. Today, the teachings of Dao Dua on peace and ecological preservation form an integral part of Ben Tre's cultural legacy. This folk belief in coconuts, which once guided generations in Con Phung, has become a medium for intergenerational communication, helping to illuminate the enduring values of peace and environmental protection.

The Coconut Religion, while no longer active as an organised movement, represents a system of indigenous knowledge that integrated both tangible and intangible practices, encompassing complex, multifaceted expressions that resonate with meaning across time and place. The materials gathered and analysed in this study serve as a foundation for future research, providing insights into the depth and uniqueness of this knowledge system. As such, "Coconut Religion" embodies Ben Tre's cultural identity of protecting the ecological environment, with multiple meanings in its complex and vivid expressions, evoking many levels of meaning and value that transcend time and space. The materials collected, researched, and explained in this article serve as a guide for further research that contributes to understanding the profound, broad, and unique levels of meaning that knowledge holds. The folklore's role in protecting the ecological environment has manifested itself in the "Coconut Religion" of Ben Tre

people. It is our hope that this study will contribute to the reminder that every mention of a coconut tree is a time to raise the level, spread unique meanings, and spread lessons of protecting peace and the environment. The ecological lessons from Dao Dua hold timeless value in the context of protecting peace and the environment, inspiring global conservation efforts.

CRediT author statement

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COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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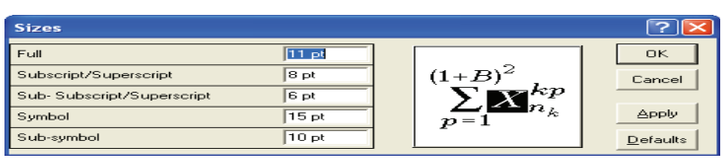

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[1] D. Acemoglu, U. Akcigit, H.I. Alp, et al. (2018), "Innovation, reallocation and growth", *American Economic Review*, **108(11)**, pp.3450-3491, DOI: 10.1257/aer.20130470.

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