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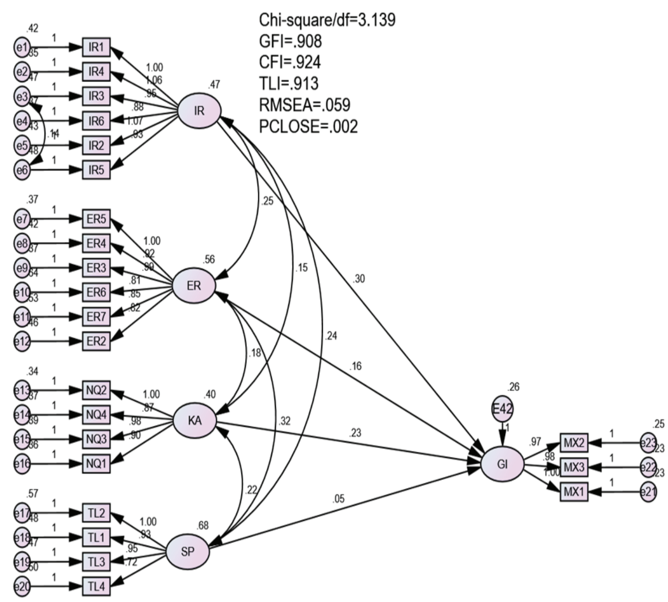

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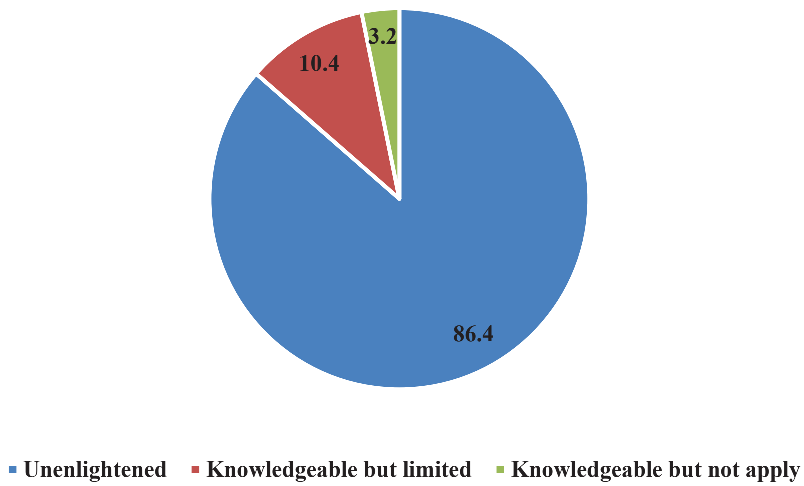

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Technical and scale efficiencies of the salinity-induced rice production system in the western coastal region of the Mekong delta, Vietnam

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Abstract:

Salinity events make Mekong delta's rice production change significantly. In the salinity-impacted regions, shrimp-rice production is a possibility besides the traditional rice models. This paper aims to assess the economic efficiency of rice-based farms in the Mekong delta in the context of salinity-induced hazards. The random sample is collected from 254 rice-based farms in 28 villages in 24 districts in the western coastal region in the Mekong delta. The method of Data Envelopment Analysis and OLS and Tobit regression estimations are used to measure the economic efficiency and identify the determinants of the technical and scale efficiencies respectively. The findings show that the average overall efficiencies for the technical efficiency and the scale efficiency are 0.642 and 0.848 respectively, implying that substantial inefficiencies occur in farming practices in the Mekong delta. It indicates that there is still potential for improving the economic efficiency of rice-based system. The findings also show that, statistically significantly, the land ownership and the area are the determinants of the economic profit; the irrigation system, saltwater drains, salinity impact, are the determinants of the economic irrigated water use; the land ownership status, the area, and type of seed are the determinants of the technical efficiency; and the gender, age, education level, irrigation system, saltwater drains, area, type of seed, and numbers of fertilizing and weeding are the determinants of the scale efficiency.

Keywords: **data envelopment analysis, economic efficiency, rice-based system, scale efficiency, technical efficiency.**

Classification number: **2.1**

1. Introduction

With a total area of 39,712 km^2, the Mekong delta (MD) has various potentials for agricultural development. It is the key rice production area of Vietnam. The MD rice area has always accounted for more than 50 percent of the total rice area in the country with about 1.781 thousand hectares and 21-22 million tons. One of the world's most climatically vulnerable and rapidly changing agricultural production environments [1]. The MD was impacted by climate change coupled with sea level rise and natural hazards [2]. Among impacts of sea-level rise the saltwater intrusion has the greatest economic impact through agriculture, aquaculture, and fresh water availability [3]. In the context of climate-induced risks, the MD is currently coping with the saltwater intrusion and adverse weather changes that cause serious challenges to its rice-based system. During the dry season, the saltwater intrusion comes sooner and leaves lately. The annual loss of saltwater intrusion-induced rice yield is estimated at 2.50 to 4.05 tons per ha [4]. Since 2020 the rice-based system has been changed into diversified cropping pattern with intensive rice and rice-shrimp models. Under the Resolution No. 09/2000/ND-CP the area of rice-shrimp has been developed from 71,000 ha in 2000 to 153,000 ha in 2015 and 200,000 ha in 2020. Kien Giang and Ca Mau provinces located in the western coastal region of the MD are the largest rice-shrimp producers along with Soc Trang, Tra Vinh, and Ben Tre

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provinces in the eastern coastal region. In the Winter-Spring rice model, the yield usually reaches 7-10 tons/ha while it is at 4-7 tons/ha in the rice-shrimp model. Coping with the constraints of irrigated water resource availability and irrigation system investment, the efficiency of rice-shrimp model is still in question.

The concept of efficiency has been widely used in assessing the productivity of the Decision Making Unit (DMU) such as a farm. F. Chemak (2011) [5] used Data Envelopment Analysis (DEA) - a nonparametric method to analyze the technical efficiency (TE), the water use efficiency and the dynamic of the productivity of the irrigated areas in Tunisia. Findings showed that the TE of the farms increased by 17 percent due to an improvement of water use efficiency, up to 22 percent. It revealed a positive impact on the farms' productivity change. N. Anuradha, et al. (2010) [6] estimated the TE in rice production and assessed the farm-specific socio-economic factors on the TE. This study applied a stochastic frontier production function in determining the TE and regression analysis in identifying the socio-economic determinants of the TE. The findings revealed that the farm-specific TEs range from 71,39 percent to 99.82 percent with a mean of 72.78 percent. Besides, factors of operational area, experience, education and distance of plot were the determinants of the TE. N.M. Malana, et al. (2006) [7] used economic efficiency analysis of selected wheat areas in Pakistan and India using the DEA method. Results revealed a ranking of economic efficiency based on four inputs including irrigated water. K.N.R. Kumar (2022) [8] applied DEA and Malmquist Total Factor Productivity (MTFP) Index to ascertain the TE of rice productivity (2021-2022) and its changes over the study period (2019-2020 to 2021- 2022) in India. The results revealed that the overall mean TE score across all the DMUs was 0.860 ranged between 0.592 and 1.000. So, rice farmers could reduce their input usage by 14 percent and still could produce the same amount of rice. Fertilizers, seed, water, and organic manure use can be reduced in rice productivity. MTFP indices (2019-2020 to 2021-2022) revealed that the mean scores of TE change, pure TE change and scale efficiency change are more than one, unlike technological change (0.983). All the DMUs showed impressive progress with reference to TE change (1.112) and it is the sole contributor for TFP change in rice production. The DEA results suggest that farmers should reduce the usage of inputs to boost the TE of rice productivity in India. In Vietnam, H.N. Chuong (2020) [9] used DEA method to measure the efficiency of rice production of Vietnam rural farmers based on the VHLSS database in 2016 with 3,299 observations surveyed in all 6 regions in Vietnam. The results showed that the score of Vietnam's rice production efficiency was poor with a mean TE of 8.95/100. Besides, Tobit regression results revealed that labor and livelihood diversity were determinants of the TE. Moreover, the geographical and socio-economic heterogeneity caused the difference in rice production TE in Vietnam. D.T. Tung (2013) [10] employed the DEA technique to measure changes in TE and SE in rice production in the MD using the sample production datasets from 1998 to 2010. The results showed that the TE changed significantly over this period and increasing return to scale was the dominant trend reflecting the need to increase both production scale and rice area.

This article aims to measure the economic efficiency (EE) of the rice-based models in the MD at the salinity-induced prones. There is the statistical testing of economic efficiencies on production and irrigation usage in the study. Either intensive rice model or rice-shrimp model is more economically effective is the key research question in this study. The article consists of three sections. The methodology of the DEA is presented in the first section. The results and discussion of assessment on the EE of rice-shrimp model are shown in the second section. The third section presents the conclusions and policy implications of the study.

2. Methodology

2.1. Conceptual framework

A conceptual framework presented in Fig. 1. was developed to guide data collection and analysis. The first elements of the framework include socio-economic and livelihood factors. The second set of factors includes salinity intrusion situation and human behavior coping with salinity-related risk and hazard. The third set of factors relates to irrigated water use and management. The fourth set of factors links to rice-based production, the farming system, and community- and region-based interventions. These factors are examined to assess the EE of rice-based production models (rice vs rice-shrimp model).

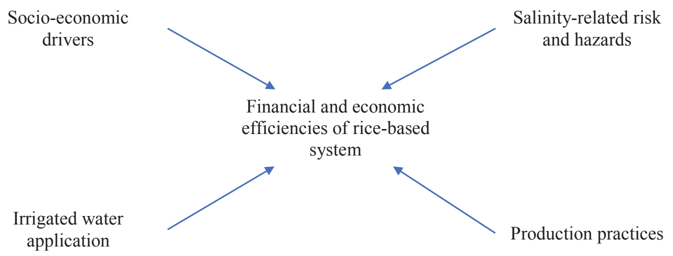

Fig. 1. Conceptual framework of the study.

2.2. Economic efficiency of irrigated water use framework

Theoretically, because of non-priced input data type collected in the survey, the parameter method of stochastic frontier function could not be defined to measure the TE. So, this study uses the non-parametric DEA approach to assess the economic efficiency (EE) of rice-based model with irrigated water use efficiency. Measures of efficiency include the TE and the scale efficiency (SE). The TE refers to functional relation between inputs including irrigated water and output. It is attained when the maximum possible improvement in output is obtained from a set of inputs. The SE measures the potential productivity gain from attaining optimal size of a farm. The EE refers to the maximization of output for a given cost. Methodologically, in the non-parametric procedure, a mathematical programming method of DEA is used to overcome the limitation of parametric Cobb-Douglas production function method. That is, using actual observations, a frontier is defined with reference to all the farms in the sample set. The frontier gives the efficient farms in the set as a benchmark against which to measure other farms' performance. A farm's efficiency is analyzed by comparing its performance with that of other farms located along the frontier. The assumption of a constant return to scale (CRS) works all firms operate optimally [11]. In addition, a variable return to scale (VRS) is proposed by D.E. Banker, et al. (eds.) (2005) [12].

First, the constant returns to scale DEA model for a single output is used to compute output-oriented measures of the TE and the SE is described below.

$$\begin{aligned} &\mathrm{Min}_{\theta,\lambda}\ \theta \\ &\text{Subject to} \quad -y_i + Y\lambda \geq 0 \\ &\qquad\qquad\quad \theta_i x_i - X\lambda \geq 0 \\ &\qquad\qquad\quad \lambda \geq 0 \end{aligned} \tag{1}$$

where θ_i is the proportional increase in output possible for the i-th farm; λ is the weights relative to efficient farms; y_i and x_i are output and input of i-th farm, respectively; Y and X are vectors of output and input, respectively. In other words, equation (1) with the CRS assumption shows that farms are operating at their optimal scale [13].

Second, the variable returns to scale DEA model uses the CRS specification when not all farms are operating at the optimal scale. The CRS linear programming problem is then modified to account for VRS by adding the convexity constraint:

$$\begin{aligned} &\mathrm{Min}_{\theta,\lambda}\ \theta, \\ &\text{Subject to} \quad -y_i + Y\lambda \geq 0 \\ &\qquad\qquad\quad \theta x_i - X\lambda \geq 0 \\ &\qquad\qquad\quad N1'\lambda = 1 \\ &\qquad\qquad\quad \lambda \geq 0 \end{aligned} \tag{2}$$

where N1 is an Nx1 vector of convexity constraints. It provides the TE scores which are greater than or equal to those obtained using the CRS model. A measure of the SE, ranging of (0, 1), which reflects the role of return to scale in the TE is made by comparing the TECRS and TEVRS scores. A difference between the two TE scores indicates that there is the SE that limits achievement of an optimal (constant) scale:

$$SE_i = TE^{VRS}{}_i \,/\, TE^{CRS}{}_i \tag{3}$$

where $SE_i = 1$ indicates full-scale efficiency and $SE_i < 1$ indicates scale inefficiency.

This study applies the DEA to measure the TE and the SE of the farms in relation to the optimal situation in irrigated water use in the MD. A second step is to analyze the determinants of efficiency measures. A Tobit model with censored variable of range of 0-1 is estimated as a function of attributes of farms to identify the determinants of inefficiency via the estimation of a second-stage process as follow:

$$\begin{aligned} \theta^{k*} &= \beta 0 + \beta 1Z1 + \beta 2Z2 + \ldots + \beta jZj + e \\ &= Z\beta + e \\ \theta^{k} &= \theta^{k*} \text{ if } 0 < \theta^{k*} < 1 \\ &= 0 \text{ if } \theta^{k*} < 0 \\ &= 1 \text{ if } \theta^{k*} > 1 \end{aligned} \tag{4}$$

where θ^k is the DEA efficiency index for water used as dependent variables (k = 1 for the TE^{VRS} and k = 2 for the SE) and Z is a vector of independent variables related to attributes of farms. The estimation of the Tobit model is based on maximum likelihood procedures [14]. The Tobit estimates require that residuals are normally distributed [15].

So, a normality test with the conditional moment test for normality in censored data is used in the study.

Study location: As shown in Fig. 2, in the period 2005-2019 there is an abnormal weather pattern happening in the coastal areas of the MD. Annual temperature and sunshine hours tend to increase, while annual rainfall and humidity tend to decrease except in Kien Giang province. Moreover, the fluctuation of monthly climate means over the years shows that the MD currently follows a heterogeneous climate pattern. According to V.T. Danh, et al. (2019) [16], the combination of these climate factors triggers the adverse impact on the sustainability of the rice model in the MD.

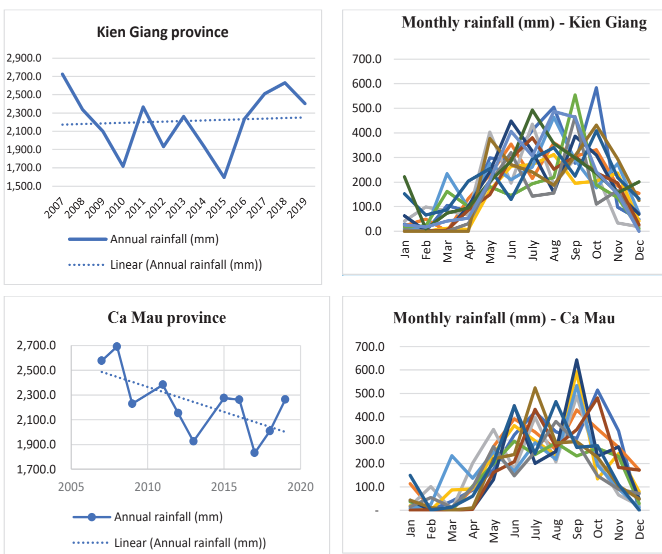

Fig. 2. Province-level weather patterns in the period 2005-2019. Source: General Statistics Office (2020).

2.3. The pattern of rice-based system

In the period 2015-2019, the rice-based system in the western region of the MD changed in terms of a reduction in intensive rice areas and an increase in rice-shrimp areas. However, the pattern of change is quite different. In Ca Mau province, a part of rice-based areas is replaced with extensive- or semi-intensive aquaculture models consisting of monodon and vannamei models. As a result, both rice and rice-shrimp areas decrease at the annual rate of 8.7 percent and 3.2 percent respectively. Meanwhile, in Kien Giang province, the decreased rice areas were set aside for rice-shrimp areas. So, the rice area in this five-year period reduced at the annual rate of 6.2 percent while the rice-shrimp area increased at the annual rate of 25.2 percent. Table 1 shows the changes of rice and rice-shrimp areas in Ca Mau and Kien Giang areas.

Table 1. Rice-based area in western coastal provinces in the MD, period of 2015-2019.

Province	2015	2016	2017	2018	2019	Change (%)
Ca Mau						
Rice	126,587	112,243	113,148	117,390	115,585	-8.69
Rice-shrimp	278,745	276,433	271,535	268,062	269,869	-3.18
Kien Giang						
Rice	769,464	766,033	735,266	728,415	722,014	-6.17
Rice-shrimp	98,753	104,935	117,336	122,701	126,822	28.42
Total						
Rice	896,051	878,276	848,414	845,805	837,599	-14.86
Rice-shrimp	377,498	381,368	388,871	390,763	396,691	25.24

Source: General Statistics Office (2020). Unit: ha.

Regarding the impact of the salinity intrusion in the study location, it also shows that nearly 26 percent of farmers in the survey have to cope with issues of agricultural hazards. Those who are impacted by diseases, extreme weather and salinity intrusion are 52.6 percent, 28.1 percent, 17.5 percent respectively. This, of course, affects the rice yield for the risk-induced farms.

2.4. Sampling procedure

This study employs a random sample of 224 rice-shrimp households in Ca Mau and Kien Giang provinces. The study sites are in salinity-prone western coastal areas. Household selection is conducted in three stages. Firstly, based on a salinity-intrusion map (SIWRR, 2019) [17], of 24 districts, 9 salinity-prone districts are selected with the recommendation by local authorities. Secondly, a population-weighted random sample of 23 communes is drawn from a total of 245 communes. As a result, there are 28 villages selected for the face-to-face interviews. Finally, eight households are selected within each village. Where a list of all village farmers is available, eight households are randomly chosen; if it is not available, the village head is invited to provide a list of twenty households, in which five households are well-off, ten households are at a medium, and five households are less well-off. The chosen farmers are rice farmers and rice-shrimp farmers. The target farmers are selected with three years or more in rice-based production. The interview is then implemented using a well-designed questionnaire. As a result, eight households will be randomly selected from the list of twenty households applying a function of RAND() in EXCEL among 224 rice-based farmers with a total of 254 plots of rice land selected for interviewing, there are 32 and 138 rice farms in Ca Mau and Kien Giang, respectively; and 41 and 43 rice-shrimp farms in Ca Mau and Kien Giang, respectively. A face-to-face interview is implemented using the Census and Survey Processing System (cspro) package written for the well-designed questionnaire.

3. Results and discussion

3.1. Characteristics of sample

In the sample, the average household head is 45 years of age and has been cultivating rice for at least 7 years. Of the respondents, 89 percent are men. Of the heads of households, 10 percent have an education of high school or above, and 86 percent of households who participate in the survey are of Kinh ethnicity. There are 85 percent of farmers are landlords. The average rice area is 2.74 ha per household with the average pieces of rice land per household at 1.13. On irrigation investment, the proportion of investment in irrigation water and saltwater drains are 60 percent and 32 percent, respectively. There are 84 percent, 72 percent, and 41 percent of farmers use marketed seed, certificated seed and salt-tolerant seed respectively. The average rice yield in the 2019 Winter-Spring crop is at 6.05 tons per ha. Statistically significant, the results of t-test show that there are differences in rice yields in the rice model and the rice-shrimp model in Ca Mau versus Kien Giang ($p=0.0030$) and ($p=0.0240$). Finally, numbers of fertilizing, spraying pesticides, and weeding are 4, 4, and 1 times respectively. The results of t-test also show that many differences in economic variables depend on different contexts of such an agricultural system (Appendix 2). Table 2 presents descriptive summaries of sampled household characteristics.

Table 2. Sample's characteristics.

Item	Unit	N	Minimum	Maximum	Mean	Standard deviation
Head's age	Year	254	22	73	49.23	11.58
Head's gender	1: Male 0: Female	254	0	1	.89	0.31
Head's education level	1: high school or above 0: otherwise	254	0	1	0.10	0.30
Ethnic	Kinh: 1 Other: 0	254	0	1	0.86	0.35
Number of years of living in the area	Years	254	7	73	44.26	15.15
Landowner status	Landlord: 1 Leaser: 0	254	0	1	0.85	0.36
Having a salinity protection gate	Yes: 1 No: 0	254	0	1	0.32	0.62
Source of production water	Irrigation: 1 Other: 0	254	0	1	0.60	0.490
Agriculture model	Rice: 1 Rice-shrimp: 0	254	0	1	0.67	0.47
Salinity impact	Yes: 1 No: 0	254	0	1	0.10	0.30
Rice area	Ha	254	0.26	38.00	2.74	3.10
Rice yield	(ton/ha)	254	0.80	10.45	6.05	2.07
Marketed seed	Yes: 1 No: 0	254	0	1	0.84	0.37
Certificated seed	Yes: 1 No: 0	254	0	1	0.72	0.45
Salt-tolerant seed	Yes: 1 No: 085	254	0	1	0.41	0.49
Number of fertilizing	Time	254	0	8	3.34	1.10
Number of pesticiding	Time	254	0	12	3.30	2.38
Number of weeding	Time	254	0	2	0.89	0.33

Source: Survey (2019).

3.2. Irrigated water use

The result of statistical summary in Table 3 shows that the mean of irrigated water cost is at 260,000 VND per ha. There is more than three-fourths of the farms having the irrigated water cost below one million VND per ha. However, there were differences in irrigated water cost in rice production under different scenarios (Appendix 2). Statistically significant, there is no difference in irrigated water cost per ha between rice model and rice-shrimp model ($p<0.5770$).

Table 3. Distribution of irrigated water cost.

Irrigated water cost	N	%
Below 1,000	193	76.0
1,000-2,000	38	15.0
Above 2,000	23	9.0
Total	254	100.0

Source: Authors' calculation. Unit: thousand VND/ha.

3.3. Economic analysis of rice production

3.3.1. Economic efficiency

Table 4 presents the production outputs of the rice and rice-shrimp models. First, results reveal that the rice revenues or rice sales in rice model and rice-shrimp model are 39.7 million VND and 22.4 million VND per ha respectively. Statistically significant, the result of the t-test shows that there is a difference in the revenue means in the two systems ($p<0.0000$). Second, the financial costs of rice production per ha are 13.5 million VND and 10.0 million VND for the rice model and rice-shrimp model respectively. Statistically significant, the result of the t-test shows that there is a difference in the financial production cost means in the two systems ($p<0.0000$). Third, the economic costs of rice production per ha

Table 4. Statistical summary of financial and economic inputs and outputs.

Index	Unit	Total		Rice model		Rice-shrimp model		t-value
		FE#	*EE##*	*FE#*	*EE##*	*FE#*	*EE##*	
Revenue	Thousand VND/ha	33,971	33,971	39,695	39,695	22,387	22,387	13.3166***
Land preparation cost	Thousand VND/ha	1,299	1,299	1,483	1,483	926	926	5.5835***
Seed cost	Thousand VND/ha	123	123	143	143	83	83	9.2750***
Pesticides cost	Thousand VND/ha	2,588	2,588	3,569	3,569	604	604	9.5112***
Fertilizer cost	Thousand VND/ha	3,644	3,644	4,281	4,281	2,353	2,353	8.2193***
Irrigation cost	Thousand VND/ha	260	260	272	272	235	235	0.7833
Rent-labor cost	Thousand VND/ha	1,704	1,704	741	741	3,652	3,652	-12.6649***
Own-labor cost	Thousand VND/ha	-	1,233	-	813	-	2,083	-6.2451***
Harvesting cost	Thousand VND/ha	3,233	3,233	2,391	2,391	4,937	4,937	-15.7477***
Financial cost	Thousand VND/ha	12,288	-	13,478	-	9,880	-	7.6982***
Economic cost	Thousand VND/ha	-	13,520	-	14,290	-	11,963	4.9466***
Financial profit	Thousand VND/ha	21,684	-	26,218	-	12,507	-	10.4727***
Economic profit	Thousand VND/ha	-	20,191	-	25,133	-	10,190	11.2790***
Financial return-to-sale	%	57.37	-	62.60	-	46.77	-	4.6826***
Economic return-to-sale	%	-	50.95	-	59.50	-	33.64	6.5991***

Note: *** statistically significant level at 1%; #, ## are financial efficiency and economic efficiency respectively numbers in t-value column show the mean differences of rice model vs rice-shrimp model descriptions of variables are presented in Appendix 1.
Source: Authors' calculation.

are 14.3 million VND and 12.0 million VND for the rice model and rice-shrimp model respectively. Statistically significant, the result of the t-test shows that there is a difference in the economic production cost means in the two systems ($p<0.0000$). Fourth, the financial profits per ha are 26.2 million VND and 12.5 million VND for the rice model and rice-shrimp model respectively. Statistically significant, the result of the t-test shows that there is a difference in the financial profit means in the two systems ($p<0.0000$). Fifth, the economic profits per ha are 25.1 and 10.2 million VND for the rice model and rice-shrimp model, respectively. Statistically significant, the result of the t-test shows that there is a difference in the economic profit means in the two systems ($p<0.0000$). Sixth, the financial rates of return are 62.6 percent and 46.8 percent for the rice model and rice-shrimp model respectively. Statistically significant, the result of the t-test shows that there is difference in the financial rate of return means in the two systems ($p<0.0000$). Finally, the economic rates of return are 59.5 percent and 33.6 percent for the rice model and rice-shrimp model respectively. Statistically significant, the results of the t-test show that there is a difference in the economic rate of return means in the two rice-based production systems ($p<0.0000$).

To measure the EE of rice-based system, a DEA function of economic profit with its arguments of irrigated water cost, fertilizer cost, pesticide cost, labor cost, and seed cost is applied in this study. Table 5 presents the summary of TE and the SE of the rice model, rice-shrimp model, and rice-based system as a whole. Results show that the overall means of the TE and the SE are 0.642 and 0.848 respectively. They tell that the TE of rice-based farms is low while the SE is relatively high. The results also indicate that the distribution of the SE is widely scattered at the range of 0.400 to 1.000. The highest proportion of farms with the SE of 0.901 to 1.000 is 48.4 percent. In general, the proportion of farms with the SE above 0.500 is 97.7 percent. For the TE, there is a dispersed distribution pattern in the range of 0.100 to 1.000 in which a wide distribution of the range 0.300 to 0.800 is 63.8 percent and the range of 0.900 to 1.000 is 22.8 percent. It proves that many rice-based farms in the MD are producing at low-efficiency levels. Lastly, in term of the EE of economic return-to-scale, there are 78 percent and 11.8 percent of the farms having the decreasing return to scale (DRS) and the constant return to scale (CRS) respectively while the proportion of farms having increasing return to scale (IRS) is 10.2 percent. Results show that there is still potential for improving the EE of rice-based system in the MD.

In the rice model, the SE is relatively high. The distribution of the SE is at the range of 0.600 to 1.000 with more than 67 percent of farms attaining the efficiency level of above 0.800. The fact that the average score of the TE is 0.605 implies the TE of farms is still low and needs to be improved. There is only nearly one-fourth of farms attaining the high TE of 0.800-1.000. In term of the EE of economic return to scale, there are 79.4 percent and 16.5 percent of farms having the DRS and CRS respectively while the proportion of farms having IRS is 4.1 percent. In the rice-shrimp model, the average scores of the TE and the SE are 0.665 and 0.509 respectively implying that inefficiencies happened. The distribution of the SE is widely dispersed at the range of 0.100-1.000. The highest proportion of farms with the SEs at the range of 0.100-0.200 and 0.900-1.000 are 18.3 and 17.2 percent, respectively. There are 49 percent of farms attaining the low TE (below 0.500) while there are 22.1 percent of them getting the high TE (0.800-1.000). In term of the EE of economic return to scale, there are 86.9 percent and 2.4 percent of farms having the DRS and CRS respectively while there are 10.7 percent of farms having IRS. Comparing the two models it is concluded that the rice-shrimp farms have more TE than rice farms but reversely in the case of the SE.

Table 5. Summary of the technical efficiency, scale efficiency, and economic efficiency.

Index	TE^{CRS}		TE^{VRS}		SE	
	N	*%*	*N*	*%*	*N*	*%*
OVERALL RICE-BASED SYSTEM						
EFFICIENCY						
Mean	0.538		0.642		0.848	
Min	0.109		0.115		0.145	
Max	1.000		1.000		1.000	
S.d.	0.232		0.250		0.152	
Range of efficiency	254	100.0	254	100.0	254	100.0
<0.100	0	0	0	0	0	0
0.101-0.200	12	4.7	9	3.5	1	0.39
0.201-0.300	19	7.5	8	3.1	1	0.39
0.301-0.400	43	16.9	34	13.4	-	-
0.401-0.500	57	22.4	33	13.0	4	1.57
0.501-0.600	41	16.1	36	14.2	13	5.12
0.601-0.700	26	10.2	32	12.6	21	8.27
0.701-0.800	13	5.1	27	10.6	42	16.54
0.801-0.900	11	4.3	17	6.7	49	19.29
0.901-1.000	32	12.6	58	22.8	123	48.43
Total	254	100.0	254	100.0	254	100.0
RETURN TO SCALE	N	%				
Constant return-to-scale	30	11.8				
Decreasing return-to-scale	198	78.0				
Increasing return-to-scale	26	10.2				
Total	254	100.0				
RICE MODEL						
EFFICIENCY						
Mean	0.494		0.605		0.830	
Min	0.005		0.006		0.125	
Max	1.000		1.000		1.000	
S.d.	0.264		0.285		0.167	
Range of efficiency	170	100.0	170	100.0	170	100.0
<0.100	8	4.7	7	4.1	0	0
0.101-0.200	9	5.3	5	2.9	1	0.6
0.201-0.300	14	8.2	10	5.9	1	0.6
0.301-0.400	42	24.7	21	12.4	2	1.2
0.401-0.500	29	17.1	26	15.3	5	2.9
0.501 - 0.600	21	12.3	19	11.2	4	2.4
0.601 - 0.700	14	8.2	21	12.4	22	12.9
0.701 - 0.800	5	2.9	12	7.1	21	12.4
0.801 - 0.900	3	1.8	7	4.1	38	22.4
0.901 - 1.000	25	14.7	42	24.7	76	44.7
RETURN TO SCALE						
Constant return-to-scale	28	16.5				
Decreasing return-to-scale	135	79.4				
Increasing return-to-scale	7	4.1				
Total	170	100.0				
RICE-SHRIMP MODEL						
EFFICIENCY	84	100.0	84	100.0	84	100.0
Mean	0.361		0.665		0.509	
Min	0.022		0.122		0.127	
Max	1.000		1.000		1.000	
S.d.	0.279		0.245		0.256	
Range of efficiency	84	100.0	84	100.0	84	100.0
<0.100	8	9.5	0	0	0	0
0.101-0.200	9	10.3	16	18.8	15	18.3
0.201-0.300	8	10.1	9	10.8	10	11.4
0.301-0.400	7	8.5	8	9.9	8	9.6
0.401-0.500	8	9.2	8	9.5	9	10.3
0.501-0.600	10	11.4	9	10.6	4	5.1
0.601-0.700	6	7.4	8	9.1	12	14.7
0.701-0.800	4	4.7	8	9.2	8	9.0
0.801-0.900	10	11.7	6	6.6	4	4.4
0.901-1.000	14	17.2	13	15.5	14	17.2
RETURN TO SCALE						
Constant return-to-scale	2	2.4				
Decreasing return-to-scale	73	86.9				
Increasing return-to-scale	9	10.7				
Total	84	100.0				

Source: Authors' calculation.

Overall, in the salinity-induced areas the TE of both intensive rice and shrimp-rice models are low. Besides, a large proportion of rice-based farms in the MD are producing at the low efficiency. It implies that there is chance of improvement on the EE of rice-based system in the salinity-induced areas at the MD. The study also shows that the intensive rice model has the higher SE than the rice-shrimp model. In the context of agricultural policy analysis, the fact that the SE of the intensive rice model is higher than the SE of the rice-shrimp model presents a necessity of increase in scale of cultivated rice area in the salinity-induced regions.

3.3.2. Determinants of economic efficiency

Table 6 presents the results of OLS and Tobit estimations on the economic efficiencies. First, the results in Model 1 show that, statistically significant, the gender, ethnicity, education level, type of rice-base system, irrigation system, and number of fertilizing are the determinants of the economic profit. These factors have positive effects on the economic profit excepting the irrigation system. In terms of the on-farm earnings, it raises questions about the role of irrigation system investment in the MD. Furthermore, the positive effect of number of fertilizing implies that the rice-based farms are still dependent of modern inputs in the rice production practice. Besides, there is a difference in economic profit among provinces. That is, rice-based farms in Kien Giang have a higher economic profit than rice-based farms in Ca Mau. Second, the results in Model 2 show that, statistically significant, the age, irrigation system, saltwater drains, salinity impact, are the determinants of the efficiency of irrigated water use. These factors have positive effects on the efficiency of irrigated water use excepting the irrigation system. Third, the results in Model 3 show that, statistically significant, the gender, ethnicity, area, type of rice-base system, type of seed, number of pesticides, and salinity impact are the determinants of the TE. The factors of the gender, ethnicity, area, and

Table 6. Results of regression estimations on the economic efficiency of the rice-based system.

Variable	Model 1[a/]	Model 2[a/]	Model 3[b/]	Model 4[b/]
(Constant)	-77,639.91** (-2.0982)	-0.221* (-1.9367)	0.5493*** (3.8700)	1.0175*** (12.6200)
Gender	34,662.16** (2.5820)	0.119 (2.3715)	0.1069** (2.0900)	0.0136 (0.4700)
Age	-316.47 (-0.6324)	0.003* (1.8329)	0.0029 (1.5100)	0.0002 (0.1600)
LivYear	207.21 (0.5767)	0.001 (0.0864)	-0.0009 (-0.6700)	-0.0008 (-0.9500)
Ethnic	52,145.28*** (4.0546)	0.016 (0.3453)	0.1067** (2.0600)	-0-0308 (-1.0800)
D_Primary	-6,599.40 (-0.5586)	-0.042 (-0.9542)	0.0047 (0.9800)	0.0058 (0.2200)
D_Secondary	-12,414.24 (-0.9808)	-0.028 (-0.5999)	0.0019 (0.0400)	-0.0320 (-1.1700)
D_HighSchool	3,800.72 (0.2160)	-0.014 (-0.2119)	-0.0325 (-0.4900)	-0.0538 (-1.4200)
D_AboveHighSchool	53,301.77* (1.7786)	0.023 (0.2118)	0.2210 (1.6200)	0.0920 (1.3500)
LandOwnership	-1,908.85 (-0.1714)	-0.053 (-1.2850)	0.0593 (1.3900)	-0.0018 (-0.0700)
Irrigationsystem	-47,885.92** (-2.2291)	-0.181** (-2.2560)	-0.0440 (-0.5300)	0.0266 (0.5700)
SalProteGate	38,498.03*** (3.2245)	0.137*** (3.1177)	-0.1179 (-0.3900)	0.0231 (0.8900)
Salinity_Impact	-13,058.88 (-0.9081)	0.253*** (4.6977)	-0.1207** (-2.2200)	-0.0406 (-1.3000)
Area	-	-	0.0650*** (6.9300)	-0.0249*** (-8.0300)
AgriModel	32,753.21*** (2.9456)	0.034 (0.9796)	0.1447*** (3.4000)	0.0539** (2.2100)
Marketed_Seed	-6,206.11 (-0.4046)	-	-0.2879*** (-4.7600)	-0-04.19 (-1.2500)
Certificated_Seed	-14,966.62 (-1.1766)	-	0.0023 (0.0500)	0.0149 (0.3800)
SaltTolerant_Seed	520.40 (0.0632)	-	0.0349 (1.0600)	0.0278 (1.5400)
NumberFert	18,153.39*** (3.9500)	-	-0.0197 (-1.0600)	-0.0143 (-1.3600)
NumberPes	-1,841.04 (-0.8690)	-	-0.0351*** (-4.3200)	-0.0107** (-2.3200)
NumberWeeding	-10,303.58 (-0.7972)	-	-0.0707 (-1.4100)	-0.0134 (-0.4700)
D_KienGiang	19,766.37* (1.8170)	-0.062 (-1.5860)	0.0369 (0.8700)	-0.0041 (-0.1700)
R^2	0.390	0.120		
F-value	7.4461 (0.000)	2.5254 (0.002)		
LR chi square			142.31 (0.0000)	106.00 (0.0000)
Psedo R^2			0.6954	-0.8346

Note: [a/]Models 1 and 2 are estimated in OLS with the dependent variables of the economic profit and the ratio of irrigated water cost to economic profit respectively; [b/]Models 3 and 4 are estimated in Tobit truncated regression with the dependent variables of the variable return to technical efficiency and the scale efficiency respectively; *, **, *** statistically significant level at 10%, 5%, 1%, respectively. Numbers in parenthesis () show t-values. Descriptive of variable is presented in Appendix 1.
Source: Authors' calculation.

type of rice-base system have the positive effect on the TE. Meanwhile, the factors of the type of seed, number of pesticides, and salinity impact have negative effects on the TE. It provides the evidence that applying the marketed seed and much pesticides would reduce the TE of the farms. Finally, the results in Model 4 show that, statistically significant, the type of rice-base system, area, and number of pesticides are the determinants of the SE. The factors of area, and number of pesticides have the negative effects on the SE. Result also indicates that the rice farms are higher economically efficient than the rice-shrimp farms.

4. Conclusions and policy implications

The study uses the DEA approach to assess the EE of rice-based system in the western coastal region of the MD. The rice model has higher financial/economic profits and financial/economic rates of return than the rice-shrimp model. Specifically, the financial profits per ha are 26.2 and 12.5 million VND for the rice model and rice-shrimp model, respectively; and the economic profits per ha are 25.1 and 10.2 million VND for the rice model and rice-shrimp model, respectively. Furthermore, the financial rates of return are 62.6 and 46.8 percent for the rice model and rice-shrimp model, respectively; and the economic rates of return are 59.5 and 33.6 percent for the rice model and rice-shrimp model, respectively. Second, the average overall technical efficiencies for the TE and the SE are 0.665 and 0.509, respectively implying that substantial inefficiencies occurred in farming operations of the sample farm households. Results also reveal that the distribution of the SE is widely scattered at the range of 0.100-1.000. The highest proportion of farmers with the SE of 0.100-0.200 and 0.900-1.000 are 18.3 and 17.2 percent, respectively. The results indicate that there are 49 percent of farmers who attain the low TE (below 0.500) while there are 22.1 percent of them who attain the high TE (0.800-1.000). In term of the EE of economic return-to-scale, there are 86.9 percent and 2.4 percent of farmers having the DRS and CRS respectively while the proportion of farmers having IRS is 10.7 percent. Furthermore, it is found that the rice-shrimp farms have more TE than rice farms. However, the rice farms have more SE than rice-shrimp farms. Results showed that there was still potential for improving the EE of rice-based system. Third, results show that, statistically significant, the land ownership and the rice area are the determinants of the economic profit; the irrigation system, saltwater drains, salinity impact are the determinants of the economic irrigated water use; the land ownership status, the area, and type of seed are the determinants of the TE; and the gender, age, education level, irrigation system, saltwater drains, area, type of seed, and practices of fertilizing and weeding are the determinants of the SE. Nevertheless, the effect of irrigation system on economic profit is not as the expectation. Besides, the positive effect of number of fertilizing proves that the rice-based farms are still dependent of modern input uses. Results also indicate that the rice farms are higher economically efficient than the rice-shrimp farms. Finally, results also reveal that rice-based farms in Kien Giang attain a higher economic profit, TE and SE than farms in Ca Mau.

For policy implications on rice-based farming system in the MD's coastal area, the intensive rice production models is more economically efficient than other farming models like rice-shrimp model. There is still a room for improvement on TE, SE, and EE for all rice-based models. Comparing to intensive rice model vis-à-vis rice-shrimp model, the scale of area is an important factor causing higher TE and ES of rice farmers. This has a significant policy implication in the practice of rice industry development in the MD. A land accumulation policy is needed in order to improve the TE and EE of rice production system in the MD. This recommendation on land accumulation policy should be tested for other rice production regions so that it can be a proof for agricultural land use policy reform in Vietnam.

APPENDICES

Appendix 1. Description of variables used in the study.

Variable	Unit	Description
Revenue	Thousand VND	Rice revenue
Seed	Thousand VND	Cost of seed
LandPreparation	Thousand VND	Cost of land preparation: in the 1st stage of land preparation
Pesticides_1	Thousand VND	Cost of pesticides: in the 1st stage of land preparation
Rentlabor_1	Thousand VND	Cost of rent labor: in the 1st stage of land preparation
OwnLabor_1	Thousand VND	Cost of family labor: in the 1st stage of land preparation
Fertilizer_2	Thousand VND	Cost of fertilizers: in the 2st stage of rice production
Pesticides_2	Thousand VND	Cost of pesticides: in the 2st stage of rice production
WaterIrriCost	Thousand VND	Cost of irrigated water cost: in the 2st stage of rice production
Rentlabor_2	Thousand VND	Cost of rent labor: in the 2st stage of rice production
OwnLabor_2	Thousand VND	Cost of family labor: in the 2st stage of rice production
ProdCost_2	Thousand VND	Cost of rice production: in the and 2rd stage of rice production
TotalProdCost_1_2	Thousand VND	Total cost of rice production: in the 1st and 2rd stage of rice production
MachineCost_3	Thousand VND	Cost of machine for harvesting: in the 3st stage of harvesting
TransportCost_3	Thousand VND	Cost of transport for harvesting: in the 3st stage of harvesting
DryingCost_3	Thousand VND	Cost of drying for harvesting: in the 3st stage of harvesting
Rentlabor_3	Thousand VND	Cost of rent labor: in the 3st stage of harvesting
OwnLabor_3	Thousand VND	Cost of family labor: in the 3st stage of harvesting
HarvestCost	Thousand VND	Total cost of harvesting: in the 3st stage of harvesting
FinProfit	Thousand VND/household	Financial profit
EconProfit	Thousand VND/household	Economic profit
FinCost	Thousand VND/household	Financial cost
OwnLabor	Thousand VND/household	Cost of family labor
EconCost	Thousand VND/household	Economic cost
FinROS	%	Financial return on sales
EconROS	%	Economic return on sales
Area	ha	Rice area
AgriModel	Dummy (1: rice; 0: rice-shrimp)	Agricultural Model
LandOwner	Dummy (1: owned; 0: leased or rent)	Land owner
Irrigationsystem	Dummy (1: irrigated; 0: non-irrigated)	Irrigation system
MarketedSeed	Dummy (1: marketed; 0: in-house)	Marketed seed
CertificatedSeed	Dummy (1: certificated; 0: non-certificated)	Certificated seed
SaltTolerantSeed	Dummy (1: tolerant; 0: non-tolerant)	Salt-tolerant seed
Yield	ton/ha	Rice yield
Seed_Kg	kg	Quantity of seed
Seed_ha	kg/ha	Quantity of seed
NumberFert	Number	Number of fertilizing
NumberPes	Number	Number of pesticiding
NumberWeeding	Number	Number of weeding
IrriCost	.000 VND	Irrigated water cost
SalProteGate	Dummy (1: having a gate; 0: no gate)	Salinity protection gate
Salinity_Impact	Dummy (1: impacted; 0: not impacted)	Salinity impact
Gender	Dummy (1: male; 0: female)	Head's gender
Age	Years	Head's age
LivingYear	Years	Number of year to live in the location

Appendix 2. Results of t-tests of critical variables by categories.

Indicator	Agricultural model (1: rice; 0: rice-shrimp)	Irrigation system (1: yes; 0: no)	Seed status 1 (1: bought; 0: in-house)	Seed status 2 (1: certificated; 0: non-certificated)	Seed status 3 (1: salt-tolerant; 0: non-salt tolerant)	Land ownership (1: owned; 0: rent or leased)	Salinity protection system (1: yes; 0: no)	Salinity impact (1: yes; 0: no)
Financial profit/ha (,000 VND)	-10.7433	-7.7732	0.5657	-1.1803	1.0825	0.0362	-7.4764	8.4380
	0.0000	0.0000	0.5718	0.2382	0.2793	0.9711	0.0000	0.0000
Economic profit/ha (,000 VND)	-2.4572	-2.9352	-0.6548	-0.8172	1.0823	0.8876	0.1532	2.3554
	0.0142	0.0034	0.5127	0.4140	0.2794	0.3750	0.8783	0.0187
Scale efficiency	-1.6675	-0.6447	0.1384	0.4252	-1.1441	-0.9606	-2.5455	2.1089
	0.0958	0.5193	0.8900	0.6708	0.2529	0.3370	0.0112	0.0353
Rice yield (ton/ha)	-13.0300	-7.8371	-1.5699	-3.2236	1.0219	-0.4864	-7.1352	7.7372
	0.0000	0.0000	0.1168	0.0013	0.3071	0.6268	0.0000	0.0000
Seed (kg/ha)	-15.4614	-3.5411	3.4886	4.4431	1.7177	1.9079	-4.8956	0.8210
	0.0000	0.0004	0.0005	0.0000	0.0862	0.0567	0.0000	0.4119
Number of fertilizing	-10.9297	-7.3029	1.5917	2.7919	3.2221	2.8878	-7.5803	2.3619
	0.0000	0.0000	0.1118	0.0054	0.0013	0.0040	0.0000	0.0184
Number of pesticiding	-9.2883	-5.3482	-0.8518	-2.5127	3.4555	0.4964	-4.4047	2.0798
	0.0000	0.0000	0.3946	0.0122	0.0006	0.6197	0.0000	0.0379
Number of weeding	-5.5963	-1.9686	2.1179	2.8424	0.2580	0.7968	-2.7731	1.3303
	0.0000	0.0493	0.0345	0.0046	0.7965	0.4258	0.0057	0.1838
Irrigation cost (,000 VND)	-1.7537	-6.2149	-1.1733	0.0146	0.9073	1.8217	-7.4111	0.1501
	0.0799	0.0000	0.2410	0.9883	0.3645	0.0689	0.0000	0.8807
Area (ha)	1.8570	-0.3467	-1.4209	-0.8622	0.8381	1.3181	5.0832	0.0068
	0.0637	0.7289	0.1557	0.3888	0.4022	0.1878	0.0000	0.9946
Financial Return on Sales (%)	-5.6892	-4.0651	2.8110	0.3525	0.7482	-0.0355	-4.2425	8.5855
	0.0000	0.0001	0.0051	0.7245	0.4545	0.9717	0.0000	0.0000
Economic Return on Sales (%)	-7.5200	-3.1414	2.2096	-0.5492	1.2562	0.1141	-3.3141	8.1871
	0.0000	0.0017	0.0274	0.5830	0.2094	0.9092	0.0010	0.0000

First subrows show t-values and second subrows show p values.

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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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Impacts of inflation on the Vietnamese stock market in economic turbulence

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Abstract:

This study employs the GARCH model to examine how inflation affects the Vietnamese stock market. The analysis uses 2001-2022 data from the General Statistics Office and the Ho Chi Minh Stock Exchange (HoSE). This time frame encompasses various market cycles, including the recent financial crises, which alter the characteristics of stock variance. The findings reveal that inflation has a strong impact on the volatility of stock indexes because the psychological herd of the stock players has a huge impact on market volatility such that it weakens the market, leading to instability due to stock prices being blown up too high or depressed too low. Herd mentality facilitates price manipulation, stock price manipulation, and speculation. When the demand for capital flows into the secondary market, a surge has led to a large amount of money in circulation. This has caused a high level of inflation. The findings indicate that a one percent increase in inflation is associated with a 6.692 percent increase in the VN index, suggesting that Vietnam's stock market returns can hedge against inflation. Yet, the popularity of speculative investments necessitates that the Vietnamese government not only address inflation but also improve financial regulations and stock market oversight.

Keywords: **economic crisis, inflation, stock return volatility, Vietnam stock market.**

Classification number: **2.1**

1. Introduction

The impact of inflation on the stock market often receives great attention from both the government and investors [1]. Investors frequently have a strong desire to utilize inflation as a metric for predicting future trends in the stock market. This has the potential to improve their capacity to properly manage their positions and portfolios, thereby leading to higher returns and/or less risk. Meanwhile, policymakers may pay attention to the situation of the stock market, which can be regarded as a leading indicator of future macroeconomic activity [2]. They perceive that the operation of the stock market may be able to explain some changes in key macroeconomic measures, and they could hold clues for Vietnam's post-pandemic recovery. As such, they can better control the direction, magnitude, and stability of the economy by adjusting macroeconomic variables such as inflation if the relationship between stock returns and inflation has predictive power to stimulate the growth of the economy.

However, the effect of inflation on the stock market, has never been fully determined. The examination of the relationship between inflation rate and stock market returns in the field of economics is based on two divergent concepts: the I. Fisher's hypothesis and the E.F. Fama's hypothesis [3, 4]. The I. Fisher's hypothesis proposes that equity stocks operate as security interests against a firm's tangible assets, thereby potentially providing protection against inflation [3]. The I. Fisher's hypothesis posits that the stock market is subject to the influence of the inflation rate via three main channels. Firstly, the production of goods and services by firms is impacted, which in turn affects stock market performance. Secondly, investor behavior and the value of investments on the stock market are influenced by inflation. Lastly, monetary policy tightening is implemented to manage inflation, and this has implications for the stock market. In contrast to the I. Fisher's hypothesis, E.F. Fama's hypothesis posits that the apparent correlation between inflation and stock returns is not genuine [4], as it is driven by a positive correlation between stock returns and anticipated economic activity, as well as a negative correlation

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between anticipated economic activity and inflation [5]. In the statistical association between stock returns and inflation, inflation is functioning just as a proxy for anticipated economic activity.

In empirical analysis, there is also a divergence of findings regarding the impact of economic health on stock market volatility and, consequently, the risk posed by inflation to investors. For instance, J.T. Sokpo, et al. (2017) [6] have provided empirical evidence supporting the notion that inflation has no predictive power in determining conditional stock exchange volatility in Nigeria. In contrast, T.C. Chiang (2023) [7] suggested that there may be a negative correlation between real stock return and anticipated (and unanticipated) inflation in the US. L. Li, et al. (2010) [8] discovered the relationship between inflation and stock returns differs across inflationary regimes. Likewise, within the context of Vietnam, a number of empirical investigations demonstrate a convergence of results. For example, a recent study by T.H. Nguyen, et al. (2009) [9] used OLS regression with data from the VN-Index and each industry sector to examine the impact of inflation on the stock market, demonstrating that inflation was a systemic risk factor that had an effect on the entire stock market. The return on stocks is significantly impacted negatively by inflation. This meant that stock market investments were not a hedge against inflation. On the contrary, L.V. Long (2021) [10] demonstrates that there exists a positive correlation between the inflation rate and the magnitude of the VN-Index, whereby an increase in the former leads to a corresponding increase in the latter. Other studies using Vector Autoregression (VAR) [11, 12], Autoregressive Distributed Lag (ARDL) [13, 14], Error Correction Model (ECM) [15], as well as other approaches such as Autoregressive Integrated Moving Average (ARIMA) yielded a mixed pictures.

During the recent economic instability, a notable argument has emerged on the extent to which the movement of share prices exceeds the level considered reasonable, so exemplifying a phenomenon commonly referred to as "excess volatility". This phenomenon implies that asset prices exhibit greater volatility than can be rationalized by alterations in the fundamental attributes of the underlying firms, thereby indicating that stock prices may not consistently serve as reliable predictors of future events [8]. The price fluctuations of financial assets in the stock market occasionally appear to be incongruous with the prevailing conditions in the broader economy, commonly known as the 'real economy'. This phenomenon has been particularly evident in recent years, characterized by significant fluctuations in prices during periods of economic turbulence. Consequently, the efficiency of the economy has diminished, while the stock market has become increasingly volatile and challenging to navigate [16]. The characteristics of stock variance might be changed through market cycles including financial crises. This leads to two important questions that frequently preoccupy policymakers and investors recently: does inflation really have an effect on the stock market, particularly in light of the recent economic shocks? Is it possible to quantify this impact?

This article will answer these questions by investigating the impact of inflation on the operation of the stock market in Vietnam using a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. This research diverges from the previous literature by incorporating recent economic shocks and the intrinsic attributes of stock market volatility inside these shocks, which bear noteworthy consequences for policymakers and investors. The findings of this research may provide significant knowledge regarding the fundamental elements influencing the performance of the stock market in Vietnam. Additionally, it may present potential approaches to improve its operational effectiveness, particularly considering the recent economic disruptions.

2. Methodology

2.1. Empirical model

In order to investigate the impact of inflation on the stock market return, time series data will be utilized in this article. We particularly pay attention to heteroskedasticity when performing the time series analysis because the disturbance variances in time-series data usually less stable than usually assumed [17]. Specifically, the uncertainty of stock market returns, which are measured using variance and covariance, changes over time. For this problem, it is necessary to specify the variance dynamics (volatility). R.F. Engle (1982) [17] suggested that the ARCH (Autoregressive Conditional Heteroskedasticity) model can be a standard time series treatment. It is well known that a period of high volatility continues for a while after a period of increased volatility, a phenomenon called volatility clustering. The ARCH model takes the high persistence of volatility into consideration captured by allowing volatility to depend on the lagged values of the innovation terms and q [see equations (1) and (2)], which are chosen such that the residuals of the variance equation are white noise.

$$Y_t = \beta_1 + \beta_2 X_t + u_t \quad (1)$$

$$u_t \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \gamma_0 + \sum_{i=1}^{p} \delta_i \, \sigma_{t-i}^2 + \sum_{j=1}^{q} \gamma_j \, u_{t-j}^2 \quad (2)$$

where: u_t = Error term at time t; σ_t^2 = Conditional variance for the current time t; σ_{t-i}^2 = Conditional variance for the current time t-i; u_{t-j}^2 = News about volatility from the previous period t to the next period j, measured as the lags of the squared residual from equation; X_t represents a*(kx1)* vector of explanatory variables; β_1, β_2 are the coefficients of the explanatory variables; q is the length of ARCH lags; p is the periods in the series; δ_i is the coefficients of ARCH; γ_0, γ_j are the parameters of the model.

However, this research uses the following extended generalized ARCH (1,1) model to estimate the impact of inflation on the operation of the stock market in Vietnam because Q.H. Vuong (2002) [18] found that there was a generalized ARCH(1,1) effect in the daily stock returns series with Vietnam's market price index. The notation (1,1) between parentheses is a standard symbol in which the first number refers to the order of ARCH terms, while the second number refers to the order of generalized ARCH terms, sometimes referred to as the number of GARCH terms. The GARCH model has greater flexibility in terms of non-negativity constraints, volatility clustering, parsimony, and the ability to account for leptokurtosis. This is seen in Table 1, which demonstrates that the time series are characterized by leptokurtosis.

$$R_t = \beta_1 + \beta_2 R_{t-1} + u_t$$

$$\sigma_t^2 = \gamma_0 + \delta_1 \sigma_{t-1}^2 + \gamma_1 u_{t-1}^2 + \alpha_1 CPI_t$$

Condition for the model: $\delta_1 + \gamma_1 < 1$

where: u_t = Error term at time t; σ_t^2 = Conditional variance for the current time t; σ_{t-1}^2 = Conditional variance for the current time t-1; u_{t-j}^2 = News about volatility from the previous period, measured as the lags of the squared residual; u_{t-1}^2 = News about volatility from the period t-1 CPI_t = Consumer price index; R_t = market return at time t. R_{t-1} = market return at time t-1; β_1, β_2 are the coefficients of the explanatory variables; δ_1 is the coefficient of GARCH; α_1 is the coefficent of CPI; γ_0, γ_j are the parameters of the model to ensure that the conditional variance is positive.

2.2. Data

2.2.1. Data collection

The data source for this research was obtained from the General Statistics Office of Vietnam and from the Ho Chi Minh Stock Exchange (HoSE).

The inflation employed in this study is the monthly consumer price index (CPI) data spanning from August 2001 to July 2022. The change in CPI is calculated as follows:

$$IF_t\,(\%) = 100 \times \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}}$$

where: IF_t = Change in CPI; CPI_t = Consumer price index at month t; CPI_{t-1} = Consumer price index at month *t - 1*.

The stock market return (R_t) is estimated from *VN-Index* values, which are taken at the last trading session of each month from the stock market index of HoSE. Stock market return is estimated by the formula:

$$R_t\,(\%) = 100 \times \frac{VNI_t}{VNI_{t-1}}$$

where R_t = market return at time t; VNI_t = *VN-Index* at month t; VNI_{t-1} = *VN-Index* at month *t - 1*.

The information, such as the number of listing codes, the listed sectors, and market capitalization at HoSE, fully reflects the nature of the Vietnamese stock market; thus, the data can help to ensure that the research results are reliable, objective, and closely reflect the actual operation of the market.

2.2.2. Data description

Description of the data is shown in Table 1.

Table 1. Description of data (August 2001 - July 2022).

Variables	R	CPI
Mean	101.4841	100.5172
Median	100.8154	100.3550
Maximum	138.5171	103.9100
Minimum	65.66302	98.46000
Std. Dev.	9.716498	0.769575
Skewness	0.289238	1.515395
Kurtosis	4.849501	6.372016
Jarque-Bera	39.43052	215.8399
Probability	0.000000	0.000000
Sum	25573.99	25330.33
Sum Sq. Dev.	23697.00	148.6537
Observations	252	252

Source: Authors' calculations based on data provided by GSO and the HoSE.

Table 1 indicates that both variables are skewed towards the right (having positive skewness coefficients of 0.289 & 1.515). The kurtosis of the two variables exceeds 3 (= 4.849 and 6.372), implying that leptokurtic or both series have a distribution with a fatter tail and more peaking at the mean than a normal distribution. This means that we need to test whether there is a unit root.

2.2.3. Unit root test

Augmented Dickey - Fuller (ADF) test is used to test whether inflation contains a unit root or is stationary. The result is reported in Table 2.

Table 2. Augmented Dickey-Fuller unit root test.

For R variable			
Augmented Dickey-Fuller test statistic		***t-Statistic***	***Prob.***
-10.93574		0.0000	
Test critical values	1% level	-3.456302	
	5% level	-2.872857	
	10% level	-2.572875	
For CPI variable			
Augmented Dickey-Fuller test statistic		***t-Statistic***	***Prob.***
-8.051721		0.0000	
Test critical values	1% level	-3.456302	
	5% level	-2.872857	
	10% level	-2.572875	

Source: Authors' calculations based on data provided by GSO and the HoSE.

Table 2 reveals that the critical values at 1% and 5% were -3.456 and -2.872 respectively, thus the stock return and inflation are all found to be stationary by the Augmented Dickey-Fuller test. This result allows us to further analyze the relationship between inflation and the stock market index using the GARCH model.

3. Results and discussion

The impact of inflation on stock market returns and volatility is investigated through the modified GARCH model. The regression results are reported in Table 3.

Table 3. Regression results of the modified GARCH model.

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	79.19218	7.620809	10.39157	0.0000
R(-1)	0.216486	0.075308	2.874669	0.0040
Variance equation				
C	-661.9713	294.4567	-.248111	0.0246
RESID(-1)^2	0.274304	0.096711	2.836310	0.0046
GARCH(-1)	0.597505	0.108799	5.491836	0.0000
CPI	6.692404	2.950267	2.268406	0.0233
R-squared	0.105347	Mean dependent var		101.4366
Adjusted R-squared	0.101754	S.D. dependent var		9.706621
S.E. of regression	9.199534	Akaike info criterion		7.045838
Sum squared resid	21073.22	Schwarz criterion		7.130111
Log likelihood	-878.2526	Hannan-Quinn criter.		7.079751
Durbin-Watson stat	1.677912			

Source: Authors' calculations based on data provided by GSO and the HoSE.

Table 3 reveals that the coefficient of CPI has a probability equal to 0.0233 which is less than the critical value of 0.05. Hence, this coefficient is statistically significant. The estimated coefficient on the CPI rate is +6.6924, meaning that 1% of an increase in the CPI causes a 6.69% increase in the VN-index. In other words, the higher the rate of inflation, the greater the stock market indexes become. This meant that stock market investment is a hedge against inflation. This result contradicts to the findings of T.H. Nguyen, et al. (2009) [9] who found that the inflation and stock returns have opposite direction. The positive correlation between inflation and stock returns is perhaps due to the existence of two parallel relationships: (1) inflation with real economic activity and (2) real economic activity and equity yield rates. In this case, the rate of profitability of a stock is related in the same direction as real economic activity, and the actual economic activity is related in the same direction as inflation; therefore, the ratio of profitability of a share is positively related to inflation.

Inflation has a relatively strong impact on the volatility of stock indexes, probably because, first, the psychological herd or mob mentality of the stock players is very common in Vietnam and has a huge impact on the volatility of the market. This is a phenomenon that has a negative impact in emerging markets such that it weakens the market, leading to instability due to stock prices being blown up too high or depressed too low, and in some cases, it even causes the stock bubble. Herd mentality facilitates price manipulation, stock price manipulation, and speculation. Vietnam's stock market has gone through periods like that, typically from 2006 to early 2007. When the demand for capital flows into the secondary market, a surge has led to a large amount of money in circulation. This has caused high inflation (in the same direction and at the same tempo or pace).

In addition, Vietnamese investors in securities typically invest with short-term credit financing, which contributes to market and economic instability. The majority of these investors are domestic, while the proportion of foreign investors and foreign portfolio investment is only 15 to 20% of total market capitalization. The internationalization of both the transaction and the market as a whole is quite low. The majority of the capital used by domestic investors to invest in securities comes from bank loans. During periods of robust economic expansion, investors frequently exploit financial leverage for short-term or speculative investments (surfing). Such a substantial quantity of capital does not flow directly into the economy's production and service requirements. As inflation rises, a substantial portion of the population's capital has migrated from bank deposits to investments in securities. A positive correlation between stock returns and inflation stems from the notion that stocks are inflation hedges because they represent claims on actual assets. This trait explains why the inflation rate has a relatively significant effect on the rate of change of the stock market index.

4. Conclusions

The stock market indexes play a crucial role in providing insights into economic performance and are typically influenced by changes in the inflation rate. Policymakers frequently employ volatility estimation as a method for determining the susceptibility of the stock market, whereas investors and agents view this fluctuation as an indicator of risk. Therefore, the inherent characteristics of stock market volatility have significant implications for policymakers and investors alike. Using the GARCH model, this article investigates the impact of inflation on the Vietnamese stock market. The data for this study was collected from the General Statistics Office of Vietnam and the Ho Chi Minh Stock Exchange (HOSE). The results reveal that a one percent increase in inflation is associated with a 6.692% increase in the VN-index, as indicated by the correlation between stock indexes and the inflation index. This indicates that the returns on Vietnam's stock market are adequate to act as a hedge against inflation during the recent economic turbulance. However, inflation affects stock index volatility because the psychological herd of stock players undermines the market, causing stock prices to rise excessively high or fall too low. Herd mentality aids price manipulation, stock manipulation, and speculation. A spike in secondary market capital demand has put a lot of money in circulation. This created significant inflation. The popularity of short-term or speculative investments (surfing) necessitates that the Vietnamese government not only address inflation, but also improve financial regulations and stock market oversight.

CRediT author statement

Nguyen Huu-Dung: Conceptualisation, Methodology, Data curation, Writing - Original draft preparation; Le Viet Long: Methodology, Software, Validation, Writing-Original draft preparation, Editing.

COMPETING INTERESTS

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

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Development of maize hybrids for production and economic growth in the northern midland and mountainous region of Vietnam

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Abstract:

Maize is an important crop in the northern midland and mountainous region of Vietnam with the area of 406.1 thousand hectares, accounting for 45.8% of the whole country. In order to exploit the potential and advantages for developing sustainable and highly valued maize production, the program on development of maize hybrids for production and economic growth in the northern midland and mountainous region of Vietnam in accordance with the Government policies and the Ministry of Agriculture and Rural Development's directions on sustainable agricultural development strategy has been successfully implemented in which newly released maize hybrids developed by Maize Research Institute (Vietnam Academy of Agricultural Sciences) with high yield, good quality, good resistance and over-all advanced technologies were accordingly introduced in rainfed based maize areas of larger scale. The program partly contributed to improving the grain yield from 1.5 tons/ha in the early 1990s to 4.99 tons/ha in this region that played an important role not only in maize production development but also in national food security and environmental protection as well.

Keywords: **economic growth, maize hybrids, mountainous region, production.**

Classification number: **2.1**

1. Introduction

Maize (*Zea mays* L.) is one of the more important food crops, and is used as a main raw material for feedings in Vietnam [1, 2]. With achievements in maize research and development based on integrated cultivating technologies, Vietnam's maize production has continuously developed with a rapid increase in grain yield of 4.99 tons/ha and the production of 4.42 million tons in 2022 compared to 1.5 tons/ha in the early 1990s [3].

To sustainably develop maize production on the basis of improving the quality, the added value and competitiveness of maize products in the market, and the programs of developing maize hybrids for production and economic development in Vietnam's mountainous provinces, based on product value chain should be needed that significantly contribute to a sustainable agriculture development and ecological environmental protection which is targeted to increase the income of local people in mountainous and remote areas [4].

The northern midland and mountainous region has great potential and advantages for developing sustainable maize production, achieving high economic efficiency along with the value-added chain. However, the current maize yield in this region is quite low, 4.16 tons/ha equivalent to about 83% compared to Vietnam's average maize yield [3]. Because of that, Resolution No. 96/NQ-CP authorized by the Government dated 1 August 2022 states that the socio-economic development and national defense for northern midland and mountainous region by 2030 and vision towards 2045 must be implemented with the sustainable development of agricultural production suited to the chain of economic regions, in which maize is considered as a significantly beneficial for the region and should be paid great attention to, especially the overall application of maize hybrids to be effectively cultivated in climate change conditions with properly integrated farming technologies must be accordingly prioritized [5].

On the basis of scientific achievements obtained from the research and development of maize hybrids for production in combination with experiences that resulted in the large-scale increase of maize production in the whole country over the past 50 years, the Maize Research Institute of Vietnam (MRI) has proposed and is approved

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for implementation of the program titled "Development of maize hybrids for production and economic growth in the northern midland and mountainous region of Vietnam". The aim of the program is to partly contribute to sustainable agricultural development, improve socio-economic efficiency, protect ecological environments and promote agricultural value chains based on the overall evaluation of effectively advanced technologies applied in shortening and breeding maize hybrids with high grain-yield quality, good tolerance to stresses and adaptability to rainfed based maize areas without active irrigation systems in the northern midlands and mountainous provinces. And, what is more, the application of synchronous technologies aimed to improve economic efficiency and reduce greenhouse gas emissions during maize production should accordingly be addressed.

As a review on effects of the program on development of maize hybrids on production and economic growth in the northern midlands and mountainous provinces as well as major solutions given for developing maize production in the region, the research method presented is based on scientific analysis of data and information officially published on prestigious sources of General Statistics Office of Vietnam, Vietnam Ministry of Industry and Trade and etc. in according with the system of laws on the sustainable Agriculture and Rural Development including maize for the northern midlands and mountainous region, approved by the Government and the Ministry of Agriculture and Rural Development.

2. Current situation of maize production and development in the northern midland and mountainous region of Vietnam

The northern midland and mountainous region plays an important role in the national socio-economic development, defense and security. The whole region covers a total area of about 116,898 km², accounting for 35% of the country's natural land massy, including 14 provinces (Ha Giang, Cao Bang, Lao Cai, Bac Kan, Lang Son, Tuyen Quang, Yen Bai, Thai Nguyen, Phu Tho, Bac Giang, Lai Chau, Dien Bien, Son La, Hoa Binh) and 21 western districts and one town of Thanh Hoa and Nghe An provinces are involved with a population of 13.02 million, accounting for about 15.2% of the country [3].

Up to now, the region's potentials and advantages have not been effectively exploited, the agricultural value chain has not been accordingly implemented and promoted among provinces in the region, resulting in still low development of regional economy as indicated by a low average gross regional domestic product (GRDP) of 63 million VND per year in 2022 compared to 95.6 million VND per capita of Vietnam's average GDP equivalent to 4,110 USD [3].

Maize has been considered an important crop for the economy of the northern midland and mountainous regions, an area of 406.1 thousand hectares is now cultivated, accounting for 45.8% of Vietnam's maize area that produces 1,688.9 tons annually [3]. The achievements in maize development program is mainly caused by the utilization of high-yielding, well-qualified maize hybrids resulting from research institutions that have significantly contributed to food security and economic development of the region for more than the past 30 years.

The northern midland and mountainous region are considered as the largest maize area in Vietnam where maize hybrids developed by MRI such as LVN10, LVN885, LVN092 and others of foreign companies such as NK7328, NK6253, CP511 have been commonly cultivated. Moreover, the synchronous application of cultivating technical packages in maize production has also improved the potential productivity of varieties and increased economic efficiency by 15-25% for maize farmers in the northern provinces [6]. As a matter of fact, different programs related to maize studies have been proposed and successfully implemented in the past decades involving research into improving maize-based farming systems on sloping lands in Vietnam [7] as well as post-harvest seed preservation technology in maize production [4].

It is also emphasized that timely policies issued by the Government concerning maize production are closely linked to the development of the agricultural extension system and have significantly contributed to creating a main motivation for the formation of a commodity maize industry, including largely concentrated maize areas in Son La province playing an important role in improving economic efficiency and developing sustainable maize production in the scope of the value-added chain under regional integration. Of the above mentioned policies, The following have been effectively implemented:

1) Agricultural development towards green, sustainable and comprehensive development in the northern midland and mountainous region according to the Resolution No.

96/NQ-CP dated 1 August 2022 on the Government's plan of action to implement the Politburo's resolution on orientations for socio-economic development and defense-security maintenance in the northern midland and mountainous region by 2030, with a vision to 2045 [5]. The orientation towards forming sectoral value chains and regional products such as the agricultural product processing centers in Son La province; The development of regional agriculture aimed to produce highly valued and safe specialized commodities in the scope of organic and green production with an appropriate scale.

2) The sustainable agriculture and rural development strategies for the period 2021-2030 with a vision towards 2050 approved by the Government according to the Decision No. 150/QD-TTg dated 28 January 2022, clearly clarified in crop production sector that takes advantages for reasonably developing less advantageous crops for processing and domestic consumption (maize, cotton, tobacco, subtropical fruits and vegetables, soybean) [8].

3) The Decision No. 915/QD-TTg, dated 27 May 2016 of the Prime Minister on policies for supporting the shift to maize production from rice cultivation, including the northern midlands and mountainous region [9].

In the light of the above-mentioned directions, the shifting to highly valued crops including maize and forage particularly from rice cultivation of lowly added value in Lao Cai province in the scales of the implementation of the Decree No. 62/2019/ND-CP dated 11 July 2019 by the Government amended some issues of the Government's Decree No. 35/2015/ND-CP on 13 April 2015 has achieved successes resulting in raising economic efficiency and improving living standard of local farmers that were reported in documents concerned in 2022 [10].

Apart from, the favorable factors of weather and soil conditions, this region is also facing many challenges indicated by insufficient quantity of agricultural laborers that are mainly lowly trained, ethnic minorities with limited capacity of investment. In addition, the strongly separated topography, the incomplete system of transportation and the lowly utilized mechanization caused by high slope cultivated area are considered as great difficulties for rainfed-based maize production in the region [11]. Because of that, the average yield in the whole region is quite low, estimated to be about 83% compared to Vietnam's average yield during the period of 2018-2022 [3].

Table 1. Maize area, yield and production in the northern midlands and mountainous region in the period of 2012-2022.

Year	Area (thousand ha)		Grain yield (quintals/ha)		Production (thousand tons)	
	NMM	*Vietnam*	*NMM*	*Vietnam*	*NMM*	*Vietnam*
2012	502.0	1.156,6	36.7	43.0	1,844.0	4,973.6
2018	455.9	1.032,9	39.5	47.2	1,801.5	4,874.1
2019	435.2	986.7	39.5	48.0	1,720.9	4,731.9
2020	426.4	942.5	40.3	48.4	1,716.5	4,558.2
2021	414.4	902.8	40.9	49.3	1,695.7	4,446.4
2022	406.1	887.0	41.6	49.9	1,688.9	4,423.2

NMM: Northern midlands and mountains region. Source: General Statistics Office of Vietnam, 2023.

Data presented in Table 1 shows that maize yield in this region has increased continuously resulting from the utilization of new maize hybrids with improved resistance, adaptation to climate change and the overall application of advanced cultivating technologies in large-scale maize production. It is, however, obvious that the maize area has decreased in recent years from 502 thousand hectares in 2012 to 406.1 thousand hectares in 2022. The crop conversion programs of provinces are regarded as a main cause for this situation.

According to the US Department of Agriculture (2023), the demand for maize of Vietnam would be increased up to 14.5 million tons in the 2023/24 crop year [2] whereas 4.426 million tons could be annually reached in whole country including 1.69 million tons produced from the northern midlands and mountainous region, accounting for about 38.2% of Vietnam's maize production [3], much lower than the requirement. Vietnam imported 10-12 million tons of maize per year equivalent 2.12-3.33 billion USD in the period 2018-2022 (Table 2). In the first 7 months of 2023, the quantity of 4.28 million tons of maize with the value of 1.4 billion USD was imported. On the other hand, shipping being the main transportation mean of imported maize was more expensive, which made maize prices significantly increase to 10,300-10,500 VND/kg in March 2022 [12]. In order to have enough raw materials used for feeding livestock while accordingly reducing the quantity of maize imported, the policies concerned to sustainable maize production for gradual replacement of lowly valued and disadvantageous crops must be suitably issued and implemented. The northern midlands and mountainous provinces regarded as one of the more important regions for maize cultivation in Vietnam should paid more attention to.

Table 2. Vietnam's imported maize quantity and value in the period of 2018-2022.

Year	Imported quantity (million tons)	Increase/ decrease in quantity compared to the previous year (%)	Value (billion USD)	Increase/ decrease in value compared to the previous year (%)
2018	10.18	31.8	2.12	40.9
2019	11.5	13.7	2.3	10.3
2020	12.07	5	2.39	2.8
2021	10.03	-17.0	2.88	20.6
2022	9.57	-4.5	3.33	15.6

Source: Vietnam Ministry of Industry and Trade (2018-2022).

3. Achievements from the research and development of maize hybrids released by MRI in the northern midlands and mountainous region of Vietnam

With the function of a research institute in breeding and transferring maize in Vietnam for more than 50 years, 108 new maize hybrids were developed by MRI and certified by the Ministry of Agriculture and Rural Development in which 69 maize hybrids were officially recognized as national varieties e.g. LVN10, LVN4, LVN99, LVN61, VN8960, LCH9, LVN885, VS36, LVN092, VN5885, LVN17, HN68... Up to now, the property rights of 15 maize hybrids with the price of 150,000 to 300,000 USD each were transferred to business companies and organizations. The quantity of maize hybrids developed and released by MRI annually accounts for about 25% of the hybrid seed market share in Vietnam, 500-600 tons of which were directly produced and transferred by MRI itself which saves 1.0-1.2 million USD for producers because of low seed price, about 2 USD/kg lower than foreign companies [4].

3.1. The research and development of grain purposed maize hybrids used for production and economic development in the northern midlands and mountainous region

Aimed to develop maize production in accordance with highly valued chain in sustainable agricultural production in the northern midlands and mountainous provinces based on the processes of innovation, technological and scientific application and cooperation in maize production, MRI has successfully studied and developed new maize hybrids of high economic value to be used effectively in the Northern mountainous provinces [4].

Realizing that the cooperation programs with business organizations should be a good method for advanced technology transfers of large-scale maize production, MRI has closely cooperated with various seed companies to transfer 13 maize hybrids for maize production and development in the northern midlands and mountainous region. It is also emphasized that the maize hybrids by MRI cost only a half compared to imported ones resulting in saving 8-9 million USD annually [13].

3.2. The research and development of green forage maize hybrids used for production and economic development in the northern midlands and mountainous region

The Decision No. 1520/QD-TTg of the Prime Minister on approving animal husbandry development strategy for 2021-2030 and vision for 2045 where total meat production should be obtained at 6.0-6.5 tons with a growth rate from 4% at present to 10% until 2030 whereas the scale of beef cattle herds from 6.5 million to 6.6 million individuals, dairy cattle herds from 650 thousand to 700 thousand individuals targeted for milk production of 3 times higher quantity than at present [14]. It is obvious that a big amount of animal feed must be accordingly supplied, especially in the dry season and winter in northern Vietnam. According to the Department of Livestock Production (2020), an amount of 27.6 million tons of forage and ensilaged maize is needed for cattle feeding annually, much higher than the forage maize quantity produced in whole country [15].

To meet the demand of feed for livestock in accordance with the animal husbandry development strategy up to 2030, 0.5 to 1.0 million hectares of land for growing grass and animal feed crops is necessary whereas about 50 thousand hectares of maize cultivated for green forage and silage is now available with a biomass yield of 120-150 tons/ha/year [16], therefore green feeds for domestic livestock requires importation.

In this situation, MRI has tried its best to develop forage maize hybrids like DH17-5, VN172 and maize grain-purposed ones with higher biomass yields e.g. TM181, LCH9, CS71 and complete cultivating technologies in the form of circular economy models cooperating with business organizations such as Binh Dien Fertilizer Joint Stock Company and Loc Troi Group [17].

Research results of MRI showed that growing forage maize in the northern midlands and mountainous region gives a lot of advantages indicated by not only limitation of weather risks that affect maize productivity and quality negatively but also production of more harvests than grain-purposed maize cultivation because harvest cycles are between 75-90 days of biomass maize for the usage of green forage and silage. The utilization of land is, therefore, effectively improved with 4-5 harvests a year. In addition, the forage maize cultivation reduces production costs remarkably resulting in improving the income for growers (15-20% higher than grain-purposed maize production and 2.5-3.0 times higher than rice cultivation). The above-mentioned advantages make maize production in the northern midlands and mountainous region more and more sustainable [15, 18, 19].

3.3. The research and development of specialty maize used for production and economic in the northern midlands and mountainous region

Along with the development of processing technology and cooperation among economic regions, the recent demand of maize used for special purposes including foodstuff products in Vietnam has been growing that prevails good opportunities for specialty maize production including waxy corn, sweet corn and baby corn. With the function of research and development on maize, MRI has successfully developed plenty of specialty maize hybrids such as HN68 (NL5), VN559, G828 (NL147), Waxy8 (TG10) for sustainable production and economic development, partly contributing to the economic development in the northern midlands and mountainous region [4].

In summary, the national program of maize hybrid development has played a significant and important role in the direction of highly valued sustainable maize production in the northern midlands and mountainous provinces of Vietnam indicated by the following issues:

1) To contribute to improving economic efficiency and living standards of local farmers in the Northern mountainous areas through the application of maize hybrids with high yield, improved resistance and high adaptation to climate change.

2) To initially construct agricultural value chain in maize production with high economic efficiency from feed-specific maize hybrids such as green forage, silage, raw materials of feed processing industry for livestock and aquaculture industries to produce meat, milk, eggs or other highly valued specialty maize hybrids used in the foodstuff industry such as waxy corn, sweet corn and baby corn hybrids.

4. Some main solutions for developing maize production in the northern midlands and mountainous region

Currently, maize production in the northern midlands and mountainous region is facing lots of difficulties caused by climate change condition that has a negative influence on the growth and development of maize, especially for rainfed based maize cultivating system. In addition, lowly applied mechanization in most areas makes maize cultivation in the region difficult to form a stably market-oriented production chain with low competitiveness compared to maize products imported from abroad as well as other highly valued crops.

To sustainably improve the maize production in the above-mentioned situation, an overall solution involving properly planned projection for maize cultivation areas in combination with effectively and synchronously applying the introduction of advanced technologies and suitainably issuing policies must be paid great attention to, to establish sustainable and valuable production of maize in the northern midlands and mountainous region.

4.1. Selection and projection of proper areas for maize cultivation

As predicted by USDA, an amount of 14.5 million tons of maize grain should be targeted in the 2023/24 year [2], the area planned for maize cultivation is considered as one of the most important solutions is, therefore, in focused on especially in the northern midlands and mountainous region and regarded as the biggest maize production centre in the country. In order to ensure and improve the sustainable maize production with highly added value, closely linking market-production combination and climate change adaptation, the Decision No. 150/QD-TTg dated 28 January 2022 on approving the sustainable agriculture and rural development strategies for the period 2021-2030 with a vision toward 2050 was approved by the Government [8], in locally advantageous conditions it should be accordingly availed for the development of less advantageous crops such as maize, cotton, tobacco, subtropical fruits and vegetables, soybeans to be processed and consumed domestically.

The scheme on "Development of agriculture in some western provinces in the northern midlands and mountainous region towards increasing added value and sustainable development until 2025, with a vision to 2030" issued by the Ministry of Agriculture and Development Rural stated that an area of about 222 thousand hectares to produce about 943 thousand tons of maize should be maintained by the year 2025 while about 228 thousand hectares and around 1.06 million tons respectively will be targeted for the year 2030. The sandy and alluvial soils must be prioritized for maize cultivation in the forms of rotating and intercropping with other crops on which the regions of commodity-oriented maize, sweet and waxy corn for processing and forage maize for livestock will be properly established [20].

4.2. Scientific and technological solutions

4.2.1. Solutions for breeding and development of maize hybrids

- To invest and upgrade research facilities and equipment involving infrastructure concerned to meet requirements for maize breeding program such as genetics, molecular marker and cell technologies in combination with human resource training, especially highly qualified experts who can master and apply advanced technologies and integrate internationally.

- To strongly boost the study on breeding and developing Vietnam's maize hybrids used in the northern midlands and mountainous region aimed to active preparation of maize hybrid seeds at low prices (3-4 USD/kg), resulting in reducing foreign currency for importing high-priced seeds from multinational companies (7-9 USD/kg). The grain yield of domestic maize hybrids is up to 10-12 tons/ha in the condition of intensively applied cultivation, 5-7 tons/ha in rainfed areas, with high tolerance to heat and drought, adaptation to climate change and meeting the demand of various markets.

- To strengthen and diversify domestic maize hybrids, especially forage and specialty maize, towards sustainable development and product diversification in maize value chain of the region.

4.2.2. Technical solutions for sustainable maize cultivation

- To develop a set of maize hybrids suitable for sub-regions or locations in the northern midlands and mountainous region to effectively exploit their potential in appropriate cropping structure and crop seasons.

- To complete packages of advanced technologies including crop season determination, land preparation, fertilization, sowing, taking care, harvesting, post-harvest treatment, processing and preservation that need synchronous application in maize production in the northern midlands and mountainous region with the aim of improving productivity, efficiency and increasing maize value chain.

- To strengthen mechanization application in maize production in the region as much as possible.

4.2.3. Solutions for improving product quality and reducing post-harvest losses

- To suitably reorganize the maize production with sufficiently scaled area and use the few hybrids on applying the similar procedure of cultivation, processing and preservation to produce uniformly and highly valued commodities.

- To improve the facilities of harvesting, processing and preservation based mainly on strengthening mechanization application in large scale of maize production in the region.

4.3. Solutions of policies related to investment, cooperation and development of sustainable maize production in the northern midlands and mountainous region

4.3.1. Solutions for upgrading infrastructure investment concerned to maize production in the region

- To strongly invest in upgrading transportation system in important locations of maize production in the region aimed to facilitate favorable conditions for transportation of materials, fertilizers and commercial maize products resulting in reduction in the cost of production and improvement in product quality.

- To develop irrigation systems for major areas of maize cultivation. As calculated, about 80% of the maize cultivated area in this region is under rainfed condition at present.

- To strengthen public-private cooperation and to call upon capital invested for maize production in the region, firstly focused on large-scale maize processing plant systems in accordance with regional planning projection and raw material consumed chain.

4.3.2. Solutions on governmental policy

- To effectively implement the contents of related policies issued and approved by the Government and highly ranking organizations as well especially the Decree No. 98/2018/ND-CP dated 5 July 2018 on incentive policy for development of linkages in production and consumption of agricultural products, including maize in the northern midlands and mountainous region [21].

- To establish production linkage-based large-scale production demonstrations in which mechanization utilization, overall advanced technology application of cultivation, harvest, processing and preservation aimed to reduce production costs and improve product quality should be presented.

- To closely link product consumption with raw material localities, keeping prices stabilized and profits harmonized and risks shared with farmers.

- To establish market-related information systems and boost trade promotion through propaganda targeted for the development of stable market for maize products.

- To issue policies concerned to call upon businesses for investment to strengthen R&D activities and maize production as well.

4.3.3. Solutions on policy mechanisms

- To issue the policies related to regional advantage-based planning projection for sustainable, largely concentrated and highly valued maize production closely linked with consumption markets in and out the region.

- To issue policies on supporting local farmers in crop shifting structure directed to increasing maize area and reducing post-harvest losses and improving product quality and value added as well.

- To issue policies on enhancing the capital investment in infrastructure construction, maize research and development towards increasing mechanization in maize production in the region.

5. Conclusions

The program of development of maize hybrids for production and economic development in the northern midlands and mountainous region of Vietnam has played an important role in improving economic efficiency in maize production and partly contributed to establishing a maize based sustainable, highly valued agricultural chain through the introduction of high yield maize hybrids well adapted to climate change, developed and released by MRI, and the overall application of advanced technologies used in maize cultivation.

In the scope of the program targeted for the sustainable and highly valued maize production, the cooperation among farmers, scientists, businesses and state management agencies was strongly strengthened that takes an important part in ensuring food and nutrition security and poverty reduction in mountainous regions .

With the implementation of the above-mentioned program under the direction of the Government and the Ministry of Agriculture and Rural Development concerned to sustainable agricultural and rural development strategy, the research capacity of MRI is significantly improved particularly in the field of maize breeding and development in a large scale.

Thus, with maize hybrids with good tolerance and high yield and technical packages in terms of economic efficiency, suitable for maize production, the program on development of maize hybrids for production and economic growth in the northern midland and mountainous region of Vietnam has upgraded the maize yield of 3.67 tons/ha in 2012 to 4.16 tons/ha in 2022, partly contributing in national food security and environmental protection as well as production development and economic growth in this region.

In order to ensure the sustainable development of maize production in the northern midlands and mountainous region of Vietnam, meeting requirements of the market, international integration and added value of agricultural products, the overall policy including plan projections of maize planted area, stronger investment for R&D activities in maize hybrid development programs, more funding resources for forage and specialty maize hybrid breeding and specific funds for processing industry of maize products under particular and public-private sector cooperation should be paid more attention to and synchronously implemented in the region.

CRediT author statement

Nguyen Xuan Thang: Reviewing, Methodology, Formal analysis, Writing, Editing; Nguyen Chi Thanh: 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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Factors affecting Vietnamese consumers' intention to continue using e-wallet: A case study of MoMo

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Abstract:

MoMo stands as a leading e-wallet in Vietnam. Amidst the backdrop of intensified market competition, e-wallets are urged to transcend the reliance solely on sales promotions for user retention. This paper aims to investigate the key factors that elucidate the intention to continue using MoMo e-wallet services, which is essential for acquiring strategic insights that enable organizations to leverage their competitive advantages. The authors incorporate a framework comprising Technology Continuance Theory (TCT) factors and four additional variables to explore this phenomenon in a novel context: price benefit, trust, habit, and operational constraints, which may influence users' intention to persist in using e-wallets. Research data was obtained by distributing questionnaire to 310 respondents and then analyzed using Partial Least Square Structural Equation Modelling. The findings indicate that users' behavioural intention to continue using e-wallets hinges upon attitude and habit, which are identified as pivotal factors in predicting users' desire to sustain e-wallet usage. Conversely, these findings are poised to aid service providers in comprehending user behaviour and devising more apt business strategies, thereby enabling them to leverage and uphold their competitive advantage in retaining users.

Keywords: **e-wallet, intention to continue to use, MoMo, Technology Continuance Theory (TCT), Vietnamese.**

Classification number: **2.2**

1. Introduction

The utilisation of electronic payment services in urban areas of Vietnam saw a notable increase, with at least 50% of families adopting such services by 2020, as per a survey conducted by the World Bank. By 2021, Vietnam had secured a significant position among the leading Asian nations, boasting 29.1% of mobile payment users [1]. A surge in mobile wallet transactions, estimated to increase over sevenfold, was anticipated by fintech experts. Moreover, both the user base and transaction value were projected to grow by more than threefold [2]. The proliferation of mobile and digital payment systems has propelled Vietnam to the forefront of electronic payment growth globally. Allied Market Research (2021) [3] reported an impressive annual growth rate of 30.2% in electronic payments from 2020 to 2027. Visa research further underlined this trend, revealing that presently, 76% of Vietnamese individuals utilise e-wallets [4]. Following the COVID-19 pandemic, 65% of users reported carrying less physical cash, with 32% expressing intentions to discontinue cash usage altogether. Thus, Vietnam presents a substantial e-wallet market ripe for exploitation and development.

Over a span of six years, the number of e-wallet options in Vietnam has expanded significantly, surging from a mere five to over 43 [5]. Some e-wallet providers capitalise on early market entry by forming exclusive alliances with super-apps, while others leverage connections with financial institutions to tap into a shared customer base [5]. MoMo, ShopeePay (AirPay), and ZaloPay have emerged as the top three e-wallets, primarily due to their penetration rates [5]. Notably, these e-wallets differentiate themselves, enhancing their appeal among consumers. Among them, MoMo stands out as the most recognised name, maintaining its leadership position with an active customer base of 86% and being the preferred e-wallet for 56% of users [6]. Furthermore, MoMo has extended its services to small and medium enterprises (SMEs), which constitute 98% of businesses in Vietnam. Keeping pace with global development, MoMo has continuously expanded its portfolio with services contributing to its robust business

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performance in recent years. However, only a minority of e-wallet enterprises have turned a profit, with the majority recording losses for several years [7, 8].

In the burgeoning e-wallet market in Vietnam, users may hesitate to continue using existing e-wallets as competitors offer more attractive promotions. A survey focused on mobile application performance revealed that only 24% of users continued using an app after three months, with this figure decreasing to 14% after six months and plummeting to 4% after a single installation [9]. Prior research has shown that acquiring new customers can cost up to five times more than retaining existing ones [10]. Furthermore, a 5% improvement in customer retention can increase company profits by 25 to 95% [11]. Consequently, e-wallet providers must focus on customer retention. However, research on e-wallets in Vietnam often centres on the acceptance stage rather than usage retention [12]. To gain insights into users' acceptance and sustained usage of information systems, the TCT has been instrumental. TCT comprises six key constructs derived from earlier models: confirmation, perceived usefulness, perceived ease of use, satisfaction, attitude, and continuous intention. Its comprehensive nature enables effective explanation of post-adoption behaviour [13]. Thus, employing this integrated model can significantly enhance our understanding of the motivational factors, attitudes, and behaviours influencing users' continued utilisation of e-wallet services.

Additionally, it is pertinent to note that users incur no additional expenses when employing digital payment methods such as e-wallets. Instead, they may experience financial benefits through cost savings facilitated by conducting online transactions via e-wallets. Consequently, the concept of "cost" has transformed into "price benefit" in academic literature [14]. Moreover, trust in the system is crucial when using e-wallets for transactions. The secure connection between users' bank accounts and mobile payment service providers ensures a high level of trust in financial transactions. Trust is a critical component in mobile payment systems, directly influencing users' perception of system safety [15]. Therefore, trust aligns well with the current research methodology. Additionally, users may develop an intention to use such payment systems after gaining experience with mobile payments [16]. Hence, habit becomes a crucial variable in this study. However, it's essential to acknowledge existing limitations in global digital literacy, which present operational barriers hindering effective utilisation of mobile applications [17]. Therefore, the author has constructed a model by adapting TCT factors along with four variables to extend TCT, including price benefit, habit, trust, and operational constraints.

Despite numerous studies on e-wallet users' continuance intentions globally, the number of such studies, particularly in Vietnam, has increased remarkably, especially after the COVID-19 pandemic. The TCT has been widely used as the primary theoretical framework for investigating factors influencing users' continued usage of e-wallets. TCT has been the subject of numerous prior research [18-20] employing various empirical data and application scenarios. However, results have not been consistently uniform across different studies. In Vietnam, although some researchers have explored this topic, the number of studies remains relatively limited, with most focusing on the stage of user acceptance rather than continued usage. Given these challenges and gaps, this study aims to analyse and verify which components have a significant impact on users' continuance intention towards MoMo, a leading e-wallet in Vietnam. This analysis incorporates extended variables of price benefit, trust, habit, and operational constraints in influencing users' intention to continue using e-wallets.

2. Relevant literature and hypothesis development

2.1. E-wallet

An electronic wallet, also known as a digital wallet, serves as the digital counterpart of a physical wallet, containing monetary assets and various cards such as membership, debit, or credit cards [21]. Technology utilises the internet to establish a secure connection between users and suppliers, facilitating financial transactions for the purchase of goods or services [22, 23]. Therefore, e-wallets function as mobile payment solutions, enabling users to initiate, approve, and authenticate transactions conveniently [24].

K.K. Eswaran (2019) [25] highlighted the escalating adoption of e-wallets as an alternative mode for online transactions, attributing their growing prominence to the increasing prevalence of online business activities. The adoption of non-cash methods has gained traction in numerous countries, with the fear of the coronavirus pandemic further influencing confidence. The survival of the coronavirus on card or paper media has led to increased e-wallet usage and a rise in the overall number of e-wallet users [26]. Government initiatives have also been shown to spur the use of e-wallets in some nations, as evidenced by India's demonetisation program [25].

Although mobile wallets, mobile banking, and mobile money all enable users to conduct financial transactions via mobile devices, their design and implementation differ due to varying approaches and contexts. N. Iman (2018) [22] demonstrated that mobile banking is typically tied to bank procedures and has a narrower scope. Similarly, mobile banking, often referred to as Internet banking, is an application developed by banks to provide consumers with various channels for accessing their savings and conducting transactions available in bank systems, including account transfers, deposits, bill payments, withdrawals, and balance inquiries [27, 28]. On the other hand, according to P.M. Tun (2020) [29], a mobile wallet is an extension of mobile banking and mobile money, allowing users to store personal information and payment method details. An electronic wallet or e-wallet encompasses a broader concept involving the digital storage of money and the execution of payments through desktop computers, laptops, or smartphones [28].

MoMo currently stands as the number one super app platform in Vietnam and one of the largest and fastest-growing fintech companies [30]. With a market share of 68%, it dominates the market, facilitating transactions for almost all online and offline payments in major Vietnamese cities [30]. MoMo acts as a one-stop shop for digital payments, financial services, and a wide range of daily life services. Therefore, MoMo, as one of the most popular e-wallets in the Vietnamese market, serves as the primary focus of this research.

2.2. Theoretical framework

The TCT initially developed by C. Liao, et al. (2009) [13], has proven effective in predicting individuals' intentions to utilise technology. TCT amalgamates three well-known information system models: the Technology Acceptance Model (TAM), Expectation-Confirmation Model (ECM), and Cognitive Dissonance Theory (COG). N.A.A. Halim, et al. (2022) [31] utilised the TCT framework to examine the variables impacting Malaysians' ongoing use of e-wallets. According to existing literature, consumers' intentions to continue using e-wallets were significantly influenced by satisfaction, attitude, price advantage, habit, and operational restrictions [32]. However, it was demonstrated that within this framework, perceived utility and trust had no significant influence. Nevertheless, trust may play a crucial role when consumers choose to use an e-wallet for the first time [33]. According to D. Chatterjee, et al. (2019) [34], trust is considered a psychological condition, referring to the customer's belief in the service provider's moral character and readiness to rely on the provider's services Additionally, numerous studies have shown that perceived usefulness directly impacts continuance intention [10, 35]. According to Bhattacherjee's ECM, satisfaction with the use of information systems (IS) emerged as the most influential predictor of users' intention to continue, while perceived usefulness played a significant but comparatively weaker role. Similarly, in the TAM, extensive research has validated perceived usefulness as a key antecedent influencing consumers' intention to persist with the service [36]. Recognising the gap in existing research, the author aims to conduct a study applying the TCT model with four extended variables to elucidate users' continuous usage intention of MoMo - E-wallet application in the Vietnamese context.

2.3. Hypothesis development

Drawing upon an extensive literature review of previous relevant studies, the author proposed a research model that explores the impact of TCT alongside four extended variables - price benefit, trust, habit, and operational constraint - on individuals' intention to continue using e-wallets. The model is depicted in Fig. 1.

2.3.1. Continuance intention (CI)

The term "Continuance intention" refers to an individual's desire to persist in using a service once they

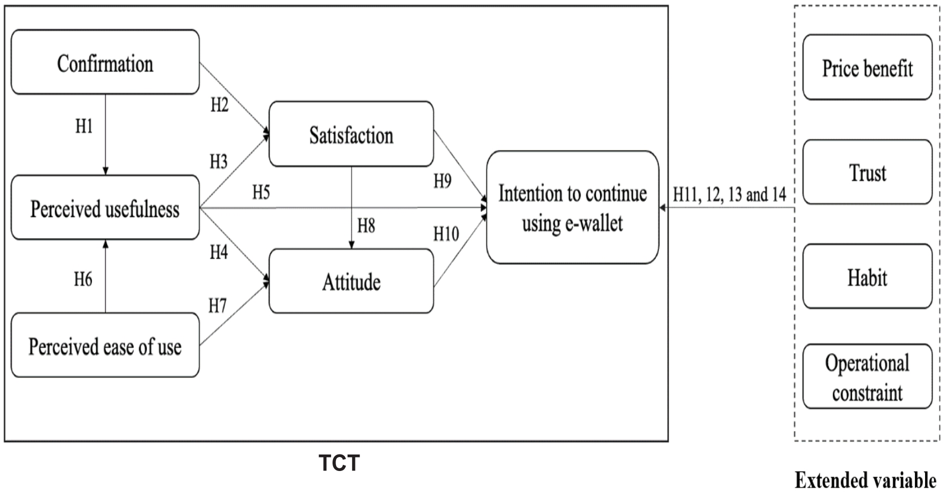

Fig. 1. The research model [31].

have accepted it, as described by A. Bhattacherjee (2001) [10]. Since 2001, continuation intention has been studied in various scenarios including electronic technologies such as smartphone applications [18, 37], e-learning [38], online banking [10, 39], and online self-service [40].

Psychological factors, such as personal experiences and cognitive processes encompassing ideas, emotions, and beliefs, influence user behaviour [41]. Satisfaction and attitude consistently emerge as key elements frequently identified in research on continuance intention. The results of this research show, in summary, how users' opinions of social connections, mindsets, and emotions may be influenced by continuation intention, which in turn can affect their likelihood of engaging in a specific behaviour [42].

2.3.2. Confirmation (CONF)

Confirmation refers to users' perception that the actual performance of a specific IT system aligns with their expectations [10]. A. Bhattacherjee (2001) [10] proposes that users may use their confirmation experience to adjust their impression of usefulness when doubt arises over what may be anticipated from system operation beyond the users' initial perceived utility. More specifically, the level of perceived usefulness is enhanced by confirmation, while disconfirmation diminishes it.

Past studies examining continuous usage behaviour have established a noteworthy association between confirmation and user satisfaction [13, 43]. Satisfaction is defined as "a positive affective state that results from a global judgment of performance based on previous purchasing and consumption experience" [44]. Prior research by X.M. Fu, et al. (2018) [45] found that confirmation was connected to satisfaction. Additionally, A. Susanto, et al. (2016) [46] found that user's confirmation after initial service usage had a significant impact on their level of satisfaction. In the context of this study, where initial expectations for using MoMo align with actual experiences, it is anticipated that satisfaction levels will be positively affected. Users' expectations may vary as they gain more experience using an e-wallet. As a result, the following theories were developed:

H1: A more favourable confirmation will lead to higher perceived usefulness.

H2: A more favourable confirmation will lead to higher satisfaction.

2.3.3. Perceived usefulness (PU)

Perceived usefulness refers to users' perception of the expected benefits of information system use. Users can gain from information systems in several ways, such as by ensuring greater accuracy, efficiency, and speed in work fulfilment [47]. Earlier research has demonstrated a direct link between perceived usefulness and satisfaction, as well as between perceived usefulness and intention to continue using the service [10, 48]. W. Zhou, et al. (2018) [49] found that confirmation greatly affects users' desire to keep using e-finance when studying e-finance persistence. Similar to this, research has shown that confirmation and perceived usefulness have a substantial impact on whether or not people continue the use of technology [10, 13, 19, 49].

Within the scope of this study, it can be referred to as users' expectations regarding the performance of the e-wallet. Users consistently anticipate obtaining beneficial mobile services, such as ubiquity and convenience [50]. Users will be satisfied when their expectation is met [17]. Numerous studies have established a favourable correlation between perceived usefulness (PU) and user satisfaction [51]. The influence of PU on individuals' attitudes and intentions to use mobile banking services has been well-established [52]. B. Foroughi, et al. (2019) [19] found that consumers' future attitudes towards the adoption of mobile banking were predicted by their levels of perceived usefulness and satisfaction. In the context of e-wallets, perceived usefulness plays a significant role in predicting behavioural intention to continue using them [53]. Moreover, PU has been identified as a crucial factor in shaping individuals' mindset and decision to persist with e-wallet services [19]. Hence, the following hypotheses were developed:

H3: A more favourable perceived usefulness will lead to higher satisfaction.

H4: A more favourable perceived usefulness will lead to a higher attitude.

H5: A more favourable perceived usefulness will lead to a higher intention to continue using e-wallets.

2.3.4. Perceived ease of use (PEU)

Perceived ease of use pertains to the level of convenience associated with utilising an information system and the comprehensibility of the system [54]. Within the context of this study, ease of use refers to the minimal effort required by users to comprehend, learn, and operate the mobile payment system. Users are more likely to embrace new technology if they find it effortless to integrate into their daily routines. Previous research [55] has established a significant association between perceived ease of use and perceived usefulness, as well as attitude, in the adoption of technology.

If modern technologies are user-friendly, people will use them [31]. According to C. Liao, et al. (2009) [13], PEU describes how much prospective users anticipate this target system to be simple. In regards to using an e-wallet, a person's perceptions influence their emotions, which subsequently impact their acceptance of and engagement with e-wallet usage [19]. Additionally, it is argued that perceived ease of use (PEU) acts as a determining factor for perceived usefulness (PU) in online transactions, thereby playing a significant role in the readiness to continue using e-wallets and establishing a strong association with PU [16]. Hence, it is logical to assume that PEU has a substantial influence on an individual's decision to continue or discontinue the use of an e-wallet [31]. Thus, we suggested that:

H6: A more favourable perceived ease of use will lead to higher perceived usefulness.

H7: A more favourable perceived ease of use will lead to a higher attitude.

2.3.5. Satisfaction (SAT)

Satisfaction can be defined as the retrospective assessment of users' initial experience with a service, encompassing positive feelings and overall contentment. In marketing literature, consumer satisfaction is recognised as a vital factor in cultivating and sustaining loyalty [56]. This principle extends to the realm of information systems, where user satisfaction tends to enhance their intention to repeatedly utilise the system. Customer happiness is a critical factor that affects post-adoption habits, especially continuation intention, according to A. Bhattacherjee (2001) [10].

B. Foroughi, et al. (2019) [19] claim that satisfaction has a favourable impact on people's attitudes toward various technology applications. According to reports, satisfaction may easily affect the reason for continuing to use an e-wallet [18]. This also applies to the setting of information systems, where user satisfaction tends to increase a user's intention to use the system repeatedly. According to the literature, the choice to reuse the application may have been motivated primarily by the degree of customer satisfaction with the e-wallet [57]. Consequently, we hypothesised that:

H8: A more favourable satisfaction will lead to a higher attitude.

H9: A more favourable satisfaction will lead to a higher intention to continue using e-wallets.

2.3.6. Attitude (ATT)

While satisfaction deals with how people view e-wallet applications, attitude refers to the user's evaluation of e-wallet services [58]. The relationship between attitude and intent to act in the context of mobile payments has been the subject of numerous studies [59].

Previous studies conducted within this research context have consistently demonstrated a confident connection between attitude and the desire to keep using e-wallet applications [60]. As a result, attitude is thought to be a key factor in predicting the desire of users to continue using e-wallets [19]. Consumers who hold favourable perceptions of e-wallets exhibit enthusiasm towards adopting and utilising them [18]. However, perceived ease of use (PEU), perceived usefulness (PU), and satisfaction play influential roles in shaping users' attitudes towards e-wallets, ultimately impacting their intention to continue using them. Accordingly, we formulated the following hypothesis:

H10: A more favourable attitude will lead to a higher intention to continue using e-wallets.

2.3.7. Price benefit (PB)

In comparison to available alternatives, information and communication technology (ICT) has brought about various advantages, including cost reduction. However, economically disadvantaged segments in emerging economies may not be willing to incur additional charges for a technology when a low-cost alternative such as cash is readily accessible [61]. When there is an economic benefit, the dynamics change because banking programs and other e-commerce platforms around the world offer discounts to encourage the use of these payment methods, leading to increased adoption [62]. This financial benefit directly impacts consumers. Given the high price sensitivity among less privileged sections of society [63], users are more likely to continue using mobile payment services that offer cost advantages. Consequently, due to the significant price sensitivity of marginalised groups, customers may expect to continue utilising programs like e-wallets that provide such price benefits [14]. Therefore, this study hypothesised that:

H11: A more favourable price benefit will lead to a higher intention to continue using e-wallets.

2.3.8. Trust (TRU)

Trust is the expression of one party's willingness to expose themselves to the actions of another party [64]. It is widely regarded as a crucial factor for successful business transactions [65]. Previous research [17, 59] has established trust as a key determinant influencing perceived usefulness, perceived ease of use, satisfaction, and usage intention among mobile payment consumers. The significance of trust in the context of mobile payments has been consistently demonstrated through various studies.

P. Gerrad, et al. (2003) [66] found that consumers in banking contexts were worrying that their profiles and information may be shared across the banking group to improve the sales for other banking products. Consequently, trust serves as a vital component for increasing users' intention to continue using e-wallets and ensuring satisfaction in conducting e-wallet activities. Therefore, we proposed the following hypothesis:

H12: A more favourable trust will lead to a higher intention to continue using e-wallets.

2.3.9. Habit (HAB)

Habit refers to the extent to which users engage in behaviour unintentionally as a result of the learning process [58, 67]. Previous research has consistently demonstrated a strong correlation between habit and both usage and intention to continue using a specific technology [68].

A recent study conducted by D.C. Herting, et al. (2023) [69] emphasised the significance of habit as a critical factor in influencing repeated use of technology, considering its impact on decision-making and the perceived usefulness or functionality of applications. Consequently, individuals who have been using e-wallets for an extended period develop a habit and find it easy to utilise these systems for their transactions [70]. As a result, it is anticipated that the habitual use of e-wallets would lead users to have intentions to continue utilising them [31]. In this vein, we set the following hypothesis:

H13: A more favourable habit will lead to a higher intention to continue using e-wallets.

2.3.10. Operational constraint (OC)

The pervasive issue of inadequate digital literacy worldwide [71] poses a significant obstacle to the adoption of mobile phones, as citizens may struggle to utilise these devices proficiently, presenting a noteworthy challenge. According to D. Ma, et al. (2016) [72], mobile application technologies significantly contribute to their inaccessibility, leading to various obstacles and issues. These restrictions include those brought on by constrained mobile data allowances and outside obstacles that are connected to mobile services, such as security worries, difficult internet-based lessons, pointless pop-ups, and a lack of flexible selections.

In the case of e-wallets, the limited scope of mobile applications, including constrained displays and underperforming apps, can prove arduous and impede application responsiveness, thus presenting additional challenges. Users normally expect applications to run smoothly and efficiently and when they don't, their patience is notoriously thin. That is why we proposed the hypothesis:

H14: A more unfavourable operational constraint will lead to a higher intention to continue using e-wallets.

3. Methodology

3.1. Measure

TCT is important to this study model. The construct of A. Bhattacherjee (2001) [10], V. Venkatesh, et al. (2000) [58], and P.G. Schierz, et al. (2010) [73], which includes five factors: confirmations, perceived utility, perceived ease of use, satisfaction, and attitude are used in this study to measure TCT. Three indicators form the structure of confirmations and attitudes. There are five indicators used to structure perceived usefulness and perceived ease of use. Four indicators make up the structure of satisfaction.

Besides these, price benefit is one of the most important factors in this investigation. Price benefit and habit were developed by V. Venkatesh, et al. (2012) [74]. Price benefit is built on two indicators, while habit has four indicators. The scale for trust was drawn by A. Pal, et al. (2020) [32]. Trust constructs have three indicators. Operational constraints also have a significant impact on whether people decide to keep using e-wallets. The scale for this factor is adapted from Y. Song (2011) [75]. Operational constraints have four indicators. On the other hand, the intention to keep using e-wallets is taken from K.M. Alraimi, et al. (2015) [76]. In the present study, a 7-point Likert scale was utilised to assess the responses to all inquiries included in the questionnaire. This scale ranged from 1, representing a disposition of strong disagreement, to 7, indicating a stance of strong agreement (Table 1).

Table 1. Measurement items of the survey.

Items	Description	Sources
	Demographic	[31]
GEN	What is your gender?	
AGE	What is your age?	
EDU	What is your education level?	
EUT	E-wallet usage to make transactions?	
EUS	Sector-specific usage of e-wallets	
	Confirmations	[10]
CONF1	I had a better e-wallet experience than I had anticipated	
CONF2	I was pleasantly surprised by the level of service offered by the e-wallet	
CONF3	Overall, using the e-wallet confirmed the majority of my expectations	
	Perceived usefulness	[58]
PU1	I can complete transactions more quickly by using the e-wallet	
PU2	Making transactions is simpler when using the e-wallet	
PU3	My transactions are more effective when I use the e-wallet	
PU4	The quality of the transactions would increase with the use of the e-wallet	
PU5	My transactions would benefit from using the e-wallet	
	Perceived ease of use	[58]
PEU1	I become proficient at using the e-wallet	
PEU2	I find using the e-wallet simple	
PEU3	It does not take much mental effort to interact with the e-wallet	
PEU4	My interaction with the e-wallet is understandable	
PEU5	I find using the e-wallet convenient	
	Satisfaction	[10]
SAT1	I am satisfied with e-wallet	
SAT2	I am pleased with e-wallet	
SAT3	I am happy with the e-wallet	
SAT4	I am delighted with e-wallet	
	Attitude	[73]
ATT1	Using e-wallet services is a good idea	
ATT2	Using e-wallet services is a beneficial	
ATT3	Using e-wallet services is a wise idea	
	Price benefit	[74]
PB1	E-wallet apps or offer discounts and cash back	
PB2	I save money when I pay through e-wallet apps	
	Trust	[32]
TRU1	E-wallet apps meet my interests	
TRU2	My needs are met by my e-wallet apps	
TRU3	The e-wallet apps have features as promised by the providers	
	Habit	[74]
HAB1	Using e-wallet apps has become a habit for me	
HAB2	I am used to apply e- wallet apps	
HAB3	I automatically use e- wallet apps	
HAB4	Using e-wallet apps is natural to me	
	Operational constraints	[75]
OC1	E-wallet app’s display and screen make it difficult to use	
OC2	E-wallet apps often freeze or malfunction	
OC3	The buttons and options of the e-wallet apps are difficult to find	
OC4	The features provided by the e-wallet apps are not sufficient for my needs	
	Intention to continue use e-wallet	[76]
CI1	I intend to continue using e-wallet in the future	
CI2	I will continue using e-wallet in the future	
CI3	I will strongly recommend e-wallet for others to use it	
CI4	I will keep using e-wallet as regularly as I do now	

3.1.1. Population

The study's target audience comprises individuals who have used MoMo at least once in Vietnam. This selection criterion ensures that participants possess updated knowledge of MoMo, aligning with the research objective of understanding reasons for continued e-wallet usage.

3.1.2. Sampling method

According to J.J.F. Hair (2010) [77], the minimum sample size required is five times the number of research indicators. Thus, the study necessitates a minimum sample size of 185. Employing convenience sampling, a non-probability sampling technique, from a population requiring a sample size between 100 and 200 respondents for Structural Equation Model (SEM) interpretation, the author aimed to gather at least 200 responses. Primary data collection was conducted via an online survey using Google Forms.

3.2. Analytical method

3.2.1. Descriptive analysis

Descriptive statistics in SPSS 25.0 software were utilised by the author to present basic characteristics of the research sample, such as frequency (%) of sex, age, and education level, through statistical tables.

3.2.2. Independence testing

To assess nonresponse bias, the authors examined whether the sample was representative of the population. A t-test was conducted to compare differences between genders. The non-significant t-values (ranging from 1.08 to 1.16, p>0.05) indicated no statistically significant differences in means, allaying concerns of nonresponse bias. Harman's one-factor test was employed to address the possibility of common-method variance (CMV), revealing that the largest factor explained 49.90% of the total variance (<50%), suggesting minimal common method bias threat.

3.2.3. Partial Least Square Structural Equation Modelling (PLS-SEM)

The author adopted the partial least squares (PLS) technique for model measurement and hypothesis testing using SmartPLS (v. 3.0) software. PLS is suitable for maximising the explanation of dependent constructs and is widely applied. Given the study's small sample size (n=200) and complex structural model (10 variables and 37 indicators), PLS is a powerful modelling method. As per J.J.F. Hair, et al. (2014) [78], PLS is appropriate for examining structural models when the primary objective is not theory confirmation.

4. Results

4.1. Respondent demographics

Table 2. Sample profile.

	Item	Frequency	Percent
Gender	Male	152	49.03
	Female	158	50.97
Age	Less than 25	46	14.84
	25-30	66	21.29
	31-40	117	37.74
	41-50	75	24.19
	Above 50	6	1.94
Education	College and under college	33	10.65
	Bachelor	212	68.39
	Master and higher	65	20.97
MoMo usage to make payment	Once in a while	71	22.90
	Often	30	9.68
	Always	209	67.42
Sector-specific usage of e-wallets	Food delivery	56	18.06
	Groceries	35	11.29
	Bill payment	160	51.61
	Food & beverage	59	19.03

The sample (Table 2) comprises 310 responses from the online survey, with 152 male respondents (49.03%) and 158 female respondents (50.97%). In terms of age distribution, respondents under the age of 25 accounted for 14.84%. The age groups of 25-30, 31-40, and 41-50 represented 21.29, 37.74, and 24.19% respectively. Approximately 1.94% of respondents were aged 50 and above. Respondents with college and below college education constituted 10.65% of the sample, while those with higher education qualifications, including diploma and master's degrees, comprised 68.39 and 20.97% respectively. Regarding payment frequency, 67.42% of respondents exhibited constant usage behaviour, while 9.68 and 22.90% reported frequent and occasional usage, respectively.

4.2. Results

Table 3. Convergent validity.

Construct	Item	Loading	CR	AVE
Confirmation	CONF1	0.836	0.910	0.771
	CONF2	0.897		
	CONF3	0.900		
Perceived usefulness	PU1	0.847	0.947	0.781
	PU2	0.880		
	PU3	0.916		
	PU4	0.891		
	PU5	0.885		
Perceived ease of use	PEU1	0.856	0.945	0.774
	PEU2	0.899		
	PEU3	0.839		
	PEU4	0.913		
	PEU5	0.890		
Satisfaction	SAT1	0.946	0.965	0.872
	SAT2	0.948		
	SAT3	0.939		
	SAT4	0.900		
Attitude	ATT1	0.914	0.947	0.856
	ATT2	0.939		
	ATT3	0.923		
Price benefit	PB1	0.953	0.947	0.898
	PB2	0.943		
Trust	TRU1	0.872	0.934	0.826
	TRU2	0.936		
	TRU3	0.917		
Habit	HAB1	0.932	0.944	0.807
	HAB2	0.944		
	HAB3	0.826		
	HAB4	0.887		
Operation constraint	OC1	0.893	0.930	0.770
	OC2	0.860		
	OC3	0.894		
	OC4	0.863		
Intention to continual usage	CI1	0.929	0.932	0.774
	CI2	0.921		
	CI3	0.825		
	CI4	0.839		

Using factor loading, average variance extracted (AVE), and composite reliability (CR), the model was evaluated for convergent validity analyses. All item loading values are higher than 0.707 as demonstrated by the PLS algorithm results, and all AVE values are higher than 0.50, indicating convergent validity at the construct level [78]. Additionally, all the CR values surpassed 0.70, thereby confirming the convergent validity of the measures (Table 3). Table 4 displays heterotrait-monotrait ratio of correlations (HTMT.85) values below 0.85. Therefore, the acceptable discriminant validity of the measurement model is achieved [79].

Table 4. Discriminant validity.

	ATT	CONF	HAB	CI	OC	PEU	PU	PB	SAT	TRU
ATT	**0.925**									
CONF	0.592	**0.878**								
HAB	0.596	0.598	**0.898**							
CI	0.753	0.596	0.682	**0.880**						
OC	0.230	0.174	0.357	0.247	**0.877**					
PEU	0.704	0.622	0.560	0.583	0.085	**0.880**				
PU	0.699	0.710	0.650	0.680	0.138	0.613	**0.884**			
PB	0.579	0.484	0.627	0.590	0.238	0.523	0.500	**0.948**		
SAT	0.717	0.737	0.693	0.718	0.168	0.758	0.759	0.594	**0.934**	
TRU	0.727	0.657	0.770	0.722	0.217	0.690	0.692	0.714	0.786	**0.909**

According to the findings of this study, confirmation and perceived ease of use (PEU) have an impact on perceived usefulness (PU) and satisfaction. Additionally, perceived usefulness significantly influences satisfaction and attitude, while also slightly increasing the intention to continue using e-wallets. Perceived ease of use, perceived usefulness, and satisfaction exert substantial influences on attitude, consequently influencing the intention to continue using e-wallets. Furthermore, attitude, price benefit, habit, and operational constraints play significant roles, whereas trust exhibits a relatively lower sensitivity. Utilising a blindfolding technique, the results indicated that the Q2 values for attitude, perceived usefulness, satisfaction, and intention to continue using the e-wallet were equal to or greater than 0, indicating an acceptable level of predictive value (Table 5).

According to Table 5, confirmation (H1, β=0.537, t=10.223, and p=0.000) and perceived ease of use (H6, β=0.279, t=4.596 and p=0.000) positively affect perceived usefulness has a significant impact on continuing use of e-wallet applications. Confirmation (H2,

Table 5. Summary of hypothesis testing.

Hypothesis	β	Std. Dev	t-value	p-value	Q^2	R^2	f^2	VIF	Supported
H1	0.537	0.052	10.223	0.000	0.542	0.552	0.394	1.633	YES
H2	0.399	0.063	6.283	0.000	0.605	0.655	0.228	2.019	YES
H3	0.476	0.058	8.192	0.000			0.325	2.019	YES
H4	0.334	0.062	5.367	0.000	0.521	0.621	0.123	2.379	YES
H5	0.106	0.065	1.646	0.100	0.532	0.677	0.012	2.858	NO
H6	0.279	0.061	4.596	0.000			0.107	1.633	YES
H7	0.347	0.077	4.504	0.000			0.134	2.367	YES
H8	0.200	0.103	1.953	0.051			0.030	3.484	NO
H9	0.144	0.078	1.839	0.066			0.018	3.607	NO
H10	0.369	0.072	5.106	0.000			0.156	2.702	YES
H11	0.063	0.056	1.125	0.261			0.006	2.155	NO
H12	0.070	0.072	0.969	0.333			0.003	4.510	NO
H13	0.191	0.067	2.838	0.005			0.037	3.063	YES
H14	0.025	0.033	0.751	0.453			0.002	1.201	NO

β=0.399, t=6.283 and p=0.000) and perceived usefulness (H3, β=0.476, t=8.192 and p=0.000) have a positive impact on satisfaction. Both perceived usefulness (H4, β=0.334, t=5.367 and p=0.000), perceived ease of use (H7, β=0.347, t=4.504 and p=0.000) have a positive impact on attitude. On the other hand, satisfaction (H8, β=0.200, t=1.953 and p=0.051) has no impact on attitude. Perceived usefulness (H5, β=0.106, t=1.646 and p=0.100) and satisfaction (H9, β=0.144, t=1.839 and p=0.066), price benefit (H11, β=0.063, t=1.125 and p=0.261), trust (H12, β=0.070, t=0.969 and p=0.333), and operational constraint (H14, β=0.025, t=0.751 and p=0.453) with a marginal impact, in contrast to attitude (H10, β=0.369, t=5.106 and p=0.000), and habit (H13, β=0.317, t=6.132 and p=0.000) have a positive impact on intention to continue to use the e-wallet.

5. Discussion

The research results are expounded upon through a discussion of the associations among Technology Continuance Theory (TCT), price benefit, trust, habit, operational constraint, and the intention to continue using the MoMo e-wallet, derived from responses of 310 existing MoMo users via an online questionnaire. As observed in section 4.2, perceived usefulness (PU) and satisfaction are influenced by confirmation and perceived ease of use (PEU). While PU has a modest effect on the intention to continue using e-wallets, it significantly affects satisfaction and attitude. Attitude, in turn, influenced by PEU, PU, and satisfaction, greatly influences the likelihood of continued e-wallet usage. Furthermore, attitude, price benefit, habit, and operational constraints significantly impact the intention to continue using e-wallets, unlike trust, which lacks significant evidence of effects.

5.1. Confirmation and perceived usefulness

Confirmation shows a significant positive correlation with PU to a large extent (f^2=0.394), consistent with the findings of N.A.A. Halim, et al. (2022) [31]. Confirmation towards MoMo reflects users' satisfaction after using it, implying that e-wallet application developers should invest in features that enhance user satisfaction and comfort, thereby increasing PU and the likelihood of continued e-wallet usage.

5.2. Confirmation and satisfaction

Confirmation has a moderately positive impact on satisfaction (f^2=0.228), indicating that higher confirmation levels on the e-wallet application correspond to increased satisfaction levels. This finding aligns with previous research by N.A.A. Halim, et al. (2022) [31]. Service providers should design applications catering to general user preferences to bolster satisfaction levels towards the system.

5.3. Perceived usefulness and satisfaction

According to the findings, user satisfaction is significantly influenced by perceived usefulness, which is in line with those of N.A.A. Halim, et al. (2022) [31] and

G.S. Weng, et al. (2017) [48]. Due to technology's utility, more tasks may be completed quickly and easily. These results also indicate that emphasising the utility of the e-wallet application could lead to greater happiness. In this scenario, MoMo must establish and maintain strong relationships with users to address their demands and preferences for e-wallet applications. Therefore, it is reasonable to infer that cultivating robust relationships with users and fostering mutual understanding will lead to an improvement in user happiness.

5.4. Perceived usefulness and attitude

In agreement with N.A.A. Halim, et al. (2022) [31] and D. Chatterjee, et al. (2019) [34], this study also confirms the associated hypothesis that perceived usefulness can largely impact attitude. Adapted to the context of e-wallet application systems, users' attitude toward them is influenced by the PU of such applications. When making online and offline payments, users perceive the means of payment as more useful and comfortable to them when the time spent on transaction completion is reduced, which can be achieved when e-wallets improve their job performances.

5.5. Perceived usefulness and intention to continue using e-wallet

In contrast, perceived usefulness was found not to significantly influence the intention to continue using e-wallets, with a modest effect size (f^2=0.012), consistent with previous research [13, 31]. One potential explanation for this phenomenon is that perceived usefulness (PU) is typically established during the initial introduction of e-wallet features to users. The awareness and assessment of the perceived usefulness level of e-wallet applications prompt users to initiate their usage. Unless e-wallets introduce new features, users generally develop expectations regarding the functionalities of e-wallet applications and how they can enhance their daily activities with improved efficiency. MoMo, for instance, is recognised for its ability to assist users in managing various financial aspects using multiple funding sources such as credit cards, savings accounts, and credit-line accounts. As users interact with MoMo for the first time, they are required to review and agree to the terms and conditions, as is customary with any e-wallet application. This initial interaction ensures that users are well-informed and educated about the utility of e-wallets. Consequently, the direct influence of PU on the intention to use may be more pronounced during the early stages of adoption. Given that users already possess general concepts of e-wallets and their expected functionalities, service providers must differentiate themselves effectively to maintain attractiveness and shape customers' perceptions of usefulness. This underscores the importance of continuous innovation and differentiation strategies to sustain user engagement and satisfaction over time.

5.6. Perceived ease of use and perceived usefulness

Perceived ease of use was observed to significantly influence perceived usefulness, corroborating the findings of N.A.A. Halim, et al. (2022) [31]. Fundamental functions such as transactional activities are deeply ingrained in users' daily routines, and the assistance provided by e-wallets is perceived as greatly supportive. Therefore, for e-wallet users to continue using them, especially for core services, service providers and policymakers must prioritise ensuring optimal system performance [53].

5.7. Perceived ease of use and attitude

Consistent with previous research [80], this study also confirms the related hypothesis that users perceive e-wallets as applications that streamline their lives and tasks, leading to a positive attitude towards them as this characteristic becomes more pronounced. Users' perceptions of an e-wallet application's usability often engender positive sentiments. Consequently, service providers should strive to create user-friendly applications that simplify daily activities, thereby increasing user appreciation for e-wallet apps.

5.8. Satisfaction and attitude

Surprisingly, satisfaction was found to have minimal to no impact on attitude. In this regard, the findings of this study diverge from existing literature. One possible explanation is that satisfaction typically arises in the later stage of usage, once users have somewhat assessed the level of usefulness, whereas an individual's attitude is generally shaped by their initial perception and overall experience upon encountering a new service. Nonetheless, the discrepancies in the results may simply stem from differences in research contexts.

5.9. Satisfaction and intention to continue using e-wallet

The findings of this study suggest that satisfaction does not influence the intention to continue using e-wallets, which contrasts with the results of N.A.A. Halim, et al. (2022) [31]. This may be attributed to the highly competitive e-wallet services market in Vietnam. With e-wallets widely accessible and available, the impact of satisfaction on fostering intentions to continue use becomes diluted. Users may already find satisfaction in switching between service providers, as indicated by previous research [81].

5.10. Attitude and intention to continue using e-wallet

In alignment with the literature G.S. Weng, et al. (2017) [48], this study concludes that attitude positively affects the intention to continue using e-wallets. When users have a positive perception of an e-wallet, they are more inclined to continue using the application. Therefore, service providers should prioritise enhancements that address operational issues and cater more effectively to users' needs to garner positive evaluations of the applications.

5.11. Price benefit and intention to continue using e-wallet

Contrary to the findings of N.A.A. Halim, et al. (2022) [31], this study discovered that price benefit did not significantly influence intentions to continue using e-wallets. The underlying explanation for this response could be that as users' habits become well-established, the impact of price benefits diminishes. In a competitive market like Vietnam, where numerous e-wallets operate, offering special offers and coupons to attract users is common. While this may be an effective strategy to initially attract consumers, this study suggests that other factors are more critical for sustaining continued usage behaviour. This implies a fascinating tactic among market participants to offer pricing discounts only during the early adoption stage, such as offers valid only for the first few uses, as supported by previous findings [32].

5.12. Trust and intention to continue using e-wallet

Despite being consistent with the results of N.A.A. Halim, et al. (2022) [31], the effect of trust on the intention to continue using e-wallets was found to be insignificant, contrary to the researcher's expectations and contradicting the study of H. Qasim, et al. (2016) [15]. Initially, the research considered fraud, data risk, and personal data piracy issues as common concerns regarding e-wallets and investigated the variable of trust. Upon examining users' characteristics, it became apparent that survey participants are predominantly young consumers who may lack knowledge of e-wallet risks or be sufficiently IT-savvy to be aware of them. In either case, trust becomes less significant in their decision to continue using an e-wallet.

5.13. Habit and intention to continue using e-wallet

Habit has been found to heavily influence the intention to continue using e-wallets, aligning with the results of N.A.A. Halim, et al. (2022) [31]. Users are more likely to make subsequent payments using an e-wallet when they are already accustomed to the application. As transactions have become a routine yet recurring activity in the modern world, using e-wallets for transactions seamlessly merges into users' daily habits.

5.14. Operational constraint and intention to continue using e-wallet

The study suggests that operational constraints did not significantly impact intentions for continued use. Considering that all respondents had the digital infrastructure, such as smartphones, personal computers, and well-supported online networks, to participate in the survey, the insignificance can be explained. On the other hand, this could also be understood in parallel with the backgrounds of the respondents, who are current users of mobile payment apps and are inherently accustomed to operational features and infrastructure requirements. However, it is not advisable to generalise this finding to contexts in low-income countries where smartphones are not widely distributed, as operational constraints may hold greater importance in such scenarios. This presents a limitation of this study.

6. Conclusions

6.1. Theoretical implications

Previous research has primarily focused on the adoption and usage of mobile payment systems, overlooking post-adoption retention [15, 43]. Understanding users' intentions for continued usage of mobile payments can offer valuable insights into the economic sustainability of mobile service providers. By empirically investigating users' post-adoption usage and motivations for continuing to use e-wallets, this study addresses this research gap and enhances our understanding of e-wallet continuance usage behaviour.

Continuous enhancements and protection of e-wallet applications emerge as critical influences impacting e-wallet usage. Consumer preferences are continually evolving [13], necessitating that service providers and developers invest in understanding and addressing users' uncertainties to maintain user loyalty. Changes need to be promptly captured and responded to. The findings of this study can provide valuable insights applicable to other countries, particularly those where e-wallets are widely adopted and where there is a growing interest among service providers and policymakers to expand the user base. Furthermore, the increasing number of e-wallet users in Vietnam will directly impact and reinforce Vietnam's vision towards a cashless economy.

6.2. Managerial implications

Ensuring attraction, retention, and facilitation of users in actively generating continued usage is fundamental for mobile service providers to achieve success [49]. With rapid developments in e-wallet and various technologies maturing, user experience needs to be prioritised. Firstly, the current findings demonstrate that users' satisfaction and attitude are driven by confirmation and perceived usefulness. This observation underscores the importance of providing users with a seamless system that simplifies their daily transactions, thereby enhancing overall satisfaction. Consequently, e-wallet service providers should strive to offer not only a swift and efficient user experience but also a practical one that facilitates their customers' day-to-day transactions. To achieve this, it becomes imperative to expand the range of services offered by e-wallets to encompass a wider array of essential daily transactions, including incorporating additional merchants into the e-wallet payment network. Additionally, service providers must focus on upgrading app performance, ensuring that transaction processing speed exceeds that of traditional payment methods, directly addressing customers' aversion to wasting time on mundane tasks. Moreover, as critical as daily transactions are to the core service of payments, technical and informational support should not be overlooked and must be readily accessible to ensure that customers can receive assistance whenever needed. Furthermore, e-wallets should collaborate with financial institutions to offer refinancing options such as "buy now, pay later" and instalment payments, empowering customers' purchasing power to complete payments even when funds are insufficient. In summary, the perceived usefulness of e-wallet hinges on its ability to perform a multitude of functions, including but not limited to money transfers, utility bill payments, and completing online/offline transactions.

Secondly, the significant influence of confirmation and perceived ease of use on perceived usefulness implies that when an e-wallet system is considered easy to use, its usefulness is also perceived to be heightened. Designers of e-wallet systems should acknowledge that these systems serve a diverse population of users with varying backgrounds, including age and education levels. Therefore, it is crucial to recognise that there is no one-size-fits-all definition of an easy-to-use system; instead, the focus should be on increasing its perceived usefulness, leading to user satisfaction. Consequently, users will opt for an e-wallet application that they perceive as reliable in terms of ease of use.

Additionally, while users' decisions to continue using e-wallets largely depend on their attitude towards the applications, it is the user's perception of e-wallets that shapes the degree of attitude. Innovations are needed in designing service quality models to identify the range of attitudes that influence consumer opinions and drive decisions, particularly in competitive environments. Fortunately, the consequential relationship between "importance versus satisfaction" can offer a solution to the development direction of e-wallets. Providers of e-wallets should invest their time, efforts, and resources in pinpointing features that are most important to users, thus generating a higher level of satisfaction. Moreover, with the aim of satisfying users, system developers must ensure that their applications are perceived as "simple to use" and "useful", ensuring that the benefits of ease of use, usefulness, and confirmation are well executed. This study's insights are beneficial not only for business owners and application developers but also for the Vietnamese government, which is striving towards a safe, contact-free economy powered by e-wallet usage. A notable benefit of such a strategy is that cashless transactions can help the government avoid catastrophes as physical cards, wallets, and cash have the potential to facilitate the transmission of viruses, particularly during unprecedented events such as the COVID-19 pandemic. Naturally, both the adoption and continued use of e-wallets are vital stages in achieving the goal of a cashless society, and this study contributes to the latter.

6.3. Limitations and future research

This research has several limitations, particularly concerning the sample characteristics and variables investigated. Regarding sample-related issues, this research only collected feedback from MoMo users, and most participants are young consumers, which may affect the experiment's results. Regarding the insignificant impacts of perceived usefulness, satisfaction, price benefit, trust, and operational constraint, which differ from past studies, it is noteworthy that the respondents are current users of mobile payment apps, and their familiarity with them could explain the results. Therefore, it would be premature to infer that these factors are less important in countries where e-wallets are less prevalent. As a recommendation, future studies with larger sample sizes and participants with diverse characteristics could provide a more comprehensive picture, allowing for more control variables and thereby increasing the reliability of research results. Moreover, since this research was conducted in Vietnam - a developing country, the results may not precisely explain the reasons for the continued use of e-wallets in nations with different socioeconomic contexts. To enhance the generalisability of their findings, researchers should exercise caution when generalising their findings and consider conducting cross-national studies.

CRediT author statement

Minh Tuan Phung and Thi Minh Ly Pham: Providing guidance, context, and defining the research objective; Phuong Thanh Nguyen, Tan Lac Thien Vo and Le Bao Tran 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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Impact of religiosity on green purchase intention: A study of Vietnamese consumer

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Abstract:

The purpose of this article is to apply the Norm Activation Model to examine the impacts of religious beliefs (intrinsic religiosity, extrinsic religiosity spirituality, karma belief) on green purchase intention. This is the first assessment on the impact of religious beliefs on the green purchase intention of Buddhist and non-religious groups in Vietnam. Data was collected from 623 consumers. Partial least squares (PLS), a variance-based structural equation modeling technique, was selected to test the research model and hypotheses. The findings reveal that religious beliefs have positive impacts on green purchase intentions in a developing context. Karma belief, intrinsic religiosity and extrinsic religiosity positively influence green purchase intention. Spirituality does not have direct effects on green purchase intention. The results give insights into religious factors associated with green-related behaviors. Understanding religion's complex connections with eco-conscious decision-making allows for culturally tailored interventions. Theoretical contribution as well as managerial implications of this study, especially for green marketing practitioners are discussed.

Keywords: **extrinsic religiosity, green purchase intention, intrinsic religiosity, karma, spirituality.**

Classification number: **2.2**

1. Introduction

Over the last decades it has become more and more evident that unsustainable production and consumption practices have negative effects on the environment. This has led to a growing need for a shift towards behaviors that are both eco-friendly and sustainable growth [1, 2]. In order to build a future it is now widely recognized as important to promote consumption by encouraging individuals to choose "green" options such, as organic food, energy-efficient appliances and environmentally friendly products [3]. An important challenge facing marketers is to identify which customers are willing to pay more for green products. Past literature identified various factors, including environmental knowledge, attitudes, beliefs, values, materialism and the availability of sustainable alternatives on ecologically conscious consumer behavior [4, 5].

Scholars and marketing practitioners have embraced religion as a significant cultural influence on modern-day human behaviors [6]. Although religious beliefs have always been a cultural element in the consumer behavior framework, religion and its influences have long been perceived as a taboo subject matter for investigation in marketing areas [7]. Religiosity has been linked with workplace outcomes and processes like leadership, performance, motivation [2, 8]; coping with stress strategies [9] and individuals' life such as moral behavior, honesty and ethical practices [10, 11]. Scholars claim that consumers' buying behavior is positively influenced by their ethical practices [12], especially the environmental and social responsible behavior. Recent studies have shown the profound influence of religiosity on human values, attitudes, and behaviors, but few attempts have been made to empirically explore the extent to which, or how religious beliefs might affect and shape green purchase intention [7, 13, 14]. There is little common understanding among previous marketing studies in measuring the effects of religious beliefs like karma, and spirituality on green purchase intention [3, 15]. Studies have not thoroughly examined the aggregative relationship between various religious dimensions and

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green purchase intentions. A clear framework of religion's belief influences is urgently needed in marketing areas to assist in understanding the concept of green consumer behaviors. Furthermore, most studies have been conducted in the contexts of Muslims, Christians or in Western, while the belief in karma or the notion that actions bear inevitable future consequences is integral to Eastern religions like Buddhism, but its impact on green purchase intention is understudied [16].

This article attempts to explore the relationships between religious dimensions (namely intrinsic religiosity, extrinsic religiosity spirituality, karma belief) and green purchase intention based on the theory of consumer behaviour in middle-aged and young people. The research tests a conceptual framework elucidating how these cultural-religiosity factors shape intention and offers an alternative view of how religion influences consumers and buyers in the marketplace. This effort could assist marketers and future researchers in promoting sustainable lifestyles in Vietnam's cultural context.

2. Literature review and hypothesis development

2.1. Green purchase intention

The term "green product" emerged in the late 1980s along with the growing environmental consciousness and the concept of green consumerism. "Green products" are defined as having a reduced environmental impact compared to conventional alternatives across their life cycle, from design and production to usage and disposal [17]. According to W. Zhuang, et al. (2021) [1], there are three groups of factors that affect consumers' purchase decisions: psychological factors, individual characteristics and social factors.

Green purchase intention refers to an individual's tendency or willingness to purchase green products rather than non-green products in the future. In the literature, the intention to purchase or switch to green products is used as an approach to predict consumer behavior towards green products [8]. Consumer purchase intention is a kind of embodiment of consumer purchase behavior, so green purchase intention can be explained by consumer behavior theory. Green purchase intention is influenced by consumer cognitive and social factors [1].

2.2. Religiosity and green purchase intention

2.2.1. Religiosity

Religion is an abstract concept that challenges scholars in defining the term. Nonetheless, many scholars would agree that a religion represents a unified system of beliefs and practices relative to the sacred things, while religiosity is viewed as the degree to which beliefs in specific religious values and ideals are held and practiced by an individual [18]. Religiosity is a multidimensional concept [13]. Driven by the notion of R. Agarwala, et al. (2019) [7], this research examines four dimensions of religiosity beliefs, which include spirituality, karma belief, intrinsic, and extrinsic religiosity. Religious values are powerful influences; they have a track record of transforming societies and influencing behavior [19].

2.2.2. Spirituality and green purchase intention

Spirituality is the personal quest for understanding the answer to ultimate questions about life, meaning, and relationship to the sacred or transcendent, which may (or may not) lead to or arise from the development of religious rituals and the formation of community [8]. Spirituality refers to the human search for meaning and a connection with oneself, others, and nature beyond the material aspects of life [7]. So spirituality refers to an individual's internal orientation towards understanding existence in a wider consciousness "that binds all things into a more unitive harmony" [20]. Spirituality is an important construct in green marketing research, and even more in markets with strong spiritual influence [9]. Though spirituality has been considered a relevant factor in analyzing how consumers behave [8], there is scarce literature that analyzes and provides evidence of the importance of connections between spirituality and pro-environmental behaviors [15].

Spirituality states individual relatedness with earth, environment and universe, which is more amid spiritually oriented persons. This relatedness creates a feeling of thinking about self, gathering and environment which begets sustainable/ecological intents. Thus, spiritual orientation would probably prompt sustainable purchasing [5, 8]. It has also been suggested that spirituality is linked with environmentally and socially responsible behavior. Spiritual orientation engages people in activities that are meaningful in relation to both nature/essence of being and society.

H1: Spirituality has a positive effect on green purchase intention.

2.2.3. Karma and green purchase intention

Karma is one of the important doctrines, in this religious belief it is generally accepted that whoever does good will receive good results in life. According to the belief in karma, the world is a fair place grows in civilization which gives the view that everyone gets what they deserve [16]. At its essence, karma embodies the principle of "you reap what you sow" [7]. People who engage in moral behavior are sometimes recognized for their acts and receive various tangible and non-tangible rewards (e.g., reward money, improved reputation, community awards). Similarly, immoral acts, when discovered, may lead to punishment through the criminal justice system and from informal channels such as social sanctions and social rejections [21]. This belief holds immense significance and resonates across various dimensions of human behavior, including consumer choices.

Several studies have reported that karma is one of the dominant factors that influence environmental purchasing decisions. Karma has a positive effect on purchasing interest in green products in Indonesia [22]. This is because karma can increase the spiritual level and long-term orientation of the person. R. Agarwala, et al. (2019) [7] argued that consumers who believe in karma will have lower intentions to behave unethically. Karma believers gravitate toward recognizing the repercussions of their actions, even in their consumption patterns. Given this intricate relationship, it is conceivable that individuals deeply rooted in karma's belief system exhibit heightened intentions to purchase green products.

H2: Karma has a positive effect on green purchase intention.

2.2.4. Intrinsic religiosity and green purchase intention

Intrinsic religiosity refers to the internalization of faith as the primary purpose, where religious teachings provide meaning and inner motivation for behavior [23]. It represents a sincere spiritual commitment to a religion's fundamental values versus superficial participation in rituals. According to A.R. Madni, et al. (2016) [24], intrinsic religiosity can be defined as the degree to which an individual is able to express and affirm their religious identity, attitudes, values, and beliefs. This provides a complete framework for understanding life, by describing religion as an important value in an individual's cognitive structure that has the ability to influence aspects of their behavior [25].

Previous literature has highlighted the influence of intrinsic religiosity on intentions and green behaviors [26]. Intrinsic religious people have a higher sense of morality compared to extrinsic religious people. They consume green products based on their motivation to generate benefit the society [27]. E.A. Minton, et al. (2015) [2] and P. Martínez (2015) [28] revealed a robust positive correlation between intrinsic religiosity and environmentally friendly purchasing behaviors across various religious groups, intrinsic religiosity tended individuals engage more frequently in pro-environmental actions. Individuals with a stronger inclination towards intrinsic religiosity are observed to contribute financially to environmental causes, actively choose recycled products, and participate in initiatives aimed at environmental conservation [27].

H3: Intrinsic religiosity has a positive effect on green purchase intention.

2.2.5. Extrinsic religiosity and green purchase intention

Based on a study by G.W. Allport, et al. (1967) [23], extrinsic religiosity is defined as the use of religion for utilitarian ends like social conformity, benefits, and status rather than purely spiritual internal motivations. It represents participation in religious rituals driven by external social or personal reasons [29]. It also reflects their identification or denomination membership towards religious events [24]. Such activities are heavily embodied in the context of self-identification, church/pagoda attendance, church donations, charity and so on [30].

Although there are several arguments that extrinsic religious individuals pursue religious activities for the purpose of achieving social goals such as making friends and community gathering or to fulfill their business motives rather than seeking spiritual objectives [7]. They participate in behaviors that portray them in good standing with other referential or social groups. Therefore, extrinsic religiosity does not explain ethical behaviors [27]. S.H. Hassan (2014) [3] has extensively investigated the relationship between extrinsic religiosity and green consumer behavior. Hassan's study highlighted that extrinsic religiosity positively influences natural environmental orientation and environmental concerns, which in turn enhance green purchase intentions. E.A. Minton, et al. (2015) [2] extended this exploration to Buddhists, Christians, and atheists indicated that Buddhists, regardless of location, exhibited greater engagement in sustainable behaviors than Christians. Since religiosity is believed to have a profound influence on people's intentions [13], we proposed:

H4: Extrinsic religiosity has a positive effect on Green purchase intention.

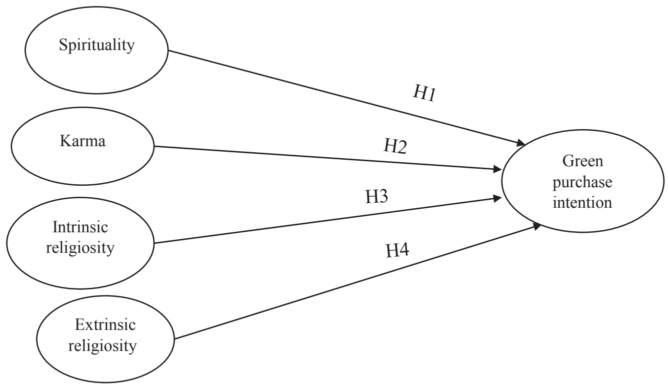

Fig 1. Conceptual framework.

3. Methodology

3.1. Samples and data collection

To examine the hypotheses (Fig. 1), data was gathered from a self-administered questionnaire conducted in Hanoi, Vietnam. The participants in this study were Vietnamese consumers aged over 15, as individuals in this age group generally possess a higher level of cognitive capacity to make buying decision of sustainable products [12]. This enables them to engage more effectively with the complex concepts of religiosity and environmental consciousness and exhibit greater maturity in decision-making processes, incorporating established values and beliefs that can significantly influence their purchasing behavior. Questionnaires were randomly distributed to target respondents with control of sex, income and occupation. A total of 623 respondents took part in the study, selected through the convenience sampling method. We conducted the data collection via Google Docs. First, the questionnaires were sent to about 1.902 email addresses, 510 answer sheets were received (response rate of 26.8%). Second, the soft electronic copies of the survey questionnaire were uploaded online to alumni, class groups, associations or Facebook accounts, and then we made phone calls or met respondents directly to administer the questioning process. After collecting the questionnaires, the data was checked to ensure that the sample consisted of the research designed subjects. 5 responses were eliminated because they had been answered by students, who were born in Hanoi - inappropriate survey subjects. I eliminated additional 3 questionnaires due to their inconsistent or biased answers. After screening the questionnaires, the final sample size is 623 responses.

In total there are 623 observations in the data set. In which, 49.6% are men, 50.4% are women. The respondent's education: 7.4% have high school degrees, 18.6% have college degrees, 62.9% have university degrees and 11.1% have graduate degrees. Regarding age, 30.5% of the respondents are 15-22 years old, 29.5% of the respondents are 23-30 years old, 21.3% of the respondents are 31-40 years old, 18.6% of the respondents are over 40 years old. 39.3% of respondents are Buddhist, 32.4% say they do not follow any religious group, 28.2% are Christian and others any religious groups. 55.1% of respondents have a monthly income less than 10 million VND/month, 38.7 of respondents have a monthly income between 10-30 million VND/month, 6.3% of respondents have a monthly income greater than 30 million VND/month.

3.2. Measurement

The questionnaire was adapted from various sources. All scales were adapted from previous studies (Table 1). For the Spirituality variable, the measurement scale was adapted from a previous study conducted by T.F. Stillman, et al. (2012) [20], the measurement scale of karma was adopted from P.K. Kopalle, et al. (2010) [21]. The scale for intrinsic religiosity and extrinsic religiosity has been adapted from A. Mas'od, et al. (2014) [31] and E.L. Worthington, et al. (2009) [32]. The measurement of green purchase intention was adopted from R.Y. Chan (2001) [12]. All variables were measured using a 5-point Likert scale (1 = Strongly disagree; 5 = Strongly agree). Before using the questionnaire for a survey, a qualitative study has been done to test the question, adapt and make it easier to use in the Vietnamese context. Two pages of questionnaire consisted of three parts. The first part consists of questions asking about perceived personal points of view of religious beliefs, the second part includes demographic and family background information of respondents.

Table 1. Scale of measurements.

Factors	Statement
Spirituality	I feel the presence of a higher power in my life
	I experience a connection with a higher power in every aspect of my life
	I have never felt alone because I am always being watched over by a higher power in my life
	I feel selfless caring for others
Karma	I believe in reincarnation where one becomes better (worse) due to good (bad) actions
	Good deeds in the present will produce a positive fruit in the future and life to come
	Evil deeds in the present will produce a negative fruit in the future and life to come
	The world was created in a continuous cycle
Intrinsic religiosity	I often read books and magazines about my faith
	I spend time trying to grow in my understanding of faith
	Religion is especially important to me because it answers many questions about the meaning of life
	I took my faith as providing purpose in my life
	I always try to carry my religion over into all my other dealings in life
	My religious beliefs are what lie behind my whole approach to life
Extrinsic religiosity	I make financial contributions to my religious organization
	I enjoy spending time with others of my religious affiliation
	I keep myself well-informed about my local religious group and have some influence on its decisions
	I go to religious activities because it helps me to make friends
	The purpose of prayer is to secure a peaceful life
	What religion offers me most is comfort when sorrows arise
	The primary purpose of prayer is to gain relief and protection
Green purchase intention	I am considering switching to products because they are less polluting.
	I am considering switching to an environmentally friendly brand for ecological reasons
	Over the next month, I plan to switch to a green version of a product

3.3. Data analysis

This research is a quantitative study that aims to find out the existence and type of relationship between one variable and another, thus, the analytical tool used is Structural Equation Modeling (SEM). The analysis stages themselves were divided into early and advanced stages of analysis. Preliminary analysis was carried out to ensure that all measurement scales were valid and reliable, as well as to perform data cleaning. While further analysis was to test the hypotheses that had been built.

4. Results and discussion

4.1. Reliability and validity analyses

First, we apply Harman's single factor test to detect possibility of common method bias. There is no problem with common method bias in this data since the total variance extracted by one factor is 31.6% and it is less than the recommended threshold of 50%. Secondly, the assessment of the reliability of this study was conducted as per many researchers' recommendations to use an index form for Cronbach's alpha values [33]. It dictated the content with a reliability coefficient of 0.7 and above to be acceptable. The convergent validity of the measurement model was obtained by ensuring that the composite reliability (CR) should be greater than 0.7.

Exploratory factor analysis is applied for all independent variables simultaneously. Results showed that factor analysis is appropriate with data (KMO=0.907) and observing variables are correlated in general (sig<0.05). The total variance explained extracted from 31 observing variables of measurement scales for organizational culture (including 8 factors) and organizational commitment was 63.7%, which is ≥60% (>60% is good). Therefore, extracted factors meet the requirements of values. The original scale for environmental concern includes 4 items, however, due to, 2 items having been loaded in the wrong factor and Cronbach's alpha values is not qualified, we eliminated these 2 items from the original scale.

Table 2 shows Cronbach's alpha reliability coefficient of the variables, this study gave the following results: All of the factor scale of variables have Cronbach's alpha greater than 0.7. Thus, the factor scale of variables is appropriate, reliable and will be retained to serve the official quantitative research phase.

Table 2. Reliability statistics.

	Variables	Items	Sources	Cronbach's alpha
1	Spirituality	4	[20]	0.810
2	Karma	4	[21]	0.780
3	Extrinsic religiosity	7	[31, 32]	0.874
4	Intrinsic religiosity	6		0.872
5	Green purchase intention	3	[12]	0.834

4.2. Hypothesis testing

Results indicate that religious dimensions including Karma, Intrinsic religiosity and extrinsic religiosity significantly affect green purchase intention (Table 3, Fig. 2). These results supported H2, H3 and H4. The positive and significant effect of karma on green purchase intention supports the arguments of P.K. Kopalle, et al. (2010) [21], R. Agarwala, et al. (2019) [7]; S. Chen, et al. (2019) [22] who found that belief in karma makes people consider the long-term consequences of their consumption choices. Consumers who believe their actions will affect their future are more likely to make eco-friendly purchases that will promote environmental sustainability. The positive effect of karma on green purchase intention is logical given the emphasis in Buddhist and Hindu teachings that current actions shape future outcomes. This study found that having religious beliefs positively influences green purchase behavior. This study confirms the applicability of a multidimensional construct "religious values" in the context of Buddhist and non-religious consumers.

The findings of the study revealed that intrinsically religious individuals possess a stronger intent to buy green products. This mirrors earlier findings linking intrinsic religiosity to pro-environmental attitudes [2, 25, 28]. Driven by faith, intrinsically religious consumers are more inclined to altruistic, sustainable actions, such as eco-friendly purchasing. The affirmative effect of intrinsic religiosity on green purchase intention underscores their commitment to embody their values in daily choices. Additionally, the study revealed that green purchase intention is positively and significantly influenced by extrinsic religiosity, this finding aligns with previous research by S.H. Hassan (2014) [3] and L. Wang, et al. (2020) [34].

The study also revealed that spirituality was not observed to influence green purchase intention. Consequently, hypothesis H1 was not supported. The insignificant effect of spirituality on green purchase intention is not in line with the works of C. Chairy (2012) [8], Y. Joshi, et al. (2019) [5], and A. Werner, et al. (2020) [35]. This non-support suggests that spirituality doesn't directly predict such intentions. This might stem from spirituality's focus on inner connection rather than outward actions. More research is needed to clarify this relationship.

Table 3. Path analysis.

Path			Hypotheses	Estimate	S.E.	C.R.	P	Results
GI	<---	SP	H1	.053	.042	1.254	.210	Not Supported
GI	<---	KA	H2	.227	.051	4.425	***	Supported
GI	<---	IR	H3	.298	.049	6.092	***	Supported
GI	<---	ER	H4	.157	.047	3.319	***	Supported

SP: spirituality; KA: karma; ER: extrinsic religiosity; IR: intrinsic religiosity; GI: green purchase - intention. Source: Our research.

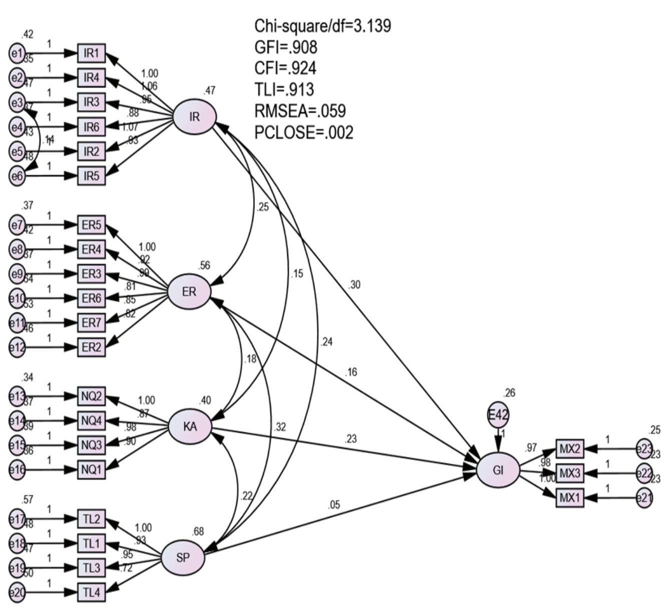

Fig. 2. Structural Equation Modeling analysis. Source: Our research.

5. Conclusions

This research has provided valuable insights into the relationship between religious dimensions and environmentally conscious consumer behavior. The findings confirm the variable impacts of karma beliefs, extrinsic religiosity, and intrinsic religiosity on green purchase intentions among Vietnamese middle-aged and young consumers. The research highlights the significance of moral considerations in driving pro-environmental behavior within various religious contexts.

The outcomes of this study have several practical implications. The results indicate that consumers who are more religious are more likely to purchase green products and this demonstrates the importance of religious beliefs in green consumption. Green product managers should give special attention to this consumer segment. Marketing communication channels should portray consumers who (symbolically) cultivate good karma. Since extrinsic religiosity and intrinsic religiosity significantly impact green purchase intention, it is recommended that practitioners may stimulate the willingness to purchase green products among consumers who express extrinsic religiosity, and intrinsic religiosity. In practical terms, this research underscores pathways for fostering sustainable consumption within the evolving landscape of Vietnam by tapping into culturally significant values. Potential strategies may revolve around emphasizing karma's principle of accountability and the moral obligations felt by individuals with intrinsic religious beliefs.

There are a few limitations to this study. Firstly, this is a cross-sectional study, future research may apply a longitudinal study to understand the change in green intention over time. The study sample is limited to middle age and young respondents which may result in the findings do not apply to old people. Future studies may widen the scope of the study for more understanding of older customers' green behaviors. Another limitation arises from not differentiating between religious and non-religious consumers. Future research should explore each religion separately, considering their distinct perceptions of environmental issues, and make comparisons between groups. Finally, this study examined the green purchase intention in general and did not consider specific kinds of products. Future research may examine various types of green product differences.

CRediT author statement

Dinh Duc Minh: Conceptualisation, Revising, Writing; Dinh Minh Trang: Methodology, Writing, Editing; Nguyen Thu Thuy: Conceptualisation, Writing, Reviewing.

COMPETING INTERESTS

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

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Testing the optimal capital structure hypothesis: A case of property firms in Vietnam

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Abstract:

This study examines the relationship between capital structure and firm value to test the optimal capital structure hypothesis. By collecting accounting and market data of Vietnamese property firms listed on the Ho Chi Minh City Stock Exchange for the period from 2017 to 2022, we employ a panel data approach with a total of 306 observations. With data that ensures stationarity, the study utilises the Feasible Generalised Least Squares (FGLS) method to address potential concerns related to heteroskedasticity within the model. The results indicate that the relationship between capital structure in general, capital structure by term, and firm value is quadratic, suggesting the presence of an optimal level of capital structure. Firm value increases with the increase in the debt ratio, and firms can maximise value at the optimal debt threshold. Additionally, the study finds that firm value is influenced by scale and asset structure, both of which have a positive impact on firm value. However, there is no evidence of the impact of sales growth and liquidity on firm value in this analysis.

Keywords: **capital structure, debt ratio, firm value, optimal capital structure**.

Classification numbers: **2.2, 2.3**

1. Introduction

Capital structure is the specific combination of debt and equity utilised by a firm to finance its overall operations and growth. The relationship between firm value and capital structure has been addressed by various theories. According to the perfect financial market hypothesis of F. Modigliani, et al. (1958) [1], in the absence of transaction costs, information costs, and taxes, there will be no distinction between internal and external capital costs. This implies that firms can access unlimited sources of capital, and thus, the capital structure does not affect firm value. However, F. Modigliani and M.H. Miller's own theory in 1963 [2] and subsequent theories have challenged these conclusions. Considering the context of taxes, firm value will increase if they increase debt capital due to benefits from new tax shields [2]. The trade-off theory of S.C. Myers (1977) [3] suggests that by balancing the benefits from tax shields and the costs of financial distress, firms can attain an optimal capital structure that maximises the value of the firm. Additionally, the pecking order theory asserts that firm value will increase but up to a certain limit [4].

Regarding empirical studies, some research indicates that capital structure has a positive effect on firm value, with increased debt leading to higher operating profits [5-9]. In contrast, the research of R. Zeitun, et al. (2014) [9], Z. Ahmad, et al. (2012) [10], and K.O. Asante, et al. (2022) [11] provided empirical evidence of the negative impact of debt on firm value. They showed that utilising loans increased the financial risk of firms due to interest payments and financial distress. On the other hand, some empirical evidence suggested that the effect of capital structure on firm value is non-linear. There is a trade-off between the benefits and costs related to debt capital, implying that firms have limits on the use of debt, suggesting the existence of an optimal capital structure. An optimal capital structure is the best mix of debt and equity financing that maximises a company's market value while minimising its cost of capital [12, 13].

From a financial management perspective, a carefully chosen capital structure not only helps firms take full advantage of the positive effects of financial leverage, such as tax savings or improving the efficiency of

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capital use, but also minimises the possibility of financial distress to achieve the goal of enhancing firm value. As the results of the above empirical studies review, however, the impact of capital structure on firm value yields relatively different results with variations in space and time. Therefore, it is impossible to ascertain whether an optimal capital structure exists for all companies.

The scale of Vietnam's financial market is still small compared to other countries in the region; thus, firms require debt capital to operate and grow, especially small firms. Therefore, capital structure is one of the important factors affecting business performance and firm value. Particularly, from the beginning of 2020 until now, the emergence and strong outbreak of the COVID-19 pandemic have had a substantial negative impact on Vietnamese businesses. In this context, debt-related costs have increased. Therefore, it is necessary for firms to determine an optimal capital structure. In Vietnam, in recent years, there have been many studies interested in the relationship between capital structure and business performance or firm value, but research results remain discrepant. The study of N.V. Chien, et al. (2022) [14] concluded that debt ratio has a positive impact on the performance of the firms listed on the Vietnamese stock market, meanwhile, D.V. Chi, et al. (2013) [15] show a negative effect of debt on the performance of consumer goods firms. Among business sectors in Vietnam, property is one of the critical sectors of the national economy, playing a vital role in attracting resources and creating fixed assets for the economy, promoting the development of other economic sectors as well [16]. Due to the significant capital requirements, property firms often have high debt ratios, accompanied by high financial risks. Therefore, we test the existence of the optimal capital structure hypothesis on property firms by examining the relationship between capital structure and firm value. If the results obtained show that the above relationship is quadratic, our hypothesis is verified.

The remainder of the article is structured as follows: In Section 2, we provide an economic background for our analysis. Section 3 outlines our research design. Section 4 presents our main results and discussion, and Section 5 presents conclusions.

2. Economic background

2.1. Theoretical framework

2.1.1. Modigliani and Miller's Capital Structure Theory

This theory primarily explores the association between firm value and capital costs concerning a firm's utilisation of debt. It was originally posited in 1958 and later in 1963 under two circumstances: (i) in the absence of taxes and (ii) in the presence of taxes.

(i) The firm's value remains constant when the capital structure changes. This implies that the capital structure does not impact firm value; in other words, the firm's value with debt is identical to its value without debt [1].

(ii) The firm's value with debt equals the total firm value without debt plus the present value of the tax shields, signifying that debt augments the firm's value. The relationship between capital structure and firm value is positive [2].

2.1.2. Trade-off theory

Companies strive to determine the target debt ratio that balances benefits and risks to maximise firm value. In essence, an optimal blend of debt and equity exists at which, for each additional increment in debt, the present value of the tax-shield benefits equals the present value of the cost of financial distress [17]. In greater detail, the use of debt elevates the weighted average cost of capital (WACC). The benefits accrued from tax shields may be offset by the amplified present value of bankruptcy costs. Initially, firms gain benefits from tax shields, as they pay less tax by increasing their debt. Nevertheless, excessive debt exposes firms to payment risks, potentially leading to bankruptcy. Consequently, firms might face insolvency if they become unable to meet their financial obligations.

2.1.3. Pecking order theory

Low-cost funding sources receive precedence. According to S. Myers, et al. (1984) [18], financial costs rise with asymmetrical information. Therefore, the pecking order theory classifies funding sources in the following sequence: internal capital from retained profits is utilised first, followed by debt capital with lower costs, and finally, equity (issuing shares). This implies that a firm's ability to augment debt capital is restricted because increasing debt escalates its cost of capital.

2.2. Empirical evidence

The impact of capital structure on firm value has been a subject of extensive debate, encompassing theoretical and empirical realms. These debates focus on whether an optimal capital structure exists or whether a company's debt ratio is linked to its value. When referring to a firm's capital structure, we are considering the amalgamation of debt and equity. S.C. Myers (2003) [19] argues that the selection of a capital structure essentially represents a business strategy employed by firms. The ultimate objective of firms is to identify a blend of capital sources that maximises the market value of the firm. According to J.F. Weston, et al. (1981) [20], the optimal capital structure is the structure that maximises the market value of the firm's outstanding shares.

Numerous studies have assessed the influence of capital structure on business performance and firm value, yielding divergent results. Some studies support F. Modigliani, et al. (1963) [2], indicating that financial leverage exerts a positive impact on business performance and firm value. For instance, research conducted by S. Fosu (2013) [6] and M.C. Mukumbi, et al. (2020) [7] demonstrates that utilising debt yields benefits from tax shields, resulting in reduced tax costs and enhanced profits. Consequently, increasing the debt ratio within the capital structure augments firm value.

However, the majority of empirical studies have shown that debt has an adverse impact on financial performance and firm value. For instance, the research of R. Zeitun, et al. (2014) [9], Z. Ahmad, et al. (2012) [10], K.O. Asante, et al. (2022) [11] indicates that high financial leverage generates conflicts of interest between shareholders and bondholders, leading to increased agency costs. This, in turn, elevates capital costs and bankruptcy risks, thereby heightening financial risks for firms. Firms may find themselves in a precarious situation where they struggle to manage these risks and costs, potentially leading to insolvency. According to a study conducted by D.A. Surjandari, et al. (2019) [21], capital structure adversely affects the performance of property firms in Indonesia. The findings reveal a negative correlation between the debt ratio and business profitability, signifying that increased debt levels result in decreased overall profitability.

Furthermore, certain studies suggest that the relationship between capital structure and firm value is contingent upon the extent of agency issues within companies [22, 23]. Specifically, F. Schoubben, et al. (2006) [23] argue that capital structure positively influences firm value when the firm's debt ratio remains below a certain threshold. Conversely, if the debt ratio surpasses this threshold, it negatively impacts firm value. Similarly, W. Ruland, et al. (2005) [22] contend that financial leverage enhances the performance of firms involved in diversification, particularly small firms linked to higher agency costs.

Regarding empirical research on Vietnamese firms, D.N. Phuc (2014) [24] concluded that short-term debt and total debt adversely affect the performance of equitised firms, whereas long-term debt exerts a positive influence on profits. Additionally, N.T. Duc (2020) [25] investigated 31 firms in the oil and gas industry, revealing that total debt ratio and short-term debt ratio have a negative impact on business performance, while the long-term debt ratio exhibits a positive relationship. Notably, V.M. Long (2018) [26] suggests the existence of a capital structure threshold to maximise firm value for firms listed on the Ho Chi Minh City Stock Exchange. Besides, both short-term and long-term debt positively impact firm value, but firms can only increase their debt ratio to a certain threshold, beyond which firm value begins to decline. A recent study by N.M. Ngoc, et al. (2021) [27] indicates that capital structure negatively affects business performance, prompting property firms to carefully consider leveraging. When employing leverage, businesses confront financial exhaustion costs along with tax shield benefits from interest. Consequently, companies must strategically use financial leverage while determining an optimal debt threshold to capitalise on these benefits.

In sum, the relationship between capital structure and firm value is a longstanding issue in both theoretical and empirical domains. F. Modigliani, et al. (1963) [2] capital structure theory suggests that the more debt a firm utilises, the greater its benefits. Conversely, the trade-off theory and pecking order theory posit that if a firm increases its debt ratio to the point where the cost of financial distress exceeds the benefits from tax shields, firm value will decline. Empirically, disparities emerge in research findings, influenced by factors such as (i) variations in research environments, including diverse business sectors and countries; (ii) temporal disparities; and (iii) differing methodologies employed to gauge capital structure and firm value. In the case of Vietnamese property firms, which face substantial capital requirements, empirical studies corroborate the necessity of ascertaining an optimal capital structure to enhance firm value while mitigating risks.

Thus, we hypothesise that whenever there is an increase in the debt ratio or a decrease in the debt ratio, the firm's value will be impacted. Consequently, it is worth postulating that the relationship between capital structure and firm value is not linear but instead follows an ascending trajectory up to a specific optimal level, after which it declines. In this context, levels below the optimum suggest a positive impact of the debt ratio on firm value, while levels exceeding the optimum indicate a decline in firm value. Therefore, the principal hypothesis to be examined in this article is that the relationship between capital structure and firm value is quadratic, implying the presence of an optimal level of capital structure.

3. Research design

3.1. Models and variables

In this analysis, we have formulated a model following the approaches of M.A. Farooq, et al. (2016) [28] and V.M. Long (2018) [26] to test the hypothesis outlined in the previous section:

$$\mathrm{FV}_{i,t} = \beta_0 + \beta_1\mathrm{CS}_{i,t} + \beta_2\mathrm{CS}^2_{i,t} + \beta_3\mathrm{SIZE}_{i,t} + \beta_4\mathrm{SALE}_{i,t} + \beta_5\mathrm{AS}_{i,t} + \beta_6\mathrm{CR}_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $FV_{i,t}$ is the value of firm i in period t; $CS_{i,t}$ is capital structure of firm i in period t, $SIZE_{i,t}$ is scale of firm i in period t, $SALE_{i,t}$ is sale growth of firm i in period t, $AS_{i,t}$ is asset structure of firm i in period t, $CR_{i,t}$ is liquidity of firm i in period t, β is the estimated coefficient corresponding to the variables, and $\varepsilon_{i,t}$ is the error term.

Given that capital structure is fundamentally the combination of debt and equity, we gauge capital structure through the debt ratio, encompassing total debt ratio (DA), short-term debt ratio (SDA), and long-term debt ratio (LDA). Further details regarding the measurement of variables are presented in Table 1.

To mitigate multicollinearity which is likely arising from the high correlation between the total debt ratio variable and the short-term and long-term debt ratios, we split model (1) into two distinct models. The final specifications of the models to be estimated are as follows:

$$\mathrm{FV}_{i,t} = \beta_0 + \beta_1\mathrm{DA}_{i,t} + \beta_2\mathrm{DA}^2_{i,t} + \beta_3\mathrm{SIZE}_{i,t} + \beta_4\mathrm{SALE}_{i,t} + \beta_5\mathrm{AS}_{i,t} + \beta_6\mathrm{CR}_{i,t} + \varepsilon_{i,t} \quad (1.1)$$

$$\mathrm{FV}_{i,t} = \beta_0 + \beta_1\mathrm{SDA}_{i,t} + \beta_2\mathrm{SDA}^2_{i,t} + \beta_3\mathrm{LDA}_{i,t} + \beta_4\mathrm{LDA}^2_{i,t} + \beta_5\mathrm{SIZE}_{i,t} + \beta_6\mathrm{SALE}_{i,t} + \quad (1.2)$$

As discussed in the previous section, the relationship between capital structure and firm value is not linear but exhibits an ascending trajectory up to a specific optimal level, beyond which it declines. This optimal level is reflected in Models (1.1) and (1.2) through the inclusion of the capital structure variable and its square term.

Consequently, upon estimating the models, if we differentiate the firm value variable with respect to the capital structure variable, we obtain the following:

From Model (1.1): $\frac{\partial \mathrm{FV}_{i,t}}{\partial \mathrm{DA}_{i,t}} = \beta_1 + 2\beta_2\mathrm{DA}_{i,t}$

From Model (1.2): $\frac{\partial \mathrm{FV}_{i,t}}{\partial \mathrm{SDA}_{i,t}} = \beta_1 + 2\beta_2\mathrm{SDA}_{i,t}$; $\frac{\partial \mathrm{FV}_{i,t}}{\partial \mathrm{LDA}_{i,t}} = \beta_3 + 2\beta_4\mathrm{LDA}_{i,t}$

Subsequently, by equating the first derivative to zero and solving for the capital structure variables, we obtain the following:

From Model (1.1): $\mathrm{DA}_{i,t} = -\frac{\beta_1}{2\beta_2}$

From Model (1.2): $\mathrm{SDA}_{i,t} = -\frac{\beta_1}{2\beta_2}$; $\mathrm{LDA}_{i,t} = -\frac{\beta_3}{2\beta_4}$

To achieve a maximum in the above equation, it is imperative that β_2 and β_4 possess negative signs. Additionally, since the optimal capital structure level derived from the equation must be positive, β_1 and β_3 should be positive. Consequently, our main hypothesis will be substantiated if these coefficients exhibit the expected signs when estimating Eqs. (1.1) and (1.2).

Control variables *SIZE*, *SALE*, *AS*, and *CR* were included in Models (1.1) and (1.2). J. Obradovich, et al. (2013) [8] demonstrated a positive relationship between firm scale and firm value. Larger firms tend to enjoy a competitive edge in the market owing to their substantial capital, ample human and material resources for expanding their operational network, diversifying their consumer markets, and reaching various customer segments. Hence, we anticipate a positive association between scale and firm value. According to R. Zeitun, et al. (2014) [9], firms with high sales growth rates often achieve better business performance and secure stronger market positions. Increased revenue serves as the driving force behind profit escalation. Consequently, we expect a positive relationship between sales growth and firm value. Asset structure is contingent on business characteristics. As posited by R. Zeitun, et al. (2014) [9], asset structure significantly impacts business performance. A high asset structure ratio indicates a firm's abundant collateral assets, thereby enhancing its borrowing capacity. Hence, we anticipate a positive relationship between asset structure and firm value. Managers generally believe that firms perform well when their current ratio is high. However, excessively high current ratios may signify that a company holds an excessive quantity of short-term assets, potentially implying ineffective utilisation of these assets and indirectly causing a decline in business performance. Thus, we predict a negative relationship between liquidity and firm value. The method to measure the variables is presented in Table 1.

Table 1. Measurement variables.

Variables	Measurement	References
FV	Tobin's Q = (Equity market value/Equity book value)	M.A. Farooq, et al. (2016) [28], D. Ater (2017) [29]
DA	Total debt/Total assets	S. Fosu (2013) [6], F.A. Duais (2016) [5], K.O. Asante, et al. (2022) [11]
SDA	Short-term debt/ Total assets	R. Zeitun, et al. (2014) [9], F.A. Duais (2016) [5], K.O. Asante, et al. (2022) [11]
LDA	Long-term debt/ Total assets	R. Zeitun, et al. (2014) [9], F.A. Duais (2016) [5], K.O. Asante, et al. (2022) [11]
SIZE	Logarithm(Total assets)	J. Obradovich, et al. (2013) [8], S. Fosu (2013) [6], V.M. Long (2018) [26]
SALE	(Current period sales/ Prior period sales) - 1	V.M. Long (2018) [26], R. Zeitun, et al. (2014) [9]
AS	Fixed assets/ Total assets	V.M. Long (2018) [26], R. Zeitun, et al. (2014) [9]
CR	Current assets/Current liabilities	M.A. Farooq, et al. (2016) [28], V.M. Long (2018) [26]

3.2. Data and method

For the empirical analysis, the author has collected data from the Fiinpro system of FiinGroup Company and constructed a balanced panel dataset of 51 property firms listed on the Ho Chi Minh City Stock Exchange during the period from 2017 to 2022, resulting in a total of 306 firm-year observations (51x6). The dataset encompasses financial statements and the market value of the company's shares.

To commence, we assess the stationarity of the panel data series. If the data exhibit stationarity at the original level, we proceed to consider suitable estimation methods for panel data. Three estimation procedures are applicable for panel data analysis: pooled Ordinary Least Squares (pooled OLS) estimation, random effect (RE) estimation, or fixed effect (FE) estimation. Nonetheless, the use of OLS models can yield biased and inconsistent results in the presence of unobserved heterogeneity (unobserved individual-specific effects among firms). To mitigate this bias, FE or RE estimators are commonly employed [30, 31]. Subsequently, we employ the Hausman test to select the appropriate method. We also examine multicollinearity through the Variance Inflation Factor (VIF) test and conduct additional tests related to the reliability of the regression model. If the model demonstrates heteroskedasticity, we finalise the regression results using the Generalised Least Squares (GLS) estimation.

4. Results and discussion

4.1. Descriptive statistics of variables

Table 2 presents the descriptive statistics of the variables utilised in this section. It is evident that most of the variables exhibit significant variation across firms, as indicated by their relatively large standard deviations compared to their means. The measurement of firm value, denoted by Tobin's Q coefficient, has an average value of 1.3741. However, some firms have Q coefficients less than 1. Property firms predominantly favour short-term debt over long-term debt in their capital structure, with some firms abstaining from the use of long-term debt.

Table 2. Descriptive statistics.

Variables	Mean	Std.	Min	Max	Obs.
FV	1.3741	1.1175	0.0444	7.4132	306
DA	0.5293	0.1883	0.0244	0.923	306
SDA	0.3642	0.1749	0.0091	0.861	306
LDA	0.1651	0.1462	0.0000	0.6116	306
SIZE	29.1016	1.5223	25.7873	33.9896	306
SALE	0.2775	2.2880	-24.1617	24.6755	306
AS	0.0553	0.0939	0.0001	0.6286	306
CR	2.3984	2.2517	0.2268	20.5502	306

Source: Analysis results from STATA.

4.2. Testing stationarity of data series

The test results in Table 3 indicate that all data series for each variable are stationary and statistically significant.

Table 3. Results of testing the stationarity of variables at I(0).

Variables	LLC (Levin - Lin - Chu, 2002)		Results
	t-statistic	*p_value*	
FV	-5.9013	0.0000	Stationary
DA	-9.5631	0.0000	Stationary
SDA	-11.4249	0.0000	Stationary
LDA	-1.3e+02	0.0000	Stationary
SIZE	-12.9675	0.0000	Stationary
SALE	-30.9864	0.0000	Stationary
AS	-1.2e+04	0.0000	Stationary
CR	-43.1567	0.0000	Stationary

Source: Analysis results from STATA.

4.3. Testing correlation coefficients

Table 4 reveals that the correlation coefficient between pairs of independent variables is less than 0.8, indicating limited potential for multicollinearity in the model [32].

Table 4. Correlation coefficient matrix between used variables.

	DA	SDA	LDA	SIZE	SALE	AS
DA	1.0000					
SDA	0.6691***	1.0000				
LDA	0.4838***	-0.3267***	1.0000			
SIZE	0.2520***	0.0426	0.2703***	1.0000		
SALE	0.0457	0.0445	0.0058	-0.0206	1.0000	
AS	-0.0621	-01246**	0.0679	-0.0409	-0.0062	1.0000
CR	-0.4385***	-0.5654***	0.1082*	-0.1247**	-0.0168	-0.0638

The notations ***, **, * denote the significance levels of 1%, 5%, and 10%. Source: Analysis results from STATA.

4.4. Research findings

The estimation results of Models (1.1) and (1.2) are presented in Table 6. Before discussing the results, it is important to highlight some key points.

While correlation coefficients provide initial insights and signs of potential multicollinearity, they are insufficient evidence to conclusively determine the presence of multicollinearity in the model. To ensure that multicollinearity is not severe, we proceed to check the Variance Inflation Factor (VIF) values. As shown in Table 5, all variables have VIF values less than 10, indicating no evidence of serious multicollinearity in the research model [29]. Additionally, the Hausman test in Table 6 demonstrates that fixed effect (FE) estimation is more suitable for both Models (1.1) and (1.2). Furthermore, the Wald statistics in Table 7 for heteroskedasticity diagnostic tests are highly statistically significant at the one percent level, indicating significant heteroskedasticity across firms. However, the Wooldridge test suggests that the model is not affected by serial correlation. Consequently, we address heteroskedasticity through GLS regression and base our final results on this estimation method.

Table 5. VIF factors.

Variables	Model (1.1) VIF	Variables	Model (1.2) VIF
DA	1.32	SDA	1.71
CR	1.25	CR	1.54
SIZE	1.07	LDA	1.24
AS	1.02	SIZE	1.12
SALE	1.00	AS	1.05
		SALE	1.00

Source: Analysis results from STATA.

Table 6. Regression results with the GLS method for Models (1.1). and (1.2).

Variables	Regression coefficient	
	(I) Model (1.1)	*(II) Model (1.2)*
DA	4.0401*** (0.7644)	
DA^2	-3.7544*** (0.7517)	
SDA		0.8464*** (0.8477)
SDA^2		-1.2913*** (0.9624)
LDA		2.1358*** (0.7395)
LDA^2		-1.4445*** (1.3522)
SIZE	0.2008*** (0.0304)	0.1637*** (0.0335)
SALE	0.0047 (0.0203)	0.0015 (0.0211)
AS	0.7129* (0.4188)	0.3036* (0.4435)
CR	0.0154 (0.0127)	-0.0184 (0.0165)
Cons	-5.6316*** (0.8329)	-3.8745*** (0.9165)
Wald chi2	107.38***	100.92***
Obs	306	306

The notations ***, * denote the significance levels of 1% and 10%. Source: Analysis results from STATA.

Table 7. Hausman test and Wald test.

Hausman test	Chi2	Prob>chi2	Results
Model (1.1)	35.34	0.000	FEM
Model (1.2)	19.58	0.012	FEM
Wald Test	Chi2	Prob>chi2	Results
Model (1.1)	1.2e+05	0.000	Heteroskedasticity
Model (1.2)	76382.81	0.000	Heteroskedasticity

Source: Analysis results from STATA.

The obtained results confirm our main hypothesis. As shown in column I of Table 7, β_1 is positive, and β_2 is negative, with both coefficients being statistically significant. In column II of Table 7, β_1 and β_3 are positive, while β_2 and β_4 are negative, and again, all coefficients are statistically significant. These findings suggest that the relationship between capital structure and firm value is quadratic rather than linear. In other words, a marginal increase in total debt, short-term debt, and long-term debt has a positive impact on shareholder wealth as long as the optimal debt level has not been surpassed. This threshold marks the beginning of a decline in firm value. Table 8 presents the optimal threshold of debt of firms in this study.

Table 8. The impact of capital structure on firm value.

Variables	The optimal level (Threshold value)	
	Model (1.1)	***Model (1.2)***
DA	53.8049%	
SDA		32.7732%
LDA		73.9287%

4.5. Discussion

4.5.1. Debt ratio

The research results in Model (1.1) reveal that when a firm increases its debt ratio, its value will rise. However, DA only increases up to 53.8049%, beyond which the firm's value begins to decline. This suggests that when a firm's debt ratio exceeds 53.8049%, property firms may become overly passive in their capital utilisation. They face an increased risk of being unable to meet their debt obligations and may encounter limitations in securing additional financing through debt. Consequently, firms must accept a higher cost of capital, among other factors. In such a scenario, the benefits from tax shields become lower than the cost of financial distress, implying that the effectiveness of using debt is inferior to using equity. This, in turn, leads to a reduction in business performance and firm value. Our findings support the research of D. Ater (2017) [29] and V.M. Long (2018) [26].

4.5.2. Short-term debt ratio

The research results in Model (1.2) indicate that when a firm increases its short-term debt ratio, its value will increase, but SDA only increases to 32.7732%, beyond which the firm's value starts to decrease. This suggests that firms that rely too heavily on short-term debt and exceed the 32.7732% threshold face a higher risk of being unable to repay their debt. In such cases, firms must divert their attention towards debt repayment, possibly by issuing more shares or selling assets, and they may neglect their production activities. This inefficiency in production indirectly diminishes firm value.

4.5.3. Long-term debt ratio

The research results in Model (1.2) demonstrate that when a firm increases its long-term debt ratio, its value will increase, but LDA only increases to 73.9287%, beyond which the firm's value declines. Notably, the long-term debt threshold is higher than the short-term debt threshold. This discrepancy can be explained by the fact that property firms still maintain a relatively low long-term debt ratio, indicating an underutilisation of this stable funding source. Moreover, long-term debt is often employed to finance long-term assets such as the acquisition of fixed assets and investments in property projects. Therefore, an excessively low long-term debt ratio fails to support the modernisation of machinery and equipment or the execution of substantial projects required to enhance competitiveness in the market. However, it's crucial to bear in mind that long-term debt entails higher costs compared to short-term debt, and it also carries higher risks. Therefore, if the long-term debt ratio surpasses 73.9287%, firm value will decrease.

Consistent with our expectations, the SALE and AS variables have a positive influence on firm value at the one and ten percent statistical significance levels. This can be attributed to the fact that larger firms often enjoy strong brand recognition and reputations in the market, which leads to lower agency costs. Additionally, their market competitiveness is high, making it easier for them to secure capital or sell products. These factors contribute to improved business performance and overall firm value. Furthermore, increasing the proportion of fixed assets also enhances firm value. According to the authors, this provides firms with the opportunity to modernise machinery and equipment, ultimately increasing labour productivity and competitiveness in the market. These research findings underscore the importance of financial managers selecting the appropriate type of fixed assets for investment to enhance firm competitiveness and long-term value.

5. Conclusions

This article has tested the main hypothesis that the relationship between capital structure and firm value is quadratic, implying the existence of an optimal capital structure. Levels below this optimum align with Modigliani & Miller's theory (1963), while higher levels support the trade-off theory and pecking order theory.

The results confirm the quadratic relationship between capital structure and firm value. For property companies, a general optimal capital structure exists, as well as specific optimal structures concerning different terms of debt. Specifically: (1) Firm value increases as debt ratio rises, but this increase only extends to 53.8049% and (2) Firm value increases with higher short-term and long-term debt ratios, but these ratios reach their respective optimal levels at 32.7732% and 73.9287%. Beyond these thresholds, firm value begins to decline.

These results highlight a preference among property firms for relying on short-term debt rather than long-term debt to finance their operations. Consequently, firms have various avenues to access short-term debt, including interest-paying finance through credit institutions and non-interest-paying finance via deferred payment purchase policies or deposits from customers. However, it is also advisable for firms to consider utilising long-term debt more extensively. Statistical findings indicate that the long-term debt ratio remains relatively low. This type of capital source typically features an extended repayment term, making it well-suited for investments in fixed assets that align with higher operational standards, meeting the escalating demands of customers and enhancing the competitive positioning of firms in the market. Furthermore, such investments can lead to shortened production cycles, cost savings, and ultimately contribute to improved business performance and firm value.

COMPETING INTERESTS

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

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Effects of water scarcity awareness and climate change belief on recycled water usage willingness: Evidence from New Mexico, United States

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Abstract:

The global water crisis is being exacerbated by climate change, even in the United States. Recycled water is a feasible alternative to alleviate the water shortage, but it is constrained by humans' perceptions. The current study examines how residents' water scarcity awareness and climate change belief influence their willingness to use recycled water directly and indirectly. Bayesian Mindsponge Framework (BMF) analytics was employed on a dataset of 1831 residents in Albuquerque, New Mexico, an arid inland region in the US. We discovered that residents' willingness to use direct recycled potable water is positively affected by their awareness of water scarcity, but the effect is conditional on their belief in the impacts of climate change on the water cycle. Meanwhile, the willingness to use indirect recycled potable water is influenced by water scarcity awareness, and the belief in climate change further enhances this effect. These findings implicate that fighting climate change denialism and informing the public of the water scarcity situation in the region can contribute to the effectiveness and sustainability of long-term water conservation and climate change alleviation efforts.

Keywords: **arid region, drinking, eco-surplus culture, Mindsponge Theory, potable water, sustainable development, water shortage.**

Classification numbers: **4.1, 7**

1. Introduction

Water, in general, and potable water, in particular, is indispensable for human beings. Water demand has rapidly increased due to industrialization, urbanization, population growth, and economic development. Due to the excessive water usage, water resources have depleted swiftly. Water scarcity, generally referred to as the condition in which the demand for water by all sectors exceeds the water supply, has become an alarming global issue, drawing much political and public concern.

According to a report published by UNESCO on behalf of UN-Water [1], it is estimated that about 2 billion

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individuals, accounting for 26% of the global population, lack access to clean drinking water. Additionally, the report highlights that around 3.6 billion people, constituting 46% of the population, do not have access to adequately managed sanitation facilities. Some projections suggest that the number of worldwide urban residents experiencing water scarcity is anticipated to increase twofold, rising from 930 million in 2016 to a range of 1.7 to 2.4 billion by 2050. The increasing prevalence of severe and prolonged droughts also exerts pressure on ecosystems, resulting in grave ramifications for various plant and animal species [1]. As a result, the solution for water scarcity and quality is set as the main focus in multiple international, regional, and national organizations, associations, committees, and conferences [2, 3].

Global climate change significantly contributes to the current water scarcity crisis. It is a worldwide issue that impacts the access and quality of water resources, especially potable water sources [4, 5]. Climate change affects the world's water in complex ways. Infectious disease epidemics frequently coincide with extreme weather events, as microorganisms, vectors, and reservoir animal hosts take advantage of the altered social and environmental conditions resulting from such occurrences [6]. Rising temperatures can also lead to the rise in seawater levels and the intrusion of salt water into the coastal aquifers, besides facilitating the rise of deadly pathogens in freshwater sources, making the water dangerous for people to drink [7]. Climate change can exacerbate water stress in areas with minimal water resources, leading to increased competition for water and even conflicts [8]. In a recent study, X. Fan, et al. (2023) [9] suggest climate change can also affect pipe failures in the United States (US).

The water stress in the Southwest of the US has intensified in recent years due to more frequent droughts, more variable rainfall, and less reliable water supplies induced by climate change [10, 11]. A recent analysis by researchers from the World Resources Institute shows that the Colorado River Basin is one of the world's most water-stressed regions, with the water stress level similar to arid countries like Saudi Arabia and Qatar. Among seven States in the Colorado River Basin, Arizona is the most severely water-stressed State, while New Mexico, where the study site is located, is ranked second [12]. It is estimated that the Colorado River's flow has declined by around 10.3% because of anthropogenic increases in both temperature and CO_2 since 1880 [13]. In 2022, more than 90% of the New Mexico region suffered from the severe drought caused by the greatest wildfire in state history and some of the driest months ever recorded [14, 15].

With the looming challenges of water scarcity worldwide, unconventional water resources are considered viable alternatives to freshwater, especially in arid and semi-arid areas [16]. These water resources require new technologies and specialized processes to convert them into safe and usable states to complement human life [17, 18]. Z. Karimidastenaei, et al. (2022) [16] have identified twelve general types of these unconventional resources, with desalination of saltwater and treatment of wastewater being the most prominent methods. The improvement of technology, analytical methods, and microbiology has allowed wastewater to be recyclable for irrigation practices and indoor applications such as toilet flushing [19, 20]. In certain countries and regions, recycled water quality has reached the drinking water standard [21]. As such, various countries around the globe have implemented multiple initiatives to encourage the use of recycled wastewater to alleviate the burden on freshwater [19].

Yet, public perceptions and acceptance of recycled wastewater are identified as one of the most significant barriers against its usage rather than the technology itself [19]. In studying the public response to the usage of reclaimed water, K.J. Ormerod, et al. (2013) [20] found that trust in water authorities can significantly impact public attitudes towards recycled water. In exploring the role of emotions in water reuse behavior, Y. Gao, et al. (2019) [21] found that the perceptions of recycled water can initiate positive and negative feelings, significantly affecting the initiation, formation, and sustainability of recycled water behavior.

A thorough review by K.S. Fielding, et al. (2018) [22] identified socio-demographic characteristics, psychological elements, and water characteristics as three major predictors of public acceptance. While most studies found mixed results about how different socio-demographic groups embrace recycled water, studies focused on mental processes found homogenous trends. Specifically, high health risk perceptions led to low acceptance of recycled water. Trust in authorities also appeared as a critical factor. Trust in authorities might help alleviate the risk perceptions, which could influence acceptance of proposed water management schemes.

Several studies investigate the link between perceived water scarcity and recycled water acceptance, but the results seem inconsistent. C. Hou, et al. (2021) [23]

discovered that the disclosure of information regarding regional water shortages and the promotion of public awareness regarding the protection of water environments are positively associated with the willingness to use recycled water. Additionally, disclosing regional water shortage information indirectly influences public acceptance of recycled water by shaping their awareness of water environment protection. Meanwhile, two studies found no significant relationship [22, 24, 25]. The discrepant findings hint at other factors moderating the relationship between water scarcity awareness and recycled water acceptance. Moreover, while general environmental concerns are found to be related to greater acceptance of recycled water, few studies have investigated the effects of climate change beliefs on recycled water acceptance.

Due to water scarcity in the city of Albuquerque, New Mexico, the Albuquerque-Bernalillo County Water Utility Authority (ABCWUA), the sole provider of water and wastewater services to the city, has considered direct and indirect potable water reuse in its 100-year water plan [26]. However, studies examining factors supporting the implementation of direct and indirect potable water reuse remain limited. Some analyses were performed [27-29], but they did not explore the potential effect of water scarcity awareness and the moderation effect of climate change belief on residents' willingness to use recycled water. Insights from the current study can benefit ABCWUA, water planners, and policymakers in the region to improve the effectiveness of recycled water usage programs.

Therefore, our study aims to fill in these gaps by performing BMF analytics on a dataset of 1831 residents in Albuquerque, New Mexico, USA, for the following objectives:

• Examine the effect of residents' water scarcity awareness on their willingness to use direct and indirect recycled water.

• Examine the moderation effect of the belief in climate change on the relationship between the residents' water scarcity awareness and their willingness to use direct and indirect recycled water.

The study consists of five main sections. The first section introduces the study's importance, rationale, and objectives. The second section elaborates on the theoretical foundation of the model construction (i.e., Mindsponge Theory) and the materials and methods employed. The third section presents the estimated results using the Bayesian analysis, while the final section discusses the implications of the study's findings.

2. Methodology

2.1. Theoretical foundation

The Mindsponge Theory was utilized as the theoretical foundation for constructing models in this study. The theory was initially the mindsponge mechanism developed by Q.H. Vuong, et al. (2015) [30] to explain how top managers absorb new values and eject waning ones out of their mindset. The term "mindsponge" is coined by analogizing the mind to a sponge, which expels unsuitable values and absorbs new ones compatible with its core values [30]. Capitalizing on the new evidence discovered in life, neuro-, and ecological sciences, the mechanism was further developed into Mindsponge Theory to explain better a wider range of processing systems and socio-psychosocial phenomena [31].

The Mindsponge Theory offers a dynamic perspective on information processing that can help connect the socio-psychological phenomena with the fundamental level of human cognition (e.g., neurons), address intricate aspects of human thinking, and elaborate and enhance existing psychological and social theories and frameworks.

Theory of Planned Behavior (TPB) is a well-known psychological theory that explains how humans' beliefs are linked to behaviors [32, 33], so it has been employed to study behaviors related to conservation, including water conservation [34-37]. Specifically, TPB was recently used to explore the effects of attitudes, subjective norms, perceived behavioral control, and connectedness to water on behavioral intent related to landscape irrigation among Florida, Georgia, and Alabama residents. K.E. Gibson, et al. (2023) [38] found that subjective norms, perceived behavioral control, and connectedness to water were positive predictors of behavioral intent and actual behaviors related to water conservation. Although TPB is an effective theory to explain the connection between beliefs, intentions, and behaviors, it lacks the ability to deal with the dynamics of human thinking that we aimed to study in this study: the non-linear relationship between awareness of water scarcity and recycled water usage willingness (moderated by the climate change belief). Thus, the Mindsponge Theory, with its capability to explain the continuous dynamic information absorption-process-ejection mechanisms of the mind, is expected to complement the TPB in reasoning the cognition and behavior-shifting processes.

Mindsponge Theory includes two primary spectrums [31]: The mind, an information collection and processing unit, and the broader environment, encompassing systems like the Earth system, social systems, and the mind. The mind's primary objective is to ensure its system's prolongation in one way or another, including survival, growth, and reproduction. Conceptually, the mind comprises three major components: the mindset, buffer zone (comfort zone), and multi-filtering system. The mindset is defined as a set of highly trusted information (or core values), while the buffer zone temporarily holds information for the multi-filtering process.

The multi-filtering system serves two key functions. When information enters the mind due to the absorption through the sensory systems, it undergoes two processes. Information consistent with the core values is integrated. However, suppose new information significantly deviates from core values. In that case, it goes through a differentiation process, evaluating the cost and benefit of the information for subsequent acceptance, rejection, or storage for later evaluation. Generally, if new information is seen as potentially beneficial, it is accepted into the mindset, influencing subsequent thinking and behaviors. If it is perceived as costly, it is likely rejected. Information with ambiguous values is stored in the buffer zone for later assessment when sufficient information is available [39].

From the mindsponge information-processing perspective, the residents' awareness of water scarcity issues can be deemed equivalent to information related to water scarcity issues stored within the mind. With a larger amount of such information in the mind, subsequent information processes, thinking, and behaviors are more likely to be affected. In other words, when residents perceive the water scarcity issues in the region, they are more likely to accept solution-related information into the mindset to minimize the risk of water shortage, that is, using water recycled water directly and indirectly. Therefore, we assume that higher awareness of water scarcity is positively associated with the willingness to recycled water usage.

However, core values (beliefs) can also affect the information process. Awareness of water scarcity does not necessarily make people think the water shortage is a persisting problem, but it depends on the situation. If people believe in climate change's impacts on the water cycle, they might consider water scarcity a persisting problem. Otherwise, the water scarcity might be perceived as temporary and to recover in the future. As a result, we also assumed that the climate change belief moderates the relationship between awareness of water scarcity and recycled water usage willingness.

These assumptions will be tested through models constructed in the following subsection.

2.2. Model construction

2.2.1. Variable selection and rationale

Data used in the current study resulted from a large-scale public survey delivered via mail to a random sample of 4000 water-utility account holders in Albuquerque, New Mexico, USA. The survey collection was conducted by L.N. Distler, et. al. (2020c) [40] in collaboration with the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) (2016) [26], the sole supplier of water and wastewater services to the broader Albuquerque metropolitan region with over 600,000 water users. The dataset and its description have been peer-reviewed and published in Data in Brief [40]. The dataset was also employed in other studies about water consumption behaviors in Albuquerque, New Mexico [27-29].

The survey queried ABCWUA account holders about their water knowledge, water consumption habits, attitudes toward water-related issues, and demographic data. The survey was available in four versions, with the only difference being on page five: Version 1 was the control and had no additional content, whereas the other three versions each had a different collection of educational materials on page five since specific sorts of educational materials are thought to alter perceptions and views relating to water reuse. Versions 2, 3, and 4 supply information on "Water sources and reliable supplies", "Environmental benefits of water reuse", and "The urban water cycle", as defined in the codebook and survey instrument, respectively.

Eight focus groups and 12 debriefing sessions were conducted with individual members of the studied population to design the survey. The focus groups took place in July, October, and November of 2016, while the debriefing sessions took place in August, October, and November of the same year. Eight 90-minute focus groups with 7-10 individuals each help test prototype survey questions to improve the survey content. Participants had to be at least 18 years old and ABCWUA clients to be included. L.N. Distler, et al. (2020c) [40] tested the draft survey on 12 individual members of the sample population in a series of one-on-one survey debriefing sessions halfway through and following the completion of the focus groups. Debriefings helped researchers to check that survey questions and materials were accurately evaluated and comprehended, as well as assess how long it would take to finish the survey.

A random sample of 4,000 accounts was drawn from a database of over 180,000 residential accounts maintained by ABCWUA. Customer names were removed from the sample to safeguard respondent's privacy, and addresses were deleted once data analysis was completed. Each potential survey participant was assigned a unique random code for anonymous tracking of responses. The sample proportions in each quadrant were compared to those in the customer accounts log to confirm that the sample and population proportions matched (within 1%). The survey was collected through mail and Survey Monkey (online).

The database also supplied information regarding the city quadrant where each customer resided. The sample's quadrant proportions were ensured to closely match those in the overall customer accounts database (within a 1% margin). The survey was administered by mail due to the availability of physical addresses, although respondents were offered the option to complete it online using Survey Monkey through a mailed invitation. As the survey was self-reported, we acknowledged some potential perceptual biases. Furthermore, due to its limitation to the city of Albuquerque, the sample size could not adequately represent regions of the United States that possess distinct geographical and climatic attributes.

A preliminary test was conducted on 200 water utility customers randomly selected to validate the survey instrument. The pretest had two purposes: it estimated the expected response rate for the main survey, and it evaluated the efficacy of the survey administration techniques. Based on the pretest's results, the survey instrument and administration process were refined and sent to a random sample of 4,000 ABCWUA account holders. Eventually, 1831 responses were obtained, with a response rate of 46%.

Four variables retrieved from the dataset were used in this study to build the model: two outcome variables and two predictor variables. Two outcome variables are *DPR_WILL_3* and *IPR_WILL_3*. These two variables represent the respondents' willingness to use recycled water directly and indirectly. *SCARCITY_AWARE* and *CLIMATE* are two predictor variables. While *SCARCITY_AWARE* reflects the respondents' awareness level of water scarcity, *CLIMATE* reflects whether the respondent believes in climate change. Detailed descriptions of these variables are shown in Table 1.

Table 1. Description of variables.

Variables	Description	Type of variable	Value	Details
DPR_WILL_3	Willingness to accept direct potable reuse	Binary*	0 = Unwilling 1 = Willing	Unwilling=506 (27.64%) Willing=856 (46.75%)
IPR_WILL_3	Willingness to accept indirect potable reuse	Binary*	0 = Unwilling 1 = Willing	Unwilling=321 (17.53%) Willing=988 (53.96%)
SCARCITY_AWARE	Awareness of water scarcity issues	Numerical	1 = Not at all aware 2 = Slightly aware 3 = Moderately aware 4 = Very aware 5 = Extremely aware	Mean=3.24 Standard deviation=1.02
CLIMATE	Belief in the impact of climate change on the water cycle in the next 10-40 years	Binary	0 = No 1 = Yes	No = 265 (14.47%) Yes = 1298 (70.89%)

*: Respondents expressing neutral responses to direct or indirect potable reuse are coded as 'Not Applicable' and removed from the analysis.

2.2.2. Statistical model

The first model was constructed to examine the effects of *SCARCITY_AWARE* on *DPR_WILL_3* and the moderation effect of *CLIMATE*:

$$DPR\_WILL\_3 \sim \text{normal}\left(\log\left(\frac{\mu_i}{1-\mu_i}\right), \sigma\right)$$

$$\log\left(\frac{\mu_i}{1-\mu_i}\right) = \beta_0 + \beta_1 * SCARCITY\_AWARE_i + \beta_2 * SCARCITY\_AWARE_i * CLIMATE_i$$

$$\beta \sim normal(M, S)$$

The probability around the mean $\log\left(\frac{\mu_i}{1-\mu_i}\right)$ is determined by the shape of the normal distribution, where the width of the distribution is specified by the standard deviation σ. μ_i indicates the probability that the residential account holder *i* willing to accept drinking recycled water directly. $SCARCITY\_AWARE_i$ indicates the awareness level of the residential account holder *i* about water scarcity issues. $CLIMATE_i$ indicates whether the residential account holder *i* believes in the impact of climate change on the water cycle. Model 1 has four parameters: the coefficients, β_1 and β_2, the intercept, β_0, and the standard deviation of the "noise," σ. The coefficients of the variables are distributed as a normal distribution around the mean denoted *M*, with the standard deviation denoted *S*. The logical network for Model 1 is presented in Fig. 1.

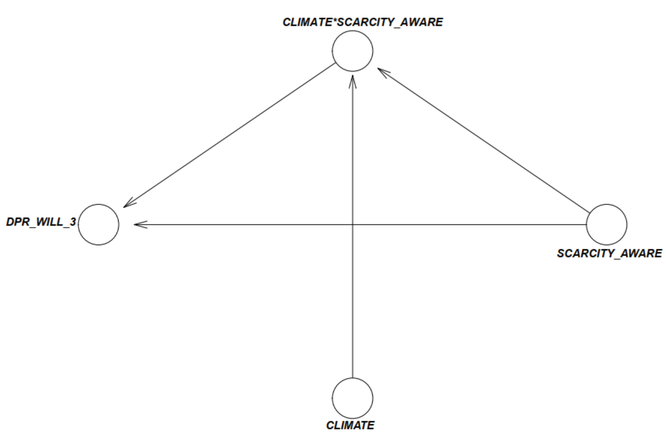

Fig. 1. Model 1's logical network.

The second model was constructed similarly to Model 1 but with the outcome variable replaced as *IPR_WILL_3*.

$$IPR\_WILL\_3 \sim \text{normal}\left(\log\left(\frac{\mu_i}{1-\mu_i}\right), \sigma\right)$$

$$\log\left(\frac{\mu_i}{1-\mu_i}\right) = \beta_0 + \beta_1 * SCARCITY\_AWARE_i + \beta_2 * SCARCITY\_AWARE_i * CLIMATE_i$$

$$\beta \sim normal(M, S)$$

IPR_WILL_3 indicates the probability that the residential account holder willing to accept drinking recycled water indirectly. Model 2's logical network is similar to that of Model 1, shown in Fig. 1.

2.3. Analysis and validation

The BMF analytics is a method combining the strengths of Mindsponge Theory and Bayesian analysis for analyzing data in cognitive, psychological, and social research [39, 41]. It is particularly useful in studying psychological processes and mechanisms in several fields, including but not limited to mental health, psychological adaptation, and environmental psychology [42-50],

BMF was applied in this research for several reasons. First, the method combines the reasoning strengths of Mindsponge Theory with the inferential advantages of Bayesian analysis [41]. Second, Bayesian inference evaluates all attributes probabilistically, allowing reliable predictions with parsimonious models that help improve predictability [51-53]. Third, Bayesian inference enables users to use credible intervals for result interpretation instead of the dichotomous decision using *p*-value, which is suggested to be one of the leading causes behind the reproducibility crisis [54, 55].

There are two main components in BMF analytics: Mindsponge-based model construction and Bayesian analysis. The former component is presented in subsection 2.1, while the second component is explained here. Bayesian analysis comprises five main steps [39]:

1) Model construction.

2) Prior selection.

3) Model fitting.

4) Result diagnosis and interpretation.

5) Model comparison.

In the current study, we aim to test the model constructed based on Mindsponge-Theory-induced assumptions, so step 5 was not implemented. The models built based on Mindsponge Theory are presented in subsection 2.2.2. As the nature of this study is exploratory, models were constructed with uninformative priors or a flat prior distribution to provide as little prior information as possible for model estimations.

After fitting the constructed models, we employed the Pareto-smoothed importance sampling leave-one-out (PSIS-LOO) diagnostics to check the model's goodness of fit. LOO is computed as follows [56, 57]:

$$LOO = -2LPPD_{LOO} = -2\sum_{i=1}^{n} log \int p(y_i|\theta)p_{post(-i)}(\theta)d\theta$$

The posterior distribution, denoted as $p_{post(-i)}(\theta)$, is calculated based on the data minus data point *i*. In the R loo package, the PSIS method was used to compute leave-one-out cross-validation *k*-Pareto values. Commonly, the model is regarded as being fit when a model's *k* values are below 0.5.

Then, we verified the convergence of Markov chains statistically using the effective sample size (*n_eff*) and the Gelman-Rubin shrink factor (*Rhat*) and visually by trace plots. The Markov chain central limit theorem holds if the Markov chains converge, and the estimated results become reliable and qualified for interpretation. The *n_eff* value represents the number of iterative samples that are not autocorrelated during stochastic simulation. If *n_eff* is bigger than 1000, it is generally considered that the Markov chains are convergent, and the effective samples are sufficient for reliable inference [58]. The *Rhat* value is alternatively referred to as the potential scale reduction factor or the Gelman-Rubin shrink factor [59]. It should not exceed 1.1 for convergence to be achieved. Commonly, the model is considered convergent if *Rhat*=1.

We employed the bayesvl and the ggplot2 R packages to conduct Bayesian analysis and produce appealing visualizations [60]. The whole code and dataset employed for this research have been deposited in the Open Science Framework to ensure openness, facilitate future replication, and contribute to lowering scientific costs [61].

3. Results

3.1. Model 1

Model fitting was performed on R version 4.2.1 ("Vigorous calisthenics") using four Markov chains, each consisting of 5000 iterations, with 2000 used for the warmup period. The simulation took 201 s to be completed. The simulated results are displayed in Table 2. First, we checked the goodness of fit between the constructed model and the dataset using the PSIS-LOO test. The test's estimated *k*-values are shown in Fig. A1, which shows that most of the *k*-values are below 0.05. These *k*-estimates suggest that the model fits the data reasonably well.

Table 2. Model 1's estimated results.

Parameters	Mean	Standard deviation	*n_eff*	*Rhat*
Constant	0.47	0.24	4085	1
SCARCITY_AWARE	0.03	0.08	3638	1
*SCARCITY_AWARE*CLIMATE*	0.09	0.05	4920	1

Source: Generated by authors using the bayesvl R package.

Then, we proceeded with diagnosing the Markov chain convergence. All the coefficients' *n_eff* values are greater than 1000, and the *Rhat* values are equal to 1, implying that the model's Markov chains have converged well.

We also visualized the trace plots to confirm the Markov chain's convergence (or the Markov chain central limit theorem). Fig. 2 illustrates the coefficients' Markov chains are well mixed around an equilibrium, which is a good signal of convergence.

The simulated results manifest the positive association between *SCARCITY_AWARE*CLIMATE* and *DPR_WILL_3* ($M_{SCARCITY\_AWARE}$=0.09 and $S_{SCARCITY\_AWARE}$=0.05). The association is reliable as its posterior distribution

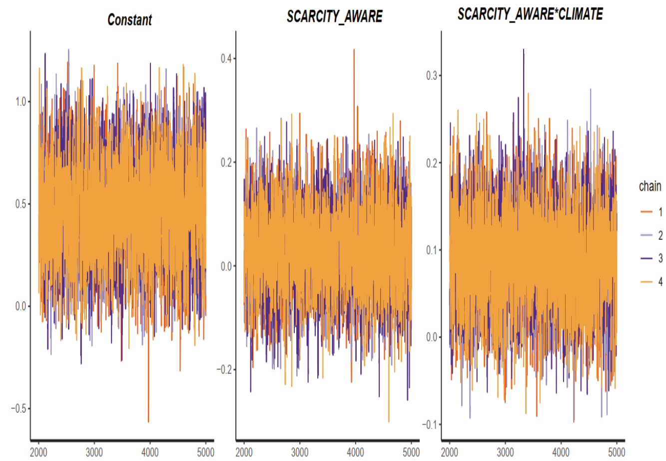

Fig. 2. Model 1's trace plots. Source: Generated by authors using the bayesvl R package.

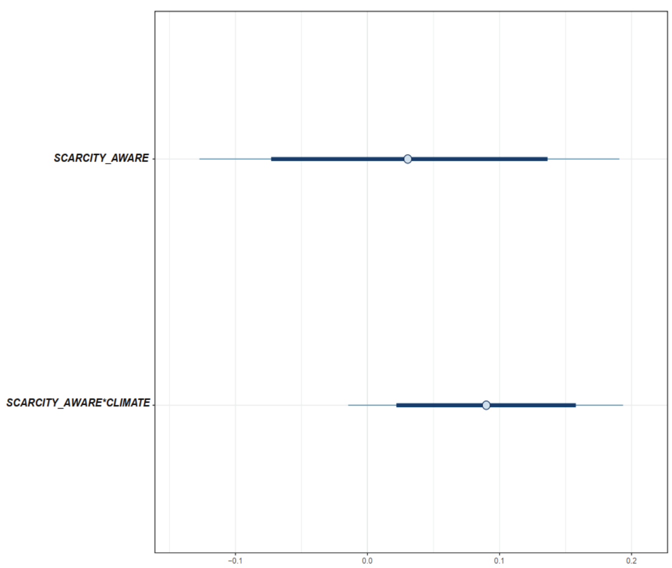

Fig. 3. Model 1' s posterior distributions. Source: Generated by authors using the bayesvl R package.

is located entirely on the positive side of the *x*-axis (Fig. 3). Meanwhile, *SCARCITY_AWARE* has an ambiguous effect on *DPR_WILL_3* ($M_{SCARCITY\_AWARE*CLIMATE}$=0.03 and $S_{SCARCITY\_AWARE*CLIMATE}$=0.08).

To aid the result interpretation, we estimated the residents' probability of being willing to use recycled water directly based on the posterior coefficients of the model. Fig. 4 shows the illustration, where the *y*-axis represents the probability of being willing to use direct recycled water, and the *x*-axis represents the awareness level of water scarcity. The colored lines distinguish whether the people believe in climate change or not. As can be seen,

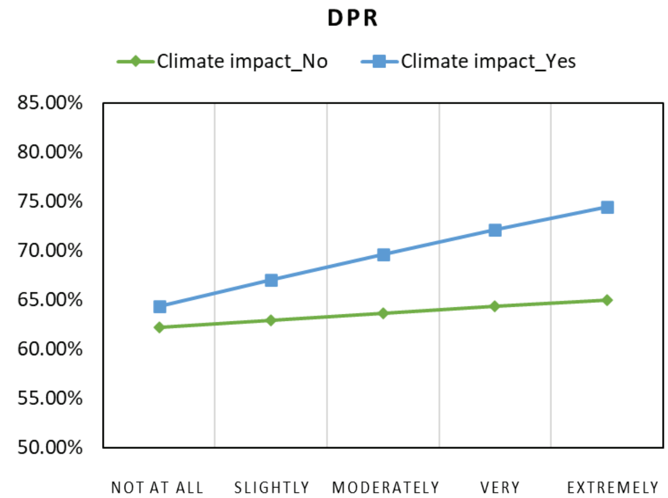

Fig. 4. Probability of being willing to use direct recycled water. Source: Generated by authors using the coefficients' mean values.

for people without the belief in climate change's impact on the water cycle, the probability of being willing to use direct recycled water is not affected by the awareness level of water scarcity. Meanwhile, the awareness level of water scarcity is positively associated with the probability of being willing to use it when the resident believes in climate change's impact.

3.2. Model 2

Model 2 was fitted using a similar setup to Model 1 (i.e., iterations, warmup period, Markov chains). The simulation took 205 seconds to be completed; its results are shown in Table 3. The PSIS-LOO test again shows all *k*-values are below 0.012 (Fig. A2). Such *k*-estimates suggest the model fits the data well.

Table 3. Model 2's estimated results.

Parameters	Mean	Standard deviation	n_eff	Rhat
Constant	0.60	0.25	4437	1
SCARCITY_AWARE	0.12	0.09	3970	1
*SCARCITY_AWARE*CLIMATE*	0.05	0.06	5015	1

Source: Generated by authors using the bayesvl R package.

We also visualized the trace plots to confirm the Markov chain's convergence. Fig. 5 illustrates the mixing of all coefficients' Markov chains around an equilibrium, representing a good convergence signal.

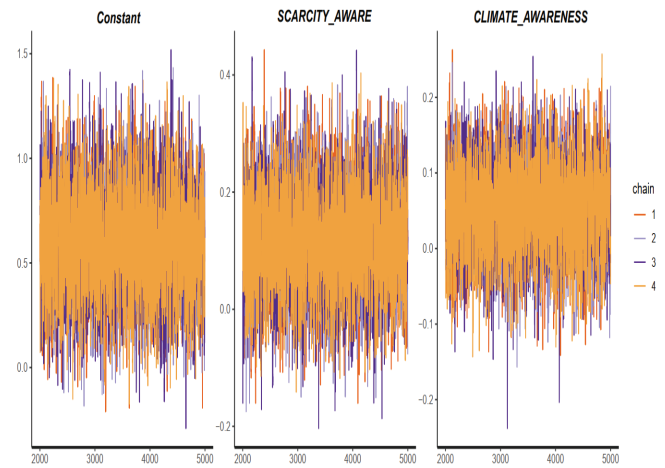

Fig. 5. Model 2's trace plots. Source: Generated by authors using the bayesvl R package.

The simulated results manifest the positive effects of *SCARCITY_AWARE* ($M_{SCARCITY\_AWARE}=0.12$ and $S_{SCARCITY\_AWARE}=0.09$) and *SCARCITY_AWARE*CLIMATE* ($M_{SCARCITY\_AWARE*CLIMATE}=0.05$ and $S_{SCARCITY\_AWARE*CLIMATE}=0.06$) on *IPR_WILL_3*. The coefficients' posterior distributions are visualized in Fig. 6, confirming the high reliability of the association between *SCARCITY_AWARE* and *IPR_WILL_3* as its posterior distribution is located entirely on the positive side of the *x*-axis. Meanwhile, the effect of *SCARCITY_AWARE*CLIMATE* on *IPR_WILL_3* is only moderately reliable because a small portion of its distribution is still situated on the negative side of the *x*-axis.

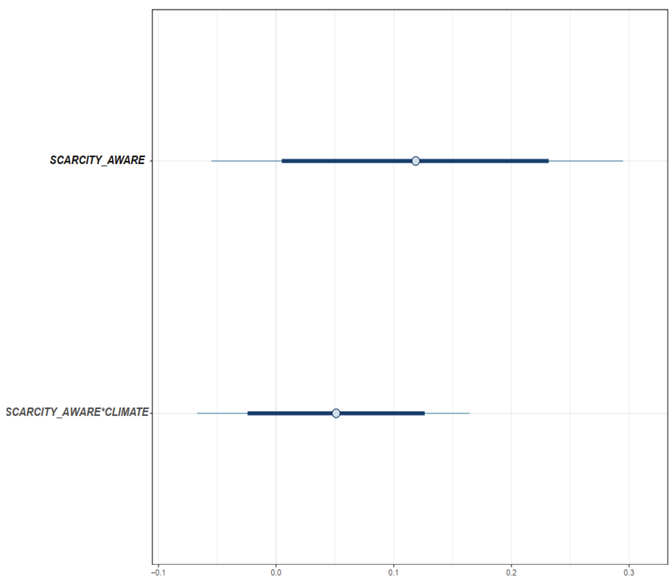

Fig. 6. Model 2's posterior distribution. Source: Generated by authors using the bayesvl R package.

Figure 7, visualized based on the estimated parameters of Model 2, illustrates the residents' probability of being willing to use recycled water indirectly. It shows that the willingness to use indirect recycled water increases regarding the awareness of water scarcity. The effect of water scarcity awareness on indirect recycled water usage willingness is positively moderated by the belief in climate change's impact on the water cycle.

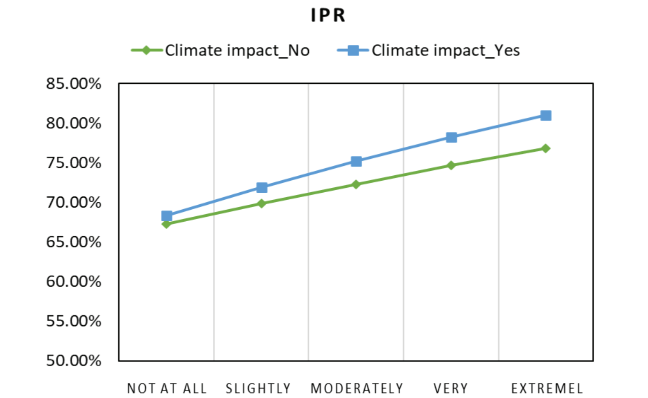

Fig. 7. Probability of being willing to use indirect recycled water. Source: Generated by authors using the coefficients' mean values.

4. Discussion

The current study employed BMF analytics to examine the effect of residents' awareness of water scarcity on the willingness to use direct and indirect recycled potable water and whether the belief in climate change moderated the relationship. Analyzing the dataset of 1831 residents in New Mexico, USA, we found that for direct recycled potable water, the awareness of water scarcity only has a positive impact on the usage willingness when the residents believe in climate change. Meanwhile, for indirect recycled potable water, water scarcity awareness has a positive impact on recycled water usage willingness, which is further amplified by the belief in climate change.

These results confirm our Mindsponge-based assumptions that the residents' water scarcity awareness (information stored in the mind) can influence their recycled water usage willingness (an outcome of the information process), but the effect is conditional on their status of belief in climate change (core value within the mindset). The person's belief in climate change will make them more likely to perceive the uncertainty of water supply in the future, adding more perceived risks/costs to the water scarcity crises. When water scarcity is perceived to threaten the well-being of the person in the future, they will be more likely to seek, absorb, and accept solution-related information that helps alleviate the crises. As a result, recycled water usage ideation is more likely to emerge in people's minds, making them more willing to use direct and indirect recycled water.

Climate change belief is a crucial factor that moderates the relationship between water scarcity awareness and the emergence of recycled water usage ideation (subsequently, the usage willingness). However, climate change denialism is an existing problem in the US, hindering the efforts to motivate people to adopt sustainable water usage practices. People advocating climate change denialism reject scientific evidence of climate change or deny the role of humans as the cause of this crisis [62, 63]. Denialism is so pervasive that it is even embedded in political activities. For example, Florida Governor Ron DeSantis recently rejected $350 million in federal funds to tackle climate change [64]. If the climate change denialism issues are not appropriately addressed, they will negatively affect not only climate change but also the water crisis in the US. Besides climate change beliefs, other factors involving mindsets like trust, beliefs, core values, worldviews, etc., can possibly moderate the relationship between water scarcity awareness and the willingness to use recycled water. Therefore, exploring these moderators is a potential research direction for future research.

Practically, the current study's findings suggest that informing the public about the current water crises and climate change issues can help improve their recycled water usage willingness, facilitating the implementation of recycled water projects. Moreover, building an eco-surplus culture among residents is no less critical as it helps shift their perspectives to be more environment-centered [65]. Eco-surplus culture is defined as "a set of pro-environmental attitudes, values, beliefs, and behaviors that are shared by a group of people to reduce negative anthropogenic impacts on environments as well as conserve and restore nature" [66]. As a result of this culture, stakeholders' thinking, decision-making, and actions will be influenced to produce more positive values "to reduce negative anthropogenic impacts on environments as well as conserve and restore nature" [66]. Residents with an eco-surplus culture can even go beyond basic sustainability and actively participate in creating environmental surplus impacts, hence improving the effectiveness and sustainability of long-term water conservation and climate change alleviation efforts [67-69].

Deep leverage points are required to foster the transitions of residents' eco-deficit core values in the mindset to environmental-healing core values (or eco-surplus core values). One potential leverage point is restoring the connection between people's mental realms and the natural world [70, 71]. Such connections can be forged through many pathways: science, community knowledge systems, art, literature, games, and lived experience [49, 65, 70, 72]. For example, climate fiction (cli-fi) and climate horror (cli-hor) are some literary genres that are expected to raise awareness of climate change and environmental degradation (including water stress) [73, 74]. However, the literature should be used prudently to restore the mental links between people and the world with other sentient beings rather than creating intensely negative emotions that could lead to counterproductive effects on environmental engagement and persuasion [72, 74]. As artificial intelligence (AI) is gradually embedded in humans' lives, and urban generations can be deemed as digital native generations, AI can be harnessed as a useful tool to mitigate climate and environmental apathy (including apathy towards water stress) [75].

The study has several limitations, so we report them here for transparency [76]. First, residents' willingness to use recycled water was self-reported, so it might not necessarily correspond with actual behaviors. Moreover, the sample size is bound in the city of Albuquerque, so it does not represent areas with different geographical and climate characteristics in the US. Future studies should be conducted to validate the effects of water scarcity awareness and climate change belief on recycled water usage willingness in other areas with different geographical and climate characteristics.

5. Conclusions

The present research utilized BMF analytics to investigate how residents' awareness of water scarcity influences their willingness to utilize both direct and indirect recycled potable water and whether their belief in climate change moderates this relationship. Analyzing data from 1831 residents in New Mexico, USA, we discovered that regarding direct recycled potable water, awareness of water scarcity due to climate change only positively affects usage willingness when residents believe in climate change. Conversely, concerning indirect recycled potable water, awareness of water scarcity positively influences willingness to use recycled water, with this effect being magnified by belief in climate change. In practical terms, our study's findings imply that educating the public about current water crises and climate change issues can enhance their willingness to use recycled water, thereby facilitating the implementation of recycled water projects. Furthermore, fostering an eco-surplus culture among residents is crucial, as it encourages them to adopt more environmentally-centered perspectives. Residents with an eco-surplus culture may even exceed basic sustainability practices and actively contribute to generating environmental surplus impacts, thereby enhancing the effectiveness and sustainability of long-term water conservation and climate change mitigation efforts.

APPENDICES

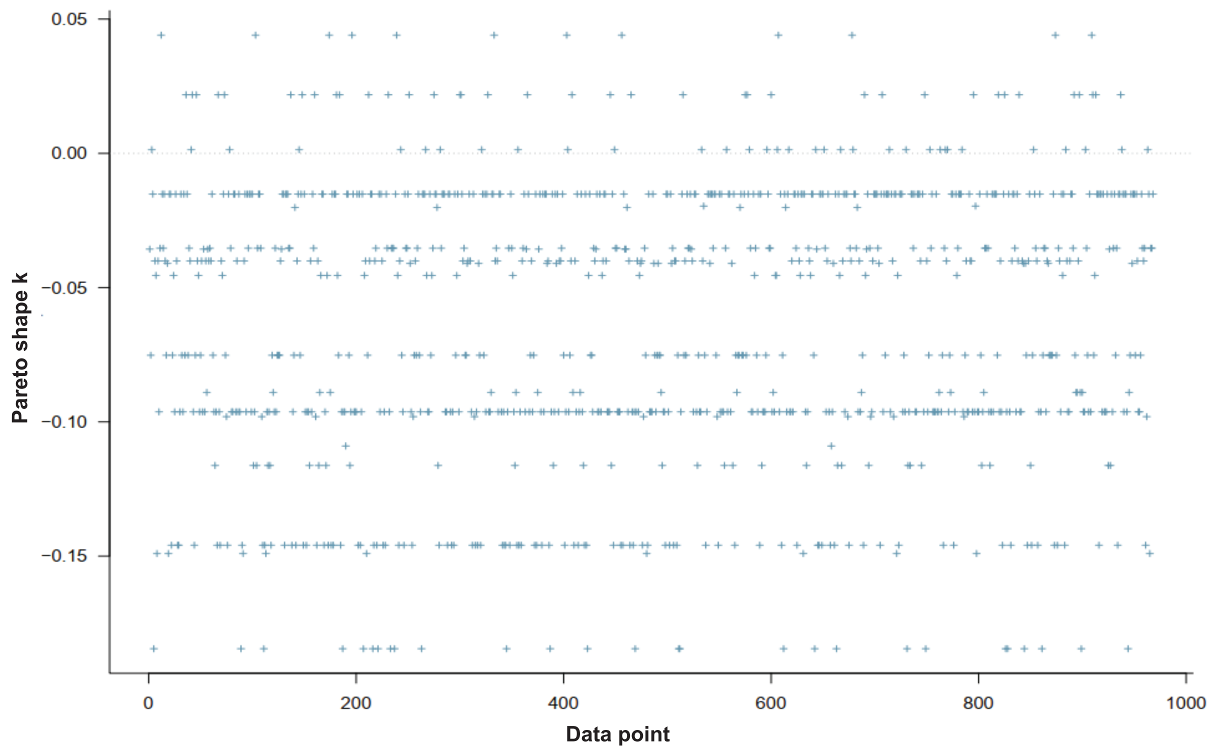

Fig. A1. Model 1's PSIS-LOO test.

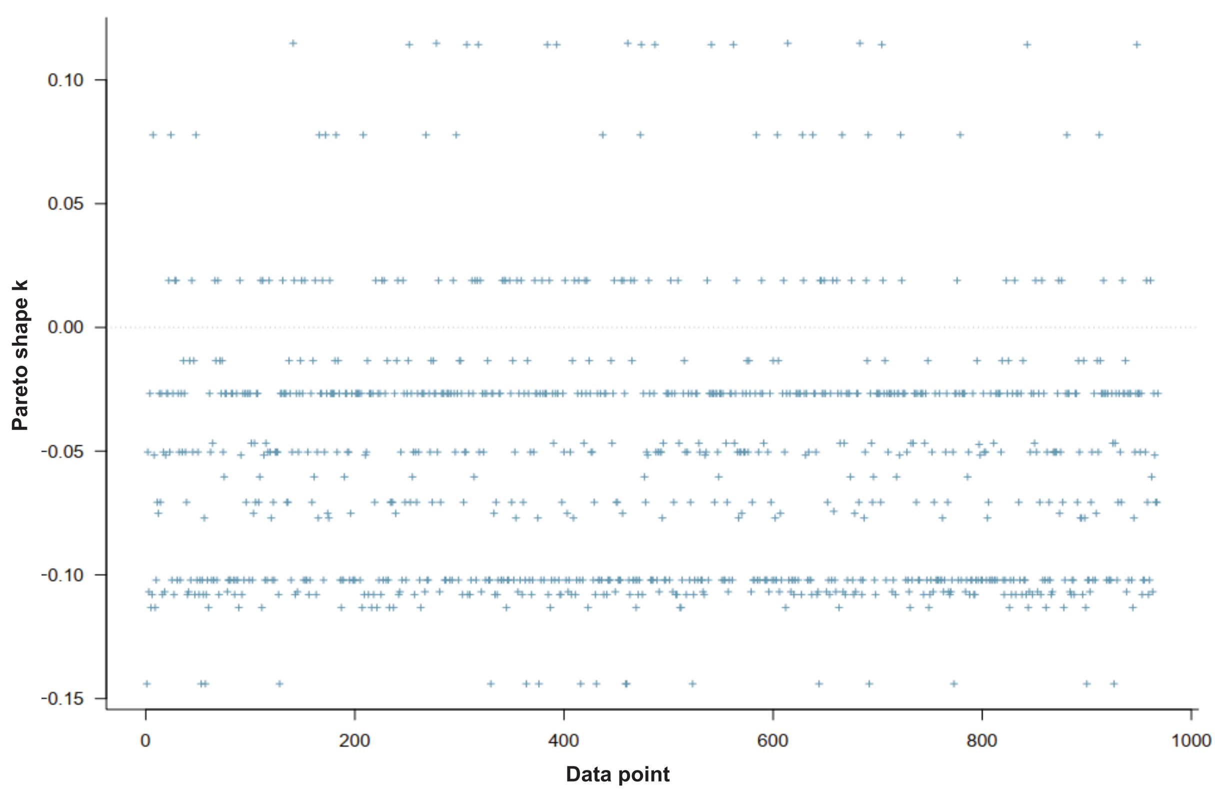

Fig. A2. Model 2's PSIS-LOO test.

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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Food security of impoverished households in Tuong Duong district, Nghe An province: The HFIAS measurement

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Abstract:

While Vietnam demonstrates overall national food security, many households, particularly in challenging areas such as Tuong Duong district, Nghe An province, continue to grapple with food insecurity. This article explores the food security status of impoverished households in Tuong Duong district, employing the Household Food Insecurity and Access Scale (HFIAS) for assessment. A survey of 125 households across two communes within the district provided insights into the prevalence of household behaviours indicating insufficient quality and quantity of food, as well as anxiety and uncertainty regarding insecure access to food supplies. The majority of respondents were categorised as "moderately food insecure" or "mildly food insecure". Key determinants of food security for this impoverished population, such as human, natural, physical, social, and financial capital, were identified. The findings suggest that policy priorities should focus on: (1) Expanding the scale of agricultural production and irrigation systems; (2) Enhancing support activities related to agricultural production for households; (3) Broadening the livelihood framework; (4) Developing infrastructure to improve market accessibility for the impoverished population in the district.

Keywords: **extremely difficult communes, food security, Household Food Insecurity and Access Scale (HFIAS), impoverished households, the poor.**

Classification numbers: **4.1, 7**

1. Introduction

The persistent challenges of food insecurity, poverty, and malnutrition represent critical impediments to human welfare in both developing and developed nations. These challenges encompass increasing food availability, feeding burgeoning populations, enhancing nutritional status, and alleviating poverty, all of which continue to pose complex dilemmas for policymakers [1].

In the 1970s, the concept of food security primarily focused on the national food supply, questioning whether a country possessed sufficient resources to meet its population's dietary energy requirements [2]. Some interpreted national food security as synonymous with self-sufficiency, implying a nation's ability to produce the food needed by its populace [3]. However, the paradigm has recently shifted to emphasise access to food at both the household and individual levels [4-7]. Hence, food security is now defined as the condition where all individuals have consistent physical, social, and economic access to adequate, safe, and nutritious food, satisfying their dietary needs and preferences for an active and healthy life [5, 6]. This definition was later expanded by the Food and Agriculture Organization (FAO) to encompass considerations of nutritional value and food preferences. The extent to which individual food security contributes to optimal nutrition is influenced by various non-food factors, including sanitation, water quality, prevalence of infectious diseases, and access to primary healthcare. This underscores the intricate interplay between food security and nutrition security, considering both the quality and quantity of food access.

In Vietnam, the literature on food security has predominantly concentrated on the national perspective, as evidenced by studies cited in [8-10]. Research focusing on food security at the individual or household level remains relatively scarce [7, 11]. Notably, Tuong Duong district - one of the three poorest districts in Nghe An province and ranking among the fifty-six most impoverished districts nationwide, has received limited attention in this context [4]. Fifteen of the district's eighteen administrative communes are categorised as exceptionally poor, falling under Program 135 - a socio-

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economic development initiative targeting extremely challenging communes in ethnic minority and mountainous regions of Vietnam. Similar to other developing nations, policies prioritizing poverty alleviation are emphasized due to their relationship with environmental degradation [5].Consequently, food insecurity has emerged as a significant challenge, particularly in the context of protecting the Reserve area. Despite the crucial importance of addressing food security in safeguarding this area, prior research has often neglected this aspect. Therefore, there is an urgent need for studies focusing on food security among the impoverished population in the district.

Among various measures of food security, the Household Food Insecurity and Access Scale (HFIAS) is a prominent tool, to identifyaspects of food insecurity, including diminished access to both the quantity and quality of food. It further investigates the psychosocial implications of anxiety and uncertainty surrounding food security, which negatively affect health and wellbeing. Owing to its proven effectiveness and applicability in various contexts, particularly impoverished regions [6], this study employs the HFIAS measurement to assess the food security of poor households in Tuong Duong district. The study objective is to derive insights from the findings to bolster food security in the district.

2. Methodology

2.1. Description of study areas

Tuong Duong is a mountainous district located in the western part of Nghe an province. It is also among the districts listed within the Western Nghe An Biosphere Reserve by UNESCO. The district is situated approximately 200 km from Vinh City and 90 km from the Nam Can border gate. It shares a 58 km border with the Lao People's Democratic Republic.

Tuong Duong encompasses a natural land area of 281,129.37 hectares, accounting for 17% of Nghe An province, of which only 901.09 ha (0.32% of the district's natural area) is agricultural land, with the remainder being forest land and other land types. As of 2019, the district had a total population of 77,830, comprising over six ethnic groups, including Thai, Kinh, Kho Mu, H'Mong, Tay Poong, and O Du. In 2019, poor households and near poor households accounted for 47.41% of the total households in the district [7].

In 2017, the Prime Minister issued Decision 900/QD-TTg, approving the list of extremely difficult communes for investment under Program 135 for 2017-2020. This list included 2,139 extremely difficult communes across 46 provinces in Vietnam. Nghe An province, with 99 communes, is among the eight provinces having the highest number of extremely difficult communes in the country. Tuong Duong district, one of Nghe An province's three poorest districts, includes 16 communes classified as extremely difficult under Program 135 (2017-2020). Despite its gradually increasing economic growth rate, the district still faces significant challenges. Local authorities are particularly focused on ensuring food security, especially for the poor. Hence, Tuong Duong district was selected for this study.

Due to time and budget constraints, the study selected two communes, Xieng My and Xa Luong, from the 16 extremely difficult communes of Tuong Duong district. Xieng My is one of the poorest communes in the district, whereas Xa Luong has a relatively better economic condition.

2.2. Data collection

The total number of poor households in Tuong Duong district is 8,586, with both Xieng My and Xa Luong communes having a high proportion of poor households. Table 1 presents the number of poor households in these two communes. Xieng My has 56.11% poor households, while Xa Luong commune has 24.24%.

Table 1. Number of poor households in Xieng My and Xa Luong communes.

Number of households	Xieng My	Percentage	Xa Luong	Percentage
Poor households	404	56.11	297	24.24
Total households	720	100.00	1225	100.00

Source: People's Committee of Xieng My and Xa Luong communes (2019).

To calculate the sample size, the study applied the following formula:

$$n = \frac{n_0}{1+\frac{(n_0-1)}{N}}$$

where n is the sample size; N is the population size (number of poor households in the commune); and n_o is calculated by:

$$n_0 = \frac{Z^2pq}{e^2}$$

where Z^2 is the abscissa of the normal curve that cuts off an area α at the tails (Z=1.96 used here); p is the estimated proportion of an attribute in the population (p=0.95); q is 1-p; and e is the desired level of precision (±5%) [8].

Following the calculation, the sample size was determined as approximately 62 households for Xieng My commune and 59 households for Xa Luong commune. Therefore, the study decided to survey 65 poor households in Xieng My and 60 in Xa Luong, totalling 125 poor households in Tuong Duong district. The households were randomly selected according to the list of poor households provided by the local government. Data was collected through a household survey using a questionnaire.

2.3. Measurement indicator

The HFIAS was developed between 2001 and 2006 by the USAID-funded Food and Nutrition Technical Assistance II (FANTA) project. The HFIAS comprises nine items that measure both occurrence and frequency, representing the universal domains associated with household food insecurity access, utilising a recall period of 30 days [9]. The HFIAS is constructed from a concise questionnaire that captures households' behavioural and psychological manifestations of insecure food security, such as having to reduce the number of meals consumed or compromising the quality of food due to a lack of resources. Responses to the questionnaire allow the household to be classified on a spectrum indicating the severity of insecure food security.

The scale includes four categories: none, rarely (1-2 times), sometimes (3-10 times), and often (more than 10 times), which has been applied in numerous pieces of literature [9-13]. A low HFIAS score signifies a high level of food security for the household. The nine questions are: Q1 (Worry about food), Q2 (Unable to eat preferred foods), Q3 (Eat just a few kinds of foods), Q4 (Eat foods they really do not want to eat), Q5 (Eat a smaller meal), Q6 (Eat fewer meals in a day), Q7 (No food of any kind in the household), Q8 (Go to sleep hungry), and Q9 (Go the whole day and night without eating).

Initially, a HFIAS score variable is calculated for each household by summing the codes for each frequency-of-occurrence question. Before summing these codes, frequency-of-occurrence is coded as 0 for all cases where the answer to the corresponding occurrence question was "no" (e.g., if Q1=0 then Q1a=0, if Q2=0 then Q2a=0, etc.). The maximum score for a household is 27 (the household's response to all nine frequency-of-occurrence questions was "often," coded with a response code of 3); the minimum score is 0 (the household responded "no" to all occurrence questions, these were skipped by the interviewer, and subsequently coded as 0 by the data analyst). After calculating the HFIAS score, the estimation of HFIAP is conducted, categorising HFIAP into four levels: food secure, mildly food insecure, moderately food insecure, and severely food insecure.

3. Results and discussion

3.1. Food security situation in Tuong Duong district, Nghe An province

The HFIAS score for each household was calculated by summing the codes for each frequency-of-occurrence question. A low HFIAS score indicates a high level of food security for the household. The maximum HFIAS score is 27, where all nine frequency-of-occurrence questions were answered as "often", and the minimum score is 0, where the household responded "no" to all occurrence questions.

According to Table 2, the average HFIAS score for poor households in Xieng My commune was 7.55, while it was lower for poor households in Xa Luong commune, with a score of 6.00. For the entire sample, the average HFIAS score was 6.81. The data provide insights into household behaviours indicative of insufficient quality and quantity of food, as well as anxiety and uncertainty related to insecure access to food. The findings also indicate that poor households in Xieng My commune face greater challenges regarding food security compared to those in Xa Luong commune.

Table 2. The HFIAS score of poor households in Tuong Duong district.

	Number of poor households	HFIAS score
Xieng My commune	65	7.55
Xa Luong commune	60	6.00
Whole sample	125	6.81

Source: Data survey (2020).

Table 3 and Fig. 1 demonstrate how the HFIAS indicator categorises households in Tuong Duong district into four levels of household food insecurity (access): food secure, mildly food insecure, moderately food insecure, and severely food insecure. A significant portion of responding households falls into the "moderately food insecure" and "mildly food insecure" categories, comprising 33.07% and 31.10% of respondents, respectively. A "moderately food insecure" household often compromises on food quality more frequently by consuming a monotonous or undesirable diet and may begin to reduce quantity by shrinking meal sizes or frequency, occasionally or regularly. About 23.03% of poor households are classified as severely food insecure, while only 12.80% are categorised as food secure. This highlights the low level of food security among poor households in the district.

Table 3. Distribution of responses from poor households to nine HFIAS-related questions in the study areas.

Question	Frequency		
	Rarely	*Sometimes*	*Often*
Q1	52.0	22.4	16.0
Q2	32.0	19.2	12.8
Q3	16.0	12.0	9.6
Q4	8.0	16.0	8.0
Q5	12.8	32.0	12.0
Q6	20.0	24.0	4.0
Q7	20.0	16.0	4.0
Q8	37.6	0	0
Q9	0	0	0

Source: Data survey (2020). Unit: %, n=125.

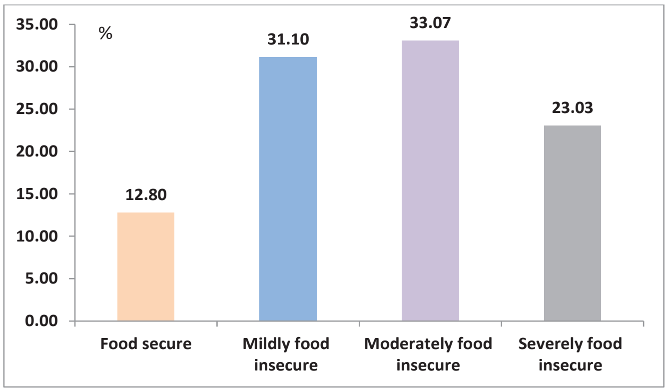

Fig. 1. Household food insecurity and access status in Tuong Duong district. Source: Data survey (2020).

3.2. Factors influencing food security in Tuong Duong district, Nghe An province

The factors influencing food security investigated include human capital, social capital, natural capital, physical capital, and financial capital. Human capital refers to education, age, household size, and ethnicity of individuals. Social capital represents relationships, networks, and social structures. It can be represented by access to supportive policies as well as information accessibility. Natural capital refers to the natural resources available in an area, including cultivated land area, weather (seasonality), natural disruptions, distance to central markets, and irrigation systems. Physical capital comprises tools, equipment, and other physical assets that individuals and households use to enhance food security. Financial capital consists of the financial resources and assets available to individuals and households, including financial accessibility and the ability to generate income [14-17].

3.2.1. Human capital

Fig. 2. Proportion of family members in activities of poor households in Tuong Duong district. Source: Data survey (2020). Unit: %, n=125.

Wives predominantly engage in all six activities, including decision-making regarding child rearing, family spending, market visits, food selection, the quantity of food per meal, and daily menu planning (Fig. 2). Notably, wives play a significant role in all activities except for deciding the type of crops to raise in the next season, where men account for over 51.2%, compared to under 43.2% for wives. However, in other decision-making aspects, wives' involvement ranges from about 57.6% to just under 90%, indicating their substantial influence. Other family members, such as children, contribute minimally to decision-making, with approximately 5% involvement.

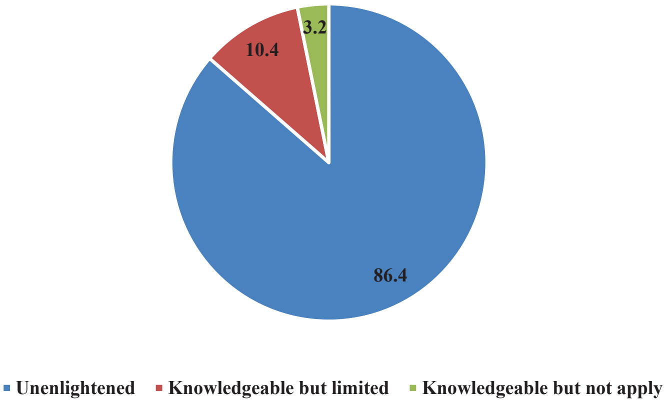

Fig. 3. Percentage of households understanding the situation of food security of poor households in Tuong Duong district. Source: Data survey (2020). Unit: %, n=125.

Figure 3 illustrates the distribution of households across three statuses regarding their understanding of food security: unenlightened, knowledgeable with limitations, and knowledgeable but not applying the information in the lives of poor households in Tuong Duong district (Fig. 3). Approximately 86.4% of households lack awareness about access to food and its preservation, while 13.6% possess some knowledge but either face limitations or do not apply this knowledge in their daily life.

The survey data indicate that the average age of the household head in Tuong Duong district is approximately 42.71 years, with a standard deviation of 17.77 (Table 4).

Table 4. General information of surveyed poor households in Tuong Duong district.

Characteristics	Unit	Xieng My commune		Xa Luong commune		Entire sample	
		Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
Age of HHH	Year	42.16	15.71	43.25	19.23	42.71	17.77
Education of HHH	Year	5.52	3.26	7.12	3.75	6.32	3.59
Household size	Person	3.76	0.98	4.06	0.58	3.91	0.83
Ethnic							
- Kinh	%	6.03		9.06		7.55	
- Thai	%	86.2		76.25		81.23	
- Mong	%	0		6.04		3.02	
- Kho Mu	%	7.77		8.65		8.21	

Sources: Survey data (2020).

Furthermore, the educational attainment of the household head is relatively low, averaging around 6.32 years, with a standard deviation of 3.59. The average household size in the study area is 3.91 (standard deviation of 0.83), with a range of 1 to 6 members per family. The number of family members directly influences the process of food utilisation and the frequency of household food consumption.

The Thai ethnic group constitutes a significant majority in Tuong Duong, comprising 81.23% of the population. Other ethnic minorities, including Mong and Kho Mu, account for 11.23% of the total population, while the Kinh people form a smaller proportion, at 7.55%.

3.2.2. Social capital

Several policies are in place to support the poor in addressing food security issues.

Table 5. Perception of poor households about support policies in Tuong Duong district.

Name of policy support	Xieng My commune (n=65)	Xa Luong commune (n=60)	Overall (n=125)
Infrastructure	56.10	72.50	63.97
Vocational and educational training	70.20	72.50	71.30
Training for farmer and local officers	75.60	80.03	77.73
Preferential credit program	65.14	78.12	71.37
Information dissemination for poverty reduction	70.18	75.20	72.60
Cash support	89.85	58.16	74.64
Rice support	91.15	46.24	69.59

Sources: Survey data (2020). Unit: %.

Table 5 shows that respondents in both Xieng My and Xa Luong communes exhibit a high perception of support policies. This high awareness is attributed to the extreme difficulties these communes face, benefitting from various support programmes. Notably, the awareness of poor household heads in Xa Luong commune surpasses that in Xieng My commune, likely due to Xa Luong's better economic condition. For instance, recent improvements in infrastructure, such as roads in Xa Luong commune, have contributed to its enhanced economic standing, while Xieng My commune continues to struggle with numerous low-quality roads.

Differences also emerge in terms of cash and rice support between the two communes. Poor households in Xieng My commune report a higher perception of cash and rice support compared to those in Xa Luong commune. Local authorities attribute this to Xieng My commune's success in garnering support for forest protection. According to Decision 2345/2016/QD-TTg, aimed at promoting forest protection, a rice support programme is provided for ethnic communities and those in need who voluntarily participate in planting and safeguarding forests. Furthermore, Decision 377/QD-UBND, issued on 9 February 2021, approved a project extending rice support to impoverished households engaged in establishing and protecting forests within Tuong Duong district. Each household receives a monthly allocation of 10 kg of rice per person, effectively alleviating food scarcity issues. The government also provides financial support of VND

500,000 per hectare annually for households participating in forest protection programmes. The survey reveals that approximately 90% of poor households in Xieng My are aware of these cash and rice support programmes, acknowledging their significant contribution to addressing food security concerns.

Social resources manifest through social connections, often established by participating in local associations and societies. The accompanying bar chart illustrates the frequency of Tuong Duong households utilising various methods for gathering information: television, mobile phone, newspaper, internet, neighbour, relative, and group/organisation.

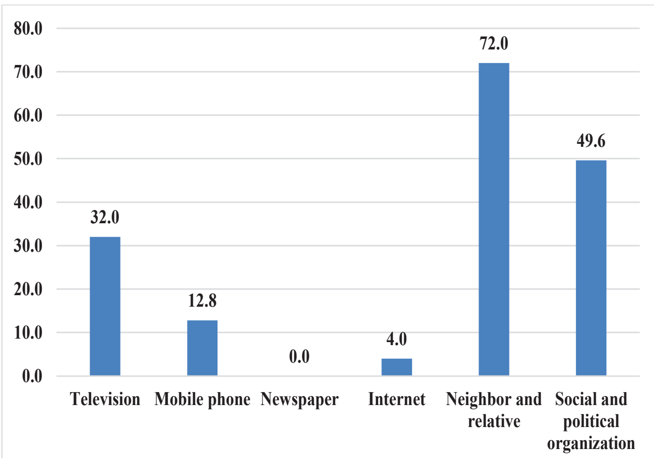

Fig. 4. Households' access to information through various methods. Source: Data survey (2020). Unit: %, n=125.

The Fig. 4 reveals an intriguing pattern: no households reported access to information through newspapers or groups (0%). In contrast, word-of-mouth channels, such as information from neighbours and relatives, are favoured, with 72% of households utilising this method. Additionally, a significant number of people rely on information from television and phones. The internet accounts for a small percentage of the total household population. Notably, none of the respondents used newspapers as a source of information regarding food security.

3.2.3. Natural capital

Cultivated land area: Based on the 2019 report by the district committee, the total agricultural land area was insufficient to meet the demands of agricultural production for the people in the communes, especially in terms of paddy rice cultivation [7]. For instance, the total paddy rice area in Xieng My commune was 61.9 hectares in 2019, representing approximately 3.2% of the overall agricultural land area in the commune. The ratio of productive land per capita was exceptionally low in Xieng My commune, amounting to only 0.03 hectares [7].

Seasonality: The table presents information on the cultivation schedule for agricultural crops in households within the research areas, focusing on three different crops in the year 2019 as provided by farmers. The units are measured in months.

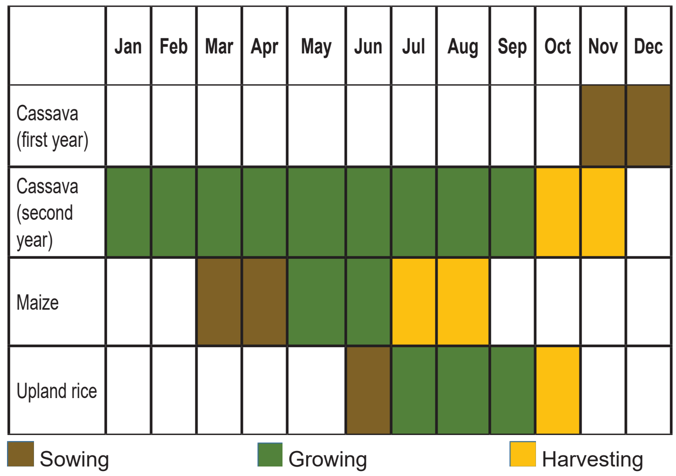

Fig. 5. Agriculture crop calendar of households in the research areas in 2019. Source: Data survey (2019).

From an overall perspective, a notable disparity exists in the processing period for three types of crops: upland rice, maize, and cassava (Fig. 5). Upland rice, for instance, experiences a singular annual season lasting five to six months. Typically commencing in May or June, farmers initiate the process through sowing and transplanting. The growth period spans 2-3 months, extending from late June to early September. Subsequently, harvesting begins, usually lasting 14 days, although the duration may vary based on rice variety and planting time, allowing some households to harvest earlier or later. The culmination of this cycle occurs in October.

Remarkably, households engaged in maize cultivation typically initiate the season in March or April, with harvesting extending into July or August of the following year. The distinctive water requirements for maize play a pivotal role in shaping the agricultural crop calendar. The concentration of rainfall from May to October, with the rainiest months being July and August, aligns with the critical period when maize demands an increased water supply. Consequently, productivity suffers due to insufficient water availability. Conversely, the duration for cassava's growth appears to be the longest among the three main crops, spanning from November of one year to the next.

Rice and maize, primarily cultivated along the stream, faced severe consequences during floods, as water for agricultural production relied heavily on stream water. Presently, only two dams in the areas have the capacity to supply water for a total of 16.5 hectares out of the 61.9 hectares dedicated to paddy rice. The limited water availability has resulted in lower productivity.

Hence, addressing the challenge of low productivity in agricultural production, it is widely acknowledged that agricultural water usage stands out as the primary factor directly influencing crop production in Xieng My commune. Advanced solutions are imperative to ensure the fulfilment of household needs in the agricultural sector.

Natural disruption: Table 6 illustrates the impact level of disruptions on agricultural production that households experienced in 2019 and 2020. Broadly, the factors contributing to increased food prices, drought, and storms and floods emerged as the most substantial challenges, causing damage exceeding 50%. Another significant concern is the rise in production costs, coupled with the addition of family members, directly affecting the food accessibility of impoverished households.

Table 6. The impact of disruptions on agricultural production faced by households in Tuong Duong district in 2019 and 2020.

Disruption	None	<50%	>50%
Drought	5.60	14.40	80.00
Storm, flood	15.20	32.80	52.00
Adding family member	12.00	64.00	24.00
Increasing production costs	15.20	36.00	47.20
Increasing food price	0.00	12.80	87.20

Source: Data survey (2020). Unit: %, n=125.

Distance to central market: Geographical location plays a crucial role in determining households' access to food, assessed by the distance between their residence and the nearest market. Currently, Xieng My and its neighbouring communes lack a local market, posing a significant challenge to food trading. The primary market is situated in the district centre, approximately 80 km away, prompting households to purchase food from there or from local hawkers (Box 1).

Box 1. Household opinions on the absence of a market in Xieng My commune.

"At present, there is no market within the commune. Residents who wish to visit a market must travel to the district market or other districts. For everyday food needs, they primarily rely on local hawkers, through the available food selection is limited to basics such as sea fish, meat, and vegetables. Purchasing from street vendors tends to be more expensive compared to market prices, and the freshness of the food is compromised".

"Along the 48C highway from Hoa Binh town to Xieng My commune, which encompasses four communes (Yen Thang, Yen Hoa, Yen Na, Xieng My), there is a notable absence of trading markets. Residents resort to purchasing goods through itinerant vendors or making the journey to the town centre, which is more than 80 km away by car, for their food needs."

Mr. Bui Van A- A resident of Xieng My commune.

Irrigation system: It is well-documented that an increasing number of households in Tuong Duong district recognise the pivotal role of irrigation systems in the development of agricultural production in this study area. The absence of irrigation systems directly impacts the economic efficiency of crops, leading to significantly lower productivity than crops with a sufficient water supply.

Primarily, the low productivity of crops arises from insufficient water use in the agricultural sector. Water is a critical factor affecting the productivity of crops such as paddy rice and maize. According to the 2020 survey data, approximately 80% of non-poor households actively engage in water usage for agriculture, with proportions ranging from almost 30% to nearly 60%. Conversely, for poor households, the rate is approximately 5%, with the proportion of agricultural land area utilising proactive water just under 30%. Additionally, while rainwater contributes partly to agricultural water usage, communes like Xieng My and Xa Luong face frequent prolonged droughts with limited rainfall, typically occurring over three months of the year. This constrains people's ability to rely on rainwater for agricultural production.

Secondly, to address the aforementioned issue, constructing irrigation systems becomes essential for the agricultural production of the local population.

3.2.4. Physical capital

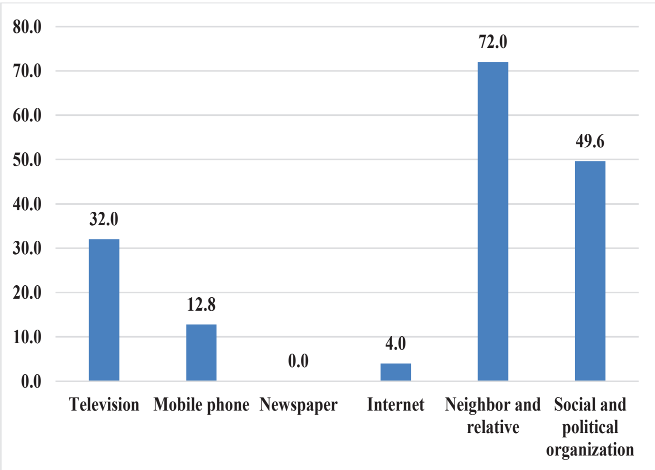

Fig. 6. Physical capital of poor households in Tuong Duong district. Source: Data survey (2020). Unit: %, n=125.

Physical capital encompasses fundamental infrastructure and producer goods essential for sustaining livelihoods, including affordable transport, secure shelter and buildings, adequate water supply and sanitation, clean, affordable energy, and access to information. Fig. 6 demonstrates information on the number of basic household equipment in Tuong Duong district for the years 2019 and 2020. Notably, 82.4% of poor households can access information through smartphones.

3.2.5. Financial capital

From an overall perspective, a notable characteristic is the similarity in the number of loan borrowers and non-borrowers.

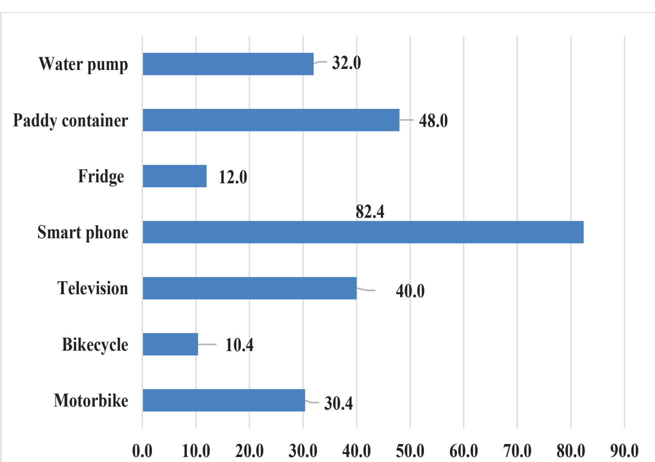

Fig. 7. Financial situation of poor households in Tuong Duong district. Source: Data survey (2020). Unit: %, n=125.

Regarding loans, 41.6% of total poor households have access to loans, primarily utilised for agricultural production or home construction (Fig. 7). Notably, non-borrowing households predominantly fall within the category of poor households, with total incomes ranging from 5-10 million VND, indicating the lowest income levels in the study. Despite preferential policies, reasons for non-borrowing include an apparent lack of need, inability to meet repayment obligations, and the absence of collateral.

Figure 8 elucidates the reasons for not borrowing money among poor households in Tuong Duong district. The primary reason cited is the absence of a need for a loan (32%), signalling a distinguishing factor between poor and non-poor households. Other reasons for abstaining from borrowing money include high interest rates, cumbersome procedures, lack of collateral, and various other factors.

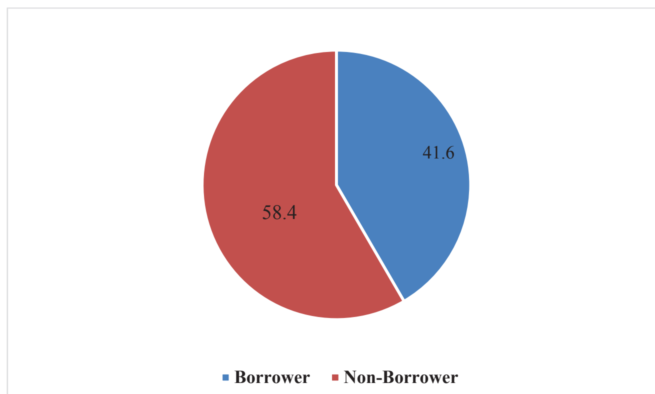

Fig. 8. Reasons for not borrowing money among the poor in Tuong Duong district. Source: Data survey (2020). Unit: %, n=125.

The ability to create income: The primary source of income for most households in Tuong Duong district is derived from various agricultural activities, including livestock such as pigs, buffaloes, cows, and chickens, as well as the cultivation of rice, cassava, and maize. Additionally, a significant number of households benefit from support programs like the 135 Program and 30A Program. Some households also generate income through labour wages, retail trade, and afforestation. Consequently, their income is heavily reliant on agriculture, resulting in limited livelihood diversity and susceptibility to external factors.

An overarching observation reveals a significant disparity in the income and loan patterns between two distinct types of households in Tuong Duong district in 2019. Non-poor households, with an average income of approximately 54 million VND, significantly outpace their poor counterparts, who exhibit the lowest average household income at around 11 million VND. Compared to the overall sample's average income of 20 million VND, it is noteworthy that the average income of the entire sample is considerably lower than that of non-poor households, being half of the latter, and twice as high as that of poor households.

3.3. Recommendations for enhancing food security in Tuong Duong district, Nghe An province

Firstly, increasing the cultivation coefficient is identified as an effective method for enhancing crop yield in Tuong Duong district. Encouraging individuals to adopt intensive cultivation techniques can significantly boost productivity and agricultural output by improving soil nutrition. The local government should promote greater investment in both capital and advanced cultivation techniques. Moreover, multi-cropping has proven to be an efficient method, aiding in pest and disease control while simultaneously increasing agricultural output for farmers.

Secondly, inadequate water usage in agriculture has led to low plant productivity, adversely affecting the quality of paddy rice and maize. This shortfall fails to meet household demands, especially during peak seasons. To address this, the local government should prioritise constructing an irrigation system to support cultivation activities, playing a pivotal role in promoting agricultural production and enhancing household development in the district.

Thirdly, to enhance support activities for agricultural production at the household level, several initiatives are proposed. Organising timely training courses is essential to equip individuals with necessary skills for cultivation and husbandry, based on specific seasonal requirements. Training content should include aspects of farm work, seed selection, plant care, harvesting, farming techniques for livestock, and basic diagnosis and treatment of diseases. Comprehensive training for extension workers and veterinary staff at the grassroots level is also imperative, focusing on effective collaboration with farmers and acquiring professional skills in disease prevention and treatment for plants and animals.

Moreover, the expansion of the livelihood framework encompasses a variety of strategies. A primary focus is on diversifying production activities, which is crucial for generating income for impoverished households and boosting the effectiveness of cultivation and animal husbandry practices. In cooperation with poverty reduction organisations, the local government has the opportunity to establish demonstration plots for rice, maize, and peanuts in less affluent communes. This initiative is designed to aid individuals in enhancing plant varieties, improving fertiliser utilisation and adopting more suitable farming techniques to increase efficiency. Additionally, support can be offered to poor households by subsidising either partially or fully the cost of purchasing livestock breeds such as buffaloes, cows, pigs, and chickens. This would empower them to expand their herd size and overall livestock numbers. Furthermore, assistance in pig and chicken breeding can be provided, focusing on local breed selection and fostering potential collaborations with households.

Finally, constructing roads and improving market accessibility for impoverished households is a pressing concern. The limited availability of markets, particularly in Xieng My commune, has led to deficiencies in the variety and nutritional content of household diets. Establishing roads and markets in this region is a fundamental strategy to address food security issues. Additionally, the local government should boost market activities to facilitate the buying, selling, and exchanging of goods upon market opening, contributing significantly to the economic development of households within the district.

4. Conclusions

Despite Vietnam's overall national food security, many households, particularly in challenging areas like Tuong Duong district, Nghe An province, continue to experience food insecurity. This study investigates the food security situation of impoverished households in the district using the HFIAS measurement.

The research, involving a survey of 125 households across two communes, revealed behaviours indicating insufficient quality and quantity of food, as well as concerns and uncertainties regarding access to an adequate food supply. A majority of surveyed households fell into the categories of 'moderately food insecure' and 'mildly food insecure'.

The study identified various determinants of food security for the impoverished population in Tuong Duong district, including human capital, natural capital, physical capital, social capital, and financial capital. The results emphasise the need for policies focusing on expanding agricultural production and irrigation systems, enhancing support activities for household agricultural production, diversifying livelihood opportunities, and enhancing road infrastructure and market accessibility for the district's population.

CRediT author statement

Le Thi Thanh Loan: Conceptualisation, Methodology, Data collection, Data analysis, Writing; Dang Xuan Phi: Methodology and Data collection; Nguyen Thi Lam Anh: Data analysis and Writing.

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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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Tourism development in national parks in the context of climate change: The case of U Minh Thuong national park, Kien Giang province

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Abstract:

Tourism is a sector that is most vulnerable to any changes. National parks in Vietnam as well as in the Mekong delta have a high potential for tourism development. However, under the impact of climate change, these national parks suffer from many negative effects. This article aims to analyse the current status of tourism development within the context of climate change in U Minh Thuong national park, Kien Giang province. The research was primarily conducted through a survey of 100 tourists and 30 local tourism businesses. The results demonstrate that U Minh Thuong national park serves as a tourist destination with abundant and diverse resources, alongside being the habitat and protected area of numerous rare plant and animal species. According to the analysis findings, climate change presents several challenges and impacts on tourism activities within U Minh Thuong national park, particularly concerning extreme weather conditions. The study also proposes several solutions to enhance the effectiveness of tourism development within the context of climate change in this national park.

Keywords: **climate change, Kien Giang province, national park, tourism, U Minh Thuong.**

Classification number: **7**

1. Introduction

Vietnam's tourism industry currently aims to become a key economic sector [1]. In the first nine months of 2023, tourism revenue increased by 47.7% compared to the same period the previous year [2]. Vietnam is renowned for ecotourism and nature-based tourism, boasting a network of natural reserves and national parks abundant in natural resources, notably U Minh Thuong national park in Kien Giang province. With its unique ecological system, U Minh Thuong is globally recognised as a rare forest type, attracting numerous tourists. However, during the course of tourism development, U Minh Thuong national park faces various challenges, including those posed by climate change. Situated in the Mekong delta, U Minh Thuong national park is among the areas most profoundly affected by climate change. Furthermore, national parks and nature reserves are ecologically sensitive areas vulnerable to alterations in the environment.

Although extensive research has examined the effects of climate change on tourism globally, the focus has predominantly been on coastal, island, and mountainous regions [3-8]. Limited attention has been given to delta regions, particularly nature reserves within these areas, despite their heightened susceptibility to climate change. Previous studies have explored the impacts of climate change on national parks and conservation areas worldwide [9-13], yet there remains a gap in understanding how climate change affects tourism operations. In Vietnam, few studies have investigated the impact of climate change on the tourism industry. Some studies have discussed the impacts of climate change on the tourism industry in specific localities [14-17]. Thus, it is noteworthy that there are currently no studies, either domestically or globally, on the effects of climate change on tourism activities in the Mekong delta, particularly focusing on national parks and nature reserves.

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This study analyses tourism development in U Minh Thuong national park within the context of climate change. The research findings will enhance understanding of the challenges posed by climate change on tourism and propose suitable solutions to mitigate and address the consequences of climate change for tourism development in U Minh Thuong national park.

2. Literature review

In recent years, the term "climate change" has become commonplace, directly impacting life and the development of nations while threatening the Earth's environment and biodiversity. Notably, climate change significantly affects tourism development. The relationship between climate change and tourism has been subject to over 25 years of research. Adaptation measures to climate change in tourism have gained increased attention and are deemed urgent within the tourism industry [18, 19]. Since the 2000s, literature reviews have increasingly focused on the interplay between tourism and climate change [20]. This relationship can yield both positive and negative outcomes. Negatively, tourism activities such as transportation, entertainment, and accommodation can exacerbate climate change [21, 22]. Climate change can induce extreme weather events, loss of biodiversity, and alterations in ecosystems and landscapes, thereby complicating tourism activities. Conversely, tourism is viewed as a sector with potential to mitigate the impacts of climate change and even derive benefits from it [23]. For instance, tourism revenue can aid communities in better preparedness to tackle climate change. Climate change may also extend the summer season on subtropical beaches. However, the adverse effects of climate change outweigh the positive factors significantly.

In 2013, the Association of Southeast Asian Nations (ASEAN) released a report titled Framework, approaches, parameters, and measures for climate change and tourism in the Association of Southeast Asian Nations [24] to establish a basis for the tourism industry for countries to respond to climate change within the tourism sector. However, there has been limited progress in addressing the impacts of climate change on tourism in the region since then.

At the domestic level, the workshop "Assessing the impact of climate change on tourism in the South Central Coast" [25] stands out as a notable forum in this field to date. The workshop, featuring contributions from experts and research institutes, underscored the importance of assessing the impact of climate change on the tourism industry and recommended clear identification of current status and impacts, alongside proposals for region-specific and feasible solutions. However, there has been limited in-depth research on the impact of climate change on tourism activities in Vietnam, particularly within natural parks in the Mekong delta.

U Minh Thuong is designated as an important bird area in Vietnam [26, 27] and currently hosts some of the largest water bird colonies in the Mekong delta [28]. Recognised as a Ramsar site in 2015, it holds international wetland importance. Given its natural beauty and rich biodiversity, U Minh Thuong national park is emerging as a popular eco-tourist destination in the Mekong delta region. A report by the International Union for Conservation of Nature (IUCN) in 2019 highlighted the main climate hazards to U Minh Thuong national park, including prolonged and severe droughts, rising air temperatures, floods, and salinisation from sea level rise [29]. Extreme weather events such as heatwaves, storms, and erratic rainfall are also anticipated to occur more frequently, posing unpredictability. Vulnerability assessments indicate moderate to high vulnerability of the melaleuca forest and open swamps, while peat swamps are deemed extremely vulnerable. Additionally, some species are assessed as moderately to very highly vulnerable.

Scholarly attention has been drawn to tourism development in national parks and protected areas in the Mekong delta [30-33], and the impact of climate change on U Minh Thuong national park has been evaluated in various aspects [29, 34-36]. However, the impact of climate change on tourism within the national park remains unclear, a gap that this research aims to address through the case study of U Minh Thuong national park.

3. Methodology

This study was conducted from August 2022 to November 2022, employing mixed methods to achieve its objectives, which included document synthesis, field observation, and questionnaire survey. It aimed to examine both the supply side (tourism businesses) and the demand side (tourists) perspectives to evaluate the current state of climate change and tourism operations within the national park. Based on the needs identified from tourists and tourism businesses, suitable solutions for tourism development in the context of climate change were proposed.

A questionnaire survey was conducted in 2022 to gather data directly from 100 tourists and 30 tourism businesses at U Minh Thuong national park, employing the convenience sampling method (Tables 1, 2).

Table 1. Characteristic of surveyed visitors at U Minh Thuong national park (n=100).

Characteristic		Frequency	%
Gender	Male	56	56.0
	Female	44	44.0
Age	Under 25	45	45
	25-34	29	29
	35-44	17	17
	45-54	7	7
	Missing	2	2
Education level	Under high school	15	15.0
	High school	35	35.0
	Vocational/College	12	12.0
	Graduate/Post-graduate	37	37.0
	Missing	1	1.0
Income	Under 5,000,000 VND	29	29.0
	From 5,000,000 VND to under 10,000,000 VND	30	30.0
	From 10,000,000 VND to under 15,000,000 VND	28	28.0
	From 15,000,000 VND	10	10.0
	Missing	3	3.0
Place of residence	Urban	35	35
	Rural	65	65

Source: Survey result, 2022.

Table 2. Characteristic of surveyed tourism businesses at U Minh Thuong national park (n=30).

Characteristic		Frequency	%
Gender	Male	15	50.0
	Female	15	50.0
Age	25-34	9	30
	35-44	16	53.3
	45-54	1	3.3
	From 55	1	3.3
	Missing	3	10.0
Education level	Under high school	9	30.0
	High school	12	40.0
	Vocational/College	5	16.7
	Graduate and Post-graduate	3	10.0
	Missing	1	3.3
Working seniority	Under 5 years	3	10.0
	From 5 years to under 10 years	18	60.0
	From 10 years to under 15 years	8	26.7
	From 15 years	1	3.3

Source: Survey result, 2022.

Secondary data were compiled from various sources, including reports, scientific journals, and books relevant to the research issue. Additionally, the author group conducted fieldwork and observations at U Minh Thuong national park to experience local services and directly engage in discussions and surveys with tourists and business households.

4. Results and discussion

4.1. Tourism development at U Minh Thuong national park

U Minh Thuong national park is situated in An Minh Bac and Minh Thuan communes, U Minh Thuong district, Kien Giang province, with geographical coordinates ranging from 9°31’N to 9°39’N and from 105°03›E to 107°07’E. The park’s functional subdivisions comprise 914 hectares for strictly protected areas, 6,924 hectares for ecological restoration, 200 hectares for historical and monument conservation, 59.4 hectares for buffer zone planning, and 59.4 hectares for administrative and service purposes [37].

With its unique ecosystem of alum-flooded Melaleuca forest on peat soil, U Minh Thuong national park serves as a destination for tourism and research, showcasing natural processes of Melaleuca and peat forests, conservation solutions, and the distribution of diverse bird sanctuaries, migratory birds, and water birds. Favoured by nature as the habitat for many rare species of flora and fauna, the park boasts a diverse species composition and is rigorously conserved to uphold biodiversity. Visitors to U Minh Thuong national park can enjoy fresh air, spacious surroundings, and immerse themselves in scenery teeming with rare flora and fauna, including observation towers and the Hoa Mai lake fishing area. Attractions such as bird arrays, crow bat arrays, primary melaleuca forests, wild boar populations, otters, and monitor lizards offer abundant sightseeing opportunities.

Attraction plays a pivotal role in a tourist destination, often determining visitors' decisions to visit. A survey of 100 tourists evaluated the attractiveness of tourism resources at U Minh Thuong national park using a 5-level scale and statistical averaging, yielding a value of 3.53 out of 5. This indicates that tourism resources at the park have achieved a satisfactory level of attractiveness, crucial for current and future tourism development.

Endowed with natural resources, U Minh Thuong national park has fostered eco-tourism, community tourism, and experiential tourism to enable tourists to explore and learn about local culture, collaborate with locals, and directly engage in activities. Tourist activities such as fishing, fruit harvesting, and cooking traditional dishes with hosts, as well as participating in traditional music performances with "farmer artists," promote environmental awareness, cultural preservation, and historical relic conservation. These activities leverage biodiversity, landscape, and environmental values while facilitating cultural exchange between residents and tourists, thereby creating employment opportunities for locals and enhancing their quality of life.

A survey of 100 respondents revealed that the majority (67%) perceived the development of U Minh Thuong national park as "normal," followed by "good" (21%), "very good" (5%), "poor" (5%), and the lowest being "very poor" (2%). This suggests that tourism activities at U Minh Thuong national park have yet to achieve significant prominence.

After employing statistical averaging, the results of a survey of 100 tourists regarding tourism development at U Minh Thuong national park yielded an average value of 3.22 out of 5, indicating that local tourism is currently operating at a moderate level. Thus, there is a need for more prominent development policies to leverage the park's potential and foster further development.

4.2. Current status of environmental protection and awareness of climate change

U Minh Thuong national park stands as one of three core zones within the Kien Giang biosphere reserve and ranks as the second-largest biosphere reserve among Vietnam's eight UNESCO-recognised biosphere reserves. To ensure its protection, the national park Management Board has implemented numerous measures to prevent and combat forest fires, alongside bolstering the conservation of plant communities and bird habitats. Remarkably, many rare bird species, including Javanese storks, white storks, and dwarf fire storks, have exhibited rapid growth in numbers compared to previous years.

In addition to forest protection initiatives, increasing emphasis has been placed on environmental education. The primary objective is to raise community awareness, fostering appropriate attitudes and behaviours towards the natural environment, and encouraging active community participation in national park conservation efforts.

Subsequently, the U Minh Thuong national park management board has conducted various training courses and public awareness campaigns within the buffer zone to promote forest environmental protection. These efforts have yielded significant results, with a notable reduction in fishing and exploitation activities within the park's core area. Regular dissemination of laws to local residents and tourists aimed at enhancing awareness of forest protection, development, and biodiversity conservation is conducted through diverse content and methods. A survey on environmental sanitation involving 100 tourists at U Minh Thuong national park produced the following results (Table 3).

Table 3. Visitors' assessment of environmental sanitation at U Minh Thuong national park (n=100).

Assessment	N	Min	Max	Mean
The restroom is clean	100	1	5	3.08
There is no rubbish outside	100	2	5	3.71
The water source is not polluted	100	1	5	2.46

Source: Survey result, 2022.

Regarding restroom cleanliness, it received an average score of 3.08, indicating that the toilets at U Minh Thuong national park may not be sufficiently clean to meet tourist needs. Presently, there are only two toilets available at the park, one situated near Hoa Mai lake and the other near the national park's media centre. Although both toilets feature separate sections for men and women, they are relatively small and have shown signs of deterioration over time.

The issue of waste management and litter received an average score of 3.71, suggesting that waste management is adequately enforced at U Minh Thuong national park. Trash bins are strategically placed throughout the park, resulting in minimal litter, ensuring visitors' comfort and security during their visit. Furthermore, heightened awareness among tourists and staff regarding environmental sanitation ensures effective management of this issue without disrupting tourism activities.

Regarding water resources, the average score was 2.46, indicating concerns over water pollution at U Minh Thuong national park. Visitors perceive the water environment, particularly in canals and lakes, as tainted due to the dark colouration caused by fallen melaleuca leaves over time. This discolouration, coupled with the odour from decomposing cajuput leaves, creates an unpleasant environment, leading visitors to feel uneasy about the water sources within the park.

Observations and insights from local tourism businesses suggest an ineffective approach to educating the public about climate change. Specifically, out of 30 respondents from tourism businesses, only 20% reported attending conferences or training sessions on climate change, while 80% had not. Although conference programmes on climate change have been conducted, they have failed to attract a diverse range of participants. A survey of households engaged in tourism businesses within or near U Minh Thuong national park revealed minimal participation in such activities.

Of the 30 businesses surveyed, only 30% believe that the government has made sufficient efforts to enhance public understanding of climate change. This underscores the necessity for greater involvement of local government in climate change awareness programmes, training sessions, and conferences.

In response to queries seeking a deeper understanding of the causes and challenges in raising public awareness, the results were shown in Table 4. 25 out of 30 respondents (83.3%) identified lack of funding as a significant challenge, while 24 respondents (80%) cited insufficient personnel. Additionally, 23.3% attributed the difficulty in this endeavour to a lack of interest.

Table 4. Assessment of tourism businesses on difficulties in raising people's awareness about climate change (n=30).

Reason / Opinion	Lack of funding	Lack of personnel	Lack of interest
Yes	83.3%	80%	23.3%
No	16.7%	20%	76.6%
Total	100%	100%	100%

Source: Survey result, 2022.

Since there was a shortage of financing and staff to support widespread implementation, local authorities made efforts to increase public awareness of climate change but did not achieve optimal outcomes. Additionally, some businesses have refrained from engaging in suggested activities due to apathy. Besides the national park management board, tourism businesses within the national park play a vital role in implementing climate change response plans. Therefore, localities should undertake more community awareness initiatives on environmental protection and climate change adaptation.

4.3. Assessment of visitors and tourism businesses regarding the impact of climate change on tourism development in U Minh Thuong national park

A survey of 100 tourists and 30 tourism businesses at U Minh Thuong national park was conducted to evaluate the impact of climate change factors on tourism development. The results are presented in Tables 5, 6.

Table 5. Visitors' assessment of the impact of factors on tourism development at U Minh Thuong national park (n=100).

Factor / Respond	Storm	Flood	Salinisation	Rising temperature	Erratic rain	Sea level rise
Yes	72	22	10	74	66	7
No	28	78	90	26	34	93
Total	100	100	100	100	100	100

Source: Survey result, 2022. Unit: %.

Table 6. Tourism businesses' assessment of the impact of factors on tourism development at U Minh Thuong national park (n=30).

Factor / Respond	Storm	Flood	Salinisation	Rising temperature	Erratic rain	Sea level rise
Yes	87	30	20	73	63	10
No	13	70	80	27	37	90
Total	100	100	100	100	100	100

Source: Survey result, 2022. Unit: %.

Climate change has become a matter of great concern, especially within national parks, necessitating careful attention to promptly grasp the actual situation and devise effective preventive solutions to minimise impacts on business activities.

Storm: Storm movements have recently posed significant challenges due to their considerable effects on various businesses, including tourism. Storms cause substantial damage, both physical and psychological. Presently, storms are a deep concern across all sectors, especially within the tourism sector in national parks, notably U Minh Thuong national park in Kien Giang province. Survey results on climate change's impact on tourism activities in U Minh Thuong national park reveal that 72% of surveyed tourists and 87% of surveyed tourism businesses believe that storm factors impact tourism development in the park. A significant proportion of respondents acknowledge the adverse impact of storms on tourism activities, necessitating further study to minimise their detrimental effects. It is crucial to pay attention to storm impacts to avoid unnecessary damage, especially concerning long-term park development.

Salinisation: Salinisation remains a persistent concern in coastal areas, particularly in Kien Giang province, requiring effective remedies to mitigate its effects. The presence of dikes and dams surrounding U Minh Thuong national park helps mitigate salinisation's impact on tourism activities. Visitors can feel reassured knowing that a robust water regulation system is in place to address salinisation issues. Furthermore, according to the U Minh Thuong national park management board, the spongy peat layer here has formed over thousands of years, remaining uncontaminated by salinity or alum and boasting high water-holding capacity, facilitating substantial water storage in conjunction with surface water and nearby canal and ditch systems [29, 38].

The survey revealed that only 10% of tourists and 20% of tourism businesses believe that salinisation affects tourism activities at the park, with some attributing discoloured water in Hoa Mai lake and canals to fallen Melaleuca leaves, which could be mistaken for saltwater. Clarifying this issue through a survey of 30 tourism businesses at U Minh Thuong national park revealed no instances of salinisation affecting tourism activities. Long-standing businesses at U Minh Thuong national park are familiar with the area's water resources and are satisfied with the effective dike system, which significantly reduces salinisation effects, facilitating seamless tourism activities. The rigorous attention of the management agency ensures strict control over water sources. Consequently, tourism activities here are largely unaffected by salinisation, owing to the stability of the water regulation and dike system, thereby minimising salinisation's impact on tourism development in U Minh Thuong national park.

Rising temperatures and drought: Survey results indicate that 74% of tourists and 73% of tourism businesses believe that rising temperatures affect tourism activities at U Minh Thuong national park, highlighting the significant challenge posed by rising temperatures. Respondents attribute increased heat to impacting tourism and leisure activities, with rising temperatures also adversely affecting local flora and fauna, potentially leading to ecological imbalances. Various factors contribute to rising temperatures, with human activities such as emissions, untreated wastewater, and deforestation exacerbating the issue. Given the profound impact and serious consequences of rising temperatures, heightened attention and collective efforts are crucial to mitigate their effects on development, particularly tourism, in U Minh Thuong national park.

Forest fires pose a significant threat to the biodiversity of U Minh Thuong national park, particularly during the dry season when low canal water levels expose flammable peat layers [39]. Consequently, preventing drought and forest fires remains a top priority. The park has implemented and adhered to rigorous forest fire prevention measures. According to interviews with the U Minh Thuong national park management board [40, 41], the park is closed during the annual dry season (from late April to mid-July) to conduct forest fire prevention activities, strictly adhering to forest fire prevention protocols to safeguard park resources and facilities.

Erratic and heavy rain: Erratic and heavy rains disrupt the experience and travel plans of tourists, diminishing their interest in visiting. The survey revealed that 66% of tourists and 63% of tourism businesses believe that erratic heavy rain affects tourism activities at U Minh Thuong national park, indicating a level of concern regarding this factor.

Erratic heavy rain poses an inevitable challenge for destinations with humid tropical monsoon climates, significantly impacting tourists' visits and the landscape and tourism development at U Minh Thuong national park. Prolonged rainfall in Melaleuca forests impedes water drainage, harming tree growth and survival. Moreover, heavy rainfall may cause tree falls, disrupting drainage and electricity systems, negatively impacting tourism in the area.

Businesses engaged in trade, transportation, food, and accommodation may incur losses on days of severe rain due to minimal or no visitors. The significant impact of erratic heavy rain necessitates heightened attention and careful preparation to minimise harm to U Minh Thuong national park and its tourism activities. Tourists often plan detailed itineraries with specific timings, but unexpected and sudden rains can delay their plans, making them uncomfortable and dissatisfied with their visit.

Sea level rise: Vietnam is among the five countries in the world significantly affected by sea level rise. Situated in Kien Giang province along the coast, U Minh Thuong national park actively manages sea level rise to prevent adverse effects, crucial for sustainable development in the area.

In a survey assessing the impact of sea level rise on tourism activities at U Minh Thuong national park, only 7% of tourists and 10% of tourism businesses believed that sea level rise affects tourism activities at the park, indicating minimal impact. The comprehensive dike system surrounding U Minh Thuong national park minimises the impact of sea level rise, facilitating smooth tourism activities without compromising visitor experiences. The diligent monitoring and control of water levels contribute to the seamless operation of tourism activities, showcasing the effectiveness of the park's management board in implementing remedial measures.

Visitors experience increased satisfaction and security during their visits, explorations, and tourism services, as the solid dike system prevents any hindrance from sea level rise. Additionally, the dense layer of peat, combined with tightly sealed coverage, offers further protection against the effects of sea level rise.

Floods: Concerning the impact of floods, 22% of surveyed tourists and 30% of surveyed tourism businesses believed that flood factors affect tourism development at U Minh Thuong national park. This suggests that tourism operations at the park are not significantly affected by flood factors. It can be inferred that floods are not a considerable concern for tourism development or the return intention of tourists to U Minh Thuong national park, as observed at a low level. Although heavy rainfall, prolonged storms, and high tides may lead to localised flooding at certain times of the year, tourism operations at U Minh Thuong national park remain largely unaffected if water level regulation is well managed.

4.4. Proposals and recommendations for tourism development in the context of climate change

In order to attract tourists and ensure long-term development, it is imperative not only to make new investments but also to preserve existing resources. Therefore, priority should be given to promoting afforestation and regeneration activities, restoring and developing existing forest resources, and continuously improving the quality and coverage of forests. Deforestation or the exploitation and trading of forest goods and wildlife must be strictly prohibited.

Simultaneously, the management board should regularly monitor forest hydrology, forecast the risk of forest fires, and proactively regulate water levels to prevent forest fires while maintaining suitable habitat for the growth and development of Melaleuca forests.

Furthermore, it is necessary to strengthen inspection and prepare scenarios to respond to natural disasters and climate change locally. Proactive planning is essential to ensure safety for tourists, and operations should be halted resolutely if there is any risk to safety. Research indicates that extreme weather phenomena due to climate change, such as erratic and prolonged rain, extreme heat, or storms, directly affect tourism activities in the area. Therefore, immediate solutions are required, including upgrading infrastructure to withstand harsh weather conditions, and designing and installing rain and sun shelters for visitors.

While respondents consider phenomena such as salinisation, floods, and sea level rise to have less serious consequences on tourism activities due to the effective dike and sluice system, attention needs to be paid to controlling and regulating water levels because the wetland ecosystem in U Minh Thuong national park is highly vulnerable.

Promoting the application of science and technology in managing and monitoring the natural environment in tourism is imperative. Investing in completing and upgrading the system of monitoring stations to monitor environmental quality, especially focusing on tourist density, is essential. An automatic monitoring system for water level and quality will identify problems (if any) and provide timely solutions.

Additionally, solutions to build environmentally friendly tourism development models, such as eco-tourism and tourism associated with the conservation of natural resources, should be implemented. Encouraging and applying the 3R models (Reduce - Recycle - Reuse) can contribute to sustainable tourism practices.

Efforts to raise awareness about the harmful effects of climate change in U Minh Thuong national park require readiness and practical action from the community, businesses, visitors, and management agencies. Local authorities should conduct more public awareness-raising initiatives, including training programs, propaganda, and seminars about how climate change affects the tourism sector.

5. Conclusions

The research findings on the current status of tourism and climate change at U Minh Thuong national park, Kien Giang province, underscore its significance as a tourist destination boasting attractive, rich, and diverse resources. It serves as a habitat and sanctuary for numerous rare flora and fauna species. However, its development remains at a normal level, not fully leveraging its abundant tourism potential. Presently, tourism activities in U Minh Thuong national park predominantly exhibit characteristics of mass tourism. Therefore, there is a need to focus on developing tourism that capitalises on the unique features of the park while highlighting the strengths of its natural resources and environment based on principles of conservation and sustainability. This will contribute to creating a distinct tourism experience at U Minh Thuong national park. Moreover, investment funding for tourism development, human resource training, and particularly climate change awareness education remain insufficient. Challenges persist in tourism advertising, promotion, and infrastructure development, as well as in enhancing entertainment, beverage, and accommodation services. Addressing these issues effectively requires targeted investment and strategic development initiatives.

Amidst the increasingly evident and potent impact of climate change in the Mekong delta, U Minh Thuong national park faces numerous challenges in its tourism operations, notably extreme weather phenomena such as storms, erratic rainfall, and rising temperatures. These manifestations underscore the direct challenges posed to tourism activities in the park. While factors such as sea level rise, floods, and salinisation have not significantly impacted tourism, measures of prevention, such as the dike system, have been implemented by U Minh

Thuong national park and local management boards. However, the perception of tourism businesses in the park regarding climate change and its impacts remains limited, potentially leading to a subjective approach in addressing climate change. Therefore, there is a critical need to enhance monitoring of climate change impacts and intensify propaganda and awareness-raising efforts.

To address these limitations, further attention, in-depth research, and enthusiastic coordination and support from management agencies are essential. Collaborative efforts are needed to study and propose appropriate solutions that contribute to tourism development in U Minh Thuong national park.

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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Transformation of French literature into Ho Bieu Chanh's work from the perspective of the polysystem theory

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Abstract:

Around the middle of the 17th century, the national language script was born and developed thanks to the merits of Western missionaries such as G.D. Amaral and A. Barbosa (Portugal); A.D. Rhodes (France). However, Catholic literature in Vietnam over the next 200 years was still mainly written in Nom, Chinese, or Latin. When the French tried to consolidate their rule in Vietnam, the Quoc Ngu script was made official throughout Vietnam in the early 20th century in order to eliminate the influence of anti-French Confucianism in Vietnam. Among the writers of this period, Ho Bieu Chanh was the most successful. Commenting on Ho Bieu Chanh's position in Vietnamese literature, the book Vietnamese Literature from the beginning of the 20th century to 1945 by the Publishing House of the University of Pedagogy wrote: "Ho Bieu Chanh is a pioneer writer of modern fiction. Vietnam in the first steps before the period of prosperity (since 1932) and also a strong writer with many merits. Ho Bieu Chanh's novel has contributed significantly to the preparation for the formation of critical realism in Vietnamese literature in the following decade" [1]. **This article studies Ho Bieu Chanh's work as a case of how Vietnamese intellectuals received creatively French literature in particular and Western culture in general. This research inspects Ho Bieu Chanh's works from the perspective of the polysystem theory to find out the acquisition of French literature as well as the author's creativity in comparison with the original ones. As a result, the contribution of Ho Bieu Chanh in modernizing Vietnamese literature and his success will be affirmed.**

Keywords: **French influence, Ho Bieu Chanh, modern Vietnamese literature, Vietnamese intellectuals the polysystem theory.**

Classification number: **9.2**

1. Introduction

Ho Bieu Chanh (1885-1958), real name Ho Van Trung, self-Bieu Chanh, Thu Tien name; he was a famous writer in South Vietnam in the early 20th century. When writing, he took the name Ho Bieu Chanh with the family name, and that name became an immortal pseudonym. He was born on October 1, 1885 in Binh Thanh village, Go Cong province (now in Thanh Nhat hamlet, Binh Xuan commune, Go Cong town, Tien Giang province). Born in a peasant family, he was taught Kanji from an early age. At the age of 13, he switched to studying the national language, passed the exam, and won a scholarship to My Tho High School. After that, he moved to Saigon to study at Chasseloup Laubat School. At the end of 1905, he passed the Diploma exam. Then, he took the exam to become Surveillance Commissioner of the Lieutenant-Gouverneur de la Cochinchine; he worked as a scriber, and interpreter, and then was promoted to the governor of chef de province (1936). He also used to hold the position of district chief in many places. He retired in 1941. He was known as an honest mandarin who loved the people and loved the poor.

After retiring, he was invited by France to be an advisor with the title of Member of the Federation Council of Indochina and Deputy Director of Saigon city, and at the same time, director of newspapers that propagated French-Vietnamese harmony. After the French re-occupied the South in 1946, the Autonomous Republic of Cochinchina was established, and he worked as an advisor to the government of Nguyen Van Thinh. When

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Nguyen Van Thinh's government collapsed after a few months of existence, he retreated to his hometown in hiding and devoted the rest of his years to a literary career. He died on September 4, 1958 in Phu Nhuan, Gia Dinh at the age of 73. His tomb is currently located on Thong Nhat street, ward 11, Go Vap district, Ho Chi Minh city.

Ho Bieu Chanh has extraordinary creativity. He left more than 100 works of various genres, such as: 64 novels, 12 collections of short stories and stories, 12 comedies and plays, 5 collections of poems and stories, 8 volumes of memoirs, 28 volumes of reviews, review - critique. In addition, there are lectures and 2 translated works. Ho Bieu Chanh has a knack for writing autobiographical prose. His compositions mainly reflect the Southern life style from rural to urban areas in the early twentieth century with social changes caused by conflicts between traditional values and modern factors. The language in his compositions is simple, and bold in the South. He has made great contributions to the formation of the novel genre on its embryonic journey and has since made an important contribution to the modernization of Vietnamese literature. Having selectively absorbed the quintessence of Western literature, Ho Bieu Chanh has contributed to enlightening modern literature and innovating the novel genre. "Ho Bieu Chanh has selected Western literary novels rich in realism and humanity to adapt to his work… that is, fresh blood drops, giving the patient's body the same blood type, making the body of Vietnamese literature quickly healthy, gradually becoming strong and rosy... Acquiring the technique of constructing Western novels, Ho Bieu Chanh contributed to innovating the novel genre in terms of construction aspects. plot, plot, and layout of works. The thought-carrying carriage of the national language, which was previously still heavy and sluggish, has been gently pushed here, gliding across miles of new literature. That is the merit of the driver Ho Bieu Chanh [2].

Ho Bieu Chanh adapted novels by a number of foreign writers, mainly French writers. When adapting from a novel, he usually states the original novel he used. However, the writer does not borrow machinery but creatively adapts. He clearly stated the way he borrowed from his foreign stories: "When I read French novels or operas that I feel, I use that feeling as a topic, then adapt it more or less or use that to compose a work. It's completely Vietnamese. Although I'm adapting, it's actually only taking the main idea, but sometimes I even reverse it to the main idea, making the plot completely contrary to psychology, far from the French story" [3]. That concept governs the writer's selection of events and character-building on the basis of foreign originals. In the following, we analyze in more detail the inheritance and creative points of Ho Bieu Chanh compared with the works that he himself confirmed to have relied on to adapt.

2. Polysystem theory

Polysystem theory was established by I.E. Zohar from many thesesdiscussed in two seminars in Louvain in 1969 and 1970. After that, I.E. Zohar completed and developed in the next few years.

Polysystem theory begins with the assumption that culture can be viewed as a system. It is "relationships that can be assumed for a given set of observed and assumed things, making it possible to assume the behavior of different sets of social semiotics" [4]. It is through these relationships that the object becomes observable. Therefore, polysystem theory focuses on studying the object in relation to other objects rather than focusing on studying the object itself in isolation. The nature of each element can be realized through relationships with other elements, the value of the object is not internal to the object but can only be established when placed in relation to the object, that is, within a system.

Applied in literary studies, polysystem theory holds that a literary work is good not because of its intrinsic nature but because it is placed in relation to other objects in the cultural space. That particular context causes its features to emerge and become exemplary. When studying literature, researchers should not only evaluate literature at its peak, or focus only on a specific area of literature, but ignore other areas of literature that seem less important and make less contribution to the overall literature such as children's literature, thrillers or romances...

Systems are not static and independent, but have internal development and interaction between systems. I.E. Zohar defines contact as "a link between cultures by which a given culture A (source culture) has the potential to become a source of direct or indirect transmission to other B culture (target culture) [4]. Interference is when the transition is either voluntary or forced. When culture is considered as a polysystem acting on categories, cross-cultural interference is in fact the transfer of items (conceived as "goods" to be "imported" into a target culture) from one system to another one which does not have available transmitted categories. According to I.E. Zohar, a true interference case is when an item does not simply appear, but must be transformed into generative patterns, which means dynamic elements in the native category. Contact is a fundamental condition of interference, but not all contact is interference because the latter requires rooting in the target culture.

When studying the process of interference from that point of view, I.E. Zohar found that when the category has completed the interference, it is no longer a matter of the source culture, but has become a matter of nature. The basic principle here is the separation of the transmitted elements from the source of export and their subsequent independence: as soon as the source of the export is no longer necessary for the establishment of the elements of the discussed category, it is a case of interference. Once the interference occurs, the source/origin issue is no longer relevant. For most members of a community, once moved into the category, the fate of an element succeeding or failing becomes an indigenous issue" [4].

From the theory of polysystem, we can see that Ho Bieu Chanh made a shift of categories from modern French novels to Vietnamese literature - contemporary literature which has cultural categories belong to medieval culture - into generative patterns - which mean dynamic elements in the native category, creating a true interference.

3. Ho Bieu Chanh localizes foreign titles, genres, and plots

The following table is a list of the names of 14 works that Ho Bieu Chanh adapted based on French and Russian literary works.

Table 1. List of works that Ho Bieu Chanh adapted based on French and Russian literary works.

No.	Ho Bieu Chanh's adapted work	Original works
1	*Ai Lam Duoc*, 1912	*Andre Cornelis* - P. Bourget
2	*Vay Moi Phai* (Poetic story), 1913	*Le Cid* - P. Corneille
3	*Chua tau Kim Quy* (Novel), 1913	*Le Comte de Monte Cristo* - A. Dumas
4	*Cay Dang Mui Doi* (Novel), 1923	*Sans Famille* - H. Malot
5	*Thay Thong Ngon* (Novel), 1926	*Les Amours d'Estève* - A. Theuriet
6	*Ngon Co Gio Dua* (Novel), 1926	*Les Miserables* - V. Hugo
7	*Chut Phan Linh Dinh* (Novel), 1928	*En Famille* - H. Malot
8	*Ke Lam Nguoi Chiu* (Novel), 1928	*Les Deux Gosses* - P. Decourcelle
9	*Vi Nghia Vi Tinh* (Novel), 1929	*Fanfan et Claudinet* - P. Decourcelle
10	*Cha Con Nghia Nang* (Novel), 1929	*Le Calvaire* - P. Decourcelle
11	*O Theo Thoi*, 1935	*Topaze* - M. Pagnol
12	*Ong Cu*, 1935	*L'artiste* (Ho Bieu Chanh did not mention the author's name)
13	*Doa Hoa Tan*, 1936	*Le Rosaire* (Ho Bieu Chanh did not mention the author's name)
14	*Nguoi That Chi*, 1938	*Crimes et Chaatiment* - F.M. Dostoievski

Table 1 shows that 12/14 works have the name of the original work adapted, 2/14 does not share the name of the original work, 13/14 works are adapted from works of French writers, 1/14 is adapted from *Crimes et Chaatiment*, by the Russian writer F.M. Dostoievski.

As can be seen, the first element to be changed is the title of the work. The titles of Ho Bieu Chanh's works are boldly Vietnamese. These may be relatively stable phrases that Vietnamese people often use to express their petty human condition such as *Cay Dang Mui Doi* (Bitter Life), *Chut Phan Linh Dinh* (Floating Fate), *Ngon Co Gio Dua* (Grass Naughty Wind), *Ke Lam Nguoi Chiu* (He Breaks, Other Pays), *O Theo Thoi* (Following The Wind)… or carry moral teachings such as *Cha Con Nghia Nang* (Parentship), *Vi Nghia Vi Tinh* (For the Sake of Love and Responsibility)…

There are also works that have been changed in terms of genres such as poetic stories. That's right, 1913 was adapted from P. Corneille's play *Le Cid*.

Along with the name of the work, the genre, many plots, although absorbed, still have significant changes (Table 2).

Table 2. Comparison between the original and Ho Bieu Chanh's works.

No.	Original plot	Ho Bieu Chanh's plot
1	***Le Comte de Monte Cristo*** - The story takes place in France, Italy, islands in the Mediterranean and the Levant in 1815-1838. - Pierre Picaud, a shoemaker, lives in Paris. Picaud was betrothed to a rich woman, but four jealous friends falsely accused him of spying for England. He was imprisoned for 7 years. - While in prison, a fellow inmate, Father Pharia, on his deathbed revealed to him a treasure hidden in Milan. - When Picaud was released in 1814, he got the treasure, changed his name to Monte Cristo and went to Paris and lived there for 10 years and successfully avenged the old friends who slandered those old friends. But after taking revenge on the last person who slandered him, he suddenly realized that revenge would not be good after the facts. - The count has in turn returned his gratitude to those who have helped and properly punished those evil minds who have harmed him.	***Kim Quy Ship's Lord*** - The context of the story was built under Minh Mang's reign in the South. - Le Thu Nghia, a young farmer, beat Tan Than and broke his arm because he violated the morality of Le Thu Nghia's sister. To take revenge, Tan Than bribed the district officials to falsely accuse Nghia of following Christianity, so he was sentenced to life in prison. - During the examination, he befriended a guest and learned to speak Cantonese. Before he died, the guest revealed to him that he was the grandson of Mac Cuu's four generations. His father hid a lot of gold and silver on Kim Quy island, a small island in the south of Phu Quoc island. - When the medical examiner was on fire, Thu Nghia took advantage of the chaos to escape back to his hometown, only to learn that his parents and younger sister had died. He found a treasure, pretended to be a Cantonese customer, bought a merchant ship, and became the lord of the Kim Quy ship. - The Lord of the ship Kim Quy seeks to repay his brother-in-law, Kinh Chi, who suffered because of worrying about his parents and sister.
2	***Sans Famille*** - Remi is a rich boy, was kidnapped by his uncle at the age of five or six months, and taken away in a public place, hoping that his sick brother will die after death, then the whole fortune of the brother will return all his part. - Remi was picked up by Barberin, a mason passing by, and brought home to raise, with the purpose that this rich child's parents would bring back the ransom. - But many years later, Barberin saw no one to redeem him and because of a professional accident, he fell into poverty, so he had to sell Remi to Vitali, a circus performer, despite the objections of his wife. She loves the little boy like her own son. - Since then, Remi lived a wandering life, many years later found her biological mother.	***Cay Dang Mui Doi*** - Le Thi Thoi's husband (Ba Thoi) is Tran Van Huu, working far away and has a young wife. - At home, Ba Thoi picked up a small child of five or six months old and left it in the bushes, so he brought it home and raised it and named it OK. - When Dua was 9 years old, Huu returned. He sold it to the interpreter Tran Cao Dang. - Because of pressure from his superiors, Tran Cao Dang resigned from his position and was abused by his wife because he couldn't stand the miserable life, so he left home and roamed around the continent, teaching him Dan singing to make money.
3	***Les Miserables*** - Jean Valjean for stealing a piece of bread for his sister's child, was sentenced to 19 years in prison with prison number 24601. - After being released from prison, he had to carry a golden passport, a sign that its bearer had committed a crime, so Jean was refused by the innkeeper and forced to sleep on the street. Bishop Myriel, a famous philanthropist, gave Jean Valjean a place of refuge. When everyone was asleep, Jean stole the Bishop's silverware and ran away, he was recaptured later but was saved by Mr. Myriel when he told the police that it was a gift he gave to Valjean. When parting, the old Bishop told Jean Valjean that he must become an honest person and do many good deeds for people. - Eight years after Valjean, now named Mr. Madeleine, became a wealthy factory owner and mayor of the small town where he lived, Valjean had to take on a false name to avoid detection by Inspector Javert is still actively searching for him. However, fate forced Valjean to reveal his identity when another man was mistaken for Jean Valjean and brought to court. At the same time, Valjean meets Fantine, a dying girl after being fired from his factory and forced to work as a prostitute to support his daughter Cosette, living with the wicked Thenardier family. - Before Fantine died, Valjean promised her to take good care of Cosette, he paid the innkeeper Thenardier to free Cosette and flee to Paris from Javert's pursuit. One of the revolutionaries was Marius Pontmercy, a student shunned by his family for his liberal views who fell in love with Cosette, now a very beautiful young woman. - Marius and Cosette get married. He also had the happiness of being with his beloved adopted daughter and son-in-law. He told them that he loved them very much, and then Valjean died.	***Ngon Co Gio Dua*** - Le Van Do for stealing a pot of pork porridge for his brother's children and grandchildren was arrested and imprisoned for 20 years. During that time in exile, mother and grandchildren died of starvation. - Released from prison, he returned to his hometown. Because he had no money, he was chased away. Long way, hungry, Le Van Do lost in a temple and fainted. Master Chanh Tam abbot let him live. Taking advantage of everyone's sleep, That was stealing from the temple, wearing a jade suit, but the monk Chanh Tam did not report the fine, but told the pursuing soldiers that this was a gift he gave, and even gave it silver as a fee. Write a letter of recommendation There with Li Ki Phung in Can Duoc to look for a job. The monk also instructed Le Van Do to become an honest person. - Le Van Do changed his name to Tran Chanh Tam, went to Can Duoc area to find Li Ki Phung but he died. That made a career by reclaiming, and then became rich. He chivalrously helped the poor, provided food for the imperial army, so he was named Thien Ho by the court. The name Pham Ki, the prison guard the day before, searched for Le Van Do aggressively. Fate also forced Do to confess when another man was mistaken for Le Van Do and was arrested. The Mandarin Chief of Binh Duong province, named Tu Hai Yen, lead the army to capture Le Van Do. Li Anh Nguyet, daughter of Li Ki Nguyen, niece of Li Ki Phung, who was an ex-wife abandoned by Tu Hai Yen, drifted everywhere, at that time she was seriously ill and relied on Thien Ho's family, saw Tu Hai Yen arrest Thien Ho, upset till die. Before her death, Anh Nguyet relied on Thien Ho to raise her daughter, Thu Van, who was living with the innkeeper Do Cam - Thi Phi at that time. - Thien Ho kept his promise, went to redeem Thu Van from the Do Cam'shouse, raised Thu Van to grow up, and became a beautiful young woman. A scholar with great ambition is Vuong The Phung - the son of Vuong The Hung, a philanthropist - who fell in love with Thu Van. - Vuong The Phung and Thu Van got married. Le Van Do gave all his accumulated assets to Thu Van, lying that it was left by Thu Van's mother. Le Van Do is happy when two children are happy. Then he died.

4	***En Famille*** - Mr. Vunphran - owner of a jute factory in Morocco has an only son, Etmong Vupran Panhdavoan. Because his son did not want to do business, he sent to India to buy jute. - Here Etmong married an Indian girl named Mari Doretsan without his father's approval. - Mr. Vunphran got angry and sent his son away. Because the business failed, Etmong and his wife and daughter Perrine wandered around to earn a living by many occupations such as photography and sales. Then Etmon fell ill and died on the road. - A few months later, his wife, Mari, also died of illness and starvation. - Perrine lost her mother when she was 12 years old. Before she died, my mother told me: Go to Macorua, live a happy life. - Following her promise to her mother, the girl went through the deep forest to find him. - When she meets her grandfather - a wealthy businessman, Perrine learns that her grandfather and father have a deep conflict because her father married her mother - an Indian woman without his approval. - I apply to work as a worker in my grandfather's factory, become independent and support myself. Because she knows English, she was assigned the job of translating documents by him. Gradually, she was loved and trusted by him. - I have to deal with deceitful relatives, so blinded by money that I am ready to sell my conscience for a huge fortune. - At the end of the work, with intelligence and energy, Perrine won a well-deserved reward. I was recognized by my grandfather, handed over the inheritance and became a kind owner.	***Chut Phan Linh Dinh*** - Mr. Le Hien Dat - former Council in Nha Man, Sa Dec province has an only son, Le Hien Vinh. When Le Hien Vinh went to Saigon to study, he became acquainted with Doan Thu Van, whose parents died early, and was living with his uncle. - Le Hien Vinh and Doan Thu Van love each other and have two little girls, Thu Ba and Thu Cuc. This marriage was also not approved by Mr. Le Hien Vinh, so he refused to face his son. Thu Ba is lost. - Having the opportunity, again encouraged by Thu Van, Le Hien Vinh decided to go to France to study medicine. On the way, the Hai Phong ship carrying 500 passengers including Le Hien Vinh was sunk by the Germans. - Not long after, Thu Van was also seriously ill. Knowing that she would not live long, Thu Van told her son about his grandfather and his paternal and maternal relatives. - Then the mother and daughter crossed a long distance and struggled to find Mr. Council's house in Nha Man. - Here, mother and daughter applied to make bricks in Mr. Council's brick kiln. - Due to a lack of food, Thu Van's illness is getting worse. Mr. Council went to the brick kiln to check it out and lovingly welcomed him back to his mansion. - Mr. Council assigned her the job of catching worms to take care of trees and reading newspapers to him every day, gradually being loved by him. - Thu Van was cured of the disease. - Once, seeing Mr. Council so sad about his descendants, Thu Cuc couldn't help telling him the truth that he was Le Hien Dat's son, and his grandson. Mr. Council is happy to welcome his children. - Le Hien Dat, after a period of wandering, has returned. Family members.
5	***Le Calvaire*** - This is the novel told in first person perspective. The character who calls himself "I" has the holy name Jean-Frangois-Marie-Mintie. He was born in Saint-Michelles-Hetres, a small town in the Orne region, into a family traditionally notary. His mother became ill and when he was 12 years old, the mother died. - After that, Jean-Frangois-Marie-Mintie volunteered to join the army. He became acquainted with Lirat, a painter. - During a visit to Lirat's studio, he became acquainted with a beautiful woman named Juliette Roux. - Jean Mintie had literary ambitions and the potential to be a good writer, but was unable to overcome her sexual obsession. Impotent, humiliated, he tries to turn his suffering into an impulse to create.	***Cha Con Nghia Nang*** - The story is told from the third person about the life of the character Tran Van Suu - a gentle, hard-working farmer. He married Thi Luu and had three children: Ti, Quyen, and Sung. He loves his wife dearly and loves his children. However, his wife is a promiscuous woman. - One day Suu caught his wife cheating, while angry, unfortunately, he pushed his wife, tripped and died immediately. - Suu fled, people thought Suu jumped into the river to commit suicide. Ti and his brother went to live with their grandfather, Huong Thi Tao. Sung fell ill and died, Ti and Quyen went to work as hired laborers for the housekeeper of Ton, loved by her, Quyen became her daughter-in-law. - After ten years of hiding, Suu sneaked home to visit his children, told by his father-in-law that their two children's lives were stable and happy, Suu hurriedly left... - After that, the Suu was cleared of the sentence and the father and son reunited.

Through the comparison table above, it can be seen that the writer has changed the details to suit the ethnic customs and habits, especially the Southern lifestyle. For example, if Jean Van Jean in V. Hugo's *Les Miserables* stole a piece of bread for his grandchildren, Le Van Do in *Ngon Co Gio Dua* stole a pot of pork porridge for his grandchildren. "Banh my" (bread) is a dish imported from the West, not a popular and easy dish for the poor, or even for common people in Vietnam at that time. Replacing the detail of "bread" with a pot of "pork porridge", Ho Bieu Chanh also shows the tragic fate of the poor. They are not even equal to a rich man's pig. After being released from prison, Jean Van Jean was allowed to stay in the church by a benevolent priest, while Le Van Do was allowed to stay in the temple by a monk… The pagoda was a space closer to the Vietnamese people at that time. Christianity was even considered heresy. In the novel *En Famille*, little Perrine came to his house and was accepted as a worker in his grandfather's jute mill, in the novel Little Destiny, Thu Van's mother and daughter were accepted as brick workers in grandfather's brick kiln. This detail of change is also consistent with the characteristics of Vietnamese society - an agricultural country. Industry is not yet developed. These changes help Ho Bieu Chanh's work reflect Vietnamese life and society in the early 20th century more delicately and closer to Vietnamese readers.

4. Creation in narrative techniques

Not only change the title of the work, events, and details in the plot, but writer Ho Bieu Chanh also has more creativity in narrative art compared to the original.

In the novel *Sans Famille*, H. Malot tells the story in the first person. The writer let the main character, the boy Remi, tell the story of his life. Here's Remi's voice-over about her adoptive mother, Barberin: "I am an abandoned child. But until I was eight years old, I still thought I had a mother like other children, because whenever I cried, a woman would come to hug and comfort me. I never go to sleep without her coming to caress me. In winter, when the wind sows snow on the white glass, she pulls my feet into her hands and lulls me. To this day I still remember her voice and lyrics. When I was watching grazing cows on green grass roads or in the wilderness, but suddenly met with heavy rain, she quickly ran to meet me, pulled the hem of my shirt to cover my head, and brought me home. When I had an argument with another child, she asked me to tell her story and then she found sweet words to comfort me and always told me it was right".

In his adapted work *Cay Dang Mui Doi*, Ho Bieu Chanh tells the story in the third person. The narrator standing outside narrates the story. In the first paragraph of the novel, the writer describes the body of the adoptive mother, Ba Thoi, and re-creates Duoc's feelings for his adoptive mother: "The yellow dog in the house suddenly ran straight to the yard, the boy looked after it and saw a tattooed woman walking in from the shore, he immediately shouted "mam back" and then ran out, holding hands happily led in. This woman was about thirty-four years old, her shirt was rolled up, her pants were pulled up to her knees, her skin was neither black nor white, her face was round, her eyebrows were full, her body was wet, and there was a stinging plant on her back, her head was covered with a white cloth shawl, in addition to wearing a coconut leaf hat, she walked in and reached the yard, glanced at the duck coop and asked the boy:

- Have you fed the pigs or not yet?

- Not yet! I just took a shower and then kicked me into the house.

- Do ducks come back enough or not?

- I locked myself but forgot to count

(Cay Dang Mui Doi)

Comparing Hector Malot and Ho Bieu Chanh in the way of character introduction, we see that there are two different writing styles: Hector Malot tells, Ho Bieu Chanh left. Hector Malot writes in the first person in a romantic way, letting emotions interfere with the pen, and using his emotions to attract readers. Ho Bieu Chanh writes in the third person in a left-footed style, in favor of reality. He stood outside, describing, without revealing any of his private feelings. He lets readers find their own emotions when reading. Through the above passage, with just a few lines, Ho Bieu Chanh introduced the woman with all her physique, clothes, age, and the mother-daughter response, expressing the motherly love between Duoc and Ba Thoi. With only a concise expression in 10 words "the child shouted loudly, let go of the bucket, and ran out with joy", Ho Bieu Chanh lets readers feel the love of Duoc with his adoptive mother.

5. Building characters with characteristics of Southern farmers

Ho Bieu Chanh's writings have a large number of readers because they are compatible with the moral tradition, as well as the tastes of popular readers, just as Nguyen Van Trung commented in *Luc Chau Hoc*: "The early years century, Ho Bieu Chanh knew how to find his own way for his novels by promoting traditional experiences, exploiting artistic inspirations suitable to the taste of popular and mass readers. Therefore, the audience reading Ho Bieu Chanh is more extensive than many writers with a high-pitched, flying and luxurious way of writing" [5]. Above all, his compositions show the spirit of democracy, of caring and protecting the poor as he once confided: "When I was a mandarin, I took care of the poor, so I gained a reputation for loving the people. In novels, we also try to keep our filial piety and always defend the poor and common people, so we gain the sympathy of the masses" [1].

5.1. Name and way of addressing people with Southern nuances

The characters in Ho Bieu Chanh's novels are named after the naming of the Cochinchina people: thang Duoc, thang Ti, con Luu, con Lien, Le Van Do, Le Van Day… or call according to the family's order Ba Thoi (Third Thoi), Sau Li (Sixth Li), or according to position such as Ba Ho Sieu (Village's Notable Man Sieu), Com Mi Danh (Commis Danh), Huong Hao Hoi (Community Hao)… Ho Bieu Chanh also faithfully reflects the address of the people of Cochinchina, especially in the countryside, during the French colonial period. For the first time in the novel, the way friends and husband and wife call each other in the countryside and fields are included in the novel by Ho

Bieu Chanh as: may tao, minh, ma sap nho, ma no, cha thang sung, or a processed way to call the third person who is absent: thay, ong, ba, con, thang, o tren…

5.2. Southerners maintaining morals

Absorbing the modern form of European literature, Ho Bieu Chanh continued to uphold the tradition of "literature primarily conveying morals" of Vietnam. The purpose of the writer is to demonstrate justice, fight evil and bring a good life to honest people, and touch people's hearts. The name Bieu Chanh expressed his aspiration. In the memoir *Doi Cua Toi Ve Van Nghe* (My Life on Art), Ho Bieu Chanh confessed: "Writing novels to inspire, to gradually lead the masses back to the righteous and clear path" [1].

Ho Bieu Chanh's characters are straightforward, chivalrous, honest, love-hate pages. Favored by nature, they have a generous personality and do not depend on money. They were originally Vietnamese exiles, the baggage they brought with them when they went to open the land were national cultural values. They uphold justice and discipline, which are values distilled from Confucianism. Loving morality, especially Confucian ethics, is a characteristic of Southern culture. Choosing this ideological theme, Ho Bieu Chanh wants to preserve the core cultural values of the nation - the moral standards of his ancestors - in the process of exchanging and interacting with the cultures of other countries, especially during the period of "European rain and American wind". He himself once affirmed: "For the past forty years, I have cherished the ambition to uphold Confucian morality. Without weak writing, not narrowly educated, I enthusiastically sow the seeds of Kong Manh's benevolence in society, secretly hoping that it will sprout and produce fresh flowers and fruits for the community to enjoy. with compatriots" [1].

This type of character, the writer inherits from the Southern line of moral literature, whose main originator is the poet Nguyen Dinh Chieu. But the man who practices the religion in Nguyen Dinh Chieu's poetry and literature has become a man who preserves morality before the strong attack on money in Ho Bieu Chanh's compositions. Qualities such as filial piety, decency, virtue, respect, and contempt for talent... in the relationships between king and I, teacher and student, father and son, brotherhood, husband and wife... - fundamental qualities of national morality always appreciated by writers. These principles also have an encounter by many French writers whose work Ho Bieu Chanh has published.

Upholding morality, the writer does not uphold rigid ethics, but he values human love. In Ho Bieu Chanh's works, the thought seed of Khong Manh has lost its holy color, becoming a way of life, a way of life, a people's morality, and popular morality.

5.2.1. Upholding family ethics

The family is the cell of society. Keeping the house religion is keeping the deep roots of social morality. Therefore, many of Ho Bieu Chanh's works promote family morality, not focusing on building great heroic character models capable of "ruling the country", or "pacifying the world". Therefore, he is called a writer who "takes morality as the root, takes the family as a model, takes loyalty as the essential thing in everything in life" [6]. The characters in Ho Bieu Chanh's works are mostly ordinary people, but they are very faithful to preserving the family and clan morality: the elderly are an example for children, and children have respect and obedience to people. When children are old, children are filial to their parents, parents love their children dearly, brothers and sisters love and protect each other, and husband and wife are faithful...

The novel *Cha Con Nghia Nang*, as Ho Bieu Chanh reveals, is an adaptation from *Le Calvaire*, however, the author retains only very few details in the original Octave Mirbeau, perhaps the motif of a man being mistreated by a woman. People who are mistreated in *Cha Con Nghia Nang* is Tran Van Suu, and the bad guy is his wife - Thi Luu. The rest, Ho Bieu Chanh mainly focuses on clarifying the closeness of family members, rather than delving into the character's psychological state. Huong Thi Tao felt ashamed because her daughter Thi Luu was a liar, and her son-in-law had to live in a foreign country. Loving the children suffering from helplessness, the family being separated, Huong Thi Tao has grey hair, a few teeth fall out, but still has to "work hard to take care of her grandchildren, when carrying Sung to feed him, when taking children with him. Quyen went to take a bath", "there was a night when I was about to sleep, he turned on the lamp and sat alone, when he saw them, he was moved to tears" [7]. In order to reduce the disadvantage of his grandchildren, he had to make every effort. He is ready for his grandchildren to have a good life no matter how hard he is. He said to Ti: "If you are poor, you can bear it, but why can't you wait for someone else's grandchildren" [7]. All his efforts stem from blood relatives and also aim to save the honor of the family. Ti, son of Tran Van Suu, also wants to be sacrificed and take care of his grandfather and sister. It told him: "Oh, okay. He took the money and then bought a cloth to sew for Quyen's son a shirt and a pair of pants to keep her busy, while the rest, he would buy and sell things" [7]. The words are very ordinary but contain "many mean meanings", which touched Huong Thi Tao.

The novel *Chua Tau Kim Quy* was adapted from the novel *The Count of Monte Cristo* by Ho Bieu Chanh. However, he also modified many details to enhance family moral examples. For example, if Pierre Picaud, because he loved a beautiful and rich woman, was hated by his bad friends, falsely accused of being a spy, and then imprisoned, then the character Thu Nghia beat Tran Tan Than and broke his arm because he had offended him. violate his sister's chastity. That action caused him to be revenged by Tran Tan Than. He was falsely accused of being a Christian and he was sentenced to prison. During the time he was imprisoned, his parents and sister died… At times, he wanted to commit suicide because of pain and resentment. It was the moral man that helped him overcome despair. He always thinks of the responsibility of being filial to a son's parents and paying tribute to a servant's country: "There are times when Thu Nghia is so upset that he wants to give up eating to die, but he thinks of his destiny as a boy. burdened with filial piety, no matter how much calamity or tribulation, one must persevere and take care of the virtues of birth and success, and build the foundation of the kingdom." (*Chua Tau Kim Quy*). When adapting A. Dumas' work *The Count of Monte Cristo* into *Chua Tau Kim Quy*, Ho Bieu Chanh also omitted a lot of content related to Monte Cristo's revenge plans, instead of events and actions to help the poor and win hearts. Farmer Thu Nghia, even though he has suffered many injustices and bitterness, is only depressed and sad, but does not burn revenge during the whole time in prison like Dantes. When it was time to get out of prison, Dantes devised a very sharp revenge plan. Thu Nghia easily erases hatred and forgets hatred, only remembers the kindness of good people and takes care to repay it completely. Ho Bieu Chanh emphasized Le Thu Nghia's act of repaying gratitude rather than revenge, thereby promoting a life of gratitude, kindness, humanity, morality, etc., rather than emphasizing the inspiration of "revenge and revenge" in *The Count of Monte Cristo* by A. Dumas.

In *Chut Phan Linh Dinh*, to emphasize family affection, writer Ho Bieu Chanh shortened the details and events of Perrine's character overcoming harsh challenges on the way back to his hometown. The character Thu Cuc also does not have to deal with greedy relatives like Perrine experienced in *En Famille* by H. Malot.

In the husband-wife relationship, Ho Bieu Chanh emphasizes fidelity. The character of Ba Thoi in *Cay Dang Mui Doi* is sad because her husband left to work far away, and heard that her husband had another wife in Can Duoc, but she "still loves and doesn't plan to marry another man, so she Returning to Le Van Tiet and his wife for nearly a year now, working day by day, lying in wait at night, silently begging for her husband to think about returning, so that the whole country can reunite, even though they are suffering, they are willing to wait for luck" [8]. This detail does not appear in the novel *En Famille* by H. Malot. Mr. Barberin did not commit adultery and did not have a concubine. Ms. Tu Chuyen in the *Chua Tau Kim Quy* is self-confident even though she doesn't know anything about the person she loves. Anh Nguyet in *Ngon Co Gio Dua* was abandoned by Tu Hai Yen, but still kept her virginity.

The behavior of Ba Thoi, Ms. Tu Chuyen, Anh Nguyet... all follow the principle of decency of feudalism. Their image is reminiscent of Kieu Nguyet Nga: "My body is still standing in the sky/I will worship the statue for the rest of my life" [9].

5.2.2. Promote human morality and humanity in society

Not only respecting family morality, Ho Bieu Chanh also upholds the morality of humanity in the way people behave with people in society. *Nhan* (仁) is the morality of being human, loving people is not for your own benefit. *Nghia* (義) is the duty and responsibility of people in a collective, community, is the right thing, the right thing to do, the work for others, the common good. Humanity means loving people, it is the spirit of mutual love and mutual help of people in society. This Confucian doctrine has blended with the traditions of the Vietnamese nation: "Nhieu dieu phu lay gia guong/Nguoi trong mot nuoc thi thuong nhau cung"; "Bau oi thuong lay bi cung/Tuy rang khac giong nhung chung mot gian". This moral was once promoted by Nguyen Dinh Chieu through the images of Luc Van Tien, Hon Minh, and Tu Truc: "In the middle of the road, even if it is unfair, let it go" in the poetic story *Luc Van Tien*. Ho Bieu Chanh demonstrated this good morality by portraying the image of benevolent people, ready to sacrifice themselves to help people without any self-interest.

In the novel *Ngon Co Gio Dua* adapted from *The Miserables* by V. Hugo, Le Van Do was arrested for stealing a pot of bran porridge for his grandchildren. Released from prison, he returned home. Because he had no money, he was chased away. Far away, hungry, Le Van Do lost in a temple and fainted. Master Chanh Tam Abbot lets him live. Taking advantage when everyone was asleep, Do stole the temple's silver clothes, but the monk Chanh Tam didn't report the theft, but told the pursuing soldiers that this was a gift he gave, and even gave that silver as a fee. He wrote a letter of recommendation there with Li Ki Phung in Can Duoc to look for a job. The monk also instructed Le Van Do to become an honest person. Following the monk's teachings, Le Van Do changed his name to Tran Chanh Tam, went to Can Duoc area to settle down by reclaiming land, and then became rich. He chivalrously helped the poor, providing food for the imperial army, so he was named Thien Ho by the court. The name Pham Ky, the prison guard the day before, searched for Le Van Do aggressively. Fate also forced Do to confess when another man was mistaken for Le Van Do and was arrested. The inner struggle of selfishness - altruism in the character is described very honestly by the writer. Witnessing the scene of the trial of Tu Hoanh - who was mistakenly identified as Le Van Do, Le Van Do kept tormenting and wondering "in my mind, should this crazy person be punished unjustly, so that he can enjoy the riches and wealth that he has. No?" [10]. At first, Le Van Do intended to let him take the sentence for him, and I would ask where the parents, wife, and children of the sentenced person were to take home and raise them, justifying that it was harming one person to save thousands. But when he heard the judge's sentence of beheading, and then sent soldiers to escort him away, Le Van Do could not help but stood up and confessed: "Wait, the soldier led that person. It's a shame for people. it's me, not him" [10].

The chief officer of Binh Duong province, named Tu Hai Yen, led the army to capture Le Van Do. Li Anh Nguyet, daughter of Li Ki Nguyen, niece of Li Ki Phung, who was an ex-wife abandoned by Tu Hai Yen, drifted everywhere, at that time she was seriously ill and relied on Thien Ho's family to see Tu Hai Yen arrest Thien Ho, is upset to die. Before her death, Anh Nguyet relied on Thien Ho to raise her daughter, Thu Van, who was living with the innkeeper Do Cam - Thi Phi at that time. Thien Ho kept his promise, went to redeem Thu Van from Do Cam's house, raised Thu Van to grow up, and became a beautiful young woman. When Thu Van married Vuong The Phung, Le Van Do gave all his accumulated assets to Thu Van, lying that it was left by Thu Van's mother. He is happy when his two children are happy. Le Van Do lived a benevolent, honest life, wholeheartedly for others. Le Van Do, it can be said, is the Vietnamese version of the character Jean Van Jean in V. Hugo's novel *Les Miserables*. It is clear that there is a close meeting in the policy of promoting benevolent people in the works of the two writers.

In *Chut Phan Linh Dinh* written based on the novel *En Famille* by Hector Malot, Thu Van made it through the journey from Hanoi to Saigon and then to Nha Man, and was acknowledged by her father-in-law because of the help of many benevolent hearts. The doctor gave Thu Van five injections of medicine to treat malaria and five tonic injections to improve her health. A kind woman allowed mother and daughter to stay overnight, made rice for food, offered tea, and offered cakes very thoughtfully. The uncle let him hitchhike. The kind granny let her live in the hut, and even taught how to make bricks for a living... Perrine's mother in Hector Malot's novel *En Famille* does not receive such sincere help, so she died of starvation, cold and sickness on the tattered carriage. This difference between the two novels comes from the different aims of the two writers. If Hector Malot mainly denounces the reality of European bourgeois society in the second half of the nineteenth century and the beginning of the twentieth century, the main purpose of Ho Bieu Chanh's priority is to show humanity's compassion for each other.

In *Cay Dang Mui Doi*, although she was kidnapped by her stepmother and uncle and thrown on the street, she was fortunate to receive love from adoptive mothers and fathers like Ba Thoi and Dang. Ba Thoi, despite being ridiculed by people, still resolutely raised Duoc until he grew up with all his love. Master Dang, even though he had bad luck, was still worried about covering and taking care of baby Duoc, whom he has redeemed. When he was in prison, she took care of him from a loaf of bread to a pair of sausages so that he wouldn't be hungry. Baby's Fate is similar to the boy Remi in Hector Malot's novel *En Famille*. Kidnapped and abandoned by her evil uncle Jame Miligon when she was still in her cradle, Remi was fortunate to be taken care of, loved, taught, and cared for by good people like Barberin's mother, Vitali's grandmother, and Acanh's flower grower, etc.

Keeping good qualities, being grateful for someone a little, not forgetting, daring to do is the way of Southern people to behave towards their neighbors, to people in society in general. Those noble people became the central figure in Ho Bieu Chanh's compositions, portrayed by him with immense inspiration and endless passion, creating a unique style for Ho Bieu Chanh's compositions. At the same time, this feature also makes Ho Bieu Chanh close to French humanitarian writers.

5.2.3. Criticism of the evil

Not only loving and promoting benevolent people, Ho Bieu Chanh also expressed his hatred of condemning evil. The balance of two attitudes of love - hate has made Ho Bieu Chanh's work unique compared to some writers. If Thach Lam is inclined to "love", Nguyen Cong Hoan is somewhat inclined to "hate". Nguyen Hong "feels sorry" while Vu Trong Phung "contempts silver and resentful". The balance of love and hate brings Ho Bieu Chanh closer to Nguyen Dinh Chieu, the man who "hates because he loves".

5.2.4. Condemn the money slaves

In every society, there are people who become evil for money, ready to harm others. In feudal times, Nguyen Binh Khiemm once mocked this type of person: "The cutting board has fishy, butterflies come/Pot without honey, ants do not come" (*Thoi Doi*). Nguyen Du once condemned those who "do harm just for money" (*The Tale of Kieu*). In the feudal-bourgeois society, money has even more powerful destructive power, corrupting human morality. Ho Bieu Chanh condemns those who are corrupt for money with an attitude of hatred and hatred. In *Cay Dang Mui Doi*, for the purpose of appropriating his brother's estate, the younger brother colluded with his younger wife to kidnap the eldest wife's child in order to destroy the child. In the novel *Chua Tau Kim Quy*, District officials, because they were bribed by Tran Tan Than with fifty coins, sent soldiers to arrest Thu Nghia and then make a report to go to the province, causing Thu Nghia to be sentenced to life in prison by the provincial mandarin. He also presented to Tran Tan Than a plot to harm Tran Mung, Cam, and Quyt. In *Cha Con Nghia Nang*, the chief executive officer of Sum received money from Huong Hao Hoi, so he tried to defend the perpetrators, causing the family of farmer Tran Van Suu to suffer, and the father and son to separate. Money has made those who are responsible for protecting and enforcing justice into conscientious objectors, pushing many people with low throats into misery.

Ho Bieu Chanh also built up honorable characters with contempt for talent, who did not hesitate to criticize and condemn money slaves. In *Chua Tau Kim Quy,* Thu Nghia frankly accused money: "Money is a very harmful thing, also because it obstructs the righteous eye, it moves the righteous heart, it urges people's greed, so we are innocent and have to sin. into labor for 11 years" [11]. The judge also loudly scolded and accused the government: "I am very sad for the Mandarin because I am a father and mother, it is reasonable to maintain justice and integrity to govern the people so that it can be relied on, okay? Such greed of the people" [11].

In the end, those who are blind to money pay a heavy price. Their fate reflects the folk philosophy of sowing, and reaping the same, which is also the philosophy that Ho Bieu Chanh believes in and espouses.

5.2.5. Condemn the liar, the deceitful, the greedy, and the wicked

In his adaptations, Ho Bieu Chanh strongly condemns the false, deceitful, greedy and cruel people that are very common in the money society. He hates Tu Cam and his wife (*Ngon Co Gio Dua*). The unscrupulous innkeeper couple took advantage of the lonely situation of the innocent girl Li Anh Nguyet to deceive her, fabricating the story that her father borrowed money to stay at the boarding house, pushing her into poverty: having to be a housekeeper for her family. He and his wife, being deceived by Tu Hai Yen to have children, had to pledge their children and eventually died tragically in anger. In *Cay Dang Mui Doi*, people like Thi Sanh and Phan Duc Loi colluded with each other, secretly abducted their husband's stepchildren, and abducted their own grandsons to win their inheritance, also became the object of the writer's condemnation. In *Cha Con Nghia Nang*, the writer criticizes promiscuous women like Thi Luu, who defy marital morality, and blatant adultery, and push the family into tragedy. In order to be more objective and convincing, the writer lets the character Huong Thi Cao impeach her own promiscuous daughter: "Your wife's daughter was so miserable before, so God made her die like that. It's not that he behaves properly like other people, today, his son and daughter should be over, how happy he would be" [7].

As a writer who wholeheartedly worships and upholds morality, Ho Bieu Chanh has no tolerance for anyone who behaves contrary to the people's morality.

5.3. The space, customs, and activities typical of the Southern countryside

One of the most "Vietnameseised" elements in Ho Bieu Chanh's adaptations is the space, customs, and activities of the characters.

Reading Ho Bieu Chanh's novels, the reader feels like living in the land of Cochinchina, especially in rural areas in the early decades of the twentieth century. Even many critics consider Ho Bieu Chanh's novel to be an encyclopedia of Cochinchina society and customs. Through his novels, readers seem to return to see the lines of sutras, rivers with the sound of train whistles, fields, Melaleuca forests with birds chirping, and markets and activities in the countryside. Nam Ki with familiar places in Nam Ki such as: O Mon, Binh Thuy, Cang Long, Soc Trang, Tra Vinh, Cho Gao station, towns such as Xa Tai and Khanh Hoi markets. He skillfully put in his composition familiar places to the Southern people: "Whoever goes to Cho Lon street down to Go Cong, once he crosses the Bao Buoc boat, gets on the bus and runs out of My Loi market to the bend"... "The field, from Rach La to Ben Loi, is the breast milk of the people in Tan Hoa district, thanks to that, every year the family is full of food and warm clothes." (*Cay Dang Mui Doi*)…

This is an innovation of Ho Bieu Chanh compared to medieval compositions. Because earlier writers often took place names in China. On the contrary, Ho Bieu Chanh has built living spaces for the characters in his novels on familiar lands to readers. According to Binh Nguyen Loc, "for the first time, Vietnamese readers can see the image of the alum dog lying on the porch of the cottage, listening to imitation music in the deep fields in the afternoon, all familiar scenes. But why is it like new, more attractive than the weeping willow by the lake, the lotus has just faded, and the chrysanthemum has just bloomed" [12]. Speak like researcher Nguyen Van Y: "The uniqueness of Ho Bieu Chanh is that the author tells us an interesting story in a popular language" [12]. That is one of the factors that makes Ho Bieu Chanh's novels close to readers and loved by Southern readers.

The scene of life in the countryside with simple, sincere, rustic, blue-collar people also appear very vividly on each page. "The yellow dog in the house suddenly ran straight to the yard, the boy looked after it and saw a tattooed woman walking in from the shore, he immediately shouted "mam back" and then ran out, holding hands happily lead in. This woman was about thirty-four years old, her shirt was rolled up, her pants were pulled up to her knees, her skin was neither black nor white, her face was round, her eyebrows were full, her body was wet, and there was a stinging plant on her back. Her head was covered with a white cloth shawl, in addition to wearing a coconut leaf hat, she walked in and reached the yard, glanced at the duck coop and asked the boy:

- Have you fed the pigs or not yet?

- Not yet! I just took a shower and then kicked me into the house.

- Do ducks come back enough or not?

- I locked myself but forgot to count.

(*Cay Dang Mui Doi*)

Through the pen of Ho Bieu Chanh, the image of a farmer in the South appears unmistakably with any farmer anywhere. This is farmer Tran Van Suu in *Cha Con Nghia Nang*: "He was wearing a humiliating black shirt, a pair of ragged pants, a bandana over his head, and a smack of betel nut".

Life is difficult, material conditions are poor, and knowing "whether rice can be made with fish sauce", Southern farmers live a very idyllic life, not fussy, not even luxurious. That simplicity is reflected in the way they live, dress and even eat. Going on a long road trip, just a few handfuls of rice, a couple of fishes packed with them is enough for them to complete their trip, these are the details mentioned in the novel *Chua Tau Kim Quy*. Or when working in the fields away from home, their meals are frugal and simple. Ho Bieu Chanh cleverly put into the work the details of everyday life, this is Mr. Suu's lunch: "Having done a good job, he climbed ashore, sat down to think, and ate the rice packet. On one hand, he holds fish sauce, and on the other, he picks up cold rice. It's sunny on his head, and there's mud under his feet, but the rice looks delicious. After finishing the packet of rice, he walked back to the nearby puddle, scooped up water with his hands, drank, and then washed his face..." (*Cha Con Nghia Nang*).

Tran Huu Ta commented very accurately about this feature in Ho Bieu Chanh's works: "Whether it is in Italy, in France or in any foreign European land in the works by V. Hugo, A. Dumas, and A. Therie, but through Ho Bieu Chanh's subtle sensibility and his brilliant adaptability, *Cay Dang Mui Doi, Chua Tau Kim Quy,* and *Ngon Co Gio Dua* still has its own nuance. Readers still think that they will meet here in the southern lands, relive the atmosphere of this land with simple, honest, and good people who have sweated and blooded in the fields and canals in the Mekong delta" [13].

5.4. Rustic language bold southern farmers

Ho Bieu Chanh's language is the language of the middle class and common people in Cochinchina, who are quite close to his life. He used the dialects of Sai Gon Luc Tinh region to subtly describe the psychology, the characters, and the scenery here. According to one statistic, he used about 800 dialects of Cochinchina in his novels: nin khe, di lon ton, mat may tem lem, nhai nhoc nhach, dau co chom bom, la bai hai, dung ke ne, hoi don hoi ren… Many words are written in the "camp" way of the common people, which readers think they write wrong: xao xien (xao xuyen - fluttering), chinh chien (chinh chuyen - fidelity), phien ba do Hoi (phon hoa do Hoi - urban prosperity), Tan hoa (tien hoa - progress). The way to say drive is also used to abstain: Binh yen (Binh an - peace), bong huong (Hong - rose), cay don (dan is an instrumental tool). There are words that young people living in the South today may have forgotten because they are no longer used as: ong bac vat (ki su - engineer), co thay thuoc (vo bac si - wife of doctor), anh bam bu (nguoi mang hanh Li - a person who carry the luggage), ong mai chinh (dai dien hang buon - representative of a business branch), anh dung em (cuoi em - marry you)…

His literary style is rustic, popular, and natural. This feature makes many literary critics in the North, as well as Dong Ho - a writer in the South, consider that Ho Bieu Chanh's novels are not literary. For example, Duong Quang Ham, the author of the work *Viet Nam Van Hoc Su Yeu* (Vietnam literature and history) (1944), The textbooks of the Vietnamese Literature Program at the high school level before 1975 did not consider Ho Bieu Chanh as a writer.

In fact, the rustic style and words in Ho Bieu Chanh's novels are very suitable to describe the portraits and describe the psychology of each typical character as in real life and true to each situation, each class of people in the world ancient Southern society.

With typical Southern language, Ho Bieu Chanh brought to life the mood of the naive farmer Tran Van Suu in *Cha Con Nghia Nang* when he heard rumors that his wife was having an affair with Huong Hao Hoi: "… He rested his chin on his knee, drew a picture under the sand with his finger, and thought about housework. For the past few years, Huong Hao Hoi often visited my house, but I mean to see, whenever Huong Hao visits, my wife takes care of the betel nut and seems to be very welcoming. However, I did not see Huong Hao teasing or joking with his wife, I did not meet two sides to talk to each other, and my wife did not want to leave me. My wife's personality is chaotic, it often scolds me, but my husband and I live as usual. If my wife married Village chief Hoi, she would have left me, there's no reason why she loves me anymore but she still lives with me. Communal chief Tam said that everyone knew that Village chief Hoi was getting married. Have they met or are they sure? Or they see that Village chief Hoi leaves the field for themselves to do, they are jealous, so they find things to say bad things."

The story that he was scolded by his wife Thi Luu when he questioned him, and then his bewilderment, half-belief, and suspicion was delicately described by Ho Bieu Chanh:

After a long time, Thi Luu in her room cried out:

- Sung's father, ah

- Like what?

- A little expressionless

Tran Van Suu scrambled to get up, went to lock the door, took the lamp and put it on the altar, and turned it off, then went into the room with a big smile on his face, because he had forgotten everything Communal chief Tam said.

The idyllic and rustic style has contributed to the unique attraction of Ho Bieu Chanh's novels.

6. Conclusions

Ho Bieu Chanh is a pioneer writer in the modernization of Vietnamese novels. He has made tireless efforts to cultivate to turn "the field of national language literature in the South, which is still wild in the South, into lush and prosperous". To achieve that goal, at the beginning, Ho Bieu Chanh had done a very meaningful right thing to adapt the works of Western writers in the direction of "Vietnameseisation" and agrarianization. At the time when Ho Bieu Chanh wrote novels in Vietnamese prose, there was no other writer who was really interested in discovering the beauty of Southern farmers in everyday life like him. Thereby, the writer shows his love, sympathy, and respect for the farmers. He wrote about them with all the heart of a writer who is trying to bridge the gap between high-level intellectuals and the working poor, "the writer's heartbeat seems to have synchronized with the heartbeat of the writer's heart. He can be considered as a writer of southern farmers, of the desire to establish a compassionate ground for daily life" [14]. Ho Bieu Chanh's creations show the writer's sense of nationalism and democracy in the process of composing, just as Huynh Thi Lanh commented when determining Ho Bieu Chanh's position in Vietnamese prose works: Before the Western culture and confidence in the national culture, Ho Bieu Chanh is often interested in the spiritual values that Vietnamese society requires and cares about the inner humanitarian and human values to suit the needs of the people. in accordance with the spirit and morality of Vietnam, not dependent on the "Western shell". This leads to the phenomenon that Ho Bieu Chanh does not follow the original work but shows a strong sense of nationalization in the process of adapting" [15]. The interference of Ho Bieu Chanh's works shows his deep knowledge of French literature, some aspects of habits and customs, Southern dialects, his appreciation with national values, the important role of Ho Bieu Chanh in the process of modernizing national literature and the modernization of Vietnamese prose.

COMPETING INTERESTS

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

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Theme of pandemics in literature: From *The Plague* by Albert Camus to Vietnamese novels in the early 21st century

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Abstract:

Since ancient times, humanity has experienced many horrifying pandemics. The anxiety about the casualties, death, and suffering of the pandemics has been boldly imprinted and reflected in literature. From 1947, Albert Camus's warnings in the novel *The Plague* and the novel still have practical significance today. His prophetic insight into the absurd world of humanity has come to fruition as we face the dangerous global COVID-19 pandemic. In recent years, theme of pandemics has received more attention from writers. Some novels published in Vietnam, such as *Quarantine Days* (B.Q. Thang), *Nalis Drifted to The Shore of Destiny* (T. Ha), and *Sadness is Sowing The Seeds of Kindness* (I. Le), all share the same theme of a pandemic. It shows the agility and timeliness of literature in the face of life's radiation. The article provides a comparative view of A. Camus's *The Plague* with some Vietnamese novels of the early 21st century. Connecting the topic of pandemics from traditional to modern, the article focuses on pointing out the exciting and unique points between this east-west literary intersection. The pandemics of the 20th century in Camus's *The Plague* and the 21st century in Vietnamese novels have exciting implications.

Keywords: **Albert Camus, COVID-19, pandemic, *The Plague*, Vietnamese novels.**

Classification number: **9.2**

1. Introduction

Birth, aging, sickness, and death is the basic law of nature. The human life cycle must go through the formation, growth, illness, aging, and death process. It is an inescapable process; but, faced with the pain and loss of pandemics, humanity is still shocked, haunted, and saddened. Since the advent of writing, human history has recorded countless pandemics that have taken countless lives, destroyed the economy, disrupted daily life, and caused mental despair and loss of faith.

We can mention some horrifying pandemics from ancient times to modern times, such as the plague in Athens that took place from 430 to 426 BC and took away a quarter of the Athenian army and population. From 165 to 180 AD, about 5,000 Romans died every day from the Antonine Plague, the origin of which scientists believe was a smallpox virus brought from the Italian peninsula by soldiers returning from the Near East. The Justinian Plague (541-542) devastated the Byzantine Empire, affecting a large territory stretching from the Middle East to Western Europe. It is estimated that this pandemic killed about 50 million people (accounting for half of the world's population at that time). The plague called the "Black Death" killed about 75 to 200 million people across Europe and Asia during the 14th century, peaking in 1346-1351. The smallpox pandemic that appeared in America in the 17th century caused about 20 million deaths, accounting for 90% of the continent's population at the time. In the 19th century, there was an influenza pandemic in 1889-1890 that spread worldwide, killing about 1 million people. The Spanish flu pandemic (1918-1920) killed more than 50 million people in the twentieth century. The HIV pandemic - the virus that causes AIDS - began in 1969, with an infection rate of about 25% in southern and eastern Africa, then spread across the globe, leaving many tragic aftershocks to this day. In the 21st century, pandemics such as SARS (2002-2003), influenza A H1N1 pandemic (2009), Ebola pandemic (2014) have seriously threatened human lives [1]. Recently, for three years (2019-2022), the COVID-19 pandemic has been causing suffering and loss, to humanity.

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Anxiety about the casualties, death, and suffering of the pandemics have been boldly imprinted and reflected in literature. Many works have taken pandemics as inspiration or artistic intention to convey a meaningful human message. For example the novel *Decameron* (1353) by G. Boccaccio; novel *A Journal of The Plague Year* (1722) by D. Foe; novel *The Last Man* (1826) by M. Shelley; the short story *The Mask of The Red Death* (1842) by A.E. Poe; novel *The Scarlet Plague* (1912) by J. London; novel *Pale Horse, Pale Rider* (1939) by K.A. Porter; novel *The Plague* (1947) by A. Camus; novel *Love in The Time of Cholera* (1985) by G.G. Marquez; novel *Blindness* (1995) by J. Saramago; novel *Plague Journal* (1999) by M.D. O'Brien; novel *Dream of Ding Village* (2005) by Y. Lian-ke; novel *Zone One* (2011) by C. Whitehead; novel *Red Ashes* (2017) by P.H. Young; novel *The Dreamers* (2019) by K. Thomas; novel *28* (2020) by J.Y. Jeong...

In Vietnam, the theme of pandemics appears in literature; some works reflect the social panoramic view of the "COVID period" such as the novel *Quarantine Days* by B.Q. Thang; the long story *Human Love during The Quarantine Period* by T.N. Thach; novel *Sadness is Sowing The Seeds of Kindness - Diary of A Nurse during COVID-19* by I. Le; novel *Nalis Drifted to The Shore of Destiny* by T. Ha; novel *Immersed in The Virus Swarm* by N.V. Hoc; the long story *Going Through Two Pandemic Seasons* by D. Khoa; the autobiography *55 Days of Detention in Paris - Diary Was Written from The Center of The Pandemic* by G. Huong; the short stories *Memoir Paris+14* by C.T. Huong; the collection of essays *Saigon Remembers The Love* of 25 authors; the short stories *I'm Here, Sister!* by B. Ngan; the short stories *Letter of COVID Season* by N.T. Cu; the short stories *In The Silence of The City* by T.T.T. Ngoc; the short stories *COVID-Era Classroom* by P.T. Mui; the short stories *Believe in The Return Date* by B.V. Phuong...

In recent years, the appearance of many works on the theme of pandemics in the world and Vietnam has shown the agility and timeliness of literature in the face of life's "radiation." From here, scholars laid the theoretical foundation for the epidemic/pandemic literature line, including basic concepts and characteristics. According to L.G. More (2021) [2]: Literature of pandemics exhibits commonality of humanistic concerns; to explore the meaning of painful experiences through reading, reflection and storytelling, shaping our experiences of health, disease, and illness and providing us with insights into how our ancestors internalized pain and anguish from pandemics. Pandemic literature has always proved to be a window on societies inflicted with plagues and pestilences, thereby offering a close picture of semblances and differences, from minor to major, from social, political, health-related, and economic problems encountered by them.

That can be considered a comprehensive definition of epidemic/pandemic literature. The core ideas and themes of this line of literature address broad issues that cover the condition and life of humans. That means it does not stop at the story of an individual but focuses on the life of the community and race. The artistic techniques of pandemic literature are typically demonstrated through the construction of pandemic images (images of viruses, types of parasites) and motifs (quarantine motifs, heroes, etc.). The content of works about pandemics all have striking similarities in describing people's reactions when the disease spreads, concerns about the virus's origin, inadequacies in society, and ways to deal with pandemics and cope in difficult and dangerous situations. Therefore, studying pandemic literature is an interdisciplinary research direction, approaching literature from the perspective of relationships with broad fields such as biology, anthropology, epidemiology, environment, ecology, culture.

Connecting the topic of pandemics from tradition to modernity, this article focuses on illuminating A. Camus's novel *The Plague* with some Vietnamese novels of the early 21st century. Specifically, the scope of research focuses on three novels: *Quarantine Days* (2020) by B.Q. Thang, *Sadness is Sowing The Seeds of Kindness - Diary of a Nurse During COVID-19* (2020) by I. Le; *Nalis Drifted to The Shore of Destiny* (2021) by T. Ha. These are typical novels deeply reflecting the reality and fate of people during the pandemic period. Furthermore, these novels were composed during the COVID-19 pandemic from 2020 to 2022. From a comparative perspective, the author finds many interesting and unique points between this east-west interference. Because pandemics are not simply a social disease that spreads quickly and affects health and mind; deeply, the pandemic will reveal people's politics, culture, lifestyle, and behavior towards the world around them. The pandemics of the twentieth century in Camus's *The Plague* and the 20th century in Vietnamese novels have exciting implications.

2. The theme of pandemics and the French-Vietnamese literary reunion

2.1. Cause and effect relationship between pandemics, war, and ecological environment

Works about pandemics are always similar in tracing the origin of pandemics. There are many factors considered to be the origin and spread of pandemics. In particular, researchers pay special attention to the issue of war and the ecological environment. Moreover, these factors are closely related to each other. It was also J. Diamon's important argument in the work *Guns, Germs and Steel* (1997) [3] when he analyzed the defeat of a powerful Cajamarca empire in the Americas before the Spanish army; it was not due to the powerful war horses, the steel weapons, the muskets; but by bacteria. Diseases from invading people, who already carried significant antibodies, infect people without antibodies. Smallpox, measles, influenza, typhus, bubonic plague, and other infectious diseases in Europe played a decisive role in the European conquests, killing many people on the continents [3].

Pathogens brought by European colonists (measles, influenza, smallpox, typhus, plague, cholera...) became a terrifying "biological weapon", causing indigenous peoples to perish. Everywhere in the Americas, European-introduced diseases spread from tribe to tribe long before Europeans arrived, killing about 95% of the pre-Columbian native American population. A smallpox epidemic in 1714 was the single and biggest step for European migrants to exterminate the indigenous San people in South Africa completely [3].

Whether we like it or not, these infectious diseases accidentally became a means of "paving the way" for European expansion worldwide for a long time. Through telling about pandemics, some writers aim to express conflicts in society and views on war. Therefore, literature about pandemics does not simply describe pandemics. Still, it also projects profound issues related to the conflict between the center and the periphery, colonizers and colonized, hegemony and ecocentrism. For example, G. Márquez's novel *Love in The Time of Cholera* can be understood as an allegory of how European colonialists imposed rule and exterminated Indian tribes partly because of disease. P.T. Anh (2022) [4] believed that, "Cholera has become a cultural symbol of colonial and post-colonial nature in Latin America... The feeling is traumatic to the spirit of the race".

As for *The Plague*, A. Camus (2002) [5] wrote the work during his anti-fascist years and was a direct participant. At this time, when people were still happy after the end of the war and joyfully sang the slogan "Never again", Camus still warned us that the next plague would "awaken its rats once again" in exchange for "the breakdown and awakening of humanity". Furthermore, the writer is well aware of the complexity of the African cholera pandemic in Oran, Algeria (1849) - the place mentioned in the novel - and other pandemics in his home village of Mondovi. Many researchers identify the Plague as "an allegory alluding to the Nazi occupation of France". The central character of the novel *The Plague* - doctor Rieux - was built with the personality, actions, and thoughts of a human resistance fighter. It was a fight against crime, against terrorism, against death for the happiness and peaceful life of people. Through the confession Tarrou shared with Rieux, the character confided: "I think the society I live in is a society based on the death penalty, and by opposing that society, I oppose murder" [5]. Oran was attacked and blockaded, similar to how other historical cities were invaded and sacked. Many times, in thinking about the pandemics, Dr. Rieux had thoughts about the event of the allied army attacking Athens, accidentally bringing the disease with them. The outbreak of war and food shortages made Athens vulnerable to disease, famine, and war. That was similar to the picture of Oran in reality. The writer A. Camus believed: "In the world, there are as many plagues as there are wars. But people are always surprised in the face of plague and war" [5]. With a deep look into the past, Camus once again evoked ancient vestiges to remind us of the pain of war and pandemics:

There is no denying the images of ancient disasters: Athens stricken with plague and deserted of birds, Chinese cities filled with silent dying people, hardworking prisoners in Marseille piled up with dying corpses, leaking water into the pit, the great wall built in Provence to keep out the fierce plague wind, Jaffa with its hideous beggars, the damp and rotten beds low against the rammed earth floor in Constantine's hospital, the Sick people being dragged away by hooks, teams of doctors, wearing masks during the Black Plague, intercourse of the living in the Milan cemetery, carts carrying corpses in the city of London, and the days and nights echo, everywhere, at all times, the endless cries of people [5].

The history of interactions between different peoples is what shaped the modern world through conquest, infectious disease, and genocide. Those conflicts created long-term effects that, after many centuries, have not stopped impacting and are still ongoing in some regions of the world. Looking at novels about pandemics in Vietnam in the 21st century, although they do not directly mention war like Camus's *The Plague*, the writers also implicitly express the conflicts between humans and humans, humans and nature are some of the challenges that cause pandemics. T. Ha (2021) [6] says, "The truth of peace between humans and nature and other viruses. God's game began when humanity was greedy and no longer wanted to live peacefully with nature. People who love weapons and war are unhappy". Therefore, Vietnamese writers perceive the fight against pandemics - as Camus did - as a war. The two novels B.Q. Thang's *Quarantine Days* and T. Ha's *Nalis Rushing to The Shore of Destiny* share the same theme of soldiers fighting the pandemic. The novel *Quarantine Days* highlights the strict, decisive, and humane response of the government and the armed forces in preventing the pandemic. The novel *Nalis Drifts to The Shore of Destiny* tells about the intense investigation process of High-Tech Police Department soldiers to track down traces of the virus via the internet. The narrative methods are different, but both novels imprint the silhouettes of police and military soldiers before the pandemic. They are important figures in the battlefield without gunpowder - the battlefield of the virus.

I. Le's novel *Sadness is Sowing The Seeds of Kindness - A Nurse's Diary During COVID-19* in 2020 shows the penetrating ideology: "Doctors and nurses are soldiers on the medical front". This is a remarkable novel in which a Vietnamese writer recounts the fight against the COVID-19 pandemic in Australia. But because of that, I. Le points out conflicts about ethnicity, religion, and continents. The story is told by nurse Mia, who is of Asian descent. When the pandemic broke out in Australia, every time she encountered people in the subway, supermarkets, and convenience stores, she was threatened, assaulted, and insulted as if she were the cause of the pandemic. Faced with criticism - "You shouldn't spread the virus so much" - Mia was sad and wondered: "Do we sacrifice our health, accept to leave our families, just to be met with such legendary, distant, and terrifying attitudes?" [7]. People vented all their frustration about the suffering and death of the pandemic because they thought that she and the "Wuhan virus" had the same origin. Here, the author shows that the pandemic has become a catalyst for people to develop racism and anti-Asian attitudes that are often seen in Western society.

In fact, pandemics are often an excuse for countries to go to war. In F.M. Dostoyevsky's *Crime and Punishment* in 2000 [8], Raskolnikov's main character is dissatisfied and dreams that "the whole world condemned by a terrible new strange plague that has come to Europe with its roots in Asia". A dream that belongs to the unconscious but can serve as a basis for blaming and attributing responsibility to countries, governments, or state institutions for pandemics. From Jews in medieval Europe to merchants in Chinese wholesale markets, everyone has been considered the source of pandemics in human history. Deely, this story exploits social divisions in terms of race, ethnicity, religion, class, and even gender identity. Borrowing the point of view of the virus, T. Ha's novel *Nalis Drifting to The Shore of Destiny* affirms that the virus did not appear by chance and that humans have used the virus for selfish and brutal purposes: "They use us as a tool for battles that massacre their own kind. That is unacceptable" [6]. With this confession, the virus has suffered unjustly over the years because humans are truly the terrifying type of contagion.

Of course, blaming the people in Asia and Africa - areas that are considered peripheral, small countries, and inferior - is just aggression that creates conflict and domination. As analyzed, much evidence has confirmed that European countries are the source of the outbreak through war. However, at the same time, many researchers point out that environmental and ecological issues are also a significant cause of pandemics. In the work *Ecological Imperialism: The Biological Expansion of Europe* by A.W. Crosby (2004) [9], the author argues that the expansion, displacement, and replacement of indigenous people for the Europeans of the world's temperate regions (including North America, Australia, and New Zealand) was a matter of biology rather than military conquest. European organisms have certain decisive advantages over their Australasian and other regional counterparts. An increase in population accompanied the spread of diseases, European flora, and fauna. As a result, these empires became the owners of the most important agricultural lands in the world. So, the history of global development goes hand in hand with European ecological expansion.

Returning to history, since humans expanded their territory, moving towards rich deltas along large river basins, humans have created a unique civilization and a dense population distribution. Accordingly, the disease has germinated and spread. High population density also increases the possibility of widespread infection. Traces of pandemics were known very early through the epics of the Sumerians in Mesopotamia, the Vedas in India, and the bones of the Yellow River and Yangtze River (China). Agricultural societies not only contributed to population growth but also increased livestock numbers. The livestock ecosystem harbors pathogens that can be transmitted to humans and vice versa, and they also suffer the same fate as humans. In addition, trade development, trade relationships, exchange of goods, and conflicts and wars between countries and continents make the epidemic go faster. From here, a circle linking disease, war, and ecological crisis is formed and highlighted over time.

Although he did not directly state that the ecological environment was the cause of the plague outbreak, through recreating space, Camus reflected the reality of natural aridity and the rugged and stuffy modern urban landscape. At the beginning of the work, Oran is envisioned as "an ugly city,": A city without pigeons, trees, gardens, a city without the sound of birds flapping their wings or the rustling of leaves [...]. The sun scorched dry houses in summer and covered the walls with grey ash. People could only live in the shade of closed doors at that time. On the contrary, autumn is filled with mud [5]. With many expectations of people to conquer nature, Oran has become a place that endures a harsh climate, scorching winds, and hot sun. The city landscape is concreted, boring, lacking trees and animals. The space exudes the commercialization of bills, discounts, purchases, vehicles, services... When the plague happened, the people here never thought: "this small city could be a particularly favorable place for mouse relatives to die under the sun and for gatekeepers to perish from strange diseases" [5]. The separation from nature and unsustainable industrialization has caused the Earth to warm up, giving rise to strange diseases that spread rapidly. It also made living insecure and fearful and left the dying "trapped behind hundreds of burning hot walls". Camus calls it "modern death, coming from a dry land" [5].

Contemporary Vietnamese novels, on the contrary, directly highlight the impact of the environment on the existence of viruses in the community. The quarantine space in B.Q. Thang's *Quarantine Days* is easily reminiscent of the city of Oran in Camus's *The Plague*. As the people lined up to be tested, the spring sun was as hot as summer, "making the atmosphere hot and stuffy... The skewed sun cast their shadows to one side on the cement floor, forming another long row of strange shapes" [10]. Writer T. Ha also has feelings about the unusual climate: Autumn in Hanoi brings with it the sweltering heat of late summer. Sometimes, it's sultry, like a warning sign for a sudden shower. It's been long since we've seen the gentle breezes carrying the scent of milk flowers. Over the past ten years, the Earth has become increasingly hotter […]. Year after year, summer temperatures each year break the previous year's record [6].

It is no coincidence that when writing about pandemics, authors tend to describe nature as harsh, unpleasant, and hot and humid. Recent studies have analyzed that any disease's existence, transformation, distribution, and transmission depends on specific environmental conditions. The Earth's ozone layer is punctured, causing the greenhouse effect, climate change, and erratic weather. An increase in temperature and humidity can be considered a stimulus for the living environment of infectious viruses [11-14]. Obviously, this will represent the relationship between disease and the environment in different ways in literary texts. Strong and straightforward, T. Ha's *Nalis Drifted to The Shore of Destiny* in 2021 [6], focusing on explaining the reason for the Nalis pandemic and its mutations stemming from the careless and irresponsible behavior and attitude of humans towards nature. The writer goes back to the past, proving that bacteria inherently existed before the homo sapiens. Gradually, humans developed, using their hands and brains to improve nature.

When people destroy forests, cut down trees, and hunt animals indiscriminately, the ecosystem gradually changes. Some animals go extinct. They become extinct not because of natural selection, but because of human selection [6].

The virus Nalis appearing in the novel is a message and warning to humanity. Mother Nature's anger through pandemics is a terrible and causal punishment for humans. “People are economically stagnant because of the pandemic. However, the amount of emissions that humans naturally emit has decreased by one-third. We are making people pay for what they have done and reclaiming the natural world that should exist” [6].

Through this narrative, Nalis drifted toward the shore of fate, like the cry for help from nature, the deep call of the jungle, and the painful voice of germs that humans cannot see with the naked eye. They exist around here, in the invisible air, and are suffering with humans from the pain of climate change, earthquakes, tsunamis, floods, droughts. All works of literature, ultimately, are about people. Regarding the topic of pandemics, the writers have met to highlight and deepen the story of a pandemic that will always lurk and happen to all humanity as an implication that pandemics are an inevitable part of history. Because as long as humans are still destroying nature, invading and warring, pandemics still exist and persist.

2.2. The visualisation of society during quarantine and people’s psychological reactions

Each work on the theme of pandemics is like a dramatic social picture, a literary story full of reality. It also helps us have multi-dimensional visualizations and imaginations about life during quarantine and different types of human psychological reactions.

Presenting a world under blockade and confinement is the meeting point of works themed on pandemics. It is like a large prison, where people play the roles of prisoner, patient, victim, and murderer. Camus’s novel *The Plague* begun on a hot day in early summer when the plague suddenly strikes Oran city. At first, when only a few rat corpses were lying on the stairs and in the middle of the street, Rieux and the residents thought this was mischief by children in the neighborhood. However, the number of dead mice was increasing, many people were infected, and the first deaths were reported. After tragic witnesses and fierce debates, the government had to admit the plague appeared and decided to blockade the city and isolate the entire society. Writer Camus painted a tableau of exile and isolation of humanity.

A numbing sadness enveloped Oran, a city built in a spiral shape on a plateau and only slightly facing the sea. Between the long exposed walls, on the streets with dusty glass display cases, on the dirty yellow train carriages, people feel more or less imprisoned by the sky [5].

Camus has provided readers with profound feelings about the bondage and oppression that humanity experienced. That stuffiness and cramped feeling spread throughout later novels. Entering B.Q. Thang’s novel *Quarantine Days*, readers will recall the horrifying period of Vietnam in the early 2020s. That was the time when the pandemic broke out in many ways and forms, the COVID-19 virus entered Vietnam, causing the first cases of infection. The main space in the work is the quarantine area, so of course, it is a place far from the center, desolate, surrounded by the military. “The B40 iron fence is taller than a person’s head around it. The only entrance also has a barrier, and there are always two guards controlling all objects and goods entering and leaving” [10].

All other living beings in the world still exist and operate freely; Only humans are imprisoned, no different from animals in a zoo. One year after the COVID-19 pandemic, the Hanoi capital, as described by writer T. Ha, is still gloomy. “The grey sky covered the whole city with heavy rain. The sound of water drops hitting the corrugated iron roof makes people feel heavy. The streets are now emptier than usual. Even though it was only six o’clock in the evening, there wasn’t much traffic on the road” [6].

The ancient streets are sad with the heaviness of squalor, garbage, and death. “This dormitory is already old and shabby. The wall was painted yellow and was stained with moss, looking patchy” [6]. If you don’t continue reading, readers can easily imagine this is a picture of the world’s end. In fact, even though there is no mention of the end of the world, deaths permeate the texts. In Camus’s novel *The Plague*, in just about ten months, the plague took the lives of many innocent people, disrupting life here and paralyzing economic development, tourism, and other industries. Each death statistic, each calendar marking the quarantine day, clearly noted by the writer, increased at dizzying levels. “In four days, the epidemic jumped four terrifying steps: sixteen people died, then twenty-four, twenty-eight, and thirty-two” [5]. “One hundred and twenty-four people died. The land is the total of the ninetieth day of the plague” [5]. Human life is measured from moments, not months or years. The number of people infected and dying from the virus in Nalis pushing the fateful shore of T. Ha also makes people afraid.

Every day the world wakes up, there are countless more people infected with new diseases. The number is increasing day by day. Every day, when people listen to the news, they see that this country and that country record a record number of patients with the disease. Records are broken every day and every hour that no one wants [6].

The pandemic does not exclude anyone. Camus's novel *The Plague* wrote that: "In the primacy of the plague, everyone, from the bishop to the worst prisoner, could die, and perhaps for the first time, there was absolute justice in the prison" [5]. Iris Le's novel *Sadness is Sowing The Seeds of Kindness* also describes, this virus may be unscrupulous and immoral, but it is fair. Everyone is at equal risk of infection, from the prime minister to a street sweeper, from a famous person to a destitute person or a movie star. The coronavirus does not spare anyone. It also does not limit any country, rich or poor. From West to East, from Europe to Asia. Advanced countries, initially subjectively believing that this virus was harmless, only the media tried to exaggerate it, are now in a tragic situation with a death toll of up to tens of thousands of people. Even the superpower America is struggling because of the rapid outbreak. Almost every country is in crisis when visited by COVID-19 [7].

In the face of piling up deaths, from hospitals, morgues, and prisons to damp boarding houses, the scenes that haunt the reader's mind are probably tragic stories about funeral services when "the living must make room for the dead" [5]. It can be said that Camus's novel *The Plague* is, to date, the novel that most thoroughly describes the rituals and burial methods during the pandemic. Unlike customary burial rituals, all procedures must be quick and simple and eliminate some rituals that are not appropriate to the context. Most of the dead are far from home, and relatives are not allowed to stay by their side to ensure epidemiological principles. Initially, people carried rows of stretchers and crawled to the bottom of the grave. At the end of the cemetery, people dug two large holes - a hole for men and a hole for women. Later, due to urgent circumstances, people buried both men and women together, regardless of whether it was appropriate or not.

Convoys of white-painted ambulances opened at full speed; their sirens sounded sadly on the deserted streets. People hastily threw the corpse into the hole. While the body was still swaying, shovels full of lime fell on its face, and dirt and rocks were silently buried in holes dug deeper and deeper [5].

The bodies were naked and slightly contorted, covered with quicklime, then with soil, but only to a certain extent because there had to be room for other corpses. The next day, relatives are invited to sign the book, which marks the remaining difference between humans and, for example, dogs: after all, humans can still be checked [5].

Never before has the human condition been so tragic, from the time of illness, dying, and until death. Overcrowding when handling dead bodies forced the authorities to carry out cremation. "In the early days, early in the morning, a thick and clear vapor wafted over the eastern neighborhoods… every evening, the plague fire devoured the tribute people paid to it" [5]. Every day, fires are always burning in a corner of Oran city. It is engraved in the memories of the people involved, with clouds of smoke rising endlessly and brutally, more than the endless trampling, crushing everything in its path. Ever since then, humanity in the 21st century continues to be haunted by those unintentionally burning fires that smell of death when mentioning the keywords "COVID-19", "Wuhan", "Corona". The heaviness and greyness cover every place, accompanied by economic crises, inflation, health care, social services, etc. Camus highlights the quiet, unstable Oran region from the city to the suburbs. "The city is closed, and the port is banned. It is no longer possible to swim" [5].

A vast, silent city is only a collection of heavy, motionless cubes, and among those cubes, the silent statues of forgotten benefactors or eternal greats silent in a layer of brass, sitting alone in the night, with a face carved in stone or metal, recalling the destroyed image of what was once human [5].

In the suburbs, groans came from a few houses. In the past, when seeing this, there were often curious people standing on the street, listening. But after the prolonged plague, everyone's heart seemed to harden, and everyone walked or lived alongside laments as if it were still the natural language of humans [5].

This blockade has threatened the city's development. Hotels, restaurants, and souvenir shops are empty, with no customers coming. "All shops are closed… with signs saying "Closed because of the plague". Some businesses exist in limbo, uncertain like the uncertain fate of people.

"The plague bankrupted the tourism industry" [5]. The plague has negatively impacted other industries, such as food and paper production. "Although the paper crisis became increasingly severe, forcing some periodicals to reduce the number of pages, (…) soon, the newspaper only published columns advertising new products, "very effective" to prevent plague" [5]. Camus emphasized the fundamental issue: the fight against the plague is also a fight for the survival of the economy, tourism, law, and state power.

Faced with the dangers of COVID-19, people of the 21st century can quickly realize what A. Camus's writing is entirely accurate. Society in Iris Le's *Sadness is Sowing The Seeds of Kindness* has changed in a not-very-optimistic direction.

After three months of fighting COVID-19, people can only see a Moscow winter afternoon behind those soulful windows: the barren tree branches of a person who has experienced so much pain and loss, the cold roads covered with white snow evoke much sadness and an endless darkness and gloom [7].

The Infectious Diseases Department of Westmead Hospital - Australia's largest hospital - "is now so dilapidated that it is no longer recognizable" and is always overloaded, reeking of disinfectant, antiseptic alcohol, and betadine. All supermarkets were so short of food that "a few weeks later, the supermarket ordered that each person only buy two items of the same type at a time" [7]. The works present us with the pandemics that could create enormous social disruptions. In particular, rifts and conflicts also arise in relationships between people in society. When people have to interact together in a cramped place, are not allowed to be active outdoors, and cannot do anything, family life is in danger of being disrupted.

These days, everyone stays home to avoid the pandemic; the loud yelling and arguing still resounds endlessly. People cannot go out to work or make a living. The remaining money seems not enough for them to maintain life as before. The burden of money and family makes those scolding voices heard every day [6].

The terrible pandemic period has passed, oppressing human life and making the already difficult survival increasingly precarious and miserable. In that unstable society, how did people react to the pandemic? This question is a concern of pandemic-themed works. Writers all have a standard answer in describing the progression from indifference and disregard for the pandemic to surprise, confusion, fear, and finally, pain, loneliness, and despair. When talking about past pandemics, O. Pamuk (2020) [15] drew notable parallels, they are most curious about similarities between the current coronavirus pandemic and the historical outbreaks of plague and cholera. There is an overabundance of similarities. Throughout human and literary history what makes pandemics alike is not mere commonality of germs and viruses but that our initial responses were always the same.

Pandemic crises in response to the pandemic have led to the "herd mentality" phenomenon. Many families, out of fear of interest and anxiety, have hoarded food, making the economic, commodity, and currency crisis increasingly severe.

Speculation played its part, and people sold the necessities that were then scarce on the market at unimaginable prices. Low-income families are challenging, while rich families need more. By its impartial action, the plague should have promoted equality among our fellow citizens. Still, on the contrary, through the natural effect of selfish habits, it makes the sense of injustice even more acute in people's hearts [5].

The distinction between rich and poor also follows with a more significant gap. But, as an existentialist, Camus's *The Plague* has differences and deeper points when focusing on portraying the suffering of human imprisonment and exile. They are "hostile to the past and have no future", "we are no different from those whom justice or hatred of humanity forced to live behind iron bars" [5]; "Our compatriots, who until then hid their worries behind jokes, now, on the streets, appear more sullen and quieter" [5]; "From then on, people began to fear and ponder" [5]. In that prison life, they fell into a state of extreme sadness, loneliness, and absurdity everywhere they looked. "Their first reaction, for example, is to blame the state apparatus" [5]. They saw the irrational and irregular nature of the government apparatus and its rigid and demagogic operations. All hope in the authorities became unfounded, so there were families of sick people who agreed to close their doors and not go to the hospital, preferring to face the plague rather than a separation that they knew would end. How is the department? They resisted violently - "the cries, the orders, the intervention of the police, and later the armed forces, and people attacking the sick" [5]. They also saw the empty and meaningless existence of humanity. It was a series of dreary days, repeating over and over in boredom - arms clinging to the doctor, lamenting, pleading, and crying; ambulance sirens blaring; Terrifying dreams that woke me up and I was alone, all my relatives died from the pandemic. Later, people are desperate to find the meaning of life by patching up the wounds that have healed deep in their hearts.

Camus's novel *The Plague* told readers about any pandemic situation, from the pandemic's victims to those who took advantage of it to speculate and profit. Groups of materialists in the expansionist trend of capitalism have painted an absurd scene: making money based on the pain of fellow human beings. Among people panicked and crazy because of the pandemic, victims barely alive waiting for oxygen machines in hospital beds amidst the gunfire guarding the city gate; dogs and cats died because of the spread of distrust, then people died not because of the epidemic but because they ran away and were shot to death; There are still greedy people who raise the prices of necessities, causing inflation and social disorder. For example, the character Cottard in Camus's novel *The Plague* tried to "make money" by raising medicine prices and selling fake medical supplies; unemployed people live freely on state subsidies but always cause agitations and protests or anonymous crowds packed with crimes, appearing as a challenge in life in Thuong Ha's novel *Nalis Drifted to The Shore of Destiny*. As proven by writers, this has always been the case: our society is full of absurdity.

More than a year has passed, even though the death toll is increasing, even though society is turned upside down, even though the economy is stagnating. Besides scientists and kind people who dedicate themselves unconditionally and sacrifice for the love of their fellow human beings, some still have been following their own selfish thoughts. They cannot let go of their greed, anger, and ignorance. And then, even at this time, when the world's epidemic is still not under control, it is people and capitalist corporations who take advantage of that to get involved in manipulating and pushing up vaccine prices or even selling fake vaccines. Witnessing such human society makes the virus discover that what this pandemic has brought is not enough to awaken humanity [7].

When recreating society and people's reactions during the pandemic, Camus focused on the realities of Oran and, at the same time, evoking the depth of history. The writer wants to emphasize the absurd nature of life: the pandemics, like many other fantastic things that have existed in the past, people have no way to escape; instead, they have to change themselves through struggle, resilience, resistance. On the other hand, Vietnamese writers focus on a broader perspective, not only confined to one country but also connecting the world, helping their works expand the scope of reflection, which is also a way to emphasize this is a severe global pandemic. This difference comes from consciousness and perspective. Because Camus looked at the pandemic from the perspective of someone who had gone through it, the text settles on the depth of time; the narrative is thoughtful and calm, focusing on the most essential and fundamental issue. As for Vietnamese writers, they stand at the center of the pandemic; they wrote and felt the pandemic as "victims" rather than "historical storytellers." Therefore, Vietnamese pandemic-themed novels in the early 21st century are complete with events that are believable, real, and close to today's life.

2.3. Ways to save people from the pandemic and messages of love

The pandemic is not only a biological crisis but also a global humanitarian crisis. Therefore, compositions on pandemics suggest ways to save people from the pandemic and convey love through many different ways of expression and situations.

The first direction of liberation that people can think of when they are in trouble or despair is thanks to the support of spiritual forces. Religion, with its magical philosophies, becomes a source of encouragement for the human spirit to overcome difficulties. During Camus's *The Plague*, people defied blockades and quarantine orders to attend churches and squares to listen to Father Paneloux's sermons. Father's speeches attempt to show the plague's divine origin and this scourge's punitive nature. From a Christian perspective, the reason the pandemic appeared was to make people think again. The good is gradually being lost because the world is compromising with too much evil. The sermon made some people - who were previously confused - now clearly realize their sins. However, the more they gather in crowded places and understand their mistakes, the more likely they will be infected and suffer confinement and a guilty conscience. The pandemic has not improved, but human psychology has fallen into an abyss of insecurity. "God just turned away. Without God's light, we will now be immersed in the darkness of the plague for a long time" [5]. Camus implied that, in the face of pandemics and death, God cannot save humans. Similar to Nietzsche's existential spirit, "God is dead", and in the modern way of musician T.C. Son, "God has abandoned humanity, Buddha has abandoned humanity". As a dialogue with Camus's novel *The Plague*, Thuong Ha's novel *Nalis Drifted to The Shore of Destiny* answers about human helplessness:

Speaking of those who pray to chase away Nalis, I am also pleased to be with you. Let's pray together!... Let's pray together and catch the pandemic together. What could be better than when you both get infected while going to pray?! I wonder if God is with you to help you avoid the pandemic? Will God save you? Or will you become pawns in the hands of God? [6].

Modern humans have lost their support. There is no god to extend a helping hand; only self-reliance and faith can help humanity overcome the great tribulation. For that reason, the novels have met each other at the intersection of love as a way to heal before the pandemic. It is also the most effective anti-pandemic solution. Father Paneloux's words still resonate: "My children, here, at last, is the mercy of God: he brings into all things good and evil, anger and mercy, plague and happiness. The disaster that hurts you lifts you and shows you the way" [5].

The expression of love is, first of all, the consensus of all classes, religions, races, and genders. The novel *The Plague* highlights Dr. Rieux's diligence and the spirit of solidarity and cooperation of the people around him. While some people do nothing, only kneel and pray to God and spread false information to confuse public opinion, Rieux, Tarrou, and their friends affirm that they must fight: "I always think that I am a stranger to this city and have nothing to do with you. But now that I've seen what's before me, I know I'm here, whether I like it or not. This work concerns all of us" [5].

Rambert's words as a journalist-storyteller affirm that the responsibility to fight the epidemic belongs to everyone, whether they are people in the city or "strangers", because the epidemic will not exclude anyone. So, readers will see that each character in the novel *The Plague* contributed to fighting the pandemic in different ways. That is Grand, an ordinary official at the city hall who always tries to grasp news promptly and accurately so as not to strengthen public opinion; That is journalist Rambert, even though he has a lover in Paris, but cannot bear to leave Oran alone; That is Father Paneloux - the priest who wants to reduce the pain of the people through words of sharing and encouragement; That is the intellectual Tarrou who always rebels with the desire to find a "Godless Saint"; especially Dr. Rieux, who worked day and night tirelessly to find ways to repel the pandemic.

The spirit of solidarity against the pandemic is also the main content in the novel *Quarantine Days* by B.Q. Thang. As the first novel on the COVID-19 pandemic in Vietnam, *Quarantine Days* focuses on raising community awareness, self-awareness, and compliance with the Ministry of Health regulations and current laws. Just one individual being unconscious and short-sighted in their thinking and acting impulsively will lead to unpredictable consequences. Because of being subjective, Tony's boyfriend forced H. Cuc and his relatives to go to the quarantine area. From here, her family's life had significant changes. There was the loss, but H. Cuc also learned to sympathize, be friendly, and understand people. In the middle of an isolated, closed place, the "rich lady" can "reinstall" herself in the enlightenment of an open self.

Each novel expresses different concepts about the "anti-pandemic hero" with this inspiration. As is a common motif in tribulation legends, a heroic character will appear to help people escape the pandemic. Although Rieux was the "hero" of the Plague, Camus refuses all methods of idealistic depiction of this character. Because Camus saw that the plague disrupts the human situation: a physical and a spiritual plague, it puts us in a precarious position between life and death, good and bad, both devastating to human life and destroying humanity. So, in the struggle with the plague, Dr. Rieux never considered himself a hero but only considered what he did as a practicing doctor and thought, "Wherever my strength is, I will protect them". Even when he learned of his wife's illness and death, Rieux could not stay by her side and take care of her in the last days of her life. He could only comfort her as Tarrou said: "Courage! Now is the time to act right!". "There are no heroic issues. It's a matter of honesty… The only way to fight the plague is honesty" [5]. The author borrowed the character's words to guide the process of anti-pandemic practice, starting from kindness, honesty, and scheming because only these things can fight the irrational virus.

On the contrary, the three novels *Quarantine Days, Nalis Drifting to The Shore of Destiny,* and *Sadness is Sowing The Seeds of Kindness* all have classic romantic qualities with respect to the doctors, the nurses, the police, and the soldiers. Writers see them as "heroes fighting the pandemic". Because if there is a pandemic, the people who work hard and sacrifice the most are them. The plot of the novel *Nalis Drifting to The Shore of Destiny* is a thorny, violent struggle between two front lines: Police Officer Thanh and the Nalis virus. Neither side can determine victory or defeat because at the end of the work, "when drifting towards the shore of destiny", Thanh realizes that the virus "Nalis is also on the shore of destiny". Thereby, Vietnamese novels affirm the truth: we must respect, cherish, and support medical professionals and the armed forces. A satisfactory ending after many incidents during the *Quarantine Days* highlights the role of Police Officers. Police Officer Tuan's love helped Hoang Cuc understand that "twenty days of quarantine here does not mean that life paused, but on the contrary, it means pausing to live - live truly, live fully, live each day to the fullest, and especially live true to yourself" [10]. Although the story's happening is still awkward, through Tuan's love, writer B.Q. Thang wants to express the message: If we have a hero, we have a fairy tale in the middle of a pandemic. Readers also understand why, in many touching stories during the pandemic season, writer I. Le describes people's feelings for nurses and doctors: "After being discharged from the hospital, patients sometimes come back with fresh flowers and lots of candy. Their gait is healthy and agile, and their faces are radiant and rosy. They will come to each nurse to thank them and give them tight hugs and kisses on the cheeks and hands to express gratitude from the bottom of their hearts" [7]. In Australia, there have been volunteer campaigns such as supporting masks for nurses and doctors, sponsoring free accommodation, "adopting medical staff". Small actions like that have spread warmth all over the Earth as a message of love.

Turning to nature and protecting the environment is also a way to eliminate the pandemic through literary texts. During the tense and oppressive plague moment in Oran, Rieux and Tarrou took a somewhat reckless action - going to the beach. The two friends felt strangely happy when immersed in nature, as if "the pandemic had forgotten them" [5]. Oran was a symbolic city, serving as a place of human exile and highlighting the nature of climate change. In that city, people live in sadness, mechanically, and lostly. As Camus demonstrated, losing trees, animals, and nature, the city became a favorable place for the plague to penetrate, develop and destroy, people were pushed into inhumanity.

As T. Ha also said: "The scary thing in this world is not the Nalis virus, nor is it a pandemic or natural disaster. The scariest thing in this world is human greed. Greed becomes the bitter medicine that, if consumed, humanity will perish. That is insatiable greed with the ambition to become the world's hegemon. Heaven or hell, the demonic animal self, is hidden inside the rotten soul. A demonic mind resides in the middle of a green planet that is gradually crying every day. Please forgive us. If one day this world disappears, and people die en masse, it will not be because of the pandemic, nor because of Nalis. It's all because of human selfishness" [6].

So, in rescuing humans on the brink of extinction, humanity has realized that the best vaccine is not prepared or invented in laboratories or factories but is the vaccine of peace and love blossoming in the human soul.

3. Conclusions

In modern society, with the rise of the individual and the desire to search for oneself, decode the spiritual world, and achieve absolute freedom, the problems of communal pandemics and physical pain are temporarily overlooked and forgotten. Only when the COVID-19 pandemic broke out did people's perceptions change direction. Literature goes from the inner mystery to the outside - it turns out, the pandemic is always with us. Physical pain is just as painful and painful as mental pain. A pandemic is like a natural screening, like a hurricane that sweeps away organisms that are considered genetically weak and unable to adapt. Or pandemics are like the "animal instinct" in each person, existing forever and always motivating people to exist between life and death. We need the synergistic operation of a vigilant mind and a warm heart to fight it. As Camus said: "The plague germ never dies or disappears. It can lie still for decades in furniture and clothes. It waits patiently in rooms, basements, chests, handkerchiefs, piles of code paper, etc. And one day, it will cause disaster to humans and teach them a lesson; the plague may wake up its rats and make them run to die in a particular city that lives in happiness, peace, and prosperity" [5]. Or T. Ha asserted: "This pandemic will not end if people are still indulging in their own greedy and selfish desires" [6]. Literature with the theme of pandemics recounts human tragedies and suggests ways to prevent pandemics. Camus's *The Plague* metaphysically reflects the state of human abandonment on Earth. The pandemic of contemporary Vietnamese writers recreates the reality of the problem of humans destroying the Earth. Although the paths have different turns, they meet in the message of love, rejection of war, and a peaceful lifestyle with all species. There is no need for expensive vaccines or scarce medical masks to prevent the pandemic, and just beautiful literature can erase each "virus" from the human mind to receive the holiest thing. That is also the mission of literature in life.

COMPETING INTERESTS

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

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Culture as a dynamic product of socially and historically situated discourse communities: A review of literature

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Abstract:

This article delves into the intricate and multifaceted relationship between culture, discourse communities, and their profound entanglement within the rich tapestry of social and historical contexts. At its core, culture is not a monolithic entity but a dynamic amalgamation of myriad components, practices, and ideologies. These elements are not static but continually evolving, shaped by the interactions and exchanges within discourse communities. Discourse communities are fertile ground for nurturing, contesting, and disseminating cultural elements. Within these communities, language, beliefs, values, and norms are not merely transmitted but actively negotiated and transformed. This ongoing process contributes to the resilience and adaptability of culture, enabling it to respond to the ever-changing social and historical landscape. Central to our analysis is recognising culture as both "socially situated" and "historically situated". The former underscores the embeddedness of discourse communities within broader socio-cultural contexts, highlighting their interconnectedness with power dynamics, social hierarchies, and institutional structures. The latter emphasises the dynamic nature of culture, acknowledging its responsiveness to historical events, cultural exchanges, and shifts in collective consciousness. Through this scholarly exploration, we seek to offer a comprehensive understanding of how culture evolves within the intricate web of discourse communities, reflecting and shaping the world around them. By unpacking the complex interplay between culture, discourse, and their socio-historical contexts, we aim to illuminate the profound implications of these dynamics on individuals, communities, and societies at large.

Keywords: **culture, discourse communities, historically situated, socially situated.**

Classification numbers: **9.3, 12**

1. Introduction

This article explores the complex relationship between culture and discourse communities, considering their deep entanglement with social and historical contexts. We examine the various facets of culture, including its smaller components and practices, which are nurtured, shaped, and transmitted within discourse communities. Our emphasis is on the socially situated nature of culture, highlighting how discourse communities are not isolated entities but are deeply embedded in the socio-cultural milieu. Additionally, we acknowledge the historically situated aspect of culture, recognising its dynamic response to historical events, societal transformations, and shifts in thought. This scholarly analysis aims to comprehensively understand how culture evolves within discourse communities, reflecting and shaping the world around them.

2. Understanding the terms

2.1. Define critical terms

Culture: Culture is a complex concept studied over 140 years by anthropologists and sociologists. Despite this extensive research, there is no universally agreed-upon definition of culture [1, 2]. Culture can be seen as central to human sociality, enabling coordination of social actions and cooperation in large-scale groups [3]. It is a unique characteristic of human beings, allowing for transmitting and accumulating knowledge, skills, and

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technologies [4]. Different definitions of culture exist, with some emphasising a society's shared knowledge and values, while others focus on the behaviours and characteristics of specific social groups [5].

Moreover, culture can be defined as the knowledge, values, beliefs, behaviours, and institutions shared by a society [2]. It encompasses the patterns of human behaviour and the attitudes that characterise a particular social group or organisation [5]. Culture is unique to humans and is based on symbolic communication, social interaction, and the cumulative quality of human interaction [4]. It allows material culture and technology accumulation within human groups [1]. Culture is essential to human sociality, enabling the coordination of social actions and cooperation in large-scale groups [6]. Culture is an intricate and multifaceted aspect of human cognition and conduct that profoundly impacts our comprehension, conduct, and principles. Even though it has been studied for years, there is still no universally accepted definition of what constitutes culture. However, it is widely acknowledged that culture is a fundamental part of human society, encompassing everything from language and communication to customs, traditions, art, and social norms. It is a complex and dynamic concept that plays a crucial role in shaping our perceptions and attitudes towards the world around us.

Socially situated: Socially situated refers to the understanding that learning and cognition are influenced by the social and cultural context in which they occur. It recognises that human action and language use are shaped by the social, cultural, material, and sequential structures of the environment in which they occur [7]. This perspective emphasises the importance of considering the specific contexts and broader social practices in which literacy and learning occur [8]. It also highlights the role of the workplace as a site for both cognitive and social activity, where learning takes place through interactions with others and the environment [9]. Furthermore, situated simulation suggests that the brain's computational mechanisms are influenced by the situated character of experience in the environment, leading to representations that reflect this situatedness [10]. Socially situated approaches recognise individuals' interconnectedness, actions, and environment in shaping cognition and learning.

Historically situated: Historically situated can be defined as a concept that recognises the influence of historical circumstances on various phenomena. It acknowledges that how these phenomena are interwoven and shaped is not universal but varies with historical context [8]. This concept applies to different fields of study, such as literacy, self-identity, and design. In literacy, Historically Situated emphasises the link between literacies in specific contexts and broader social practices [11]. The study of self-identity highlights the historical shift from the Victorian self to the post-World War II empty self and the impact of historical antecedents, economic constituents, and political consequences on the formation of the self [12]. In the design field, the concept recognises the dynamic character of the context in which designing takes place and the recursive interrelationship between different environments, leading to a situated framework for understanding the design process [13].

Discourse communities: Discourse communities are groups of people who share common ideologies and ways of speaking about things [14]. These communities can be sharply or loosely defined, and individuals can be members of multiple discourse communities [15]. Discourse communities are characterised by colonising members' thoughts through ideology, which can have positive and negative effects [16]. Being trapped within the discourse of a particular community can hinder the ability to communicate across different discourses and limit opportunities for heteroglossic discourse [17]. However, privileging critique as a mode of discourse may define an ethical community that counters the constraining effects of conventional discourse communities [18].

2.2. Interrelation between the terms

Culture is a multifaceted concept that defies simple definition. It is not a monolithic entity but a rich tapestry woven from numerous smaller components and practices. These components are not isolated; instead, they are intricately intertwined within discourse communities. This essay explores the dynamic interplay between culture, discourse communities, and the crucial role of both social and historical contexts in shaping this intricate web of shared knowledge, values, and practices.

Language, customs, traditions, art, rituals, values, and norms are all part of culture, a complex concept that creates a collective identity for different groups. Culture is not a static concept but a dynamic one, constantly shaped and sustained by discourse communities. These communities unite around shared interests, goals, or activities and exchange ideas, beliefs, and practices, ultimately contributing to creating and disseminating cultural knowledge. Individuals within these communities communicate and interact, shaping and reinforcing cultural norms within their context. Discourse communities, such as academics, share a common interest in research, scholarship, and knowledge dissemination and form a community through shared communication, such as conferences, journals, and academic discourse. Through these exchanges, they advance their field and contribute to the broader culture by shaping intellectual paradigms and norms.

The concept of “socially situated” culture emphasises that discourse communities are fundamentally products of social interactions and constructions. They are not independent entities but somewhat shaped by individuals within a particular social context. The broader dynamics of society inevitably impact these communities’ interactions. Therefore, the culture within these discourse communities is inexorably linked to the social context in which they exist. For instance, the culture within a political discourse community is heavily influenced by the larger society’s prevailing political climate, societal values, and power structures.

Culture is not only socially situated but also historically situated. This aspect of culture reminds us that cultural practices and discourse communities evolve. Historical events, societal changes, and shifts in thinking all play crucial roles in developing and transforming discourse communities and the culture they create. For example, the feminist discourse community has evolved over the years, shaped by historical events such as the suffrage movement, women’s liberation movements, and legal changes affecting gender equality. These historical factors have significantly impacted the community’s values, language, goals, and, as a result, the broader cultural discourse surrounding gender and equality.

3. Culture as a product

The concept of culture is intricate and multifaceted, stemming from the interactions and actions of individuals within their social and physical surroundings. It is learned and shared and can be defined as a set of concepts, values, beliefs, and behaviours passed down through generations [19]. It is shaped by a community’s shared history, traditions, and beliefs, influencing how they view and interact with the world around them. Culture is not static but a dynamic and adaptive system that evolves [20]. Cultural knowledge, values, and practices are passed down through everyday community interactions, such as sharing stories and participating in ceremonies. These collective experiences become woven into a culture’s fabric, shaping its members’ attitudes, beliefs, and behaviours. It is closely intertwined with society, as society and culture mutually shape and influence each other [21]. Culture is not only about intellectual and aesthetic development but also encompasses the way of life of a particular group or period [22]. It includes material elements, such as objects and technology, and non-material elements, such as beliefs and values [23].

As a result, culture plays a pivotal role in coordinating social actions and fostering collaboration within large groups. By providing a shared framework for communication, decision-making, and problem-solving, culture enables individuals to work together towards common objectives. With culture, the practical cooperation of large groups and the ability to achieve complex tasks would be easier.

Culture encompasses shared beliefs, practices, values, and norms. A shared value system shapes agents’ normative reasoning and behaviour [24]. Culture is a group’s shared beliefs, attitudes, and artefacts [25]. These shared values and beliefs contribute to developing a strong culture within a group, fostering similarities and ensuring that participants have many self-similar neighbours to observe [26]. On the other hand, norms are the appropriate, culturally varying behaviours defined by meta-norms in different relational contexts [27]. Individuals’ cultural norms and values are relevant when assessing a breach of the statutory unconscionability test in financial services transactions [28]. Culture plays a role in student retention and academic success, comprising shared values and beliefs.

Shared beliefs, practices, values, and norms significantly impact people’s behaviour in different cultures. These cultural factors shape individuals’ behaviour within their social groups and broader society. They influence the public’s willingness to support restoration efforts for European riverine biodiversity [24]. Cultural, socioeconomic, political, and religious considerations influence individual and collective values, affecting behaviour [29]. The extent to which individuals are aware of their cultural norms and values is debated, but it is clear that culture plays a role in determining behaviour [30]. Cultural beliefs and practices also influence medical attention-seeking behaviour and infant care during the postnatal period [31]. Understanding the variety of cultural beliefs and practices is essential for midwives and healthcare professionals to provide culturally sensitive care [32].

The historical human sciences see culture as dynamic and constantly changing, with self-reflexive operations that develop over generations [33]. Research into watermelon cultivation has shown that different methods and techniques can lead to increased production and adaptation to changing market demands [34]. Convergent transformation, where one item causes the production of another item with directed deviations from the original, can contribute to cultural stability without copying or selection processes [35]. Like firms and markets, culture is an institution that evolves and changes in response to external shocks [36]. As seen in Muslim culture, the interaction between faith and knowledge demonstrates the creative use of ideas and concepts to shape behaviour and create new patterns [37]. Therefore, culture is not static but evolves.

4. Socially situated discourse communities

Discourse communities are groups of people with an ideology and a common language. They provide benefits but also impose constraints. An ethical community is open to others' discourse and committed to critique, countering the limitations of discourse communities. The notion of discourse communities has been widely adopted and applied in healthcare and beyond [38]. Personalisation algorithms in the digital age learn users' behaviours and tailor content to individual interests. These algorithms categorise and represent users back to society, perpetuating bias. The relationship between personalisation algorithms and racial bias can be examined using racialised discourse communities within algorithm audits [39]. Online communities are essential in obtaining health information and sense-making during viral outbreaks. The co-evolution of online communities in response to a rapidly developing public health crisis needs to be understood [40]. Online programming communities have different discourse patterns, with some focusing more on task-specific discussions while others foster a sense of bonding and camaraderie among members [41]. Collaboration and information flow are crucial in the aerospace industry, and collaborative writing plays a role in the professional lives of engineers and scientists [42].

Socially situated discourse communities communicate and interact within specific social contexts. These communities are characterised by shared norms, practices, and values that shape how discourse is produced and understood [43, 44]. They can be oral, written, or online and may involve multiple languages and modes of communication [45]. Socialisation in these communities consists of learning and adopting the appropriate discourse practices and identities associated with them [46, 47]. Communities are multifaceted social environments where individuals must navigate complex power dynamics and conform to or question established norms. Within these groups, personal development and transformation are also possible. How individuals communicate, and their cultural backgrounds significantly impact how conversations are structured within these communities. Academic writing programs strive to provide learners with the necessary skills to actively engage in future discourse communities by introducing them to genre-specific tasks that reflect the practices of those communities. This approach enables learners to understand better the socio-pragmatic features of discourse and cultural references that shape communication within these specialised groups.

Language and communication play a crucial role in shaping culture. The relationship between language and culture is reciprocal, with language acquiring meaning and value when integrated with cultural elements [48]. Language is not just a means of communication but also reflects various aspects of society, such as social class, ethnicity, nationality, and geographical location [49]. Cultural understanding is essential for effective cross-cultural communication, as miscommunication and misunderstandings can occur without understanding the culture [50]. Language also impacts healthcare accessibility and outcomes, with language status influencing treatment engagement and disengagement [51]. Moreover, language is a fundamental aspect of globalisation, enabling mass communication and cultural interactions between people from different cultures [52].

Discourse communities play a crucial role in forming and transmitting cultural norms. These communities are groups of people who share a common discourse or way of communicating [53]. In a broad sense, discourse refers to creating, recognising, representing, and exchanging meaning in a social context [54]. Within a discourse community, social events, practices, and structures unfold, and the transmission of culture occurs through various means, such as folk narratives [55]. Informal education, which involves transmitting knowledge through discourse, is deeply embedded in society's cultural performances, beliefs, norms, rituals, and social rules [56]. Discourse shapes and reshapes the thought and practice of the speech community, acting as an agent of social change [57]. For example, online communities have a crucial influence on forming and transmitting cultural norms. Through interactions and the dissemination of ideas, these norms endure even as new users join the community, thanks to the distinctive network structure that propagates them. The cultural norms in these online communities reflect the members' values and beliefs and are frequently reinforced through social cues and interactions. Moreover, the norms that spread through these networks can have a profound, enduring impact on society, shaping how individuals behave and interact on the internet and in real life.

5. Historically situated discourse communities

Historically situated discourse communities are shaped by specific historical and cultural contexts. These communities are characterised by shared rules and practices for communicating and interpreting speech or writing [43]. They are organised forms of knowledge within a community, established and legitimised through communicative practices [58]. The study of historically situated discourse communities has been traditionally focused on speech communities, but more recently, the term "discourse communities" has also been used to include written communication [39]. These communities play a significant role in socialisation processes, such as academic discourse socialisation, where individuals learn the norms and practices of specific discourse communities [59]. Understanding historically situated discourse communities is essential for analysing the complex processes that shape culture and identity and for preparing learners to participate effectively in these communities [47].

The impact of historical context on culture is significant. Different historical events and interpretations have shaped the understanding and definition of culture over time [60]. Scholars like E.B. Tylor and Matthew Arnold have played a crucial role in interpreting and defining culture in their works [61]. Cultural relativism has emerged as a response to social Darwinism, viewing each culture as valuable [62]. The historical context also influences the manifestation of cultural traits in various organisational processes, such as the acquisition of companies [63]. Context and culture are interconnected, with context as one [64]. Understanding the historical context is essential for considering contextual and cultural variables in instructional design and learning environments. Historical context shapes viticulture in various domains, from individual interactions to organisational practices.

Different historical periods give rise to distinct discourse communities. Between 1870 and 1950, new religious understandings and practices emerged, creating various religious communities incorporating scientific language into their worldviews [65]. In healthcare, "discourse communities" have been widely adopted and applied, providing benefits and constraints to those with an ideology and common language [58]. Additionally, discourse communities discussing the sensation of pain vary in their motivations and ways of discussing and describing pain [38]. Furthermore, discourse structure evolves, with lexical diversity, graph size, long-range recurrence increasing and short-range recurrence decreasing as individuals mature and receive education [66]. These findings suggest that historical periods shape the formation and characteristics of discourse communities, influencing their language, beliefs, and practices.

6. Conclusions

As we end this discussion, we must acknowledge that culture is not a static or singular entity but rather a multifaceted and ever-changing phenomenon. It is a complex web woven from individuals' interactions, communication, and shared experiences within discourse communities. These communities are not isolated but rather deeply embedded in their social and historical contexts, shaping and being shaped by the social dynamics of the larger society. Furthermore, they evolve in response to historical events and shifts in thinking, creating a rich and diverse tapestry of human experience. Appreciating culture in this context allows us to recognise its complexity and richness and understand how it influences and is influenced by the world around us.

COMPETING INTERESTS

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

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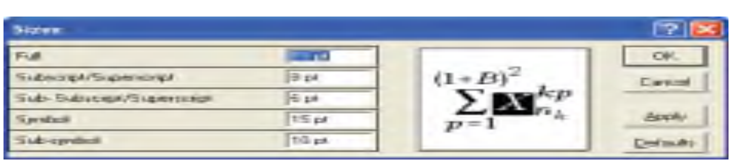

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