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Factors affecting the choice to use green packaging in food processing enterprises in Ho Chi Minh City, Vietnam

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ABSTRACT

Vietnam's food and beverage (F&B) enterprises in the industry are expanding rapidly, creating both economic growth and environmental pressures due to the increasing amount of packaging waste. This situation is forcing companies to switch to environmentally friendly packaging, especially in large cities such as Ho Chi Minh City (HCMC). This study aims to identify and quantify the determinants influencing enterprises' decisions to adopt green packaging, providing evidence for sustainable industrial transformation. Using a mixed-method approach, the research collected and analyzed 165 valid survey responses from managers and experts in food processing firms. Reliability and factor analyses confirmed the robustness of the measurement scales, while multiple regression identified five significant determinants: environmental assurance, producer awareness, legal policies, technical and technological requirements, and the cost of production and pricing. Among these, environmental assurance and producer awareness exerted the strongest influence, indicating that social and environmental pressures outweigh purely economic or technical concerns. Based on the analysis, the study proposed changes in technology and materials to produce green packaging, as well as raising awareness among F&B enterprises and consumers about legal policies related to packaging to protect the environment. This research offers managerial and policy implications for promoting sustainable packaging practices and supports the development of strategies that align industrial competitiveness with environmental responsibility in Vietnam's food processing sector. It provides a comprehensive understanding of the behavioral and institutional drivers behind the adoption of green packaging in an emerging economy.

Contribution/Originality: This study employs a novel approach using a hybrid theory of planned behavior (TPB) and rational action (TRA) to investigate the choice to use green packaging in F&B enterprises. It reflects the trend of integrating business planning and green awareness, providing guidance for F&B enterprises and assisting institutional policymakers.

1. INTRODUCTION

Currently, more than 900 enterprises in Vietnam operate in the paper and packaging industry, with about 70% located in the Southern region. The Vietnam Packaging Recycling Alliance aims for its members to recycle 100% of their product packaging by 2030. However, transitioning to green packaging faces barriers such as difficulties in changing consumer habits, production costs 20-30% higher than traditional packaging, technological limitations, lack of synchronized policies, and inadequate stakeholder awareness (PRO Vietnam, 2024). "The National Action Plan for the implementation of the circular economy" has identified packaging as one of the priority areas that need to be

focused on development (Prime Minister of Vietnam, 2025). This reflects the importance of this issue in the country's sustainable socio-economic growth strategy.

Recognizing the importance of sustainable development, HCMC has issued a strategy for the development of the food processing industry to 2030, with a vision to 2050. This strategy aims to apply green standards, ensure food safety, and traceability. The goal is that by 2030, the proportion of high-tech industrial value in the industry must reach at least 30%, and by 2050, 50% (HCMC People's Committee, 2024). In terms of the market, according to a survey by Nielsen Vietnam, about 65% of consumers are willing to pay more for products using green packaging and other green initiatives. This trend shows the significant growth potential of the green packaging market in Vietnam, especially in big cities like HCMC, which has about 2,800 enterprises and establishments producing and trading F&Bs, including 2,314 enterprises and food processing establishments and 536 enterprises and establishments processing beverages. The consumer class is highly conscious of environmental protection (HCMC People's Committee, 2024). This is a major driving force for businesses in the F&B industry to transition to a green and sustainable production model, including the use of green packaging.

Based on the study of the current situation and analysis of factors affecting the choice of green packaging in food processing enterprises in HCMC, this study proposes practical solutions to promote green packaging use, contributing to the industry's sustainable development in line with the city's strategy. The research results not only have theoretical significance in clarifying the factors influencing green packaging choices but also possess high practical value, providing a scientific basis for policy planning and sustainable development strategies for the F&B industry in HCMC and Vietnam overall.

2. THEORETICAL BASIS AND LITERATURE REVIEW

2.1. Theoretical Basis

Ajzen (1991) Theory of Planned Behavior (TPB) suggests that behavioral intention is influenced by three factors: attitude toward the behavior, subjective norms, and cognition. Accordingly, the subjective perceptions and feelings of businesses about the environment, as well as perceptions of green packaging, impact packaging choices for related subjects and food processing enterprises. The Fishbein (1967) Theory of Reasoned Action (TRA), later revised and expanded by Fishbein and Ajzen (1975), is used to examine individuals' rationale and motivation in decision-making to switch from conventional to green packaging. TPB theory has been widely applied by researchers to analyze green consumer behavior. (Emekci, 2019). Yadav and Pathak (2017) studied the determinants of green purchasing behavior of consumers in a developing country: applying and extending TPB, and Li and Shan (2025) explored the role of health consciousness and environmental awareness in the intention to purchase green packaged organic foods through an extended TPB model. Kamalanon, Chen, and Le (2022) used the Extended Theory of Planned Behavior Model for Green Product Purchase Behavior to explain "Why do we buy Green Products?". The TRA theory is also compared in two green consumption mechanisms: cognitive-affective behavior versus the theory of reasoned action, in the study of Liu, Segev, and Villar (2017). Paul, Modi, and Patel (2016) and Asih et al. (2020) predicted green product consumption using the theory of planned behavior and reasoned action. This demonstrates that using TPB and TRA in researching green packaging choices in food processing enterprises is appropriate.

2.2. Literature Review

2.2.1. Green Packaging

According to the General Department of Standards Metrology and Quality of Vietnam (1995), "Packaging is a container, wrapping food into a unit for sale. Packaging can include many layers of wrapping, can completely cover or only partially cover the product". Haghighi, Licciardello, Fava, Siesler, and Pulvirenti (2020) "Food packaging is a coordinated system for processing, transportation, distribution, and retail of food, helping meet industry and customer needs, maintain safety, and protect food from contamination".

Shaikh and Hyder (2023) define "green packaging" as packaging made from recyclable and environmentally friendly materials, contributing to waste reduction and capable of being reused, composted, or recycled. Zhang and Zhao (2012) describe "green packaging" as packaging with a low negative impact on the environment that can improve the environment without affecting the product's quality.

Taking a more comprehensive approach, Dörnyei et al. (2023) developed a comprehensive definition: "Sustainable food packaging (or "green packaging") is a food packaging solution that is designed, produced, transported, used and disposed of in a way that minimizes environmental impacts while maximizing economic and social benefits, ensuring food safety and quality throughout the product life cycle".

2.2.2. Choosing to Use Green Packaging in Food Processing Enterprises

There have been many studies on packaging choices in businesses, but none have discussed in detail the selection of green packaging in food processing businesses, as follows.

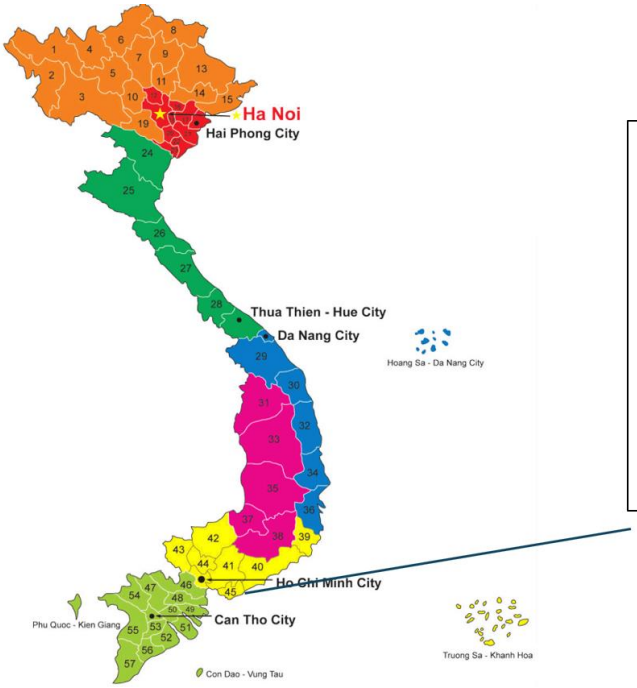
Chang and Chen (2022) used SEM (Structural Equation Modeling) to analyze the relationship between Product Knowledge and Consumer Involvement on Purchase Intention. The analysis of 165 valid questionnaires showed that both Product Knowledge and Consumer Involvement factors positively influence Purchase Intention. The results suggest that the food industry should focus on consumer trust in certification labels and 'clean label' products to promote purchase intention and attract business through practical marketing strategies. However, the study did not address the use of green packaging by food processing enterprises.

Wu, Zhang, van Klinken, Schrobback, and Muller (2021), the study developed a theoretical framework illustrating the key factors influencing trust beyond visual cues and brand associations. The study results suggest that it is necessary to ensure products can gain consumer trust by using packaging labels that fully describe food information, certification of national origin, and traceability details. Thus, consumer trust can be established through agents such as packaging and food system actors. The study has not clearly identified which factors influence packaging use in food businesses.

Gao et al. (2025) a comprehensive study analyzed the use of ZnO-NPs as functional fillers in food packaging. The results showed that ZnO-NPs affected many properties, including thickness, moisture resistance, water vapor barrier, mechanical properties, optical properties, thermal properties, and microstructure of food packaging materials. ZnO-NPs are safe, have a negligible migration rate, and their sensitivity and antibacterial properties can be used to detect changes in food quality during storage and extend shelf life. This will influence the selection of quality assurance packaging in food manufacturing enterprises. The study also did not specify which factors affect the use of packaging in food enterprises.

In summary, although many studies have examined green or sustainable packaging from technological, consumer behavior, and material science perspectives, few have systematically analyzed the determinants of enterprises' decisions to adopt green packaging, especially within emerging urban economies. Existing research mainly focuses on product attributes or consumer preferences, overlooking organizational and institutional factors that influence enterprise-level adoption.

HCMC, Vietnam's largest industrial and food-processing hub, faces increasing environmental pressure from packaging waste but lacks empirical research on how cost, technology, policy, and awareness jointly influence enterprises' green packaging choices. This study addresses both a contextual and a conceptual gap by developing and empirically validating a comprehensive model of factors affecting green packaging adoption in food processing enterprises in HCMC, Vietnam.



HCMC is located in the South of Vietnam, in 2025 it was merged from the old HCMC, Binh Duong province and Dong Nai province. It is currently the largest economic center in Vietnam, with a population of about 15 million people, and 6,772km2 of area, with 168 wards and communes, including: 113 wards, 54 communes and 01 administrative special zone. This is also the city with the most enterprises and food processing facilities, over 2,800, including: 2,314 are enterprises and processing facilities of food; 536 enterprises and processing facilities of beverages.

Figure 1. Maps of Vietnam and HCMC.

Figure 1 illustrates the research location as HCMC, the largest city in Vietnam in terms of scale and economic and social growth rate. HCMC has many representative F&B processing enterprises suitable for the study.

3. RESEARCH METHODOLOGY

3.1. Hypothesis and Research Model

3.1.1. Hypothesis Development

Hypothesis H1: Production costs and prices have an impact on the choosing of using green packaging in food processing enterprises, the conversion of production and use of conventional packaging to green packaging according to studies by Ketelsen, Janssen, and Hamm (2020); Romero, Brenes, García-Serrano, Medina, and García-García (2019) and Zhang and Zhao (2012) cost and price factors are one of the factors that determine the choosing of packaging of enterprises. The costs related to the production and use of green packaging are often higher than those of conventional packaging. This can influence enterprises' decisions to adopt green packaging, especially small and medium-sized businesses with limited financial resources. Therefore, the study should further explore the hypothesis that costs and prices impact the choice of green packaging. This forms the basis for hypothesis H1 regarding cost, with the authors also considering product price as an additional factor.

Hypothesis H2: Technical and technological requirements impact the choice of green packaging in food processing enterprises. The transition to green packaging requires enterprises to invest in new technology, train employees, and modify production processes. Most studies by Wu et al. (2021) and Gao et al. (2025) suggest that technical features such as preservation ability, antibacterial properties, and production technology significantly influence packaging choices. This forms the basis for proposing hypothesis H2, which warrants further study and discussion.

Hypothesis H3: Environmental assurance impacts the choice of green packaging in food processing enterprises. The increase in environmental awareness and stakeholder pressure to reduce environmental impacts motivates enterprises to adopt green packaging. Most researchers, such as Santi, Garrone, Iannantuoni, and Del Curto (2022); Chao, Li, Duan, and Fan (2024), and Ye et al. (2024), all believe that the trend of using environmentally friendly packaging is increasingly important and influences the decision to choose packaging. This forms the basis for proposing hypothesis H3, which requires further study and detailed discussion.

Hypothesis H4: Legal and policies impact the choice of green packaging in food processing enterprises. The government's legal framework on environmental protection, waste management, and extended producer responsibility can motivate or pressure enterprises to adopt environmentally friendly packaging solutions. According to studies by Wu et al. (2021), Chao et al. (2024), and Shin and Selke (2014), regulations on food safety and packaging standards have an impact on enterprises' decisions. Therefore, hypothesis H4 needs to be studied and discussed in more detail in terms of policy; the group of authors added the legal aspect of the state.

Hypothesis H5: Producer and consumer awareness has an impact on the choice of using green packaging in food processing enterprises. Producer and consumer awareness and attitudes towards green packaging can influence their purchasing decisions, thereby affecting the enterprise's packaging strategy. Most studies, such as Chang and Chen (2022), Ketelsen et al. (2020), and Romero et al. (2019), show that consumer needs and expectations have a strong impact on the decision to choose the packaging of the enterprise. Therefore, hypothesis H5 also needs to be studied and discussed in more detail.

3.1.2. Research Model

Synthesizing theoretical research on green packaging and the adoption of green packaging in food enterprises, combined with knowledge from the research overview, the author develops a research model with five hypothesis groups and 22 survey scales, based on preliminary interviews with experts. The model aims to analyze factors influencing the adoption of green packaging in food processing enterprises in Ho Chi Minh City, Vietnam.

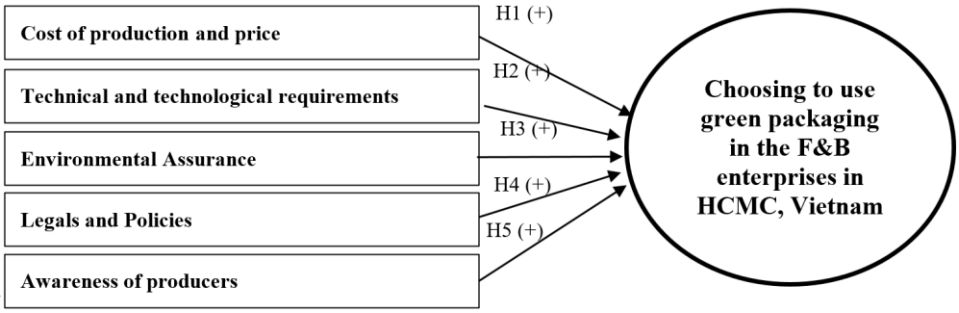


Figure 2. Proposed research model.

Figure 2 illustrates the research model on the decision to use green packaging in F&B enterprises in HCMC, Vietnam, with five influencing factors identified from the research hypothesis: Cost of production and price, Technical and technological requirements, Environmental assurance, Legislation and policies, and Producer awareness.

3.1.3. Survey Design and Measurement

Mixed research methods were used for this study. Through qualitative research, the authors collected relevant data, developed a preliminary questionnaire, and interviewed 15 experts who are in-depth researchers on the use of green packaging in food processing enterprises to adjust and refine the scale for the official study, determine the research content, and research indicators. Through quantitative research, the authors used (Bove, 2006). The required sample size is at least five times the total number of observed variables (n = 5*m, where m is the number of observed variables). Multiple regression analysis was conducted, with the required sample size calculated by the formula: n = 50 + 8*m (m: number of independent variables). Cronbach's Alpha reliability analysis, exploratory factor analysis (EFA), ANOVA analysis, Levene's test using SPSS 23.0 software (Dinh & Vo, 2023). After coding and cleaning, the data will be analyzed using SPSS 23.0 software through the following steps: describing the research sample to have an overview of the research sample, testing the reliability of the scale using Cronbach's Alpha test (Cronbach, 1951) EFA to extract and reduce the set of variables (Nunnally, 1978; Peterson, 1994; Slater, 1995) Pearson correlation matrix analysis to detect early multicollinearity (Hair, Anderson, Tatham, & Black, 2009) and finally multivariate

linear regression to analyze the relationship (Qiao, Easteal, Bolt, Coveny, & Franich, 2000) and quantify the level of impact between variables in the research model (Tabachnick & Fidell, 2019). Linear regression analysis examines five factors affecting green packaging adoption in F&B enterprises in HCMC: (1) Cost of production and price; (2) Technical and technological requirements; (3) Environmental assurance; (4) Legal policies; (5) Producer awareness. The multiple linear regression equation was used to study the impacts of variables X1, X2, X3, X4, and X5 on the decision to use green packaging. The author constructed the regression model accordingly.

$$Y_i = \beta_0 + \sum_{i=1}^{n} \beta_i X_i \qquad (1)$$

With: + Yi: Result function - Choosing to use green packaging in the F&B enterprises in HCMC

+ β (0, i = 1÷n): Affecting levels

+ Xi: X1- Cost of production and price (CG); X2- Technical and technological requirements (KC); X3- Environmental Assurance (MT); X4- Legal and Policies (LC); X5- Awareness of producers (NT), which is the factors affecting the Choosing to use green packaging in the F&B enterprises in HCMC (Y).

+ β0, βi: the constant and regression coefficient of the factor i (i = 1, 2, 3, 4, 5, respectively).

3.1.4. Data Collection

The study utilizes information from related research, reports, plans, and strategies outlined in the Research Overview section. This includes data on F&B production and processing facilities that use and convert green packaging, as well as the Strategy for the Development of the Food Processing Industry to 2030 and the vision for 2050 by the HCMC People's Committee (2024). It also considers policies related to green packaging aimed at environmental protection, such as laws and circulars from the Ministry of Natural Resources and Environment of Vietnam (2022a) and the Ministry of Natural Resources and Environment of Vietnam (2022b). Additionally, the study examines the number of food and beverage enterprises and challenges in recycling and converting green packaging, as reported by the Packaging Recycling Alliance PRO Vietnam (2024). The draft National Action Plan on implementing a circular economy highlights packaging as a priority area for development, as emphasized by Prime Minister of Vietnam (2025). Based on this, the research synthesizes the theoretical basis and constructs a model of factors influencing the decision to adopt green packaging in F&B enterprises in HCMC, Vietnam.

With 22 observed variables, the authors used convenient sampling and conducted a survey of 165 valid responses from leaders and managers in enterprises, including 60 surveys from Canned/Packaged Food (36.4%), 16 from Frozen Food (9.7%), 38 from Confectionery (32%), and 51 from Beverage (30.9%). The survey results ensure research reliability, discuss findings, and propose solutions.

4. RESEARCH RESULTS

4.1. Using Cronbach's Alpha Coefficient to Test the Reliability of the Measurement Scale

According to Cronbach (1951) and Nunnally (1978), variables with correlation coefficients greater than 0.6 are accepted. The test results indicate that all scales demonstrate good reliability, with Cronbach's Alpha coefficients exceeding 0.7: Production cost and price factor (0.902); Technical and technological requirements (0.897); Environmental assurance (0.896); Legal and policies (0.894); Awareness of producers (0.799). The total variable correlation coefficients are all above 0.5, ranging from 0.563 to 0.834, showing a close correlation among observed variables within the same group. No variable, when removed, significantly increased the Cronbach's Alpha coefficient, so all observed variables were retained for subsequent factor analysis (Dinh & Vo, 2023).

4.2. Exploratory Factor Analysis

EFA was conducted to examine the construct validity of the measurement scales and identify the underlying factor structure among the observed variables. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was

0.864, exceeding the minimum acceptable threshold of 0.5 (Dinh & Vo, 2023; Marija, 1993), indicating that the sample data were appropriate for factor analysis. Bartlett's Test of Sphericity was significant (χ^2 = 2399.229, df = 165, Sig. = 0.000), confirming that the observed variables were sufficiently correlated to justify the use of EFA. Factor extraction was performed using Principal Component Analysis with Varimax rotation (Anderson & Gerbing, 1988) as reported in Table 2. Five components with eigenvalues greater than 1.0 were retained, jointly explaining 72.915% of the total variance (Nunnally, 1978; Peterson, 1994; Slater, 1995) (Table 3). These components align with the five theoretical constructs proposed in the research model: Cost of production and Price (CG), Technical and Technological Requirements (KC), Environmental Assurance (MT), Legal and Policies (LC), and Awareness of Producers (NT). The results show that the data meet the assumptions for factorability, and the measurement scales are appropriate for subsequent regression analysis.

Table 1. KMO coefficient and Bartlett test of components.

Kaiser-Meyer-Olkin measure of sampling adequacy		**0.864**
Bartlett's test of sphericity	Approx. Chi-Square	2399.229
	df	165
	Sig.	0.000

Table 1 presents the results of the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity. The KMO index reached 0.864, exceeding the threshold of 0.5 as suggested by Kaiser (1974), and was rated as "good" (>0.8) according to the criteria of Hutcheson and Sofroniou (1999). Bartlett's test had a Chi-square value of 2399.229 with degrees of freedom (df) of 165 and a significance level (Sig.) of 0.000 (<0.05), indicating that the correlation matrix of the variables was statistically significant compared to the identity matrix (Bartlett, 1954). These two tests confirmed the data's suitability for exploratory factor analysis.

Table 2. Rotated component matrix[a].

Component	**Factors**				
	KC	**LC**	**MT**	**CG**	**NT**
KC4	0.842				
KC5	0.801				
KC3	0.747				
KC1	0.741				
KC2	0.733				
LC5		0.866			
LC1		0.832			
LC3		0.797			
LC2		0.748			
LC4		0.701			
MT3			0.867		
MT1			0.859		
MT4			0.832		
MT2			0.807		
CG2				0.846	
CG4				0.844	
CG3				0.812	
CG1				0.809	
NT3					0.795
NT4					0.757
NT2					0.712
NT1					0.678

Note: Extraction method: Principal component analysis.
Rotation method: Varimax with Kaiser normalization.
a. Rotation converged in 5 iterations.

Table 3. Total variance explained.

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	8.198	37.265	37.265	8.198	37.265	37.265	3.545	16.116	16.116
2	2.623	11.921	49.186	2.623	11.921	49.186	3.531	16.051	32.166
3	2.271	10.322	59.508	2.271	10.322	59.508	3.168	14.399	46.566
4	1.519	6.903	66.41	1.519	6.903	66.41	3.149	14.315	60.881
5	1.431	6.505	72.915	1.431	6.505	72.915	2.648	12.034	72.915
6	0.763	3.47	76.385						
7	0.629	2.859	79.245						
8	0.553	2.514	81.759						
9	0.478	2.171	83.929						
10	0.467	2.122	86.051						
11	0.416	1.893	87.944						
12	0.379	1.725	89.669						
13	0.364	1.655	91.324						
14	0.326	1.483	92.807						
15	0.284	1.289	94.095						
16	0.255	1.16	95.255						
17	0.231	1.051	96.307						
18	0.196	0.89	97.197						
19	0.182	0.827	98.024						
20	0.173	0.784	98.808						
21	0.146	0.663	99.471						
22	0.116	0.529	100						

Note: Extraction Method: Principal Component Analysis.

Table 4. Brief model fit statistics - Model Summary[b].

Model	R	R square	Adjusted R-Square	Std. error of the estimate	Durbin-Watson
1	0.812[a]	0.659	0.648	0.478	1.924

Note: a. Predictors: (Constant), NT, CG, MT, LC, KC.
b. Dependent Variable: Y

The model summary (Table 4) shows that the adjusted R2 is 0.648, meaning 64.8% of the variation in the intention to choose green packaging in F&B enterprises in HCMC is explained by five independent variables: Production costs and prices (CG); Technical and technological requirements (KC); Environmental factors (MT); Regulations and policies (LC); and Awareness of producers and consumers (NT). These variables influence the dependent variable, which is the intention to use green packaging in F&B enterprises in HCMC, Vietnam.

4.3. Multivariate Linear Regression Analysis

According to the analysis results of the five components, CG, KC, MT, LC, NT have Sig. < 0.03. Thus, at the 5% significance level, these five components have a causal relationship with the dependent variable Y: choosing to use green packaging in food processing enterprises in HCMC, Vietnam. With the standard of 1.0 < VIF < 10, it means that there is no multicollinearity (Hair et al., 2009). The VIF coefficient (Variance Inflation Factor) and the variance inflation factor both have values greater than 1.2 and less than 2.0, ranging from 1.242 to 1.735. In conclusion, there is no multicollinearity between the independent components, and it does not affect the model's explanatory results (Qiao et al., 2000). The residual distribution test also does not violate the multiple regression method. The test results show that five components affect Y. The results indicate that the hypothesis according to the model is supported (Tabachnick & Fidell, 2019).

Table 5. Multivariate linear regression analysis.

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
(Constant)	-0.066	0.220		-0.301	0.004		
CG	0.138	0.052	0.150	2.665	0.009	0.674	1.483
KC	0.136	0.051	0.163	2.672	0.008	0.576	1.735
MT	0.262	0.040	0.340	6.583	0.000	0.805	1.242
LC	0.177	0.050	0.201	3.568	0.000	0.673	1.486
NT	0.296	0.060	0.278	4.901	0.000	0.667	1.500

The study uses the analysis results (Table 5), with standardized beta coefficients (more reliable than unstandardized beta coefficients) to build a multivariate regression equation.

$$Y = 0.150 * CG + 0.163 * KC + 0.340 * MT + 0.201 * LC + 0.278 * NT \quad (2)$$

From the multivariate regression equation, it can be seen that the five components, CG, KC, MT, LC, NT, have positive standardized beta coefficients with values of β1= 0.150, β2= 0.163, β3= 0.340, β4= 0.201, β5= 0.278, respectively. That is, the dependent variable Y: Choosing to use green packaging in food processing enterprises in HCMC, Vietnam has a positive relationship with the factors. The analytical results of the model were accepted (6) (Tabachnick & Fidell, 2019).

Table 6. Results of testing the research hypothesis.

Hypothesis	Hypothetical relationship	Standardized regression coefficient (β)	Sig.	Result
H1	Production cost and price (CG) → Choosing to use green packaging (Y).	0.150	0.009	Accept
H2	Technical and technological requirements (KC) → Choosing to use green packaging (Y).	0.163	0.008	Accept
H3	Environmental assurance (MT) → Choosing to use green packaging (Y).	0.340	0.000	Accept
H4	Legal and policies (LC) → Choosing to use green packaging (Y).	0.201	0.000	Accept
H5	Producer and consumer awareness (NT) → Choosing to use green packaging (Y).	0.278	0.000	Accept

Table 6 presents the results of hypothesis testing: Hypotheses H3, H4, and H5 all have significance < 0.000, and hypothesis H1 has significance = 0.009, while H2 has significance = 0.008, the all of them are < 0.05 and are accepted with a 95% confidence level (Fisher, 1922).

4.4. Correlation Analysis

The residual plot (Figure 3) has a mean value = 1.59x10^-15, which is very small and close to 0; the deviation value of 0.985 is close to 1, meaning the standardized residuals have a normal distribution. This proves that the quantification of the impact level between variables in the model is consistent with the research results (Qiao et al., 2000; Tabachnick & Fidell, 2019).

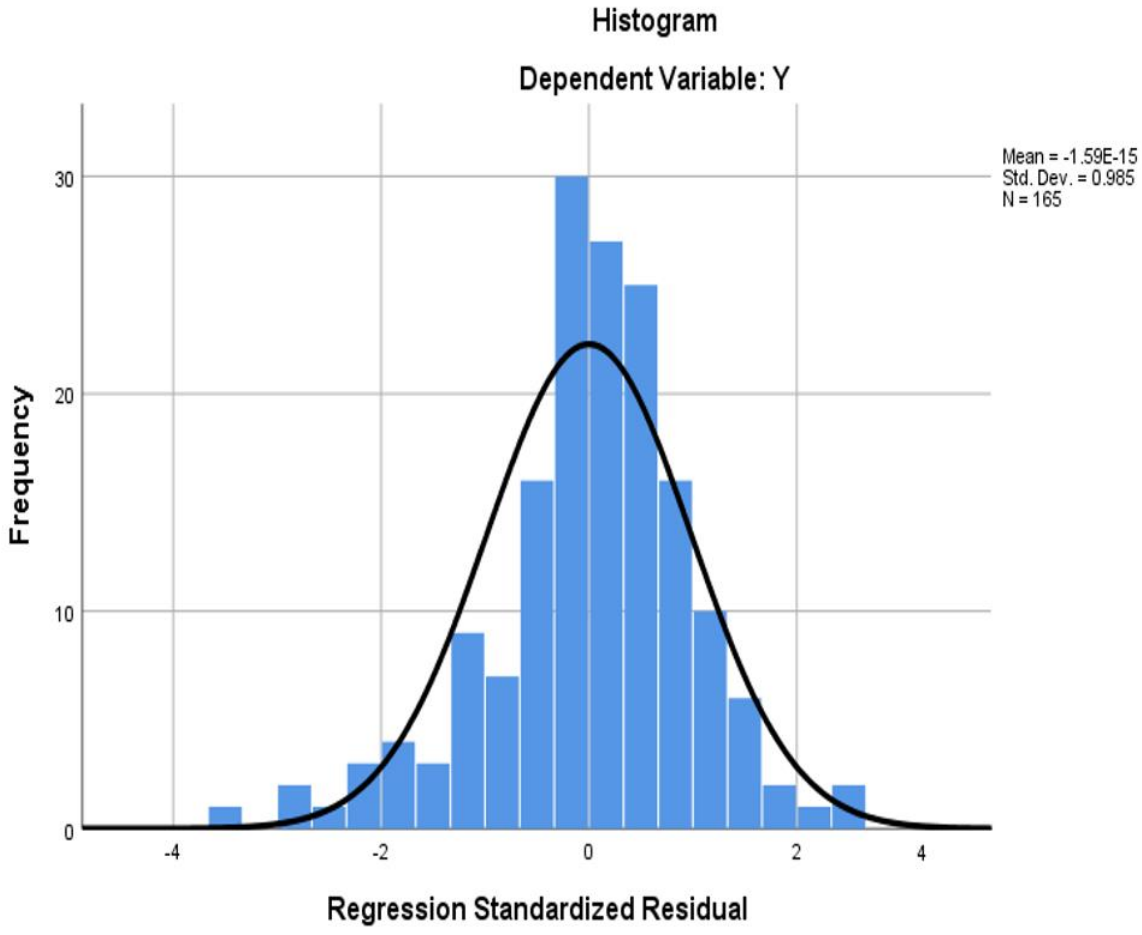


Figure 3. Residual plot.

The residual correlation plot is randomly scattered around the value line = 0 (Figure 4), indicating no autocorrelation between residuals. Therefore, residual correlation does not influence the research results (Qiao et al., 2000; Tabachnick & Fidell, 2019).

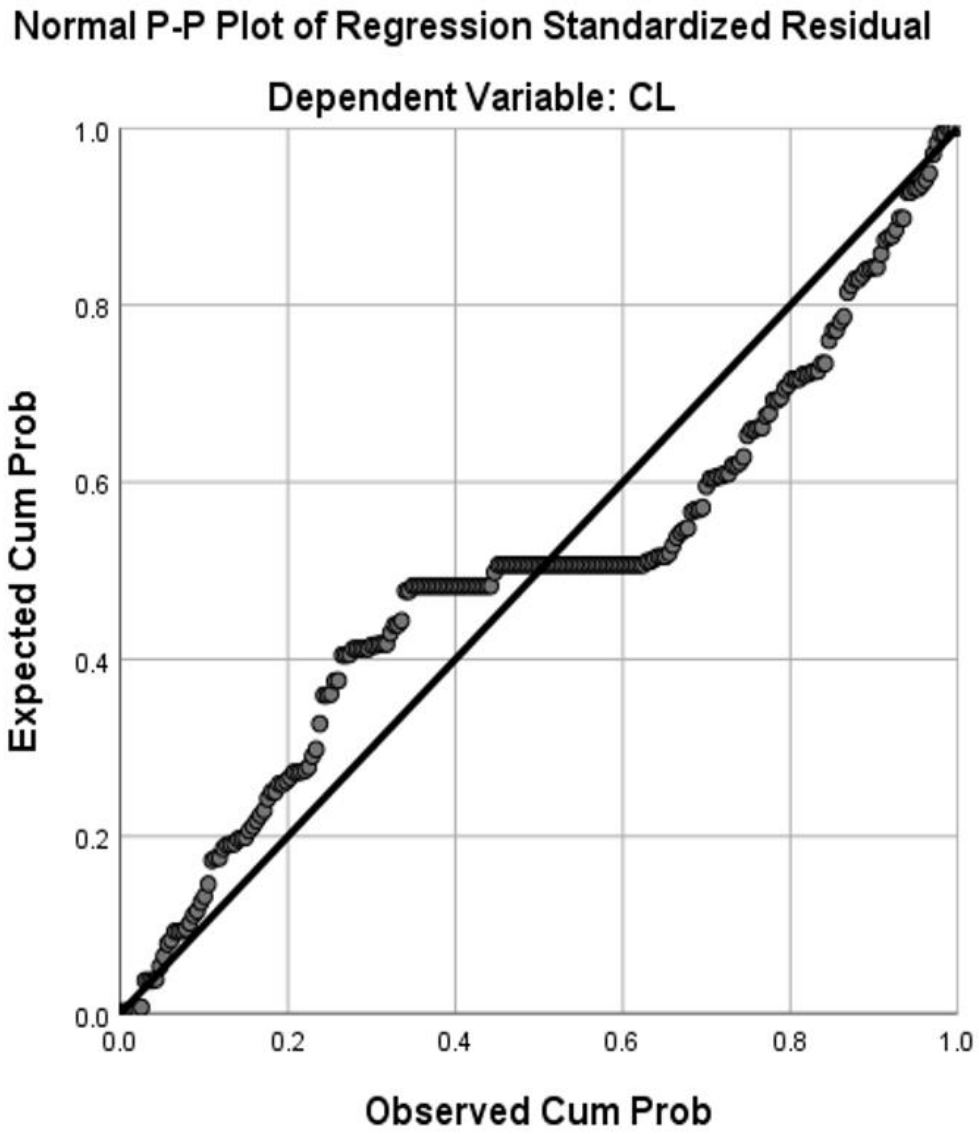


Figure 4. Residual correlation plot.

5. DISCUSS RESEARCH AND PROPOSE SOLUTIONS

The research results indicate that the Environmental Assurance Factor (MT) has the strongest influence on the decision to use green packaging in food processing enterprises in HCMC, Vietnam, with a coefficient $\beta 3 = 0.340$. This research result is consistent with the research conclusions of Santi et al. (2022), Chao et al. (2024), and Ye et al. (2024). The observed variables on environmental assurance of people choosing to produce and use packaging and packaging materials all reflect the increasing concern for environmental protection. The trend of consumers selecting environmentally friendly packaging is creating pressure for businesses to change. Therefore, food processing enterprises in general, and in HCMC, Vietnam in particular, need to proactively strengthen cooperation with relevant parties to build a circular economy model to increase the use of green packaging in food processing enterprises. Specific solutions include: (1) establishing a tripartite cooperation model between the government, enterprises, and the community, similar to the Vietnam Packaging Recycling Alliance, which aims to recycle 100% of product packaging by 2030 (Ye et al., 2024); (2) building a system for collecting, classifying, and recycling post-used packaging

to address low recycling rates, according to data from the Ministry of Natural Resources and Environment of Vietnam (2022b); (3) promoting links between food processing enterprises and recycling units to create a closed value chain, optimizing raw material reuse; (4) establishing a life cycle assessment (LCA) system for food packaging to help businesses and consumers evaluate environmental impacts; (5) developing a mechanism for sharing costs and benefits among participants in the green packaging value chain. Implementation requires close coordination between the Department of Natural Resources and Environment, the Department of Industry and Trade, and support from industry associations and environmental NGOs in HCMC to assist F&B enterprises in switching to green packaging during production and processing, through communication, monitoring, and improving sustainable business efficiency.

The research indicates that the Factor of Awareness of Producers (NT) has the second-largest influence on the choice of green packaging in food processing enterprises in HCMC, with a coefficient $\beta 5 = 0.278$, demonstrating its significant role in decision-making. This result is consistent with the research of Chang and Chen (2022), Ketelsen et al. (2020), and Romero et al. (2019). Producers' awareness of green packaging creates market pressure and motivation for conversion. Zhang and Zhao (2012) also show that even students in Hanoi, Vietnam, have a high awareness of environmental issues, with 73% intending to use environmentally friendly packaging. Therefore, food processing enterprises need to proactively deploy mass communication programs, integrated with marketing activities, to raise stakeholder awareness regarding packaging choices, such as food production, packaging materials, and consumption, about the long-term benefits of switching from conventional to green packaging. Specific solutions include: (1) Building a multimedia communication program on the economic, social, and environmental benefits of green packaging, especially on digital channels to reach young audiences, as proposed by Hoang (2024); (2) Organizing seminars and forums to share practical experiences from pioneering enterprises; (3) Integrating green packaging content into university and college training programs (Ye et al., 2024); and (4) Building a transparent eco-label system to enhance consumer confidence (Wu et al., 2021). Solutions requiring implementation involve the Department of Science and Technology of HCMC, research institutes, universities, and technology enterprises. Their role is to provide professional support and raise awareness among F&B enterprises, consumers, and stakeholders involved in transitioning to green packaging. This effort aims to promote a unified understanding of the sustainable shift toward green packaging within society, especially considering Vietnam's classification as an emerging economy.

With the Legal and Policies (LC) factor, the research results show that LC has the third influence on choosing to use green packaging in food processing enterprises in HCMC, with coefficient $\beta 4 = 0.201$. This result aligns with the proposal from Pauer, Wohner, Heinrich, and Tacker (2019) study on the role of government support policies. Legal regulations on the use, production and recycling of food packaging create a mandatory legal framework, while support policies create incentives for the transition process, including: The National Assembly of Vietnam (2020) issued the "Law on Environmental Protection No. 72/2020/QH14; the Ministry of Natural Resources and Environment of Vietnam (2022b) issued Decree No. 08/2022/ND-CP and the Ministry of Natural Resources and Environment of Vietnam (2022b) issued Circular No. 02/2022/TT-BTNMT, detailing a number of articles of the Law on Environmental Protection, for example: the mandatory recycling rate for packaging is from 10 - 22%, of which: carton packaging is 20%, mixed paper is 15%, aluminum is 22%, PET plastic is 22%, iron and other metals are 20%); glass bottles, jars, boxes 15%.

Therefore, food processing enterprises need to be proactive and propose solutions to the State for transitioning from conventional to green packaging. These include: (1) Developing a specific roadmap to limit and eliminate packaging that is difficult to decompose in the food processing industry, in accordance with Decree 08/2022/ND-CP (Ministry of Natural Resources and Environment of Vietnam, 2022b); (2) Proposing that the State establish preferential mechanisms on taxes, fees, and access to capital for businesses investing in the production and use of green packaging, such as reducing corporate income tax and environmental protection tax; (3) Proposing that the State develop financial support policies for small and medium enterprises during the transition to green packaging;

(4) Encouraging businesses to promote consumer preference for products using green packaging through promotional and discount programs; (5) Implementing the extended producer responsibility (EPR) mechanism for food packaging, encouraging businesses to participate in collecting and recycling post-used packaging. These solutions should be implemented in coordination with the Department of Industry and Trade, the Department of Natural Resources and Environment of HCMC, and related industry associations. The goal is to monitor progress closely and improve the effectiveness of transitioning to green bags in F&B businesses in HCM, Vietnam.

With the factor of technical and technological requirements (KC), the research results show that KC has the lowest influence on the choice of using green packaging in food processing enterprises in HCMC, with a coefficient $\beta_2 = 0.163$, consistent with the research of Wu et al. (2021) and Gao et al. (2025). Production techniques, recycling techniques, and green packaging technical standards all determine the feasibility of applying green packaging in practice. Therefore, in combination with cost and price solutions for products and packaging, food enterprises need to be proactive and recommend to the government to invest in developing green packaging production techniques and technology through the following solutions: (1) The state needs to support enterprises in accessing and transferring green packaging production technology through technology innovation funds and international cooperation programs; (2) The state needs to establish a green packaging research and development center in HCMC to provide technical support to enterprises, especially those in the green packaging testing phase; (3) Food enterprises should proactively coordinate with research centers on new packaging materials that are environmentally friendly and suitable for the characteristics of the Vietnamese food industry, such as nano-ZnO technology in food preservation; (4) Build a database on green packaging technology and materials, creating conditions for enterprises to access updated information; and (5) Organize specialized training programs on green packaging production and usage techniques for engineers and technical staff at enterprises. Implementation requires the participation of the HCMC Department of Science and Technology, research institutes, universities, and technology enterprises. The aim is to support F&B enterprises in increasing the application of science and technology in production and processing to switch to green packaging.

With the factor of production cost and price (CG), the research results show that CG has the lowest impact on the choice of using green packaging in food processing enterprises in HCMC, with coefficient $\beta_1 = 0.150$, consistent with the research of Ketelsen et al. (2020), Romero et al. (2019), and Zhang and Zhao (2012). Although cost is often considered a barrier, the results show that customers may pay more for products that use environmentally friendly packaging. If businesses actively research and improve technology, and find solutions to reduce production costs and product and packaging prices to a level acceptable to consumers, the transition to green packaging is very feasible and aligns with current trends. Proposed solutions include: (1) Developing a local supply system for raw materials for green packaging production to reduce costs and stabilize supply, addressing the challenge of costs being 20-30% higher than traditional packaging (Thorakkattu et al., 2025); (2) Connecting green packaging manufacturing enterprises with food processing enterprises through specialized fairs, exhibitions, and digital platforms; (3) Building and promoting the "Green Food" brand for products using green packaging, leveraging consumer willingness to pay for environmentally friendly packaging; (4) Developing specific distribution channels for products using green packaging, including e-commerce channels and specialized stores; (5) Implementing promotional and discount programs for products using green packaging to encourage consumers to choose environmentally friendly products. The implementation requires coordination among the Department of Industry and Trade, the Trade Association, food processing enterprises, and distribution and retail companies. This involves sharing information, roadmap plans, management experiences to reduce costs and product prices, and experiences in converting to sustainable green packaging in F&B enterprises in HCMC, Vietnam.

6. CONCLUSIONS

This study reviews related research and identifies theoretical gaps in factors influencing the adoption of green packaging in F&B enterprises. Using a mixed research method, data was collected from 165 survey questionnaires completed by leaders and managers in F&B businesses in HCMC, Vietnam. The findings highlight five key groups of factors affecting green packaging adoption: production costs and prices, technical and technological requirements, environmental assurance, legal policies, and producer awareness. The analysis underscores the impact of these factors on decision-making in F&B enterprises. Based on the results, the authors propose solutions to promote the use of green packaging in HCMC and Vietnam overall. The research also offers a foundation for policymakers to encourage businesses to transition to sustainable packaging, supporting future sustainable development.

At the same time, it aims to address the limitations of this study, such as measuring and ranking the difficulties in converting to green packaging use in F&B enterprises; comparing the impact of choosing green packaging in different types of food and beverage manufacturing and processing enterprises. From there, it proposes a roadmap to prioritize and support institutional development for green packaging application in Vietnam's emerging economy.

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Institutional Review Board Statement: The study involved minimal risk and followed ethical guidelines for social science fieldwork. Formal approval from an Institutional Review Board was not required under the policies of Institute for Research Ethics Committee of the Ho Chi Minh City University of Industry and Trade, Vietnam. Informed verbal consent was obtained from all participants, and all data were anonymized to protect participant confidentiality.
Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423. https://doi.org/10.1037/0033-2909.103.3.411

Asih, D., Setini, M., Soelton, M., Muna, N., Putra, I. G. C., Darma, D. C., & Judiarni, J. A. (2020). Predicting green product consumption using theory of planned behavior and reasoned action. *Management Science Letters*, *10*(14), 3367-3374.

Bartlett, M. S. (1954). A note on the multiplying factors for various χ^2 approximations. *Journal of the Royal Statistical Society: Series B (Methodological)*, *16*(2), 296-298. https://doi.org/10.1111/j.2517-6161.1954.tb00174.x

Bove, R. (2006). *Estimation and sample size determination for finite populations*. West Chester, PA: West Chester University of Pennsylvania.

Chang, M.-Y., & Chen, H.-S. (2022). Understanding consumers' intentions to purchase clean label products: Evidence from Taiwan. *Nutrients*, *14*(18), 3684. https://doi.org/10.3390/nu14183684

Chao, E., Li, J., Duan, Z., & Fan, L. (2024). Bigels as emerging biphasic systems: Properties, applications, and prospects in the food industry. *Food Hydrocolloids*, *154*, 110089. https://doi.org/10.1016/j.foodhyd.2024.110089

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297-334. https://doi.org/10.1007/BF02310555

Dinh, P. H., & Vo, K. T. (2023). *Application of PLS-SEM model in research for accounting and banking fields and writing scientific articles in Vietnam*. Vietnam: Eliva Press.

Dörnyei, K. R., Uysal-Unalan, I., Krauter, V., Weinrich, R., Incarnato, L., Karlovits, I., . . . Corredig, M. (2023). Sustainable food packaging: An updated definition following a holistic approach. *Frontiers in Sustainable Food Systems*, *7*, 1119052. https://doi.org/10.3389/fsufs.2023.1119052

Emekci, S. (2019). Green consumption behaviours of consumers within the scope of TPB. *Journal of Consumer Marketing*, *36*(3), 410-417. https://doi.org/10.1108/JCM-05-2018-2694

Fishbein, M. (1967). A behavior theory approach to the relations between beliefs about an object and the attitude toward the object. In M. Fishbein (Ed.), Readings in attitude theory and measurement. In (pp. 389-400). New York: John Wiley and Sons.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Fisher, R. A. (1922). On the interpretation of χ^2 from contingency tables, and the calculation of P. *Journal of the Royal Statistical Society*, *85*(1), 87-94. https://doi.org/10.1111/j.2397-2335.1922.tb00768.x

Gao, Q., Feng, Z., Wang, J., Zhao, F., Li, C., & Ju, J. (2025). Application of nano-ZnO in the food preservation industry: Antibacterial mechanisms, influencing factors, intelligent packaging, preservation film and safety. *Critical Reviews in Food Science and Nutrition*, *65*(22), 4327-4353. https://doi.org/10.1080/10408398.2024.2387327

General Department of Standards Metrology and Quality of Vietnam. (1995). *Packaging is a container, wrapping food into a unit for sale.* Vietnam: General Department of Standards, Metrology and Quality of Vietnam.

Haghighi, H., Licciardello, F., Fava, P., Siesler, H. W., & Pulvirenti, A. (2020). Recent advances on chitosan-based films for sustainable food packaging applications. *Food Packaging and Shelf Life*, *26*, 100551. https://doi.org/10.1016/j.fpsl.2020.100551

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2009). *Multivariate data analysis* (7th ed.). USA: Pearson.

HCMC People's Committee. (2024). *Decision No. 4700/QD-UBND dated October 23, 2024, on approving the Strategy for developing the food processing industry in Ho Chi Minh City to 2030, with a vision to 2050.* Vietnam: HCMC People's Committee.

Hoang, T. (2024). Building a multimedia communication program on the economic, social, and environmental benefits of green packaging: A focus on digital channels for young audiences. *Journal of Environmental Marketing*, *12*(3), 45-58.

Hutcheson, G., & Sofroniou, N. (1999). *The multivariate social scientist: Introductory statistics using generalized linear models.* Thousand Oaks, CA: Sage Publication.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, *39*(1), 31-36. https://doi.org/10.1007/BF02291575

Kamalanon, P., Chen, J.-S., & Le, T.-T.-Y. (2022). "Why do we buy green products?" An extended theory of the planned behavior model for green product purchase behavior. *Sustainability*, *14*(2), 689. https://doi.org/10.3390/su14020689

Ketelsen, M., Janssen, M., & Hamm, U. (2020). Consumers' response to environmentally-friendly food packaging - A systematic review. *Journal of Cleaner Production*, *254*, 120123. https://doi.org/10.1016/j.jclepro.2020.120123

Li, Y., & Shan, B. (2025). Exploring the role of health consciousness and environmental awareness in purchase intentions for green-packaged organic foods: An extended TPB model. *Frontiers in Nutrition*, *12*, 1528016. https://doi.org/10.3389/fnut.2025.1528016

Liu, Y., Segev, S., & Villar, M. E. (2017). Comparing two mechanisms for green consumption: Cognitive-affect behavior vs theory of reasoned action. *Journal of Consumer Marketing*, *34*(5), 442-454. https://doi.org/10.1108/JCM-01-2016-1688

Marija, J. N. (1993). *SPSS guide to data analysis release 4.0: Illustrated, revised.* USA: SPSS Inc.

Ministry of Natural Resources and Environment of Vietnam. (2022a). *Circular No. 02/2022/TT-BTNMT, dated January 10, 2022. Circular detailing a number of articles of the Law on environmental protection.* Vietnam: Ministry of Natural Resources and Environment of Vietnam.

Ministry of Natural Resources and Environment of Vietnam. (2022b). *Decree No. 08/2022/ND-CP, dated January 10, 2022, Decree detailing a number of articles of the Law on environmental protection.* Vietnam: Ministry of Natural Resources and Environment of Vietnam.

National Assembly of Vietnam. (2020). *Law on environmental protection No. 72/2020/QH14, promulgated on November 17, 2020.* Vietnam: National Assembly of Vietnam.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Pauer, E., Wohner, B., Heinrich, V., & Tacker, M. (2019). Assessing the environmental sustainability of food packaging: An extended life cycle assessment including packaging-related food losses and waste and circularity assessment. *Sustainability*, *11*(3), 925. https://doi.org/10.3390/su11030925

Paul, J., Modi, A., & Patel, J. (2016). Predicting green product consumption using theory of planned behavior and reasoned action. *Journal of Retailing and Consumer Services*, *29*, 123-134. https://doi.org/10.1016/j.jretconser.2015.11.006

Peterson, R. A. (1994). A meta-analysis of Cronbach's coefficient alpha. *Journal of Consumer Research*, *21*(2), 381-391. https://doi.org/10.1086/209405

Prime Minister of Vietnam. (2025). *Decision No. 222/QD-TTg, dated January 23, 2025, promulgating the national action plan for implementing circular economy by 2035*. Vietnam: Prime Minister of Vietnam.

PRO Vietnam. (2024). *Greening food secrets - an inevitable trend for sustainable development*. Vietnam: PRO Vietnam.

Qiao, L., Easteal, A. J., Bolt, C. J., Coveny, P. K., & Franich, R. A. (2000). Improvement of the water resistance of poly(vinyl acetate) emulsion wood adhesive. *Pigment & Resin Technology*, *29*(3), 152-158. https://doi.org/10.1108/03699420010334303

Romero, C., Brenes, M., García-Serrano, P., Medina, E., & García-García, P. (2019). Packing black ripe olives in retortable pouches with different oxygen permeability. *Food Packaging and Shelf Life*, *20*, 100323. https://doi.org/10.1016/j.fpsl.2019.100323

Santi, R., Garrone, P., Iannantuoni, M., & Del Curto, B. (2022). Sustainable food packaging: An integrative framework. *Sustainability*, *14*(13), 8045. https://doi.org/10.3390/su14138045

Shaikh, M. J., & Hyder, M. (2023). Green packaging as a positive catalyst for green environment: Implementation in emerging markets around the globe. *Pakistan Journal of Humanities and Social Sciences*, *11*(1), 655–669. https://doi.org/10.52131/pjhss.2023.1101.0382

Shin, J., & Selke, S. E. M. (2014). Food packaging. In S. Clark, S. Jung, & B. Lamsal (Eds.), Food processing: Principles and applications. In (2nd ed., pp. 249–273). USA: Wiley-Blackwell.

Slater, S. F. (1995). Issues in conducting marketing strategy research. *Journal of Strategic Marketing*, *3*(4), 257-270. https://doi.org/10.1080/09652549500000016

Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). USA: Pearson.

Thorakkattu, P., Awasti, N., Sajith Babu, K., Khanashyam, A. C., Deliephan, A., Shah, K., . . . Nirmal, N. P. (2025). 3D printing: Trends and approaches toward achieving long-term sustainability in the food industry. *Critical Reviews in Biotechnology*, *45*(1), 48-68. https://doi.org/10.1080/07388551.2024.2344577

Wu, W., Zhang, A., van Klinken, R. D., Schrobback, P., & Muller, J. M. (2021). Consumer trust in food and the food system: A critical review. *Foods*, *10*(10), 2490. https://doi.org/10.3390/foods10102490

Yadav, R., & Pathak, G. S. (2017). Determinants of consumers' green purchase behavior in a developing nation: Applying and extending the theory of planned behavior. *Ecological Economics*, *134*, 114-122. https://doi.org/10.1016/j.ecolecon.2016.12.019

Ye, X., Wei, L., Sun, L., Xu, Q., Cao, J., Li, H., . . . Liu, X. (2024). Fabrication of food polysaccharide, protein, and polysaccharide-protein composite gels via calcium ion inducement: Gelation mechanisms, conditional factors, and applications. *International Journal of Biological Macromolecules*, *279*, 135397. https://doi.org/10.1016/j.ijbiomac.2024.135397

Zhang, G., & Zhao, Z. (2012). Green packaging management of logistics enterprises. *Physics Procedia*, *24*, 900-905. https://doi.org/10.1016/j.phpro.2012.02.135

Appendix 1. Measurement scale and observed variables.

No.	Code	Scales and observed variables
H1	**CG**	**Production costs and prices**
1	CG1	Green packaging production costs
2	CG2	Product costs using green packaging
3	CG3	Raw material costs for green packaging production
4	CG4	Green packaging recycling costs
H2	**KC**	**Technical and technological requirements**
5	KC1	Green packaging production techniques
6	KC2	Green packaging raw material production techniques
7	KC3	Green packaging technical standards
8	KC4	Green packaging quality standards
9	KC5	Green packaging recycling techniques
H3	**MT**	**Environmental assurance**
10	MT1	Packaging users' awareness of the environment
11	MT2	Packaging producers' awareness of the environment
12	MT3	Packaging raw material producers' awareness of the environment
13	MT4	Consumers' tendency to choose environmentally friendly food packaging
H4	**LC**	**Legal and policies**
14	LC1	Regulations on the use of food packaging
15	LC2	Regulations on the production of food packaging
16	LC3	Regulations on the recycling of food packaging
17	LC4	Policies on the use of green packaging
18	LC5	Policies on the production of green packaging
H5	**NT**	**Awareness of producers' production, consumption**
19	NT1	Producer awareness of green packaging
20	NT2	Consumer awareness of green packaging
21	NT3	Producer awareness of products
22	NT4	Consumer awareness of products
	Y	**Choosing to use green packaging in food processing enterprises**
	CG	Production costs and prices
	KC	Technical and technological requirements
	MT	Environmental assurance
	LC	Legal and policies
	NT	Awareness of producers' production, consumption

Appendix 1. The scales and observed variables were constructed based on the results of the literature review and research hypotheses. After preliminary research, the scales will be adjusted and refined through in-depth interviews with experts and will be used to construct the survey questionnaire for the study. The official scale includes 22 observed variables, corresponding to five independent variables and one dependent variable.