Journal of Science and Technology – Engineering and Technology for Sustainable Development
Volume 35, Issue 5, November 2025, 069-077

Exploring Factors Influencing the Willingness to Try Novel Alternative Protein Products in Hanoi

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Abstract

The study explores the factors influencing the willingness to try (WTT) novel alternative prote in (NAP) products among consumers aged 18–25 in Hanoi, Vietnam. Anchored in the Theory of Reasoned Action (TRA), the research examines the roles of health concerns, environmental and sustainability concerns (ESC), price, novelty, and subjective norms in shaping attitudes and WTT toward NAP products. Data were collected through a structured questionnaire, with 288 valid responses, and eight hypotheses were confirmed using Structural Equation Modeling (SEM). The findings confirm that health concerns, ESC, novelty, and subjective norms positively influence attitudes toward NAP products. In contrast, price negatively affects attitudes and WTT. Subjective norms and positive attitudes significantly enhance the WTT toward NAP products. Notably, health concerns emerged as the most influential factor affecting attitudes, while subjective norms were the strongest predictor of WTT. These results underscore the importance of addressing health benefits, environmental sustainability, and social influences while mitigating price barriers to promote the adoption of NAP products in Vietnam. The insights provided by this study can support food companies in this field to develop new products and policymakers in developing strategies to enhance consumer acceptance and drive the transition toward sustainable dietary practices.

Keywords: Alternative protein, Hanoi, food choice, young consumer, willing-to-try.

1. Introduction

The dietary habits in Vietnam have undergone significant changes over the past decade, with a notable rise in meat consumption. Total meat production in 2023 reached 7.83 million tons, reflecting the rising demand for animal-based protein among consumers [1]. Excessive meat intake is linked to an elevated risk of chronic diseases such as obesity, cardiovascular disease, and type 2 diabetes, posing significant public health challenges [2]. This industry is crucial to the country's agriculture, contributing approximately 28% to the agricultural gross value added. According to the General Statistics Office of Vietnam, livestock production has experienced significant growth over the past decade. The buffalo and cattle population in 2023 reached 8.4 million heads, while poultry numbers have risen to 559 million [1]. Effluent from livestock farms has had a detrimental impact on the environment, especially in relation to water pollution [3].

In response to these challenges, global research efforts have increasingly focused on exploring alternative protein sources, such as plant-based proteins, fungi, and insects. Transitioning to alternative proteins in Vietnam can diversify consumers' food choices, promote a sustainable and healthy diet, and align with the United Nations' Sustainable Development Goals (SDGs 2, 3, 12, and 13). Furthermore, developing alternative proteins can mitigate the environmental impact of the livestock sector, particularly in reducing greenhouse gas emissions [4], thereby supporting Vietnam's commitment to achieving net-zero emissions by 2050, as pledged at the COP 26 conference.

Despite introducing novel alternative protein (NAP) products to the Vietnamese market in recent years, including plant-based meats, yeast-based protein products, and insect-based proteins, consumer experience and usage remain limited. These products, distinct from more familiar plant-based foods like tofu and soy milk and non-commercialized products like cultivated meat, represent a critical area for consumer adoption. Due to their novelty to consumers, NAP products may be influenced by factors similar to those affecting organic food, functional food, and vegetarian food, as previously studied in Vietnam [5,7].

The consumer group aged 18–25, belonging to Generation Z, represents a segment that is highly open to adopting novel products. At the same time, this demographic in Vietnam demonstrates elevated awareness of sustainability issues, thereby exhibiting greater consideration for environmental factors in their food choices [8, 9]. Consequently, they are a potential target group for NAP products.

p-ISSN 3093-3242
e-ISSN 3093-3579
https://doi.org/10.51316/jst.186.etsd.2025.35.5.9
Received: Feb 26, 2025; Revised: Jun 24, 2025
Accepted: Sep 23, 2025; Online: Oct 20, 2025.

The Theory of Reasoned Action (TRA), a well-established framework developed by Fishbein and Ajzen [10], is used for investigating consumers' insights. The TRA posits that an individual's behavioral intention, which directly determines their behavior, is shaped by two key factors: attitude and subjective norm. Attitude refers to the individual's evaluation of the behavior, reflecting whether they view it positively or negatively. In consumer behavior and food consumption, attitude is crucial as it encompasses the assessment of an object, concept, or behavior along a spectrum of favorability-ranging from good to bad or like to dislike. Subjective norms pertain to the social influences or pressures significant others exert by significant others, such as family, friends, or societal expectations. These norms reflect whether critical individuals or groups think the person should perform the behavior.

This research aims to address the gap in consumer acceptance by investigating the factors influencing attitude and willingness to try (WTT) NAP products among potential customers who are aware of them but have not yet used them. The study is guided by three specific objectives: (i) To develop a model of factors influencing attitudes and WTT towards NAP products among consumers aged 18–25 in Hanoi, (ii) To validate the hypotheses within the proposed model, and (iii) To assess the impact of these factors on attitudes and WTT towards NAP products among the target group.

2. Research Method

2.1. Hypothesis Development

To tailor the theoretical model to the context of NAP products, we identified key factors that influence attitude and subjective norms through a comprehensive literature review. These factors encompass personal concerns, product-related information, and external influences, precisely Health Concerns (HC), Environmental and Sustainability Concerns (ESC), Price (PR), Novelty (NV), and Subjective Norms (SN).

Health Concern is hypothesized to positively influence consumer attitudes toward NAP products as health increasingly becomes a priority in dietary choices, and the consumption decision in Vietnam is strongly influenced by health and food safety [5-7, 9]. Similarly, ESC is expected to positively impact attitudes, driven by growing consumer awareness of environmental issues and the desire to support sustainable practices [5, 7-9]. It is noted that younger consumers tend to be more environmentally conscious than older generations. Although new technologies can sometimes induce food neophobia [11], Novelty is included to capture the attraction of new and innovative products, particularly among younger consumers, which may enhance positive attitudes toward trying NAP products [12].

Price has been reported as a challenge in promoting alternative protein products [12, 13]. Therefore, it is hypothesized that this will negatively impact attitudes and WTT NAP products, reflecting the price sensitivity of consumers in emerging markets like Vietnam.

The influence of Subjective Norms was reported to positively affect the intention of young consumers in Southern Vietnam on plant-based meat and organic foods [5, 7, 9]. Therefore, this research considered a twofold effect in this model: Information from experts, celebrities, peers, and feedback from e-commerce platforms is expected to positively shape both attitudes toward NAP products and the intention to try them.

The proposed model and the corresponding hypotheses are summarized in Fig. 1.

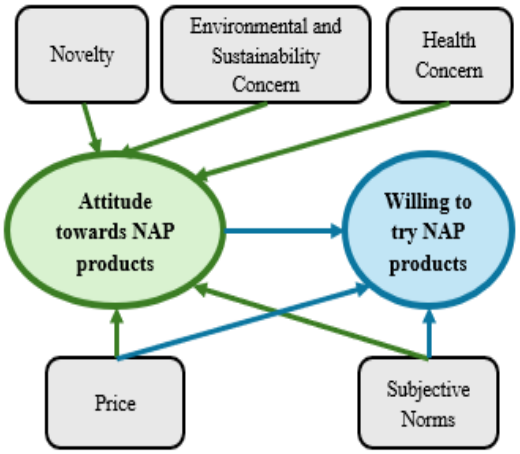

Fig. 1. Proposed research model

Based on the proposed model, 8 hypotheses (from H1 to H8) were developed for the influencing factors toward NAP products.

H1: Health concern positively influences attitudes towards NAP products.

H2: ESC positively influence attitudes toward NAP products.

H3: Novelty positively influences attitudes towards NAP products.

H4: Price negatively influences attitudes towards NAP products.

H5: Subjective norms positively influence attitudes towards NAP products.

H6: Attitudes towards NAP products positively influence the WTT these products.

H7: Price negatively influences the WTT NAP products.

H8: Subjective norms positively influence the WTT NAP products.

2.2. Questionnaire Design

Factors identified from the literature review included Health Concern, ESC, Price, Novelty, and Subjective Norms. Three Focus Group Discussions (FGD) with 20 participants aged 19–22 from Hanoi were then conducted. The discussion script focused on these factors. The qualitative research revealed agreement with the listed factors. Additionally, participant insights provided the author with a deeper understanding of what influences consumer intentions toward these products. Based on suggestions, two new variables were added to suit the research context in Vietnam.

Due to the small sample size, the FGD results were not representative. Therefore, quantitative steps were followed. A preliminary survey was pilot tested to evaluate the clarity of aspects under investigation, with feedback from 35 participants helping to refine the final questionnaire for the Official Survey. The final version consisted of 36 questions covering demographics, awareness of NAP products, and factors influencing attitudes and WTT these products. Completing the survey took around 5–7 minutes. The variables and factors are shown in Table 1, and the full questionnaire is shown in the supplement document.

Table 1. Research factors and variables

Source	Factors	Variables and their measuring items
[5, 9]	**1. Health Concern**	HC1: NAP products can provide sufficient nutrients for the body.
		HC2: NAP products are healthier than conventional products.
		HC3: Consuming NAP products helps reduce the risk of diseases.
		HC4: Consuming NAP products to promote long-term health benefits.
		HC5: Consuming NAP products to ensure good health.
[9, 11]	**2. Environmental and Sustainability Concern**	ESC1: NAP products are produced in an environmentally friendly manner.
		ESC2: Using NAP products can help protect the environment.
		ESC3: I am concerned about the impact of food production on the natural environment.
		ESC4: I try to avoid food products, whose production has adverse effects on the natural environment.
		ESC5: The world can easily sustain the food demands of a growing population in one or two generations' time.
[5], Focus group discussion	**3. Price**	PR1: The price of alternative protein products is higher than that of conventional products.
		PR2: The higher price of NAP products prevents me from buying them.
		PR3: The price of NAP products is not commensurate with their quality.
		PR4: People should buy NAP products, even though they are more expensive than conventional products.
[11]	**4. Novelty**	NV1: I am constantly trying new and different foods.
		NV2: I like food from various national cuisines (ethnic food).
		NV3: I eat almost everything.
		NV4: I like trying foods that are new to me.
[9,11] Focus group discussion	**5. Subjective Norms**	SN1: The information about NAP products that I obtain from experts positively influences me.
		SN2: The information about NAP products that I obtain from online celebrities positively influences me.
		SN3: The information about NAP products that I obtain from family, relatives, and friends positively influences me.
		SN4: The information about NAP products that I obtain from e-commerce platforms positively influences me.
[11]	**6. Attitude towards NAP products**	ATT1: I find buying NAP products a good idea.
		ATT2: I like the idea of buying NAP products.
		ATT3: I find buying NAP products a wise choice.
		ATT4: Buying NAP products would be nice.
[5]	**7. Willing to try NAP products**	WTT1: I am willing to pay a high price for NAP products.
		WTT2: I am willing to try NAP products.
		WTT3: I am willing to buy NAP products.
		WTT4: I will recommend NAP products to my friends and family.

2.3. Data Collection and Analysis

According to Hair *et al.* [14], the minimum sample size is determined by the number of variables in the research model, with an observed variable ratio of 5:1. This means that five observation variables are required for each measurement variable in the model. With 30 observed variables in this research, a minimum sample size of 150 is needed.

The data analysis techniques used in this research include (i) Scale reliability with Cronbach's Alpha coefficient, (ii) Exploratory factor analysis (EFA), (iii) Confirmatory factor analysis (CFA), and (iv) Structural equation modeling (SEM). The analysis criteria are inherited from the standards established in the previous work of Thanh-Lam Nguyen *et al.* [15]. A scale is considered reliable if its observed variables have a corrected item-total correlation greater than 0.3 and a Cronbach's Alpha coefficient greater than 0.6.

For EFA, the following criteria must be met eigenvalue greater than or equal to 1.00, Total variance explained greater than or equal to 50%, Kaiser-Meyer-Olkin (KMO) greater than or equal to 0.5, and the significance (Sig.) coefficient of the KMO test less than or equal to 0.05. Additionally, factor loadings of all observed variables must be greater than or equal to 0.35, and the weight difference between the loadings of the two factors must be greater than 0.3.

Following EFA, CFA is used to further confirm the uni-directionality, scale reliability, convergence value, and distinctive value of the extracted scales. SEM is employed to provide numerical results to test the proposed hypotheses. A model is considered suitable if the significance value (*p*-value) of the Chi-square test is no more than 5%; *CMIN/df* is less than or equal to 2 (in some cases, *CMIN/df* less than or equal to 3 is also acceptable), where *CMIN* and *df* stand for chi-square value and degrees of freedom, respectively. The goodness of fit index (*GFI*), Tucker Lewis index (*TLI*), and comparative fit index (*CFI*) should be greater than or equal to 0.9. Additionally, it is recommended that *GFI* be more significant than 0.8, the root mean square error of approximation (*RMSEA*) be less than or equal to 0.08, overall reliability be more critical than 0.6, and the extracted variance be more significant than 0.5.

3. Result and Discussion

3.1. Awareness of Novel Alternative Protein Products

The consumer survey targeted young adults aged 18–25 living in Hanoi, with 288 respondents participating (51% male and 49% female). Among them, 202 responses were from individuals aware of but who have not used the products, satisfying the minimum required sample size.

The survey revealed a high level of awareness of NAP products among the participants, with most participants (84%) being aware of the products but not having used them (Fig. 2). Most participants became aware of NAP products through social media (47.9%) and e-commerce platforms (22.7%). These two channels are particularly effective for food manufacturers aiming to reach young consumers efficiently.

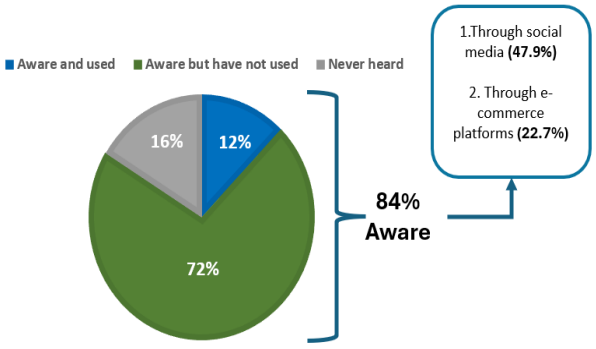

Fig. 2. Awareness of consumers on the NAP product

3.2. Reliability Test and Exploratory Factor Analysis

3.2.1. Independent variables

Initially, scale reliability tests were conducted on 22 variables, divided into five categories. As shown in the last three columns of Table 1, the results confirm that the extracted factors are reliable for further analysis, with all Cronbach's alpha values exceeding 0.6. Subsequently, an Exploratory Factor Analysis was carried out to identify the underlying structure and relationships among the 22 items. The Principal Axis Factoring method for extraction and Promax rotation was employed, resulting in the extraction of 5 factors based on the eigenvalue criteria, with the lowest eigenvalue being 1.475 (greater than 1). This suggests that these five factors effectively capture the information from the 22 observed variables in the EFA. Moreover, the total variance explained by these factors is 58.62%, and the KMO measure of sampling adequacy is 0.862, with a significance value of less than 0.001. These findings indicate that applying EFA in this study is justified.

Additionally, all factor loadings exceed 0.5, confirming that these factors are appropriate for further analysis.

3.2.2. Mediation and dependent variables

Similar to the independent variables, the mediating variable (*ATT*) and the dependent variable (*WTT*) were each subjected to reliability testing and EFA within their respective groups, with the results shown in Table 2.

Table 2. Pattern matrix of EFA of independent factors

Component	Factor					α	[a]CITC	[b]α If Del
	1	2	3	4	5			
HC1	0.837					0.875	0.767	0.834
HC2	0.782						0.691	0.853
HC3	0.755						0.685	0.859
HC4	0.749						0.727	0.845
HC5	0.727						0.700	0.851
ESC3		0.815				0.869	0.702	0.843
ESC4		0.788					0.718	0.838
ESC5		0.766					0.696	0.841
ESC1		0.708					0.676	0.846
ESC2		0.684					0.708	0.840
SN2			0.804			0.835	0.698	0.778
SN4			0.789				0.670	0.789
SN3			0.710				0.632	0.807
SN1			0.696				0.664	0.792
NV4				0.868		0.860	0.739	0.809
NV3				0.804			0.704	0.824
NV2				0.758			0.698	0.826
NV1				0.625			0.689	0.830
PR1					0.739	0.810	0.642	0.757
PR3					0.727		0.636	0.759
PR4					0.713		0.639	0.757
PR2					0.703		0.600	0.775
Eigenvalues	1.475							
KMO	0.862							
Bartlett's Test of Sphericity	Approx. Chi-Square		2146.095					
	Freedom degree (df)		231					
	Significance level (Sig.)		0.000					

Notes: *[a] Corrected item-total correlation; [b] Cronbach's Alpha if item deleted*

For the ATT variable, reliability analysis revealed that all observed variables demonstrated strong internal consistency, with Cronbach's Alpha coefficients exceeding 0.6 and Corrected Item-Total Correlations greater than 0.3. This suggests the scale is reliable, and no observed variables were removed from the analysis. The EFA results further confirmed the suitability of the factor analysis, as indicated by a KMO value of 0.808, which is greater than 0.5 and a significance level (Bartlett's Test) of 0.000 (Sig. less than 0.05), confirming that the observed variables are sufficiently correlated.

For the WTT group, the initial analysis showed that WTT1 had a Corrected Item-Total Correlation less than 0.3. Therefore, this observed variable was removed, and the analysis was repeated. The subsequent study showed that the Corrected Item-Total Correlation for all remaining variables exceeded 0.3, and Cronbach's Alpha coefficient for the factor was more significant than 0.6. The significance level (Bartlett's Test) was 0.000 (Sig. < 0.05), indicating that the observed variables included in the EFA are correlated with each other. The significance was greater than 0.5, indicating that these variables meaningfully contribute to the model.

3.3. Confirmatory Factor Analysis

The findings from the Confirmatory Factor Analysis (CFA) are detailed in Table 3, which evaluates the model's validity with an emphasis on both convergent and discriminant validity. All scales exhibit Composite Reliability (CR) above 0.7, reflecting strong reliability. Moreover, the Average Variance Extracted (AVE) for each scale surpasses 0.5, which indicates solid convergent validity. The square root of the AVE (highlighted in bold) exceeds the correlations among the latent variables, and the Maximum Shared Variance.

MSV is lower than the *AVE* as shown in Table 4, confirming the result of convergent and discriminant validity. The standardized estimates for the saturated model in the CFA present the following fit indices: *p*-value ≤ 0.001, *CMIN/df* = 1.128, *GFI* = 0.886, *TLI* = 0.982, *CFI* = 0.984, *RMSEA* = 0.025, and *PCLOSE* = 1.000. These metrics meet the necessary CFA criteria for unidimensionality, scale reliability, convergent validity, and discriminant validity, as outlined in Section 2.4. Consequently, it can be concluded that the research model is a good fit with the collected data, offering strong support for the proposed theoretical framework.

Table 3. EFA results of mediation and dependent factors

Component	α	CITC[a]	α If Del[b]	Factor
ATT3	0.848	0.738	0.783	0.830
ATT4		0.732	0.786	0.821
ATT2		0.640	0.826	0.705
ATT1		0.633	0.828	0.697
Eigenvalues	2.747			
KMO	0.808			
Bartlett's Test of Sphericity	Approx. Chi-Square	333.585		
	Freedom degree (df)	6		
	Significance level (Sig.)	0.000		
WTT1		0.239	0.841	
WTT2	0.841	0.651	0.590	0.869
WTT4		0.620	0.603	0.826
WTT3		0.652	0.600	0.716
Eigenvalues	2.290			
KMO	0.714			
Bartlett's Test of Sphericity	Approx. Chi-Square	256.924		
	Freedom degree (df)	3		
	Significance level (Sig.)	0.000		

Notes: *[a] Corrected item-total correlation, [b] Cronbach's Alpha if item deleted*

Table 4. Result of Convergent and Discriminant Validity in CFA

	CR[a]	*AVE*[b]	*MSV*[c]	HC	ESC	SN	NV	PR	ATT	WTT
SK	0.881	0.598	0.324	**0.773**						
MV	0.874	0.580	0.324	0.569***	**0.762**					
CQ	0.822	0.536	0.264	0.051	0.075	**0.732**				
ML	0.862	0.609	0.262	0.344***	0.400***	0.344***	**0.780**			
GC	0.805	0.509	0.219	0.008	-0.023	-0.142	-0.146†	**0.713**		
TD	0.827	0.545	0.262	0.462***	0.463***	0.389***	0.512***	-0.468***	**0.738**	
YD	0.848	0.651	0.264	⁂	⁂	0.514***	⁂	-0.459***	0.364***	**0.807**

Notes: *⁂: No correlation in the model, † $p < 0.100$, * $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$*

[a] Composite Reliability, [b] Variance Extracted, [c] Maximum Shared Variance

3.4. Structural Equation Modeling

The results of the SEM analysis, following the CFA, provide insights into the effects of the five factors on Attitude and WTT (Fig. 3). The standardized parameters of the SEM model all meet the necessary criteria for SEM, indicating that the proposed model is a good fit for the actual data. The results of the SEM, as shown in Table 5, clearly indicate that all eight proposed hypotheses (H1–H8) are statistically supported, with the ***p***-values of the related coefficients being less than 0.05.

3.5. Discussion

The findings regarding consumer awareness of alternative protein products, as depicted in Fig. 3, align closely with a previous report by the Good Food Institute (GFI) in the Asia-Pacific (APAC) region [16]. The GFI report highlighted that many Vietnamese consumers fall into the 'Curious' category-individuals aware of alternative protein products but have not yet tried them. This suggests a substantial potential market for novel food manufacturers, particularly those producing alternative protein products. The 'Curious' segment represents a promising target audience for companies looking to introduce and expand the adoption of innovative protein sources in Vietnam.

The findings of this study provide valuable insights into the factors that influence attitudes and WTT NAP products among young consumers in Hanoi. Confirming all eight proposed hypotheses highlights the robustness of the theoretical framework grounded in the TRA.

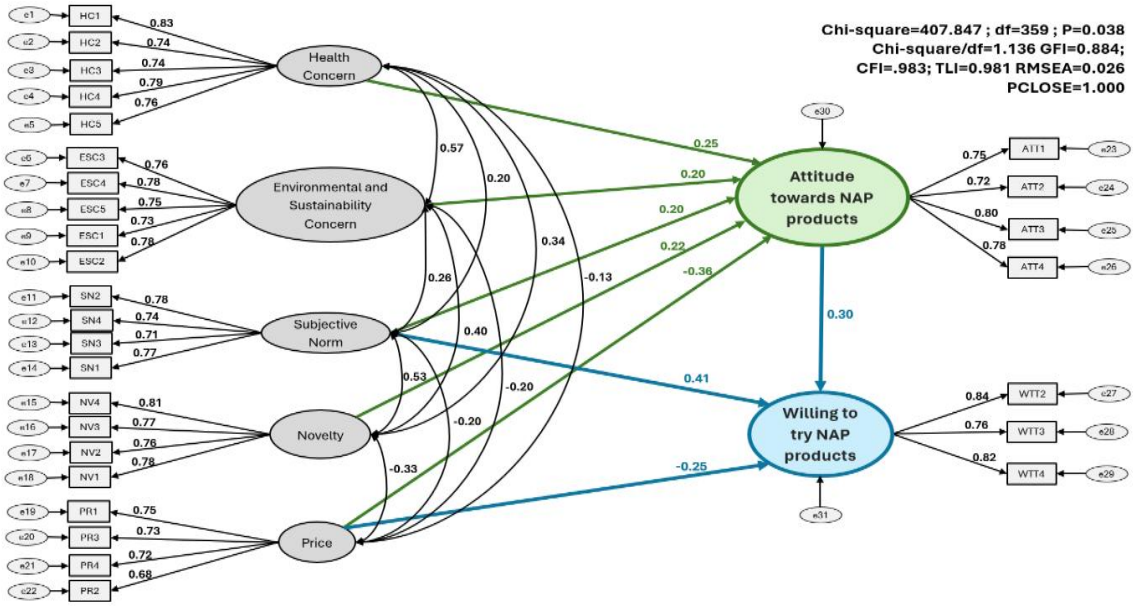

Fig. 3. Standardized SEM model

Table 5. Coefficients from the analysis of SEM

Relationship	Std. Coefs. β [a]	S.E [b]	C.R [c]	*p* Value	Conclusion
ATT ← HC	0.251	0.049	3.350	***	H1 Accepted
ATT ← ESC	0.204	0.078	2.618	0.009	H2 Accepted
ATT ← NV	0.219	0.072	2.725	0.006	H3 Accepted
ATT ← PR	-0.359	0.077	-5.092	***	H4 Accepted
ATT ← SN	0.198	0.067	2.701	0.007	H5 Accepted
WTT ← ATT	0.300	0.087	3.169	0.002	H6 Accepted
WTT ← SN	0.411	0.071	4.869	***	H7 Accepted
WTT ← PR	-0.250	0.085	-2.954	0.003	H8 Accepted

***Notes**: [a] Standardized Coefficients, [b] Standard Error, [c] Composite Reliability, ***Less than 0.1%*

Health concern (HC) emerged as the most influential factor positively affecting consumer attitudes towards NAP products (β=0.251). This aligns with existing literature [9, 15], which suggests that modern consumers, particularly the younger demographic, are increasingly health-conscious and seek food products that contribute positively to their overall well-being. The significant impact of HC on attitudes suggests that emphasizing the health benefits of NAP products in marketing and educational campaigns could be a key strategy in driving consumer acceptance.

Although previous surveys in Southern Vietnam yielded statistically insignificant results [9, 15], the current study in Hanoi reveals that young people have a positive attitude towards NAP products. Though not extensive, the positive impact of ESC on attitudes also reflects a heightened awareness of the ecological implications of food choices among this demographic. This is an encouraging sign for food manufacturers aiming to promote sustainable transitions.

While previous research indicated that Novelty negatively affected Polish students' attitudes toward insect-based products [11], our study with younger consumers in Hanoi, Vietnam, found that novelty positively influences attitudes. This suggests that younger consumers in Hanoi are more open to experimenting with new food technologies and products that offer novel experiences. However, it is crucial to balance the novelty factor with clear communication about the safety and benefits of NAP products, as food neophobia could still pose a potential barrier.

Conversely, price negatively impacted attitudes and WTT NAP products, underscoring that cost remains a significant barrier to their adoption. This finding aligns

with studies on functional foods and organic products [5, 6]. It suggests that pricing strategies must be carefully considered to make NAP products more accessible, especially in a price-sensitive market like Vietnam. Additionally, promoting research and development of alternative protein products derived from byproducts of the agriculture and food industry could help lower costs, making these products more accessible to younger consumers [13]. Subjective Norms had the most substantial positive impact on the willingness-to-try(β=0.411). Still, it did not significantly influence attitudes (ATT), contrary to previous findings in studies on functional foods in Vietnam [6]. Notably, one participant shared during the second focus group discussion, *"I would buy the product if I saw my favorite music idol using it."* This highlights the potential for collaborating with trusted influencers or positive reviews on e-commerce platforms to introduce novel products, as their endorsement could significantly sway young consumers' WTT NAP products.

A limitation of this study is that it focuses on the young consumer group. However, the trend of consuming healthy alternative protein foods is not only emphasized by the younger generation but also of interest to other age groups, particularly middle-aged and older adults. Moreover, the primary objective of this research was to capture general consumer insights when considering novel alternative proteins (NAP), rather than to analyze specific factors in detail, such as health concerns or environmental motivations in depth. Broadening the scope to include different age groups and exploring these drivers more thoroughly would provide policymakers and food producers with a more comprehensive understanding of the alternative protein market in Vietnam.

4. Conclusion

This study developed a comprehensive model to understand the factors influencing attitudes and WTT NAP products among consumers aged 18-25 in Hanoi. The model includes 30 observed variables categorized into five factors influencing attitudes and three influencing willingness to try.

Our research confirmed all eight proposed hypotheses (H1-H8) derived from preliminary studies. The findings indicate that health concerns, ESC, novelty, and subjective norms positively affect attitudes toward NAP products. Additionally, subjective norms and positive attitudes toward NAP products significantly enhance the intention to try these products. Conversely, price influenced attitudes and intentions negatively, highlighting cost as a barrier to adoption. The impact analysis revealed that health concern is the most influential factor positively affecting attitudes towards NAP products. Subjective norms exert the strongest positive influence on the intention to try NAP products.

In conclusion, promoting the adoption of NAP products in Vietnam to young consumers will require addressing health benefits, environmental sustainability, and social influences while mitigating the barriers posed by price. These insights can support food companies, manufacturers in this field, and policymakers who are developing strategies to enhance consumer acceptance and drive the transition towards sustainable dietary practices.

Acknowledgments

This work was financially supported by the Sustainable Healthy Diets (SHiFT) Project Work Package 5. The technical support provided by Hanoi University of Science and Technology (HUST) is also gratefully acknowledged.

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