

7-31-2026

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Recommended Citation

Ngoc, Quyen Nguyen Thi; Xuan, Vung Nguyen; Hai, Nam Vu; Thuy, Cuong Nguyen; Huu, Nghi Tran; Tran, Thang; and Thi, Thuy Phan (). Payment for Forest Environmental Services for Sustainable Coffee Production: Engaging Stakeholders' Perspectives. *ASEAN Journal of Community Engagement*, 10(1), 52-68.

Available at: <https://doi.org/10.7454/ajce.v10i1.1468>

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Payment for Forest Environmental Services for Sustainable Coffee Production: Engaging Stakeholders' Perspectives

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Received: March 1, 2026, Accepted: July 21, 2026

Abstract

Engaging the community becomes crucial for environmental payment mechanisms as their implementation depends on the participation and coordination of beneficiaries, businesses, public agencies, and local resource users. Departing from this belief, this study examines the potential for expanding Vietnam's Payment for Forest Environmental Services (PFES) program to the coffee sector, with a focus on sustainable production. Using a mixed-method approach, the study assessed consumers' perceptions of forest environmental services and their willingness to pay for PFES-supported coffee, while also examining stakeholder perspectives on a potential implementation mechanism. Data were collected from a survey of 457 customers in Dak Lak province and through interviews with representatives of coffee companies, government agencies, and relevant experts. The findings revealed that respondents generally rated forest environmental services as important, and most expressed a willingness to pay an additional premium for PFES-supported coffee. Among respondents with a positive WTP (Willing to pay), the estimated mean premium was 5.3% above the regular coffee price. Binary logistic regression results showed that income, perceived relevance of forest benefits, and normative support for customer contributions were positively associated with personal WTP. By connecting consumer willingness to contribute with institutional perspectives, the study found conditional support for integrating PFES into the coffee value chain, emphasizing transparent fund management, clear legal guidance, and effective communication. Despite farmers and forest-dependent communities were not directly consulted in this study, their participation should therefore be incorporated into future consultation and pilot design.

Keywords

community engagement; payment for forest environmental services; sustainable coffee production; stakeholders participation; willingness to pay

SDGs

12 (Responsible consumption and production), 13 (Climate action), 15 (Life on land)

1. Introduction

Environmental payment mechanisms depend not only on economic incentives but also on the engagement of the actors who finance, administer, implement, and receive benefits from them. In agricultural value chains, these actors may include consumers, businesses, public agencies, farmers, and forest-dependent communities. Their roles and interests differ, making participation, trust, transparency, and coordination important for the design of an acceptable payment mechanism. From this perspective, community engagement involves more than informing local people about an established policy. It also requires opportunities for affected groups to express their preferences, discuss responsibilities, and participate in decisions concerning payment collection and benefit distribution.

Vietnam's Payment for Forest Environmental Services (PFES) program, institutionalized in 2010, stands as a pioneering state-led policy linking forest conservation with economic incentives (Do et al., 2018). While it has successfully mobilized substantial financial resources and covered nearly 45% of the national forest area (Do et al., 2018; Pham et al., 2013), the framework faces critical structural bottlenecks. Current payment rates remain low and unequal across watersheds (Pham et al., 2023). Operating on a rigid, state-driven command-and-control model rather than a flexible market mechanism (Pham et al., 2021), the existing system excludes vital ecosystem services derived from high-value agricultural landscapes like coffee and rubber (Dang et al., 2021). This structural rigidity severely constrains governance equity, localized institutional flexibility, and policy innovation (Johnson et al., 2018).

Pivoting toward market-based, consumer-financed PFES models offers a strategic solution under the beneficiary pays principle, allowing end-consumers to fund conservation finance directly (Kirby, 2016; Kotchen, 2009). Conceptually, consumer premiums could provide an additional source of PFES funding. If transparently collected and effectively redistributed, these funds could support forest conservation or agroforestry practices and thereby contribute to a more sustainable coffee value chain. However, each link in this proposed mechanism requires further institutional and empirical testing.

Specifically, sustainability premiums on retail coffee leverage voluntary market mechanisms to promote corporate green innovation (Chen et al., 2023). When channelled through a transparent fund, these capital flows are redistributed as targeted financial incentives to smallholders, lowering the financial entries and market shocks of transitioning from degrading monocultures to sustainable agroforestry (Tamirat & Mekides, 2020; World Bank, 2024). Agroforestry adoption subsequently enhances vital environmental services, including carbon sequestration, soil stabilization, and watershed regulation (Raj et al., 2020; Reckmann et al., 2025). Rather than pricing nature's destruction, this integrated approach utilizes economic valuation to foster verified certification and traceability systems (Kill, 2015), cultivating a resilient value chain that aligns with national net-zero goals (Ministry of Agriculture and Rural Development, 2022) and satisfies international mandates like the European Union Deforestation Regulation (EUDR) (IDH, 2026; Mai, 2024).

Dak Lak Province, which accounts for approximately one-third of Vietnam's coffee production, provides a relevant setting for examining how agroforestry may contribute to

more sustainable and resilient coffee production (D'haeze, 2020). Although over 60% of global consumers are willing to pay (WTP) a premium for sustainable commodities (Li & Kallas, 2021), a profound research gap persists regarding its domestic policy translation. Previous studies in Vietnam have mainly examined the operation and outcomes of existing PFES arrangements or willingness to pay for specific ecosystem services. Less attention has been given to how consumer willingness to contribute may be connected with the perspectives of businesses, government agencies, and other actors involved in designing an agricultural value-chain mechanism. Moreover, WTP is often treated as an individual economic preference, with limited consideration of how it may represent one potential form of public participation in environmental financing. To fill this literature gap, this study contributes to this discussion by combining consumer WTP analysis with stakeholder consultation. Its contribution is therefore not limited to estimating a price premium. It also examines how consumer contributions could be situated within a broader engagement process involving businesses and public institutions. The study further identifies the conditions that stakeholders consider important for a potential pilot, including transparency, allocation of responsibilities, communication, and benefit distribution. Because farmers and forest-dependent communities were not directly consulted, the study represents an initial stage of stakeholder assessment rather than a complete community-engagement process.

2. Conceptual Framework and Determinants of Willingness to Pay

2.1. Willingness to pay (WTP) and contingent valuation method

WTP is widely used in environmental economics to estimate the value of goods and services that are not directly traded in conventional markets, particularly environmental attributes and ecosystem services (Jo et al., 2021; Liu, 2020; Mayer & Woltering, 2018). WTP is commonly defined as the maximum amount an individual is willing to pay for a good or service. In environmental valuation, it represents the maximum voluntary contribution an individual is prepared to make to obtain or maintain a specified environmental benefit (Do et al., 2018; Guo et al., 2023; Maleknia, 2024; Schniederjans & Starkey, 2014; Thuy et al., 2024; Wertenbroch & Skiera, 2002). In the context of PFES, WTP reflects the maximum amount that customers are willing to contribute to support forest conservation and the provision of ecosystem services through market-based mechanisms. Several approaches have also been developed to estimate WTP for non-market goods and ecosystem services (Carson, 2012; Whitehead 2006).

Among stated preference methods, the Contingent Valuation Method (CVM) is the most widely applied approach in environmental valuation studies (Ready et al., 1996, 2001). CVM is a survey-based approach where respondents are asked how much they would pay for a specific hypothetical change, such as implementing a conservation program. It creates a hypothetical market and asks participants to state a price that reflects their preferences (Carson, 2012). Several techniques can be used, including bidding games, payment cards, open-ended questions, and dichotomous choice formats (single or double-bounded). In this study, the bidding-game format was selected because it was straightforward for respondents and allowed WTP to be elicited through a sequence of predefined premium levels. However, the use of a fixed initial bid may introduce starting-point bias. In addition, previous studies suggest that customers' WTP for environmental

goods and socially responsible products is influenced by several groups of factors (Fuller & Grebitus, 2023; Guo et al., 2023; Maleknia, 2024).

2.2. Determinants of willingness to pay

Previous studies have identified three broad groups of factors associated with WTP for environmental or socially responsible products. The first includes socio-economic and demographic characteristics, particularly income and education (Guo et al., 2023). The second concerns environmental awareness and perceived responsibility. Consumers who recognize the ecological functions of forests may attach greater value to conservation initiatives and be more willing to contribute financially (Maleknia, 2024). The third relates to consumption behavior. More frequent coffee consumers may have greater product involvement and stronger preferences for sustainability attributes (Fuller & Grebitus, 2023). Accordingly, this study groups explanatory variables into three categories: (i) socio-economic and demographic characteristics; (ii) environmental awareness and responsibility; and (iii) coffee consumption behavior. Figure 1 presents the conceptual framework underpinning the empirical analysis of customers' WTP for PFES-embedded coffee.

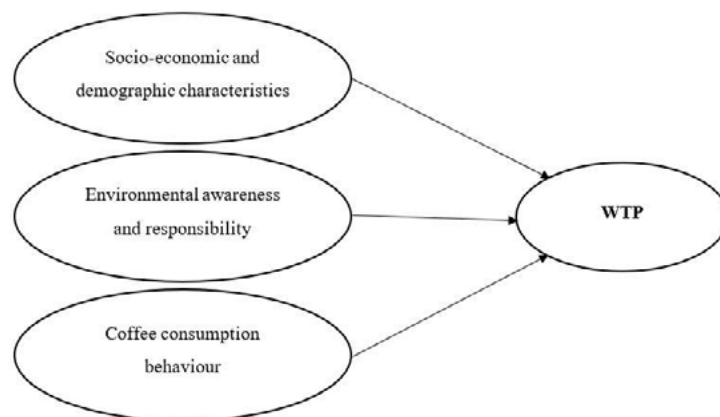


Figure 1. Conceptual framework of consumers' willingness to pay a positive premium for PFES-supported coffee products

3. Methods

A pilot survey was first conducted to pre-test and refine the questionnaire. The main survey was subsequently implemented using two complementary data collection approaches at coffee shops in Dak Lak province. Coffee shops were purposively selected as survey venues to obtain geographical coverage and variation in customer profiles. At each venue, interviewers approached available customers without targeting particular demographic groups. Additional respondents voluntarily completed the questionnaire by scanning QR codes displayed at the participating venues. Therefore, the final sample combined face-to-face intercept recruitment and voluntary QR-based participation and should not be interpreted as a probability sample of all coffee consumers in Dak Lak.

The quantitative analysis examined both whether respondents were willing to pay a positive premium and the approximate premium level they were willing to accept. The study applied the sample size determination formula as proposed by Burns et al. (2013), as follows:

$$n = Z^2 \frac{p^*q}{e^2} \quad (1)$$

Where n is the required sample size, p is the assumed population proportion, $q = 1-p$; e is the margin of error, and Z is the critical value corresponding to the selected confidence level. Using $p = 0.5$, $e = 0.05$, and $Z = 1.96$, the minimum sample size was:

$$n = 1.96^2 \frac{0.5 * 0.5}{0.05^2} = 385 \quad (2)$$

In practice, 546 questionnaires were collected through these two approaches. After data cleaning and quality control procedures, 457 valid responses were retained for analysis. The questionnaire comprised three main sections: (i) socio-economic and demographic information; (ii) perceptions and awareness regarding Forest Environmental Services (FES); and (iii) WTP attitudes and decision-making regarding PFES. In addition, in-depth interviews were also conducted with selected stakeholders to examine institutional perspectives on a potential PFES pilot mechanism. The interviewees included experts and representatives from coffee companies, beneficiaries of forest environmental services such as national parks and conservation areas, local government authorities, and academic researchers.

Quantitative analysis: For items measured on a five-point Likert scale, means and standard deviations were calculated. In addition, one-sample t -tests were conducted to determine whether each mean score was significantly higher than the neutral midpoint of 3. Mean scores were also descriptively classified into levels of importance using the predefined interpretation intervals (Stehlik-Barry & Babinec, 2017). For descriptive interpretation, mean scores of 3.41–4.20 were classified as “Important,” while scores of 4.21–5.00 were classified as “Very important.” All quantitative analyses were conducted using Stata 17.0.

Measuring WTP: To estimate the WTP, the study employed the CVM using a bidding-game approach. The process consisted of two steps. Respondents were first provided with a concise description of the proposed PFES mechanism and its potential environmental benefits. They were then asked whether they were personally willing to pay an additional premium for PFES-supported coffee. Respondents expressing a positive WTP proceeded to the bidding game. The reference coffee price was based on the average retail price of conventional coffee sold in coffee shops. The proposed premium levels were informed by the pilot survey to ensure realism and clarity. For descriptive estimation, the categories of less than 5%, 5–10%, 10–15%, and more than 15% were represented by 2.5%, 7.5%, 12.5%, and 17.5%, respectively.

Respondents were first asked whether they were willing to pay any additional premium for PFES-supported coffee products. Those who answered “No” were classified as having zero WTP and did not proceed to the premium-level estimation. Those who answered “Yes” proceeded to the bidding game. The bidding started at a 5% premium. Respondents who rejected the initial 5% bid but remained willing to pay a smaller positive premium were classified in the “less than 5%” category. Those accepting the initial bid were subsequently offered premiums of 10% and 15%. The mean premium was calculated only among respondents who expressed a positive WTP. Respondents with zero WTP were excluded from this calculation but were retained in the binary logistic regression analysis.

Binary logistic regression model: The logistic regression was also applied to identify factors influencing WTP probability.

Where p denotes the probability that respondent is willing to pay. The term α represents the intercept, β_j denotes the estimated coefficient for the j -th explanatory variable, and k is the number of explanatory variables. The explanatory variables were grouped into three categories. The first comprised socio-economic and demographic characteristics: gender, age, education, occupation, monthly income, ethnicity, household size, residential location, and respondent status (Đan et al., 2020; Wei et al., 2018). The second included awareness of forest roles, perceived relevance of forest benefits, and normative support for customer contributions to PFES. The third comprised usual coffee price and coffee consumption frequency. Occupation and residential location were entered as categorical predictors, while age, education, income, coffee price, and consumption frequency were entered as ordinal predictors. Table 1 presents the definitions and coding of all variables.

Table 1. Variable definitions and value labels

Code	Variable	Value Labels
WTP	Willingness to pay	0 = Unwilling to pay any additional premium; 1 = Willing to pay an additional premium for PFES-supported coffee products
X1	Gender	0 = Female; 1 = Male
X2	Age	0 = Under 18; 1 = 18–25; 2 = 26–35; 3 = 36–45; 4 = 46–55; 5 = Over 55
X3	Education	Educational attainment, from 1 (no schooling) to 6 (tertiary education or higher)
X4	Occupation	0 = Student; 1 = Office employee; 2 = Government employee/public servant; 3 = Business/self-employed; 4 = Manual worker; 5 = Farmer; 6 = Other
X5	Monthly income (VND)	0 = Under 5 million; 1 = 5–10 million; 2 = 10–20 million; 3 = Above 20 million
X6	Ethnicity	0 = Ethnic minority; 1 = Kinh
X7	Household size	Number of household members
X8	Residential location	0 = Urban; 1 = Peri-urban, 2 = Rural
X9	Respondent status	0 = Tourist/non-local visitor; 1 = Local resident
X10	Awareness of forest roles	0 = No; 1 = Yes
X11	Perceived relevance of forest benefits	0 = No; 1 = Yes
X12	Agreement that customers should contribute to PFES	0 = No; 1 = Yes
X13	Usual coffee price (thousand VND)	0 = Below 15; 1 = 15–20; 2 = 20–25; 3 = Over 25
X14	Coffee consumption frequency	0 = Less frequent; 1 = Two or three times per week; 2 = Daily

Qualitative analysis: In parallel, interviews were conducted using a semi-structured guide covering three main topics: responsibility and consensus, legal frameworks and transparency, and incentive mechanisms. Interview notes and transcripts were reviewed

and grouped according to these themes to identify common views and differences across stakeholder groups. Representative quotations were used where appropriate to illustrate key perspectives. The stakeholders interviewed included coffee companies, government representatives, and experts involved in PFES policy. First, four coffee companies were interviewed to explore their strategies. Second, several government representatives in Dak Lak province were consulted, including officials from national parks, forest management boards, and forestry companies. In addition, representatives from the Forest Protection and Development Fund, the Department of Agriculture and Rural Development and the Provincial Crop Protection Sub-Department were interviewed to clarify institutional mechanisms and procedures for PFES payment collection and distribution. Finally, two experts from academia and international organizations were consulted to assess the feasibility of implementing a customer-based PFES approach and developing a pilot payment model in the province. The criteria and results regarding the selection of stakeholders for interviews are summarized in Table 2.

Table 2. Stakeholder groups, number of interviewees, and selection criteria for key informant interviews

Stakeholder Group	Selection Criteria	Number of Interviewees
Coffee companies	Engagement in environmental protection, green production, coffee agroforestry, or interest in participating in future PFES schemes for coffee farmers	4
Government representatives	Direct involvement in PFES implementation, forestry management, and agricultural policy: - Dak Lak Agriculture and Environment Department - Dak Lak sustainable coffee development project team - Dak Lak Forest Protection and Development Fund - Dak Lak Cultivation and Plant Protection Department - Forestry companies, national parks, and nature reserves	8
Experts	Experience in forest conservation, PFES implementation, and environmental policy from academia and international organizations	2

4. Results and Discussion

4.1. Descriptive characteristics of customers and their perception of FES

Table 3 presents the descriptive statistics of the variables included in the analysis. The sample was relatively balanced by gender, with males accounting for 54% of respondents. Additionally, most respondents were in the middle age categories, had relatively high educational attainment, and reported moderate to high income levels. Moreover, the average household size was 4.33 members, and the average coffee price paid was VND 17.76 thousand per cup. With respect to locality, most respondents were local residents and identified as Kinh ethnicity. Furthermore, coffee consumption was relatively frequent, while awareness of forest environmental services and support for contributing to forest protection were generally high among participants. Detailed variable definitions and coding schemes are provided in Table 1.

Table 3. Respondent characteristics

Variables	N	Min	Max	Mean	SD
Gender	457	0	1	.54	.499
Age	457	0	5	2.50	1.013
Education	457	2	6	4.79	.959
Occupation	457	0	6	2.18	1.507
Income	457	0	3	1.29	.798
Ethnicity	457	0	1	.94	.244
Household size	457	1	9	4.33	1.091
Residential location	457	0	2	.53	.808
Respondent status	457	0	1	.976	.153
Awareness of forest roles	457	0	1	.98	.114
Perceived relevance of forest benefits	457	0	1	.836	.371
Normative support for customer contributions	457	0	1	.818	.386
Usual coffee price	457	0	3	1.053	0.717
Coffee consumption frequency	457	0	2	0.630	0.751

Table 4. The respondents' perception of FES

Indicators	Mean ^a	SD	Importance Level
1. Agricultural support functions			
1.1. Soil conservation	4.24	0.75	Very important
1.2. Water regulation	4.23	0.78	Very important
1.3. Climate regulation	4.30	0.82	Very important
1.4. Carbon sequestration	4.25	0.86	Very important
2. Ecosystem protection and community engagement			
2.1. Tourism and landscape services	3.98	0.81	Important
2.2. Biodiversity conservation	4.21	0.6	Very important
2.3. Livelihood development	3.93	0.62	Important
2.4. Ecosystem restoration	4.01	0.69	Important
2.5. Environmental education	4.00	0.72	Important
3. Product and market-related services			
3.1. Eco-friendly product provision	4.16	0.77	Important
3.2. Sustainable consumption promotion	4.10	0.74	Important

^aAll means were significantly higher than the neutral midpoint of 3 ($p < 0.01$).

The survey results reveal a generally high level of customer perception comprising three key domains: (1) agricultural support functions; (2) ecosystem protection and community engagement; and (3) product and market-related services (Table 4) (Kindler, 2016).

All indicators had mean scores significantly higher than the neutral midpoint of 3 ($p < 0.01$), indicating that respondents generally considered these forest environmental services important. Based on the descriptive interpretation intervals, the mean scores ranged from “Important” to “Very important.” This implied that individuals generally perceived FES as important to very important across multiple dimensions (Table 4). In other words, the findings suggest that respondents generally assigned high importance to the listed forest environmental services, particularly climate regulation, carbon sequestration, soil conservation, and water regulation. These insights highlight the need to strengthen communication and policy interventions to enhance understanding and engagement in less visible aspects of FES.

4.2. Customers’ WTP and its value estimation

Table 5 presents WTP for PFES-supported coffee. Of the 457 respondents, 346 (75.7%) expressed a positive WTP. Among respondents who expressed a positive WTP, the estimated mean premium was 5.3% above the regular coffee price. The assigned values ranged from 2.5% for the “less than 5%” category to 17.5% for the “more than 15%” category. Correspondingly, the acceptable price range for a cup of FES-supported coffee ranged from 12,800 VND to 32,300 VND, with an average of 18,800 VND per cup.

These findings indicate the presence of a customer segment with positive WTP for environmentally responsible products. The findings suggest potential consumer interest in environmentally differentiated coffee products. Moving forward, it is essential to enhance the perceived value of FES contributions and ensure transparent and credible mechanisms to foster trust, potentially increasing the size of the high-WTP segment.

Table 5. Estimated premium among respondents with positive WTP

Measure	Min	Max	Mean
Estimated premium (%)	2.5	17.5	5.3
Acceptable coffee price (thousand VND/cup)	12.8	32.3	18.8

Note: Premium categories of <5%, 5–10%, 10–15%, and >15% were represented by 2.5%, 7.5%, 12.5%, and 17.5%, respectively.

The value of 17.5% is an assumed representative value for the open-ended upper category rather than an observed maximum.

Table 6 reports the binary logistic regression results for respondents’ WTP for a positive premium for PFES. The model was statistically significant (Wald $\chi^2(20) = 124.72$, $p < 0.001$), with a Pseudo R^2 of 0.339. The Hosmer–Lemeshow test did not indicate a lack of fit ($\chi^2(8) = 2.44$, $p = 0.965$). The model correctly classified 86.21% of observations and achieved an AUC of 0.850, suggesting a good ability to distinguish between respondents with and without positive WTP. Specifically, income was positively related to WTP. Each one-category increase in monthly income was associated with approximately 81% higher odds of positive WTP (OR = 1.81, 95% CI: 1.08–3.02, $p = 0.024$) and corresponded to an average increase of 6.5 percentage points in the predicted probability. This result is consistent with the role of purchasing capacity in consumer support for environmental public goods (Baumgärtner et al., 2017).

Attitudinal factors were more strongly related to WTP than most socio-economic characteristics. Respondents who viewed forest benefits as relevant to their lives or livelihoods were more likely to express positive WTP, with an average difference of 12.0 percentage points in predicted probability. An even larger association was found for normative support for customer contributions. Those who agreed that customers should contribute to PFES had substantially higher odds of being personally willing to pay, corresponding to an average probability difference of 66.5 percentage points. This result is broadly consistent with evidence that customer participation can be associated with greater WTP for green products (Wei et al., 2018) that customer participation improves customers' WTP more.

Table 6. Binary logistic regression estimates of WTP for a positive premium for PFES-supported coffee products

Variable	Coefficient (Robust SE)	OR (95% CI)	AME	<i>p</i> -value
Male	0.087 (0.323)	1.09 (0.58–2.05)	0.010	0.787
Age	-0.131 (0.213)	0.88 (0.58–1.33)	-0.014	0.539
Education	-0.152 (0.170)	0.86 (0.62–1.20)	-0.017	0.371
Occupation ¹	-	-	-	0.355
Monthly income	0.591 (0.262)	1.81 (1.08–3.02)	0.065	0.024**
Kinh ethnicity	0.899 (0.471)	2.46 (0.98–6.19)	0.115	0.056*
Household size	0.043 (0.122)	1.04 (0.82–1.33)	0.005	0.723
Residential location ¹	-	-	-	0.625
Local resident	0.416 (0.801)	1.52 (0.32–7.28)	0.049	0.604
Awareness of forest roles	3.346 (1.811)	28.39 (0.82–988.16)	0.547	0.065*
Perceived relevance of forest benefits	0.965 (0.386)	2.62 (1.23–5.59)	0.120	0.012**
Normative support for customer contributions	3.678 (0.366)	39.58 (19.32–81.07)	0.665	<0.001***
Usual coffee price	-0.126 (0.210)	0.88 (0.58–1.33)	-0.014	0.549
Coffee consumption frequency	0.399 (0.209)	1.49 (0.99–2.25)	0.044	0.057*
Observations	457			
Wald $\chi^2(20)$; <i>p</i> -value	124.72; <0.001			
Pseudo <i>R</i> ²	0.339			
Correctly classified	86.21%			
Hosmer–Lemeshow $\chi^2(8)$; <i>p</i> -value	2.44; 0.965			
AUC	0.850			

Note: OR = odds ratio; AME = average marginal effect. Robust standard errors are in parentheses. *P*-values refer to logit coefficients; those for occupation and residential location are from joint Wald tests. Reference groups are female, office employee, ethnic minority, urban resident, tourist/non-local visitor, and “No” for the attitudinal variables. * *p* < 0.10; ** *p* < 0.05; *** *p* < 0.01.

Evidence for the remaining variables was limited. Ethnicity, awareness of forest roles, and coffee consumption frequency showed weak statistical evidence of an association with WTP, but none met the 5% significance threshold. The estimate for awareness was particularly imprecise, as reflected in its wide confidence interval. Moreover, occupation and residential location were not jointly significant. No statistically significant associations were found for gender, age, education, household size, respondent status, or usual coffee price.

4.3. Perspectives of key stakeholders on PFES implementation

The qualitative findings capture the perspectives of coffee companies, government representatives, and experts on linking consumer-financed PFES to community-based forest protection and sustainable coffee production. Three recurring themes emerged from the interviews: responsibility for PFES contributions, legal and financial arrangements, and incentives for stakeholder participation. As coffee farmers and forest-dependent communities were not directly interviewed, the findings represent stakeholders' perceptions of potential community implications rather than the views or experiences of community members themselves.

a. Responsibility for PFES contributions

Stakeholders differed in their views on how financial responsibility should be allocated. Coffee-company representatives expressed conditional willingness to participate, particularly if the same requirements were applied across businesses. As one representative explained, "We are willing to pay only if clear and uniform government regulations are in place" (CC2). This concern was linked to the possibility that voluntary participation by only a small number of registered companies could create unequal costs and unfair competition. Government representatives and experts generally considered consumers a more appropriate source of additional contributions than farmers, who already face production and market risks. Across stakeholder groups, the central issue was therefore not only who should pay, but also how payment responsibilities would be defined and applied.

b. Legal and financial arrangements

Interviewees consistently emphasized the need for clear legal guidance and transparent fund management. Several government and expert respondents considered the provincial Forest Protection and Development Fund a possible institutional channel for collecting and managing contributions. One government representative stated, "All contributions should be channelled through the provincial Forest Protection and Development Fund to ensure transparency and efficiency" (GR3). An expert similarly noted that "building trust requires transparency in how PFES funds are collected and used" (EX1). These views suggest that transparency was considered important not only for administrative accountability but also for gaining the confidence of participating businesses and consumers.

c. Incentives for stakeholder participation

Interviewees also discussed the incentives that could encourage business participation. Coffee-company representatives viewed environmental differentiation and compliance with emerging sustainability requirements, including the EUDR, as possible sources of market and reputational benefits. Government respondents suggested promotional support, environmental certification, or recognition in local programs as potential incentives for participating businesses. Experts recommended beginning with a limited pilot before

considering wider implementation. As one expert explained, “Pilot models should first be developed to demonstrate feasibility in practice and encourage other stakeholders to participate” (EX2). A pilot was therefore viewed as a means of testing collection procedures, stakeholder participation, monitoring arrangements, and benefit distribution under actual implementation conditions.

Although the proposed mechanism has potential implications for coffee-growing and forest-dependent communities, these groups were not directly represented in the qualitative interviews. Future research should therefore examine farmers’ and community members’ preferences, perceived fairness, and willingness to participate before any wider implementation is considered.

5. Conclusion

This study explored the potential consumer-supported PFES mechanism for the coffee sector in Dak Lak Province from the perspectives of environmental valuation and stakeholder engagement. The findings indicate consumer interest in the proposed mechanism and conditional support among the interviewed stakeholders. Income, perceived relevance of forest benefits, and normative support for customer contributions were positively associated with personal WTP. In particular, the strong association between normative support and personal WTP suggests that consumer acceptance of payment responsibility may be important for a potential consumer-financed PFES mechanism.

However, this association should not be interpreted as causal. Furthermore, stakeholder consultations highlighted several conditions for implementation, including transparent fund management, clear allocation of responsibilities, and appropriate mechanisms for collecting and distributing PFES revenues. Participants also emphasized that forest conservation in coffee-producing areas should involve contributions from multiple actors rather than relying solely on public funding or farmers. These findings underline the importance of stakeholder engagement and coordination across the coffee value chain. Taken together, the results suggest that PFES-supported coffee products could provide a complementary financing mechanism for forest conservation in coffee-growing regions. The study highlights the potential of market-based approaches to encourage broader participation by consumers, businesses, and public agencies, while recognizing that farmer participation remains to be examined.

Several limitations should be considered. The cross-sectional survey used non-probability recruitment, limiting causal and population-level inference. The hypothetical WTP estimates may differ from actual purchasing behavior, and potential differences between face-to-face and QR-based responses were not modelled. Some predictors were highly unbalanced, resulting in imprecise regression estimates. In addition, farmers and forest-dependent communities were not directly interviewed. Further consultation with farmers and forest-dependent communities, followed by a small-scale pilot, could help assess participation, benefit sharing, and implementation feasibility.

Author Contribution

Thuy Phan Thi contributes to the conceptualization, methodology, validation, formal analysis, resources, and writing and editing the article. Quyen Nguyen Thi Ngoc

contributes to the conceptualization, methodology, validation, data curation, and writing and editing the article. Vung Nguyen Xuan, Nam Vu Hai, and Nghi Tran Huu contribute to the investigation. Cuong Nguyen Thuy contributes to the investigation and editing the article. Thang Tran contributes to the validation, data curation, and editing the article. All authors have read and agreed to the published version of the manuscript.

Acknowledgment

We would like to thank Tropenbos Vietnam and all participants who were involved in our surveys and warmly answered all of our questions.

Funding

This paper was funded by Centre for Tropical Forestry Research in Vietnam (Tropenbos).

Declaration of Conflicting Interests

This section declares that the author(s) have no known competing interests (financial, personal relationships, involvement in the publication process), which may be considered potential conflicts of interest that could influence the work presented in this manuscript.

Declaration of Generative AI and AI-Assisted Technologies

The authors used ChatGPT (OpenAI) only to check spelling and grammar and to identify missing or inconsistent entries between in-text citations and the reference list. All suggested changes were reviewed by the authors, who take full responsibility for the manuscript.

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