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Abstract

This study uses a quantitative approach based on a discrete choice experiment with 586 farmers in Northern Vietnam to measure how representative market and non-market factors could influence their preferences for participating in organic certification schemes. Our results suggest that a sales contract with either flexible or guaranteed prices is a significant incentive to explain their willingness to pay higher production costs to be involved in organic certification schemes. Furthermore, providing farmers with training and technical support is also essential to motivate farmers toward organic agriculture. Finally, neighborhood cooperatives and formal leaders' participation in organic certification could encourage farmers to convert to organic agriculture.

Keywords: Discrete choice experiment; Organic certification; Farmers' preferences; Leadership; Role of network.
JEL Classification: C93; D10; Q00.

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1 Introduction

For decades, a rapid expansion of global agriculture has seriously threatened the worldwide biodiversity [35, 131]. Particularly, intensive food production poses significant threats to the environment, such as pollution from pesticides and fertilizers, greenhouse gas emissions, and loss of biodiversity from the conversion of vast amounts of natural ecosystems into croplands [111, 112]. Moreover, a conventional farming system that heavily relies on chemical inputs (e.g., pesticides and chemical fertilizers) is associated with severe environmental and health problems (e.g., extreme soil, water, and crop pollution) [13, 133]. For instance, according to the Intergovernmental Panel on Climate Change (IPCC), conventional agriculture accounts for one-fifth of the greenhouse effect, leading to global climate change [66].

As a solution, organic agriculture is proposed as a solution to prevent environmental degradation (e.g., preserve soil fertility in the long term) by producing foods that are less dependent on fertilizers and chemicals [25, 62]. Specifically, organic farming could enhance food safety, increase employment opportunities, reduce external input costs, and improve farmers' income [55, 93]. However, besides its wide range of environmental advantages, organic yields are significantly lower than those of modern agriculture, thus lowering its contribution to global food security [19, 29]. Therefore, several strategies, such as government regulations and voluntary sustainability standards (e.g., GlobalGAP or Organic), have been proposed to improve the sustainability of the global food system.

Voluntary sustainability standards (VSS), also called sustainability certificates, eco-labels or private standards, are standards relating to a wide range of sustainability metrics that producers may be asked to meet and controlled through third-party certification [99]. On the globe, since the VSS began to proliferate in the 1980s, the adoption of VSS in the agricultural sector has grown exponentially (e.g., global certified crop area expanding with an estimated 11% annually) [69]. Evidence suggests the importance of compliance with a VSS in improving agricultural production and trade environmentally, socially, and economically [65]. Particularly, adopting VSS by agri-food companies helps promote agri-food exports and attract foreign investments [39] since the VSS certification schemes help steer producers to address ecological and social problems [5]. On the other hand, the increased integration of VSS is also expensive and complex for producers because the certification process often demands documentation and record-keeping systems. Therefore, besides their positive effect, voluntary standards could have opposite effects, causing impoverishment and less involvement of agricultural producers.

Our field study is carried out in Vietnam. A developing country like Vietnam is currently in a start-up phase that requires strong support in its agricultural sector. However, despite a large proportion of land in Vietnam being dedicated to agriculture (around 40%), Vietnamese farmers still heavily rely on farming inputs, such as pesticides, fertilizers, and crop protection inputs, to produce their agricultural products [92, 125]. The current literature on VSS in developing countries has evaluated the important role of VSS certification schemes in encountering an increasing consumer interest, signaling their environmentally friendly products, differentiating between competing in the competitive market and getting access to new markets that ensure guaranteed product price [3, 84, 114].

Moreover, the existing literature has suggested that farmers' decisions to adopt voluntary certification schemes are influenced by various market and political factors, such as agricultural policy, market configuration, and technology design [27, 54, 100]. Market barriers, such as a slow expansion of the market for organic products and a lack of a certification system, need to be overcome to boost organic farming conversion [100]. Sufficient information about the benefits and standards of organic products could decrease marketing costs and thus reduce the price of organic products [106]. Therefore, voluntary certification schemes could help ensure certified farmers with a stable income coming from a higher opportunity to access new markets with a guaranteed price premium for their products [97].

Besides the market factors, non-market factors associated with organic certification schemes, such as certification, logo, training and guaranteed price, networks of farmers are an important motive for organic farming conversion. More specifically, a network is a valuable source of information for farmers to exchange information and spread social preferences since most farmers always belong to a local network, such as a network of neighborhood farmers, friends or agricultural organizations in the local area (e.g., farmers' association or cooperative) [64, 78]. Several studies have suggested that farmers are more likely to acquire information about dairy farming within their interpersonal social network, which could enhance their learning and productivity [47, 105]. Some other studies argued that frequently communicating/discussing with other neighborhood farmers could significantly promote the adoption of organic farming [60, 116]. Thus, the non-market factors (e.g., a network of farmers adopting organic farming standards) could be important to other farmers' adoption decisions.

The main motivations and contributions of this study are the following. Our study assesses the role of non-market attributes, especially the role of networks and participation of leaders, on farmers' WTP in the adoption of organic certification. In particular, we assess farmers' preferences for a hypothetical organic certification scheme as well as their willingness to pay changes in production cost to be involved in organic certification schemes using a discrete choice experiment. Our study examines the role of both market attributes and non-market attributes (i.e., the role of networks and participation of leaders in local villages) on farmers' WTP in the adoption of organic certification and estimate their economic value in terms of marginal WTP.

The remainder of the paper is structured as follows. The study's background and the literature review are explained in Section 2. Section 3 summarizes our choice of experimental design and data collection. Section 4 describes the econometric model. Section 5 discusses the main estimation results, and a discussion and conclusion are provided in Section 6.

2 Background and literature review

2.1 Adoption of voluntary organic standards

Organic agriculture originated as a critique of the expanding industrial food system between the 1920s and 1950s [8, 63]. Until the 1980s, organic agriculture, which promised a more 'natural' and healthier agriculture, had mentalism and health concerns about exposure to pesticides, antibiotics, and hormones [63]. In the United States (US), the first state-level organic rules appeared in the 1970s, followed by the National Organic Program (NOP) approximately 30 years later [74, 130]. The first European-wide organic rule was formed in 1991, replacing national regulations that had existed in most countries since the 1980s [108]. Some nations, like Australia, do not yet have a legally enforceable national organic regulation but instead rely on broadly recognized national voluntary standards established by government authorities or the organic industry [102].

At the international level, various organizations are striving to standardize organic standards worldwide. The International Federation of Organic Agriculture Movement (IFOAM), an umbrella organization founded in 1972, and the Codex Alimentarius, established in 2001 by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), aim to develop a consensus definition of organic practices across different countries, allowing for free trade in nationally regulated organic food and thus significantly impact the development of several national organic standards [83]. The role of sustainability standards is essential in facilitating international trade and farmer welfare [9, 63]. A study indicated that US farmers benefit from significant improvements in the sustainability of food production and demands for organic products when the standards are adopted [63].

In recent years, an increasing number of developing countries have implemented organic legislation to facilitate trade with high-income countries [117]. Uganda, for example, implemented a national organic standard in 2004, followed by a regional East African organic standard in 2007 [77]. Similarly, after seeing significant expansion in the organic industry, Mexico established a national organic program in 2006 and a national organic standard with production requirements in 2013 [95]. Currently, approximately 100 countries worldwide have adopted or are implementing organic standards [126]. The benefits from adopting voluntary standards could greatly affect farmer income but depend on the organization of the supply chain and transaction cost [68].

2.2 Organic standards in Vietnam

In Vietnam, research on organic agriculture is attracting researchers' attention. There are five common Sustainable Agricultural Practices (SAPs) applied in Vietnam: "Crop rotation" (i.e., growing different types of annual or biannual crops on the same land in sequential seasons), "Intercropping" (i.e., cultivating two or more crops on the same plot at the same time), "Soil and water conservation practices" (i.e., activities at the local level that maintain or enhance the productive capacity of the land in areas affected by degradation), "Organic fertilizers" (i.e., application of agricultural waste residues as effective alternatives to chemical fertilizers) and "Leaving the land fallow" (i.e., restoring soil fertility and nutrients, re-establishing soil biota, breaking crop pest and disease cycles as well as providing a haven for wildlife) [88]. SAPs help farmers reduce the appearance of pests and diseases, as well as maintain productivity despite harsh conditions from climate change, thus improving yields and household income. However, the adoption of SAPs is still low in developing countries, particularly in the context of Vietnam.

Some studies suggested a low adoption rate of organic farming is due to weaknesses in policy implications, unreliable certification processes, and the distrust of consumers [89, 109]. For instance, Vietnamese consumers are unfamiliar with organic food labels and certification because there was no official national certification or designation for organic products until recent years [76]. The Vietnamese government has encountered difficulties in managing and regulating those pesticide practices [120]. Some studies have indicated that Integrated Pest Management (IPM) helps regulate the use and management of insect pesticides and reduce the use of pesticide inputs [14]. However, IPM has been evaluated as unsuccessful in Vietnam [48]. For instance, Vietnamese farmers do not follow the correct practices required for pesticides and fertilizers in the field [113].

Moreover, most Vietnamese farmers are involved in a conventional farming scheme, in which they highly depend on the use of chemical pesticides and fertilizers to have higher yields and profits from farming since synthetic substances are easy to use and require low labor inputs [14, 94]. However, the consequences of artificial substances (e.g., pesticide overuse) tend to increase insect resistance and, therefore, lead to severe impacts on the health of both farmers and consumers in the long run [15, 128]. For instance, pesticides cause severe chemical contamination in soil and surface water, especially "ready-to-drink" sources, and thus, people living in the surrounding area are at a health risk of consuming polluted water, especially Vietnamese farmers [94, 109, 113]. Therefore, it is essential to encourage farmers to shift toward sustainable agriculture by providing information via training or sharing experiences with farmers to improve environmental quality and public health [32, 97, 115].

2.3 Discrete choice experiment and adoption of voluntary organic standards

The discrete choice experiment (DCE) is based on repeated individual choices among hypothetical scenarios differentiated by attributes and status quo scenarios. The DCE is commonly used to calculate the WTP or WTA to participate in some agricultural schemes [57, 101] and to determine how different attributes influence farmers' adoption of new technology [37, 53, 57]. Existing literature has argued that adopting organic standards requires farmers to change their habits by limiting the use of pesticides and fertilizers. From a farmer's perspective, reducing pesticides and fertilizers could increase the risk of productivity loss [21]. Therefore, farmers who are willing to adopt an organic farming scheme require a guarantee to compensate for this risk.

Several studies have suggested that farmers are often uncertain about markets for and the prices of organic products [53, 119]. Sales contracts for organic foods (with either flexible or fixed prices) are a solution to overcome the uncertainty of adopting organic agriculture [41]. Payment for the agri-environmental scheme is also a significant barrier to farmers' uptake of environmental programs [41, 123]. Farmers often have information about the cost of conventional farming, but they are uncertain about the cost of organic agriculture. Farmers' decisions to adopt organic farming are not only limited by economic factors but also by non-economic factors. The influence of social acceptance on farmers' adoption of organic agriculture is essential and needs to be considered [28]. In their study, the authors found that Irish farmers observe other farmers' behaviors and then consider adopting organic farming or not [58]. Based on the Theory of Planned Behavior [2], the behavioral change depends partly on the farmer's understanding. Knowledge and know-how are also necessary for them to make their choice. Moreover, farmers need information and training to grow organic vegetables [1]. Without accurate information and knowledge of organic farming, there can be resistance to adoption [16]. In the model of new technology adoption, temporal issues can play a role in the sense that some farmers will adopt earlier than others. These farmers are referred to as "opinion leaders". Opinion leaders influence their followers by providing information about the quality of adoption [85].

In addition to these crucial determinants, farmers' socio-demographic characteristics, the size of the farm (i.e., large-scale or smallholder farmers), and farmers' attitudes toward the environment can also help to explain farmers' decisions to adopt organic agriculture [27, 60, 85, 91]. In the study of the determinants of sustainable agriculture adoption in Moldova, the authors concluded that farmers' household characteristics (e.g., age, number of children, number of adults, etc.) and farm size are important factors influencing farmers to adopt sustainable agriculture [91]. Additionally, farmers' awareness and concern about the environment and the consequences of farming activities positively impact the adoption of sustainable agriculture [132].

3 Choice experimental design

3.1 Attributes

Our choice experiment was offered to respondents with multiple-choice scenarios. Given a hypothetical situation, farmers were asked to choose one of three options: two "organic certification" alternatives (options 1 and 2) and a "status quo" alternative in which farmers decided to choose neither organic option 1 nor 2. The two alternative "organic certification" options are described by a number of different attributes.

The selection of attributes in our study is based not only on the literature review but also on discussions with experts in Vietnam. A face-to-face meeting with several experts from agricultural sectors and NGOs, including the Director of the Van Duc farming cooperative, the President of the Farmer Union of the Van Duc Commune, the President of the Agricultural Extension Association, and Specialists of the Vietnam Agricultural Sustainable Development Organization, was organized at the Van Duc Commune, Gia Lam District, Hanoi. Following the discussion, we agreed that there are six important attributes that affect the farmers' decisions toward organic certification: (1) Training and technical advice; (2) Sales contract; (3) Traceability; (4) Neighbor; (5) Leadership; and (6) Additional cost per kg. Each attribute contains different levels for building scenarios.

Firstly, our experiment aims to analyze farmers' preferences for organic certification based on the first attribute, "Training and technical advice". This attribute is defined as practical lessons delivered free of cost to farmers to improve their knowledge about organic farming and organic farming practices. In addition to the "Training" aspect, local technicians or specialists would provide technical advice farmers to help them apply the principle of organic farming. Secondly, we analyze the farmers' sensitivity to different types of sales contracts between farmers and buyers within the context of organic agriculture based on the second attribute, “Sales contract”. The buyers may be retailers (e.g., supermarkets, companies), co-operatives or direct consumers. Two different types of contracts are proposed: a contract with fixed/guaranteed prices and a contract with flexible prices. Thirdly, the experiment also includes the attribute “Traceability”, a traceable code corresponding to an organic logo on each organic product. Traceable codes on organic products help consumers distinguish between organic and non-organic products and indicate that farmers’ products have already been subjected to strict quality control. Fourthly, the attribute “Neighbors” is used to capture farmers’ preferences in coordination with neighbors in doing organic farming. Fifthly, the “Leadership” attribute is the presence of formal (e.g., village leaders or president of the farmers’ association) and informal (e.g., religious leaders or the most successful farmers in the village) leaders, using to estimate farmers’ preferences in different levels of leaders’ communal participation in organic farming schemes.

Finally, the “Cost” attribute is a major element used to capture farmers’ WTPs regarding additional production costs for organic certification schemes. As for OF, yield is lower than conventional farming (i.e., OF may give a lower yield but a higher premium price than conventional farming) [24]. The additional cost per kilogram (kg) (i.e., unit cost), the ratio between total cost and yield, allows us to control yield value. The unit cost attribute also allowed us to accurately capture farmers’ WTPs because farmers in different areas often produce different types of agricultural products. Even farmers who produce the same type of products may have a wide range of production costs. Thus, our cost attribute includes six levels, which are defined in terms of percentage increase in production costs: 0%, 10%, 30%, 60%, 100% and 150%. The six levels ranging from 0% to 150% reflect the non-linear increase in production cost and cover the possible range for organic production costs, including all fixed and variable costs related to the conversion to organic farming. Furthermore, the choices of these price levels also followed the suggestions of Vietnamese experts on agricultural economics during the face-to-face meeting as previously discussed. Detailed information about attributes and their levels is provided in Table 1. The detailed definitions of each attribute are reported in Appendix D.

3.2 Experimental design

The six attributed with different levels (see Table 1) have 864 combinations using a full factorial design, which is unrealistic to include all alternatives in a discrete choice experiment. Applying the NGENE software, we constructed a fractional factorial orthogonal design with 30 choice sets divided into three blocks of ten choice sets (Table 1); the values of attributes describing the two alternative organic options vary across every choice task. The choice experiment was conducted through face-to-face iPad-assisted interviews. In particular, respondents were invited to select their favorite farming option among three alternative options (i.e., two alternative organic options and one “status quo”) across the different choice tasks. There were several assistants during the experiment to help respondents using iPads.

Before delivering the choice card to respondents, each assistant explained the detailed definition of each attribute to the farmers. Two choice card examples were given to farmers to

Table 1: Attributes, attribute levels, and experimental design in the choice experiment.

Attributes		Attribute levels
Training and technical advice		Without lessons.[1] With lessons.
Sale contract		No contract.[1] Contract with a guaranteed price. Contract with a flexible price.
Traceability		Logo without traceability.[1] Logo with traceability.
Neighbors		No neighbor producing organic.[1] Coordination with other neighbors producing organic farming.
Leadership		No leader producing organic farming.[1] Formal leader producing organic farming. Informal leader producing organic farming. Both formal and informal leaders producing organic farming.
Additional cost per unit		0%[1] / 10% / 30% / 60% / 100% / 150%.
Experimental design		
Design approach	Fractional factorial orthogonal design.	
Alternatives	Two hypothetical alternatives (option 1 and 2) and one status quo alternative.	
Blocks	3 blocks.	
Choice tasks	10 choice tasks per block.	

Notes: [1] is the baseline category.

test their understanding of the experiment. There were a total of ten choice cards for which respondents were invited to choose their preferred alternative. There were also two additional choice cards used as examples to test the farmers' understanding of the experiment (see Figure 1 for an example of the choice card).[1] On each choice card, respondents had to choose the one farming option that they preferred from among two organic certification schemes and one status quo (i.e., "no change" or "I prefer the current farming situation") situation. The status quo

[1]A Vietnamese version of the choice card is reported in Figure B1 in Appendix B.

option represents the current farming situation, meaning that respondents were not involved in organic certification schemes. A total of 5,860 valid observations were collected from 586 farmers and used for the empirical analysis.

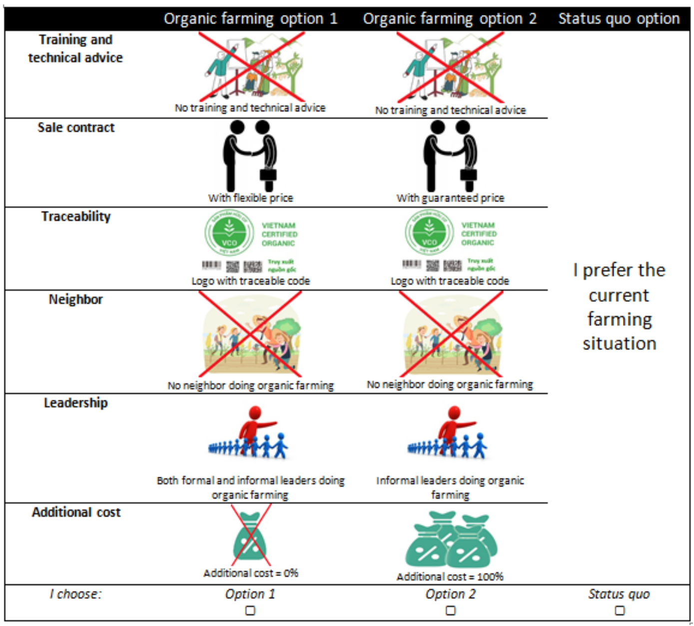

Figure 1: Example of choice card (in English).

In addition to the preliminary experiments, we also collected information from participants on various socio-demographic characteristics. In particular, we collected data on age, gender, farm size, household size, type of residence, individual and household income, health, level of education, marital status, number of children in the household, individual attitudes toward risks, attitudes toward the environment via NEP questionnaires, and perception of the adoption of organic farming. The detailed descriptive statistics are presented in the next section.

3.3 Data

Our data were collected from a choice experiment among farmers who were not involved in organic farming schemes in 31 villages in Northern Vietnam. The data was collected in August 2019 in eight villages, November 2019 in 11 villages, and December 2019 to January 2020 in 12 villages. These 31 villages in seven provinces surrounding Hanoi were chosen because they produced the greatest number of agricultural products (vegetables, rice, and fruits), and they are Hanoi's major suppliers of agricultural products. In recent years, Hanoi has been severely impacted by food safety issues, particularly vegetables, and fruits [42, 121]. Consequently, these agricultural-producing provinces were chosen to explore the influence of socio-psychological factors on farmers' decisions to transition to organic agriculture. Based on village-level data regarding the total number of agriculturally producing households, two to three villages were selected as representatives of each province.

A total of 596 farmers participated in the choice experiment (see the map of the experimental areas in Figure B2 in the Appendix). However, we finally obtained a total of only 586 valid survey answers. Ten invalid observations were removed from the dataset because of missing information about the respondent's current production costs. Note that the current production cost is essential to calculate the "cost" attribute and estimate the WTP. The experiments were conducted with farmers in the village using iPads.

The experiment consisted of four different parts. The first part of the experiment included warm-up questions designed to obtain information about farmers' current farming situations and their past situations related to organic farming. The second part addressed the choice experiment, including 12 choice cards. Note that the first two choice cards were used as examples for respondents to better understand the choice experiment. The third part of the experiment was designed to obtain information about farmers' production activities (e.g., primary agricultural products, production costs, etc.). The last part was intended to obtain information about farmers' socio-demographic characteristics, lifestyles, attitudes toward the environment, and perceptions of organic farming. In addition to farmers' socio-demographic characteristics, we also elicited information on farmers' environmental concerns via 15 NEP questionnaires (see the details of the NEP questionnaires in Table A1 in Appendix A) [36]. Several other questions related to environmental concerns were also asked to capture farmers' opinions, attitudes, and apprehensions toward the environment. All questionnaires are available in the Supplementary Materials. At the end of the questionnaire is a follow-up survey to collect information on farmers who always prefer the "status quo" or "organic certification" alternatives. This follow-up survey helps us to understand these specific behaviors.

3.4 Descriptive statistics

The descriptive statistics of socio-economic characteristics, individuals' concerns about the environment, and their perceptions of adopting organic farming are presented in Table 2. The socio-economic control variables include: *Types of agricultural products* with three dummy variables ($Rice$, $Vegetables$, and $Others$) that take a value of 1 if farmers mainly produce rice, vegetables and other types of products, respectively; $Female$, a dummy that takes a value of 1 if the farmer is female; Age is the log of individual age; $Education$ is a category variable that takes the value of 1, 2 or 3 if the level of individual's education is below secondary school (grade 6 to grade 9), or below vocational school (1 to 2 years after high school), or college and university; $Health$ is a category variable that takes the value of 1, 2 or 3 if the individual has bad health, good health or very good health, respectively; $Income$ is a category variable that takes a value of 1 if the individual is in the low-income group (monthly earnings $<$ 4 million VND), a value of 2 if the individual is in the middle-income group (monthly earnings from 4 to 8 million VND) and a value of 3 if the individual is in the high-income group (monthly earnings $>$ 8 million VND); $Farmsize$ is the log of the farmer's household farm size (in m^2).

In addition to the socio-demographic control variables, the psychological control variables include (1) *NEP score*, the aggregate score of 15 individual New Environmental Paradigm (NEP) questions (Table A1 in Appendix A); and (2)*Perception score*, the aggregate score of four items related to farmers' perceptions of adopting organic agriculture in Table A2. The total NEP score is the aggregate score of 15 NEP questions, in which Cronbach's alpha is equal to 79.02%, and questions number 2, 4, 6, 8, 10, 12, and 14 (even number questions) are reversely coded

Table 2: Summary statistics of survey respondents (N=586)

	Mean	Std.Dev	Min	Max
Types of agricultural products				
Rice	0.45	0.49	0	1
Vegetables	0.33	0.47	0	1
Others	0.21	0.40	0	1
Production cost (VND/kg)	5,843.81	4,316.78	500	46,723
Female	0.66	0.47	0	1
Age (yrs)	51.30	11.67	18	74
Age (in log)	3.90	0.25	2.89	4.30
Education				
Secondary school	0.67	0.46	0	1
High school	0.27	0.44	0	1
College/University	0.06	0.23	0	1
Health				
Bad	0.05	0.21	0	1
Good	0.78	0.41	0	1
Very good	0.17	0.37	0	1
Individual income				
Low	0.63	0.48	0	1
Middle	0.29	0.45	0	1
High	0.07	0.25	0	1
Farm size (m^2)	4,221.17	7,035.40	50	70,000
Farm size (in log)	7.79	0.96	3.91	11.15
NEP score	47.60	4.63	35	64
Perception score	15.1	2.35	4	20

Notes: Other agricultural products include fruit, coins, and other types of products.

[23]. While the *NEP score* variable is used to capture respondents' environmental concerns, the *Perception score* measures respondents' perceptions of adopting organic farming. This aggregate perception score is calculated using four 5-point Likert scale items (see Table A2).

According to the statistics reported in Table 2, a majority of farmers in our sample produced rice (45.39%) and vegetables (33.62%). The rest of the farmers produced fruit, corn, and other agricultural products. The average production cost for three different agricultural products was about 5,843 VND/kg.[2] Farmers were, on average, 51 years old, ranging from 18 to 74 years old. There were 66% of female farmers in our sample. Most of the farmers in the sample were smallholders with an average farm size of 4,221 m^2. The farmers' education level was mainly below high school, with only 6% having graduated from college or university. About 78% of the farmers in our study indicated good health. Most farmers belonged to the low-income group since their monthly income was below 4 million VND[3]. Only 7% of farmers told us that they had an income higher than 8 million VND/month.

[2] equivalent to about 0.25 USD/kg.
[3] equivalent to about 167 USD/month.

4 Methodology

In this section, we briefly discuss how Random Parameter Logit (RPL) and Hybrid Choice Model (HCM) structures are applied to study farmers' preferences toward organic certification schemes [6, 12, 17, 67]. In a standard Random Utility Model [46, 67], we have the individual i's utility function for two organic certification options $U_{i,n,t}$ for $n = \{1, 2\}$ and t choice task are written as follows:

$$U_{i,n,t} = \mu_{ASC} ASC_{i,n,t} + \sum_{l=1}^{L} \beta_l Attribute_{i,l,n,t} + \beta_c Cost_{i,n,t} + \sum_{s=1}^{S} \gamma_s ASC_{i,n,t} * Control_{i,s} + \epsilon_{i,n,t}, \quad (1)$$

where $ASC_{i,n,t}$ is defined as the Alternative Specific Constant (ASC) taking value 1 if the organic alternatives are chosen to capture the unobserved influences on the utility function in the unlabeled choice experiment (i.e., the two organic alternatives are unlabeled). Thus, parameter μ_{ASC} is the coefficient of the dummy variable $ASC_{i,n,t}$. The control variables $Control_s$ include a set of S socio-economic variables (e.g., farmer's characteristics, individual income, etc.). $Attribute_l$ is a set of L attributes, including "Training and technical advice", "Sale contract", "Traceability", "Neighbors", and "Leadership". $\epsilon_{i,n,t}$ is the error component (i.e., random component) of the utility function.

Further, to allow for random heterogeneity in respondent preferences, the RPL could be used to account for individuals' heterogeneity.

$$U_{i,n,t} = \mu_{ASC} ASC_{i,n,t} + \sum_{l=1}^{L} \tilde{\beta}_l Attribute_{i,l,n,t} + \beta_c Cost_{i,n,t} + \sum_{s=1}^{S} \gamma_s ASC_{i,n,t} * Control_{i,s} + \nu_{i,n,t}. \quad (2)$$

This corresponds to a model with parameter heterogeneity (or random parameters) associated with the attribute variables. Its estimation requires an additional assumption about this heterogeneity, i.e.,

$$\tilde{\beta}_{i,l} = \sigma_i \bar{\beta}_l + \vartheta_{i,l}, \quad (3)$$

where $\vartheta_l \simeq \mathcal{N}(0, \Omega)$ and Ω is the variance-covariance matrix of dimensions $K + 1$ (which is the total number of levels in the attributes). The regression gives estimates for $\bar{\beta}_l$, μ_{ASC} and γ_s. The term σ_i represents individual specific scale of idiosyncratic error, where $\sigma_i = exp(-\tau^2/2 + \tau v_i)$ and $v_i \simeq N(0, 1)$.

4.1 Hybrid choice model

The HCM is an approach developed to deal with the heterogeneity in respondents' decision-making [12] since their decisions to be involved in organic certification schemes could be influenced by their attitudes toward the environment in Table A1 and perceptions of adopting organic farming in Table A2. Let I_i be indicators of respondent i's attitudes toward the environment and perceptions of adopting organic farming. The existing literature has indicated that the simple inclusion of I_i (i.e., the measurement components) in $U_{i,n,t}$ is theoretically misguided because of the risk of endogeneity bias since there is likely to be a correlation between I_i and other unobserved factors $\epsilon_{i,n,t}$ influencing respondent i's behavior [12, 17]. The specification of the HCM consists of three components: the specification of the structural equation of the latent variables, the specification of the measurement model, and the specification of the utility function in the choice model component.

4.1.1 Structural equation for latent variables

The HCM model hypothesizes that the real underlying individual attitudes, concerns, and perceptions could be described as a set of k unobserved latent variables, namely $LV_{i,k}$. These latent variables (LVs) could influence the respondents' answers to the attitudinal and perceptional questions and thus drive their behaviors in the actual choice situations. More specifically, the latent variables for respondent i (i.e., the structural equation for latent variables) are given by:

$$LV_{i,k} = \sum_{s}^{S} \gamma_{LV_k,s} z_{i,s} + \xi_{i,k}, \tag{4}$$

where $z_{i,s}$ is a set of S socio-demographic variables of respondent i (e.g., age, gender, income, etc.), γ_{LV_k} is the k vector of estimated parameters capturing the impacts of socio-demographic variables on $LV_{i,k}$ and $\xi_k \simeq \mathcal{N}(0,1)$ is a random disturbance that follows a standard normal distribution across individuals.

4.1.2 Measurement model

In our HCM model, we define two latent constructs (LV_{NEP} and $LV_{Perception}$), measured by two sets of indicators, $I_{i,k}$. The first set of 5-point-Likert scale items measures the respondents' concerns about the environment (LV_{NEP}) (i.e., respondents' awareness about the environment), covering the 15 NEP questions in Table A1. The second set of 5-point-Likert scale items, with the four indicators listed in Table A2, is used to capture respondents' perceptions of adopting organic farming (e.g., "Is the adoption of organic farming approved by other villagers?", etc.) (see Table A2). The latent variables $LV_{i,k}$ used to explain the values of the indicators of attitudes and perceptions for respondent i (i.e., measurement components) are defined as follows:

$$I_{i,k} = \eta_{I_k} + h(LV_{i,k}, \zeta_{I_k}) + \psi_{I_{i,k}}, \tag{5}$$

where the functional form $h()$ is generally a linear specification, η is a vector of constant, ζ is a vector of estimated parameters showing the impact of the k latent variables on various indicators, and ψ is a random disturbance. Since the indicators $I_{i,k}$ are categorical variables (i.e., 5-point-Likert scale items), Equation (5) can be estimated using ordinal regression (i.e., Ordered Logit Model) to capture the discrete-ordered nature of the items [26]. The likelihood of the observed sequence of answers to the attitudinal and perceptional questions, $L_{I_{i,k}}$, can be written as follows:

$$L_{I_{i,k}}(\zeta_{I_k}, \tau_{I_k}, LV_{i,k}) = \prod_{I_k} \left(\frac{e^{\tau_{j,I_k} - \zeta_{I_k} LV_{i,k}}}{1 + e^{\tau_{j,I_k} - \zeta_{I_k} LV_{i,k}}} - \frac{e^{\tau_{j-1,I_k} - \zeta_{I_k} LV_{i,k}}}{1 + e^{\tau_{j-1,I_k} - \zeta_{I_k} LV_{i,k}}} \right), \tag{6}$$

where τ is a vector of threshold parameters for the indicators in the Ordered Logit Model.

4.1.3 Utility specification in the choice model component

The utility specification, where the latent variables are incorporated into (i.e., choice model components), is expressed as follows:

$$\begin{aligned} U_{i,n,t} = {} & (\mu_{ASC} + \lambda_{NEP} LV_{i,NEP} + \lambda_{Perception} LV_{i,Perception}) ASC_{i,n,t} \\ & + \sum_{l=1}^{L} \beta_l Attribute_{i,l,n,t} + \beta_c Cost_{i,n,t} + \sum_{s=1}^{S} \gamma_s ASC_{i,n,t} * Control_{i,s} + \zeta_{i,n,t}, \end{aligned} \tag{7}$$

where λ is a vector of estimated parameters measuring the impact of the two latent variables "NEP" and "Perception" on the respondent's utility.

For consistency with the choice model, we apply the same set of $control_{i,s}$ presented in Equation (7) to $z_{i,s}$ presented in Equation (4) for the structural estimation of the two latent variables. We exclude the two aggregate variables, *NEP score* and *Perception score* because we have to separately estimate respondents' environmental concerns and perceptions of adopting organic farming in the measurement model components in the HCM (see Equation (5)). The separate identification of the parameters associated with the same characteristics (i.e., the parameters of $control_{i,s}$ and $z_{i,s}$) is ensured by the fact that for one of them, the value is driven by both the choice data and the indicator variables.

Consequently, the three components of HCM (i.e., the structural equation of the latent variable, the measurement components, and utility specification in the choice model components) depend on the latent variables $LV_{i,k}$, which are estimated simultaneously. It should be noted that sequential estimation is possible, but it could result in a loss of efficiency. Thus, we have the combined log-likelihood as follows:

$$LL(\Omega) = \sum_{i=1}^{N} \ln \int_{\beta_i} \int_{LV_{i,k}} L_{C_i}(\beta_i, \gamma_i, LV_{i,k}) L_{I_{i,k}}(\zeta, \tau, LV_{i,k}) f(\beta_i) g(LV_{i,k}) d\beta_i dLV_{i,k}, \tag{8}$$

where $\Omega = \{\mu, \beta, \gamma_s, \gamma_{LV}, \zeta, \lambda\}$ combines all model parameters; L_{C_i} is the likelihood of an observed sequence of choices for the person i[4], $L_{I_{i,k}}$ is the likelihood of the observed sequence of answers to the k attitudinal and perceptional questions. The Log-likelihood requires the integration over the distribution of β_i and α_i and explains the presence of the density function $f(\beta_i)$ and $g(LV_{i,k})$. Given the many distributional assumptions made, simulation methods were used to estimate the parameters, and all models were estimated using 2000 Halton draws.

4.2 Willingness to pay estimates

When estimates for parameters of the model are available, we can calculate the MWTP for each of the attributes in order to pass from state 3 (i.e., status quo) to the alternative n (i.e., two alternative organic options $n = \{1, 2\}$) [44, 45]. The marginal WTP estimate is given by:

$$WTP = -\frac{1}{\beta_c} \ln \left[\frac{\sum_i \exp(V_{i3})}{\sum_i \exp(V_{in})} \right], \tag{10}$$

where β_c is the coefficient of the cost attribute.

In the traditional model, β_c is directly obtained by the regression based on the total cost variable. In reporting the WTP for attribute l (i.e., WTP_l), the log expression in Equation (10) simplifies to the attribute's coefficient, giving

$$WTP_l = -\frac{\beta_l}{\beta_c}. \tag{11}$$

In the RPL model, when the random parameter associated with the l attributes $\tilde{\beta}_l$ are normally distributed (see Equation (3) for the assumptions about parameter heterogeneity), we can calculate the mean WTP by

$$E(WTP_l) = -\frac{\bar{\beta}_l}{\beta_c}. \tag{12}$$

5 Estimation results

Our results are first estimated using the CL and RPL models (see Table 3). The details of econometric models are reported in Appendix C. The CL models, corresponding to the utility function in Equation (1), are first estimated without control variables (see Model (CL 1) in Table 3). It should be noted that because of the identification issue (i.e., respondent's characteristics do not vary across choices), only interaction terms between these control variables (Female, Age, Farm size, Income, Education, Health, NEP score, Perception score, and types of agricultural products) and the ASC (i.e., Alternative Specific Constant) can be estimated. The ASC, coded as a dummy, takes a value of 1 if farmers prefer the "organic certification" options to the "status quo". Hence, the estimation with relevant interaction terms is presented in Model (CL 2) (Table 3).

[4]In particular, we would have the likelihood of an observed sequence of T_i choices for the person i as follows:

$$L_{C_i}(\beta_i, \gamma_i, LV_{i,k}) = \prod_{t=1}^{T_i} \frac{\exp(V_{i,n,t})}{\sum_{j=1}^{3} \exp(V_{i,j,t})}, \tag{9}$$

Table 3: Summary results of the Conditional Logit and Random Parameter Logit models.

Variable	Conditional logit		Random parameter logit		Generalized multinomial logit	
	CL 1	CL 2	RPL 1	RPL 2	GMNL 1	GMNL 2
Fixed parameters						
ASC	-0.389***	-4.191***	-0.794***	-4.931***	-1.060***	-3.983*
	(0.090)	(0.847)	(0.098)	(0.927)	(0.092)	(2.410)
Training and technical advice	0.685***	0.689***	-	-	-	-
	(0.044)	(0.045)				
Sales contract						
With guaranteed price	1.083***	1.089***	1.133***	1.121***	1.371***	1.351***
	(0.051)	(0.062)	(0.076)	(0.074)	(0.091)	(0.112)
With flexible price	0.876***	0.880***	1.063***	1.057***	1.616***	1.569***
	(0.061)	(0.062)	(0.075)	(0.075)	(0.109)	(0.113)
Traceability	0.513***	0.517***	0.546***	0.544***	0.898***	0.880***
	(0.045)	(0.045)	(0.054)	(0.054)	(0.077)	(0.088)
Neighbors	0.250***	0.256***	0.246***	0.246***	0.406***	0.406***
	(0.047)	(0.047)	(0.050)	(0.050)	(0.063)	(0.063)
Leadership						
Formal leader	0.393***	0.396***	-	-	-	-
	(0.077)	(0.078)				
Informal leader	0.156*	0.158*	-	-	-	-
	(0.081)	(0.082)				
Both leaders	0.280***	0.281***	-	-	-	-
	(0.065)	(0.065)				
Cost	-0.010***	-0.010***	-0.109***	-0.111***	-0.136***	-0.146***
	(0.0004)	(0.0004)	(0.007)	(0.007)	(0.012)	(0.030)
Random parameters						
Training and technical advice			0.751***	0.745***	0.945***	0.918***
			(0.056)	(0.054)	(0.085)	(0.094)
Leadership						
Formal leader			0.653***	0.657***	1.303***	1.252***
			(0.080)	(0.080)	(0.128)	(0.165)
Informal leader			0.385*	0.395*	1.074*	1.028*
			(0.192)	(0.189)	(0.630)	(0.681)
Both leaders			0.393***	0.393***	0.919***	0.873***
			(0.071)	(0.071)	(0.104)	(0.134)
Std. of random parameters						
Training and technical advice			0.826***	0.715**	0.221**	0.248***
			(0.195)	(0.211)	(0.139)	(0.140)
Leadership						
Formal leader			0.205	0.162	-0.140	-0.140*
			(0.337)	(0.314)	(0.089)	(0.081)
Informal leader			0.405	0.292	0.110	-0.111
			(0.441)	(0.476)	(0.081)	(0.084)
Both leaders			0.805***	0.831***	0.005**	0.021**
			(0.287)	(0.276)	(0.002)	(0.009)
Interaction terms						
ASC*Age		0.805***		0.969***		0.994**
		(0.141)		(0.152)		(0.440)
ASC*Middle income		-0.139*		-0.180**		-0.060
		(0.082)		(0.087)		(0.228)
ASC*Good health		-0.367*		-0.518**		-0.110
		(0.199)		(0.211)		(0.506)
ASC*Very good health		-0.395*		-0.577**		-0.148
		(0.214)		(0.228)		(0.561)
ASC*High school		0.173**		0.165*		0.020
		(0.085)		(0.090)		(0.238)
ASC*Perception score		0.063***		0.065***		0.093**
		(0.014)		(0.016)		(0.039)
ASC*Rice		0.617***		0.585***		0.453*
		(0.090)		(0.099)		(0.272)
ASC*Vegetables		0.513***		0.435***		0.197
		(0.096)		(0.103)		(0.288)
Scale heterogeneity (τ)					0.978***	0.979***
					(0.056)	(0.066)
Observations	5,860	5,860	5,860	5,860	5,860	5,860
Log likelihood	-5241.9	-5158.1	-5377.5	-5290.7	-4811.0	-4769.2
LR χ^2(q)	(2392,q=10)	(2560,q=23)	(1359.71,q=16)	(1966.18,q=30)	(319.83,q=10)	(354.63,q=23)
p-value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Note: Standard errors in parentheses. ASC stands for Alternative Specific Constant.
Control variables, including *Female*, *Farm size*, *High income*, *College/University* and *NEP score*, are not significant at the 10% level.
LR test of CL 1 and CL 2: $\chi^2(13) = 163.34$ with $p < 0.001$. LR test of RPL 1 and RPL 2: $\chi^2(14) = 218.82$ with $p < 0.001$. LR test of GMNL 1 and GMNL 2: $\chi^2(13) = 83.51$ with $p < 0.001$.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The two columns (RPL 1) and (RPL 2) in Table 3 report the results of the RPL model. Model (RPL 1) corresponds to the model specified by the utility function (2) in which the coefficients of all the attributes include random heterogeneity (3) and without control variables. However, we defined "Cost", "Sales contract", "Traceability" and "Neighbors" as fixed-parameter variables since the estimated standard deviation of these parameters was not significant at the

where β_i and γ_i are groups of random and deterministic components, respectively.

10% level. Model (RPL 2) is similar to Model (RPL 1), but we consider the respondents' socio-demographic variables. The Likelihood ratio (LR) test of Models (RPL 1) and (RPL 2) is equal to $\chi^2(14) = 218.82$ with $p < 0.001$, suggesting that (RPL 2) model with control variables is preferred to Model (RPL 1). This result indicates that the RPL model controlling for the heterogeneity of the "Training" and "Leadership" attributes provides a significantly better representation of choices than the RPL model without controlling for socio-demographic characteristics in capturing heterogeneity among respondents.

To evaluate the scale heterogeneity, we adopt the Generalized Multinomial Logit (GMNL) framework proposed by [38] (See Models (GMNL 1) and (GMNL 2)). Particularly, the model estimates the parameter τ in Equation (3) as a key parameter that captures the scale heterogeneity in association with the random variable $\vartheta_{i,l}$ capturing the residual preference heterogeneity. The GMNL models consistently confirm the significance of most of the significant coefficients obtained by the RPL models (notably the attributes and their levels). However, the random scale parameters of Models "GMNL 1" and "GMNL 2" are statistically significant, suggesting a scale heterogeneity in association with respondents' preferences (i.e., respondents varied in terms of certainty in their choices). Together with the large log-likelihood improvement when highlighting the presence of scale heterogeneity (GMNL 2), the likelihood ratio test suggests the rejection of RPL 2 in favor of GMNL 2 at the 5% significant level ($\chi^2(2) = 610.47$ with $p < 0.001$).[5]

In this study, we also apply the Endogenous Attribute Attendance model (EAA) proposed by Hole (2011) [50] to check for the robustness of ANA. The results of two stages of EAA model estimation are reported in Table A5. We observe that the coefficients are qualitatively similar in terms of sign and significance compared to the CL, RPL, and GMNL models. The results also show the most frequently ignored attribute is "Neighbor" which accounts for about 60% of the respondents, while "Cost" accounts for only 15%, meaning that respondents seem to ignore the "Neighbor attribute when choosing which organic certification scheme to adopt. However, the EAA model is conclusively rejected in favor of the GMNL model using a Likelihood ratio test (LR = 490.14, $p < 0.0001$).

The results of all models suggest that the coefficients of all of the attributes are statistically significant and have the expected sign (i.e., only the cost attribute has a negative sign, while the sign of the other qualities is positive), except for the "Informal leader" attribute. Thus, farmers appreciate providing training and technical advice, supporting sales contracts, providing logos with traceable codes (e.g., QR code), encouraging the adoption of organic certification in farmers' neighborhoods, and incentivizing formal leaders in the village to adopt organic certification. As expected, the cost attribute coefficient negatively impacts farmers' decisions, indicating that higher payment for additional production costs harms respondents' utility. The results of Table 3 also suggest that ASC (i.e., Alternative Specific Constant) is negative and significant, meaning that farmers in our experiment positively valued staying in the "status quo" situation (i.e., farmers prefer the "status quo" to organic certification).

[5] [122] observed that taking scale heterogeneity into account is of great importance when comparing subgroups of respondents. The issue seems less severe here as our study did not perform this kind of comparison.

Hybrid Choice Model

In addition to the CL and RPL models, the HCM is presented to enrich the underlying behavioral characterizations with the explicit modeling of latent psychological variables (i.e., respondents' concerns about the environment and their perceptions of adopting organic certification scheme) [12, 17]. The estimation results of Model (HCM) with two latent variables, "NEP" (LV_{NEP}) and "Perception" ($LV_{Perception}$), are reported in Table 4.

Table 4: Summary results of the Hybrid Choice Model with "NEP" and "Perception" as the latent variables.

	HCM				
Variable	Coef.	Variable	Coef.	Variable	Coef.
Choice model component		**Socio-demographic variables on LV "*NEP*"**		**LV "Concern" on its indicators**	
ASC	-6.996***	$\gamma_{NEP,Female}$	-0.091	$\zeta_{NEP,1}$	0.882**
	(2.387)		(0.153)		(0.399)
Training and technical advice	0.753***	$\gamma_{NEP,Age}$	0.530*	$\zeta_{NEP,2}$	-1.090**
	(0.057)		(0.288)		(0.455)
Sales contract with fixed price	1.193***	$\gamma_{NEP,FarmSize}$	0.080	$\zeta_{NEP,3}$	0.830***
	(0.069)		(0.079)		(0.250)
Sales contract with flexible price	0.954***	$\gamma_{NEP,MiddleIncome}$	-0.059	$\zeta_{NEP,4}$	-1.545***
	(0.079)		(0.177)		(0.476)
Traceability	0.590***	$\gamma_{NEP,HighIncome}$	-0.106	$\zeta_{NEP,5}$	1.211***
	(0.062)		(0.371)		(0.435)
Neighbors	0.345***	$\gamma_{NEP,GoodHealth}$	-0.253	$\zeta_{NEP,6}$	-1.837***
	(0.057)		(0.652)		(0.435)
Formal leader	0.410***	$\gamma_{NEP,VeryGoodHealth}$	-0.108	$\zeta_{NEP,7}$	1.852***
	(0.110)		(0.807)		(0.447)
Informal leader	0.150	$\gamma_{NEP,HighSchool}$	0.078	$\zeta_{NEP,8}$	-0.206
	(0.121)		(0.129)		(0.190)
Both leaders	0.265***	$\gamma_{NEP,College}$	0.280	$\zeta_{NEP,9}$	1.453
	(0.097)		(0.511)		(0.223)
Cost	-0.011***	$\gamma_{NEP,Rice}$	-0.129	$\zeta_{NEP,10}$	-0.442**
	(0.0007)		(0.311)		(0.196)
λ_{NEP}	0.056	$\gamma_{NEP,Vegetable}$	-0.412	$\zeta_{NEP,11}$	1.493***
	(0.453)		(0.417)		(0.287)
$\lambda_{Perception}$	3.033***			$\zeta_{NEP,12}$	-1.067***
	(0.363)	**Socio-demographic variables on LV "*Perception*"**			(0.183)
Interaction terms					
ASC*Female	-1.465	$\gamma_{Perception,Female}$	0.505	$\zeta_{NEP,13}$	1.405***
	(1.202)		(0.366)		(0.497)
ASC*Age	-7.289***	$\gamma_{Perception,Age}$	2.954***	$\zeta_{NEP,14}$	-1.417***
	(0.839)		(0.391)		(0.270)
ASC*Farm size	-0.885	$\gamma_{Perception,FarmSize}$	0.338**	$\zeta_{NEP,15}$	1.763***
	(0.950)		(0.133)		(0.296)
ASC*Middle income	-2.153*	$\gamma_{Perception,MiddleIncome}$	0.609		
	(1.310)		(0.430)	**LV "Perception" on its indicators**	
ASC*High income	-2.832***	$\gamma_{Perception,HighIncome}$	0.695	$\zeta_{Perception,1}$	0.222***
	(0.834)		(0.433)		(0.045)
ASC*High school	-5.071***	$\gamma_{Perception,GoodHealth}$	0.140	$\zeta_{Perception,2}$	0.356***
	(1.325)		(0.920)		(0.126)
ASC*College	-10.344***	$\gamma_{Perception,VeryGoodHealth}$	0.147	$\zeta_{Perception,3}$	0.200***
	(0.784)		(0.348)		(0.052)
ASC*Good health	-0.974	$\gamma_{Perception,HighSchool}$	1.845 ***	$\zeta_{Perception,4}$	0.292***
	(1.844)		(0.556)		(0.076)
ASC*Very good health	-0.771	$\gamma_{Perception,College}$	3.398***		
	(1.182)		(0.450)		
ASC*Rice	1.048	$\gamma_{Perception,Rice}$	-0.062		
	(1.317)		(0.559)		
ASC*Vegetable	1.678	$\gamma_{Perception,Vegetable}$	-0.325		
	(1.569)		(0.366)		
Observations	5,860	LL of the combined model	-16780.95	AIC	33841.90
Estimation time	87h:52m:51s	LL of the choice model	4369.11	BIC	34776.53
Number of parameters	140				

Note: Robust standard errors in parentheses. ASC stands for Alternative Specific Constant.
Threshold parameters τ of the measurement component of LV "NEP" and LV "Perception" are estimated, but they are reported.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The first column of the results in Table 4 shows the estimation of the choice model component, which is estimated using the combined log-likelihood in Equation 8. The choice model is estimated with the same set of control variables as in the CL and RPL models, except for the two NEP and perception score variables that will be estimated separately in the measurement component model. The second column of Table 4 represents the results of the coefficients (γ) of the structural equation of the LVs defined in Equation (4), using the same set of control variables as in the choice model. In the third column of Table 4, the coefficients of the LVs (ζ) of the measurement component and the threshold parameters (τ) (i.e., four threshold parameters per indicator should be estimated since we have 5-point-scale dependent variables) are estimated using the Ordered Logit Model.

A comparison of Tables 3 and 4 leads to the following conclusions. The result of the HCM confirms that the ASC has a negative and statistically significant impact on respondents' choices. It suggests that farmers generally seem to be less willing to participate in organic certification schemes (i.e., they prefer the "status quo" to the organic certification options). Based on our follow-up survey, we observe that Vietnamese farmers prefer the "status quo" option is because there is a lack of subsidies and information related to organic agriculture. In particular, we observe about 7% of farmers always chose the "status quo" option. A majority of these farmers claimed that they do not prefer organic certification alternatives because they believe that none of their neighbors is involved in organic farming (37.21%), lack sufficient information related to organic farming (34.88%), lack subsidies from the government (27.91%) and too difficult to market organic products (25.58%).

The estimates of the coefficients of the Model (HCM) attributes are close to the RPL and GMNL models, with all attributes being positive and statistically significant, except for the "Informal leader" and "Cost" attributes. Thus, these results confirm that the "Informal leader", defined as the presence of informal leaders (e.g., religious leaders or the most successful farmers in the village, etc.) having adopted organic certification, has no significant effect on promoting farmers toward organic agriculture. One possible explanation should be that, unlike people living in the cities, farmers residing in Vietnamese rural areas often have close ties/connections to their formal leaders (e.g., they often have frequent interactions with their village leaders). Moreover, farmers in rural areas often rely on their formal leaders (e.g., village leaders or the president of farmers' association, etc.) to obtain information, knowledge and practical lessons about organic farming. As a result, they prefer to have either formal leaders or both leaders (formal and informal) in their villages to support them in accessing organic certification schemes [90, 104].

In addition to the "Leadership" attribute, the "Neighbors" attribute, defined as the coordination with neighborhood farmers in the village involved in organic farming, has a positive and statistically significant impact on farmers' decisions to engage in an organic certification scheme. This result indicates that a network of farmers (e.g., neighbors or friends) could play an essential role in promoting organic farming because farmers living in rural areas frequently interact with their neighbors/friends since they always live nearby and thus know each other well (i.e., they have strong connections with their neighbors). This result is in line with the existing literature since individual-to-individual links are essential and valuable sources of information, knowledge and reflection for individuals that could help significantly motivate people to behave positively toward pro-environmental behaviors [7, 52, 61, 82].

Regarding the effect of the latent variables on farmers' choices, we observe that the coefficient $\lambda_{Perception}$ is positive and statistically significant in Table 4, while the coefficient λ_{NEP} is not statistically significant. Moreover, we observe that the coefficients $\zeta_{Perception}$ (including $\zeta_{Perception,1}$, $\zeta_{Perception,2}$, $\zeta_{Perception,3}$ and $\zeta_{Perception,4}$, which represent the impacts of the LV

"Perception" on the four perceptional indicators listed in Table A2) are positive and significant, suggesting that a higher value of the latent variable corresponds to the stronger perception of organic certification. These results indicated that individuals who have a stronger perception of adopting organic agriculture (e.g., they believe that "it is useful for farmers to adopt organic farming to protect the environment and the health of the population) would be more likely to participate in organic certification schemes than others who do not. This result confirms our prior expectations that farmers' motivation to adopt sustainable agricultural practices is associated with their pro-environmental beliefs and perceptions regarding the importance of environmental conservation [75, 79, 110].

The results of the structural model components in Column (2) of Table 4 suggest that $\gamma_{Perception,Age}$ is positive and significant, indicating that older farmers have a stronger perception of adopting organic certification and thus have a higher possibility of engaging in organic certification schemes. Indeed, older farmers are often aware of health risks and care more about their future generations (e.g., children and grandchildren), and therefore, they are more likely to engage in organic farming and environmentally friendly practices than younger generations [87]. Moreover, larger-scale farmers (i.e., those with larger farms) seem to have a stronger perception of organic farming than smaller-scale ones (i.e., $\gamma_{Perception,FarmSize}$ is positive and significant). One reason could be that small-scale farmers often face financial difficulties and have less capability to adopt new and costly farming practices (e.g., organic farming) than large-scale farmers. Therefore, smaller-scale farmers are less likely to be involved in organic certification schemes.

Concerning farmers' levels of education, we observe that a higher level of education (i.e., farmers who graduated from high school, college, or university) is associated with a stronger perception of organic farming conversion. This result reveals that farmers with better education are more concerned about organic agriculture and, thus, more willing to behave positively toward organic farming than others. Evidence showed that educated farmers are eager to participate in agricultural extension programs and, therefore, have a higher incentive to adopt organic standards because farmers' education is linked to their capacity to acquire technical information [47]. Education level and information accumulation are associated with farmers' innovative ability and thus could improve the probability of adopting new technology [40].

Estimation of willingness to pay

Table 5 reports the calculation of the mean WTPs for all the attribute levels using two different Models (GMNL 2) and (HCM). We also look at the differences in WTPs for different agricultural products (i.e., rice, vegetables, and other products). We observe that the WTP estimation results of these two models are very close. It should be noted that the WTPs are calculated when both parameters (i.e., β_n and β_c; see Equation (10)) used in the calculation are statistically significant; otherwise, no meaningful WTP measure can be established. For this reason, there is no WTP estimate for either informal leadership or formal leadership attributes in some cases since their coefficient estimates are not statistically significant at the 10% level.

According to the result in the Model (HCM), we observe that farmers are willing to pay an increase in production cost up to 9.805 thousand VND/kg (i.e., about 68% more than the

Table 5: Estimated willingness to pay (WTP) for the attribute levels.

	HCM	GMNL 2			
Attributes	All products	All products	Rice	Vegetables	Others
Training and technical advice	9.805	8.865	8.678	9.866	8.012
	[9.091, 10.519]	[8.374, 9.512]	[8.164, 9.633]	[9.138, 12.085]	[7.448, 8.826]
Sales contract					
With guaranteed prices	12.118	10.482	9.819	14.289	9.888
	[11.220, 13.015]	[10.037, 11.334]	[8.989, 10.789]	[12.751, 15.858]	[9.416, 10.341]
With flexible prices	10.859	9.161	9.047	11.898	7.738
	[9.821, 11.897]	[8.593, 10.422]	[7.971, 10.153]	[10.172, 13.623]	[7.220, 8.256]
Traceability	8.945	8.231	7.859	9.801	7.771
	[8.270, 9.620]	[7.191, 8.831]	[7.048, 8.731]	[8.129, 10.973]	[7.246, 8.295]
Neighbors	7.656	7.493	7.579	7.565	7.610
	[7.072, 8.240]	[7.017, 7.972]	[6.304, 7.975]	[6.486, 8.744]	[7.018, 7.871]
Leadership					
Formal leader	7.999	6.967	7.955	-	-
	[6.757, 9.241]	[6.278, 7.856]	[6.176, 9.310]		
Both leaders	7.238	6.935	7.344	-	6.982
	[6.194, 8.282]	[6.428, 7.643]	[6.184, 8.504]		[6.171, 7.989]

Note: WTPs are in thousands of VND/kg.
Confidence interval (CI) at the 5% significance level. Standard deviation is calculated by the delta method (for computation details, see the paper of [49]).
Model (HCM) is the Hybrid Choice Model with two LV variables, "Perception" and "Concern".
The WTP estimates are calculated from the results of Models (HCM) and (RPL 2), which are the models with socio-demographic and psychological control variables. The "All products" is the model with all three types of agricultural products.
There is no WTP estimate for the "Informal leader" attribute because the coefficient estimates are not statistically significant at the 10% level.

average current production cost) to engage in organic certification schemes that provide practical lessons and have technicians or specialists advise them to convert to the organic certification scheme. Farmers seem to be willing to pay a higher production cost to be involved in an organic certification scheme that offers a sales contract with buyers or retailers (e.g., industries, supermarkets, direct consumers, etc.) on the order of 12.118 and 10.859 thousand VND/kg (i.e., about 107% and 85% more than the average current production cost) for sales contracts with guaranteed prices and flexible prices, respectively. Our result suggests that farmers prefer the contract with fixed/guaranteed prices (i.e., product prices are fixed over five years) to the one with flexible prices (i.e., product prices float with market prices). Farmers are willing to pay an increase in production cost up to 8.945 thousand VND/kg (i.e., about 53% more than the average current production cost) to obtain an organic logo with a traceable code on their products. The "Neighbors" and "Leadership" attributes are also crucial since farmers are willing to pay a higher production cost to have the opportunity to coordinate with neighbors and leaders in their village in doing organic farming.

The estimated WTAs or WTPs are of significant importance to policymakers. The relative importance of the attributes can be derived from their WTA and WTP values, whereby those with higher WTAs or WTPs are assigned more resources than the others. In this study, farmers' WTPs changes in production cost to engage in organic certification schemes, including sales contracts with guaranteed and flexible prices, are consistently higher than other attributes. This result shows that organic farmers highly value sales contracts with buyers or retailers to ensure their products can be sold at either flexible or fixed prices. This result is consistent with intuition since guaranteed product prices and outcomes are essential because most farmers in our study are smallholder farmers. The existing literature has argued that smallholder farmers in Vietnam strongly depend on traders to sell their products, but traders are the ones who set the price, and farmers have to pay the price offered to them [71]. These results are intuitive because sales contracts are directly linked to the profit or revenue of organic agriculture, which is one of the significant barriers to adopting organic standards [58, 100]. On the other hand, organic neighbors do not have a direct link to income from farming. However, they could help each other by sharing recommendations, advice, knowledge, and essential tips during the implementation of organic agriculture, which is also crucial for maintaining long-run sustainable behavior [40, 43].

Looking at the results for different types of agricultural products (including rice, vegetables, and other products), we observe that farmers generally have a positive WTP for adopting organic standards. Moreover, the "formal leader" attribute only significantly impacts rice producers' WTPs. In other words, only farmers who produce rice are willing to pay a higher production cost to have local leaders (either formal or informal) involved in organic agriculture. This result could be because organic rice often has limited demand and inadequate marketing (i.e., greater challenges to market organic rice products) than organic vegetables or other types of products [22, 72]. Consequently, smallholder rice producers are willing to pay an increase in production costs to have leaders involved in organic certification schemes in their villages. Therefore, the leaders could help share their knowledge and practical lessons with local farmers and provide the information necessary to market their crops.

6 Discussions and conclusions

This paper aims to investigate farmers' preferences for adopting organic certification schemes. We use a quantitative approach based on a discrete choice experiment with 586 farmers in Northern Vietnam to measure how various factors could influence farmers' decisions to adopt organic agriculture. We value farmers' WTPs for both market and non-market components of their choices, such as practical training lessons and local technical advice, sales contracts with guaranteed or flexible prices with retailers (e.g., direct consumers, supermarkets, industries, etc.), organic logos with traceable codes, coordination with neighbors and presence of leaders in their village involved in organic certification scheme.

Our results suggest that all the above attributes could significantly impact farmers' decisions to engage in organic certification schemes. Firstly, we found that sales contracts with flexible or guaranteed prices are significant incentives that explain farmers' willingness to pay a higher production cost to participate in organic certification schemes. This is because most farmers in our study are smallholders who always experience difficulties marketing their crops and accessing new markets. Consequently, the buyers' commitment to the outcome of agricultural products is seen as an opportunity to support organic agriculture. This result aligns with the literature on "contract farming", in which the purchaser provides farmers with credit, technical advice, market services, etc. In return, farmers produce a certain quantity and quality of products and sell them to the purchaser [11, 18, 33]. For instance, contracting linked to certification and training in sustainable farming practices could help scale up farmers to adhere to environmentally friendly cultivation methods [34]. Therefore, such an arrangement could positively contribute to farmers' revenues, in particular, as well as to growth and the reduction of poverty, in general [10, 56, 73, 96, 124].

Secondly, the "traceability" attribute is also essential in encouraging the adoption of organic certification. It is often required for farmers who would like to obtain a sales contract to have a logo with a traceable code because it indicates that their organic products have gone through strict quality controls and production monitoring systems. Additionally, consumers are always more likely to pay higher prices for higher-quality foods. Thus, a logo with a traceable code could also help them distinguish high-quality organic foods from low-quality ones. As a result, traceability is the best tool for food quality control and encourages consumer confidence in organic products [70, 103, 107, 129]. Therefore, an organic logo accompanied by a transparent traceability system is important to promote competitive pricing and expanded access to high-quality and safe agricultural products, which could boost domestic demand.

Thirdly, in addition to the market factors, training, and technical advice are dominant non-market factors that motivate farmers to move toward organic agriculture. This result is straightforward because several existing studies suggest that technical knowledge of organic farming practices is a critical barrier to the transition to organic farming [20, 31, 51, 118]. For instance, providing farmers with agricultural advisory services (i.e., agricultural extension agents visit farmers and provide them with agricultural information) could promote adopting sustainable farming practices [80, 86]. Therefore, providing training and technical assistance to farmers via village leaders or the president of the farmers' association as public extension agents could also be an effective way to motivate the adoption of sustainable farming practices since we observe that farmers in the survey areas care far more about the participation of their formal leaders in doing organic farming.

Fourthly, our results shed light on the role of coordination with neighborhood farmers in promoting farmers' adoption of sustainable agricultural practices in the survey areas. This result is in line with the existing literature that programs targeting specific individual farmers (e.g., "seed" farmers, "progressive" farmers, or early adopters) could effectively help to modify farmers' behavior [59, 64, 80, 81, 127]. In their study, the authors argued that individual farmers are less likely to apply the organic practices that help restore soil function because they fear that their neighboring farmers may free-ride on their investments in the soil and fertility improvements unless all farmers in the neighborhood commit to this organic practice [30, 127]. Therefore, encouraging neighborhood cooperatives rather than prioritizing programs for individual farmers could be more effective in promoting farmers to adopt organic certifications.

Finally, the results of the HCM model suggest that farmers' perceptions of adopting organic farming play a significant role in encouraging farmers to engage in organic certification schemes. We also observe that a higher level of perception of organic farming requires farmers to have knowledge about the importance of organic agriculture to protect the environment and population health, as well as their awareness of the benefits of organic agricultural production. Thus, education, training, and information about organic farming standards, technologies, and practices are essential for farmers to enhance their knowledge and capacity to use sustainable farming practices, organic agricultural production, and new market situations [79, 110]. Networking and social interactions in the local area should be encouraged to promote knowledge sharing among neighborhood farmers and strengthen the connections with different farmers' groups, such as local government agencies and private sectors [75].

Limitations and future research directions

There are, of course, limitations of our analysis that must be considered when interpreting the findings of the results. In particular, while farmers who participated in our research were not adopting organic farming practices, we did not control for differences in their existing farming techniques. Thus, future studies should also collect and examine this type of information. Furthermore, due to the constraint of data, we only investigate farmers' decisions to adopt organic certification schemes in Northern Vietnam. Larger and more diverse sample sizes of farmers could also enhance DCE findings by offering more profound insights and enhancing extrapolation power.

Moreover, this paper could only investigate the ANA issue based on the inferred EAA model [50]. Our formulated follow-up question on the set of all attributes cannot help us investigate the ANA issue because we cannot identify which attribute was ignored by the individual. Thus, future studies should take subjects' stated attribute non-attendance in their DCE studies and carefully formulate follow-up questions regarding subjects' reasons for ignoring attributes for dealing with heterogeneous attribute processing strategies [4, 98].

In our study, we found that farmers' WTPs are very different across different types of agricultural products (e.g., rice, vegetables, fruits, corn, etc.). For instance, rice producers are the only ones willing to pay a higher production cost to have formal leaders or both formal and informal leaders in their villages involved in organic farming because certain types of organic agricultural products (like rice) are more difficult to market than organic vegetables or other types of products. Consequently, further research is still needed to establish the actual costs and benefits of adopting organic farming by considering the different types of agricultural products. The complementary cost-benefit analysis can additionally provide policymakers with other benefits that may result from the long-term reduction of pesticide use and the use of other harmful plant protection products. The long-run discount rate should also be considered since the investment in organic agriculture has welfare effects for future generations.

Competing Interests

The authors declare no competing financial interests.

Data and Code Availability

The data and statistical codes (in R software) used in this study are available from the authors upon request.

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Appendix A: Tables

Table A1: The 15 NEP scale items and their response distributions (in percentage).

NEP scale items	Strongly disagree	Partly disagree	Unsure	Partly agree	Strongly agree	Corr
1: "We are approaching the limit of the number of people the earth can support".	6.14	24.74	17.06	40.96	11.09	0.471
2: "Humans have the right to modify the natural environment to suit their needs".[a]	7.68	15.87	6.83	55.46	14.16	0.477
3: "When humans interfere with nature it often produces disastrous consequences".	9.73	31.40	10.24	38.74	9.90	0.469
4: "Human ingenuity will ensure that we do not make the earth unlivable".[a]	5.63	9.22	8.70	63.82	12.63	0.557
5: "Humans are severely abusing the environment".	7.68	21.33	4.10	48.12	18.77	0.542
6: "The Earth has plenty of natural resources if we just learn how to develop them".[a]	4.44	2.22	4.44	71.50	17.41	0.617
7: "Plants and animals have as much right as humans to exist".	3.75	7.00	4.78	65.87	18.60	0.611
8: "The balance of nature is strong enough to cope with the impacts of modern industrial nations".[a]	11.09	39.25	16.55	28.16	4.95	0.316
9: "Despite our special abilities, humans are still subject to the laws of nature".	3.75	3.92	1.88	70.31	20.14	0.556
10: "The so-called "ecological crisis" facing humankind has been greatly exaggerated".[a]	9.56	43.34	18.09	25.94	3.07	0.381
11: "The Earth is like a spaceship with very limited room and resources".	3.41	6.14	8.02	67.58	14.85	0.571
12: "Humans were meant to rule over the rest of nature".[a]	5.63	23.04	16.04	46.76	8.53	0.505
13: "The balance of nature is very delicate and easily upset".	3.24	12.46	12.80	63.14	8.36	0.524
14: "Humans will eventually learn enough about how nature works to be able to control it".[a]	3.58	18.60	9.22	59.56	9.04	0.535
15: "If things continue on their present course, we will soon experience a major ecological catastrophe".	3.58	6.31	7.00	64.16	18.94	0.570
Total NEP score		Mean = 47.60 and SD = 4.62.				
Cronbach's alpha			0.7902			

Notes: [a] Reverse coded.
The column Corr represents the item-test correlation, which tells us how much each item correlates with the total NEP score. Cronbach's alpha is equal to 79.02 % in the reliability test, which suggests that 79.02% of the variance in the score is reliable.

Table A2: Descriptive statistics of perceptional variables (in percentage).

Item	Description	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
Perceptions of organic farming						
$Perception1$	The Food safety problem was seriously caused by the abuse of pesticides and fertilizers in farming.	3.58	6.83	1.37	57.00	31.23
$Perception2$	It is useful for farmers to adopt organic farming to protect the environment and the health of the population.	2.39	0.68	1.37	66.21	29.35
$Perception3$	Adopting organic farming practices is common in the village.	7.85	23.04	14.85	46.76	7.51
$Perception4$	Most of the other villagers approve of adopting organic farming practices during production.	2.39	9.56	20.99	58.02	9.04
Total perception score		Mean = 15.1 and SD = 2.35. Cronbach's alpha = 0.51				

Table A3: Correlation matrix of nine indicators of the "NEP" and "Perception" latent variables (with Pearson's correlation test).

	NEP 1	NEP 2	NEP 3	NEP 4	NEP 5	Perception 1	Perception 2	Perception 3	Perception 4
NEP 1	1.00								
NEP 2	-0.20 (0.00)	1.00							
NEP 3	0.28 (0.00)	-0.04 (0.00)	1.00						
NEP 4	-0.13 (0.00)	0.31 (0.00)	-0.19 (0.00)	1.00					
NEP 5	0.25 (0.00)	-0.09 (0.00)	0.42 (0.00)	-0.28 (0.00)	1.00				
Perception 1	0.17 (0.00)	-0.06 (0.00)	0.13 (0.00)	-0.11 (0.00)	0.21 (0.00)	1.00			
Perception 2	0.15 (0.00)	-0.11 (0.00)	0.11 (0.00)	-0.21 (0.00)	0.16 (0.00)	0.40 (0.00)	1.00		
Perception 3	0.06 (0.00)	-0.06 (0.00)	-0.02 (0.02)	-0.07 (0.00)	0.00 (0.60)	-0.03 (0.00)	0.16 (0.00)	1.00	
Perception 4	0.07 (0.00)	-0.05 (0.00)	0.00 (0.54)	-0.16 (0.00)	0.04 (0.00)	0.11 (0.00)	0.33 (0.00)	0.40 (0.00)	1.00

Notes: The p-values of the Pearson correlation test statistics are in parentheses.
The Pearson correlation test statistics suggest that the correlation between the indicators of the two latent variables exists. However, the correlation coefficients of these indicators are not too large (i.e., a majority of the correlation coefficients are below 0.20).

Table A4: Summary results of the Random Parameter Logit models with Cost parameter following a truncated normal distribution.

Variable	Random Parameter Logit	
	RPL 2	RPL 3
Fixed parameters		
ASC	-4.931***	-6.466***
	(0.927)	(1.131)
Sales contract		
With guaranteed price	1.121***	1.521***
	(0.074)	(0.119)
With flexible price	1.057***	1.460***
	(0.075)	(0.095)
Traceability	0.544***	0.741***
	(0.054)	(0.075)
Neighbors	0.246***	0.511***
	(0.050)	(0.102)
Cost	-0.111***	-
	(0.007)	
Random parameters		
Training and technical advice	0.745***	1.018***
	(0.054)	(0.081)
Leadership		
Formal leader	0.657***	0.956***
	(0.080)	(0.104)
Informal leader	0.395*	0.539*
	(0.189)	(0.264)
Both leaders	0.393***	0.442***
	(0.071)	(0.112)
Cost	-	-0.403**
		(0.112)
Std. of random parameters		
Training and technical advice	0.715**	1.589**
	(0.211)	(0.201)
Leadership		
Formal leader	0.162	0.745
	(0.314)	(0.474)
Informal leader	0.292	1.173**
	(0.476)	(0.426)
Both leaders	0.831***	2.847**
	(0.276)	(0.425)
Cost	-	0.115***
		(7.627)
Interaction terms		
ASC*Age	0.969***	1.024***
	(0.152)	(0.189)
ASC*Middle income	-0.180**	-0.152*
	(0.087)	(0.103)
ASC*Good health	-0.518**	-0.260
	(0.211)	(0.237)
ASC*Very good health	-0.577**	-0.319**
	(0.228)	(0.158)
ASC*High school	0.165*	0.216*
	(0.090)	(0.108)
ASC*Perception score	0.065***	0.084***
	(0.016)	(0.019)
ASC*Rice	0.585***	0.797***
	(0.099)	(0.122)
ASC*Vegetables	0.435***	0.627***
	(0.103)	(0.124)
Observations	5,860	5,860
Log likelihood	-5290.7	-5180.2
LR χ^2(q)	(1966.18,q=30)	(1966.18,q=30)
p-value	< 0.001	< 0.001

Note: Standard errors in parentheses. ASC stands for Alternative Specific Constant.
Control variables, including *Female*, *Farm size*, *High income*, *College/University* and *NEP score*, are not significant at the 10% level.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A5: Estimation results and WTP estimates of the ANA model.

Variable	ANA model		
	Coef. (2nd stage)	Prob. (1st stage)	WTP
Training and technical advice	1.965***	0.379***	3.390
	(0.147)	(0.039)	[2.292, 4.489]
Sales contract			
With guaranteed price	2.454***		4.235
	(0.186)	0.364***	[2.735, 5.736]
With flexible price	2.361***	(0.036)	4.074
	(0.137)		[2.877, 5.272]
Traceability	1.788***	0.386***	3.086
	(0.217)	(0.054)	[1.735, 4.438]
Neighbors	1.441***	0.610***	2.486
	(0.278)	(0.065)	[1.232, 3.740]
Leadership			
Formal leader	3.495***		6.031
	(0.416)		[3.358, 8.704]
Informal leader	2.968***	0.410***	5.121
	(0.460)	(0.026)	[2.529, 7.714]
Both leaders	2.997***		7.714
	(0.474)		[2.506, 7.836]
Cost	-0.579***	0.153***	
	(0.081)	(0.005)	
ASC	-5.792***	-	
	(2.904)		
Interaction terms			
ASC*Female	0.144		
	(0.253)		
ASC*Age	0.933*		
	(0.498)		
ASC*Farm size	0.026		
	(0.123)		
ASC*Middle income	-0.109		
	(0.281)		
ASC*High income	-0.402		
	(0.479)		
ASC*Good health	-0.183		
	(0.501)		
ASC*Very good health	-0.299**		
	(0.569)		
ASC*High school	0.148		
	(0.265)		
ASC*College/University	-0.047		
	(0.471)		
ASC*Perception score	0.058		
	(0.044)		
ASC*Rice	0.701*		
	(0.309)		
ASC*Vegetables	0.281		
	(0.339)		
Observations	5,860		
Log likelihood	-5482.0		
LR χ^2(q)	(724.14,q=23)		
p-value	< 0.001		

Note: Robust standard errors in parentheses. ASC stands for Alternative Specific Constant.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Appendix B: Figures

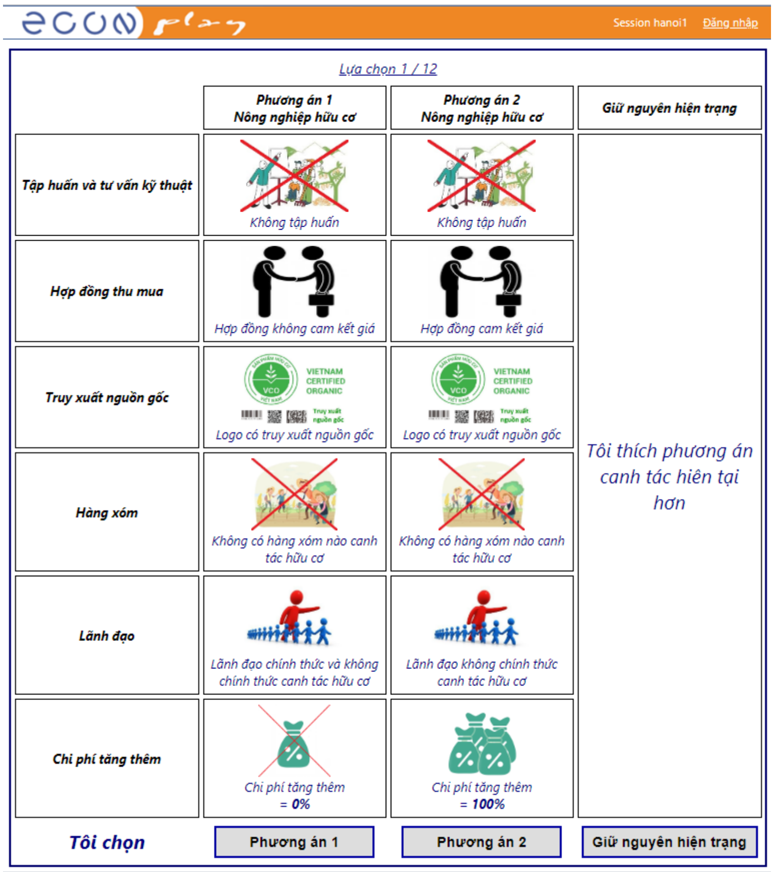

Figure B1: Example of choice card (in Vietnamese).

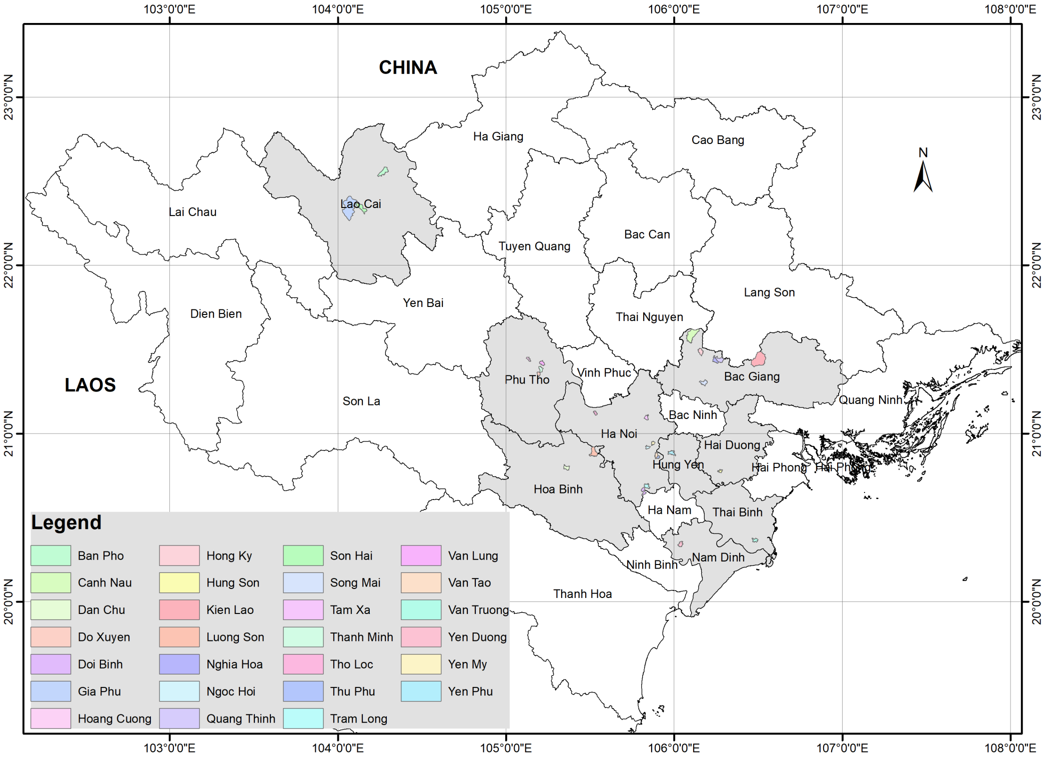

Figure B2: Experimental areas.

Appendix D: Definition of the attributes

a. Training and technical advice:

Definition: Farmers participate in training courses to improve their knowledge and are provided with practical instructions on organic agriculture.

There are two possibilities (there is no order of precedence for each possibility; all are valid; the first possibility does not mean the best possibility):

- Possibility 1: Farmers do not receive training

- Possibility 2: Farmers receive training.

b. Sale contract:

Definition: You have a contract with the buyer. Buyers can be retailers (supermarkets, companies), cooperatives, or direct consumers.

There are three possibilities (there is no order of priority for each; all are equally valid; the first does not necessarily mean the best):

- Possibility 1: There is no contract.

- Possibility 2: Having a contract with a fixed price (or commitment) for 5 years.

- Possibility 3: Having a contract with flexible prices for 5 years.

c. Traceability:

Definition: Along with the organic product label, farmers will have a traceability code on each organic product to ensure the product complies with quality control.

There are two possibilities (there is no order of priority for each possibility; all are equally valid: the first possibility does not mean the best possibility):

- Possibility 1: Have traceability.

- Possibility 2: There is no traceability.

.

d. Neighbors:

Definition: Other farmers nearby are doing organic farming.

There are two possibilities (there is no order of priority for each possibility; all are equally valid: the first possibility does not mean the best possibility):

- Possibility 1: Farmers nearby producing organic agriculture.

- Possibility 2: No farmers nearby producing organic agriculture.

e. Leadership:

Definition: Leaders in your village are producing organic agriculture.

There are 4 possibilities (there is no order of priority for each possibility; all have equal value: the first possibility does not mean the best possibility):

- Possibility 1: No leaders are cultivating organic agriculture.

- Possibility 2: Official leaders (chief of village/commune, chairman of farmers' association, ...) are cultivating organic agriculture.

- Possibility 3: An unofficial leader (family head, religious leader, most successful farmer in the village,...) is cultivating organic agriculture.

- Possibility 4: Both official and unofficial leaders are cultivating organic agriculture.

f. Cost:

Definition**:** The additional cost per unit of production for each crop of selected agricultural products (vegetables, seeds, corn, etc.) that farmers will pay when producing organically compared to conventional production. The incremental cost will be calculated as a percentage of the cost per unit of conventional production.

There are 6 possibilities: 0%, 10%, 30%, 60%, 100%, 150%.

(For example, assuming that the production cost per unit of agricultural product in the conventional way is equal to 10,000 VND/kg, the 10% possibility of **the additional cost** per unit is 1,000 VND, so the production cost for each kilogram of agricultural products is 11,000 VND).