



# What is the value of sustainably-produced rice? Consumer evidence from experimental auctions in Vietnam

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## ABSTRACT

Little is known about the value of sustainably-produced rice and incentive mechanisms for the adoption of sustainable production standards throughout rice value chains in Southeast Asia. This study tests the feasibility of a market-based incentive mechanism by eliciting consumers' willingness-to-pay (WTP) for rice produced and labeled under a national sustainable production standard in the South of Vietnam through experimental auctions. Domestic consumers are willing to pay a 9% price premium for certified sustainably-produced rice. This premium gradually increases up to 33% when incremental levels of information on certification and traceability are provided. Consumers willing to pay premiums for sustainably-produced rice are more health-conscious, have better knowledge of and greater trust in food quality certification for rice, and tend to be more environmentally conscious and to read food labels before purchasing. Findings suggest that sustainable production labels for rice should be accompanied by supplementary information on certification and traceability to increase consumers' awareness and appreciation of sustainably-produced rice. Promoting certified sustainably-produced rice hence crucially hinges on strengthening consumers' knowledge of and trust in food quality certification. Communication strategies are recommended to focus on the environmental and health benefits of sustainably-produced rice.

## 1. Introduction

Since the publication of the Sustainable Development Goals by the United Nations (UN) (2015), sustainability has been in the forefront of international debates on agricultural production and trade. Whilst most of the discussions have focused on higher-value commodities, the rice sector has generally been neglected, despite its crucial role in providing global food security. In response to this gap, the Sustainable Rice Platform (SRP) released in 2015 the world's first standard for sustainably-produced rice (SRP, 2017). The SRP is a multi-stakeholder platform convened by the UN Environment and the International Rice Research Institute (IRRI) to promote resource-use efficiency and sustainability in the global rice sector. So far, the SRP devoted substantial efforts to developing a standard and a set of performance indicators for sustainable rice cultivation. However, there is still a research gap on the incentive mechanisms that can be deployed to encourage the adoption of sustainable production standards throughout

rice value chains.

Different market-based incentive mechanisms have been proposed to encourage the adoption of sustainable production standards throughout rice value chains; i.e., embodying, internalizing, and dis-embodying sustainability (Demont and Rutsaert, 2017). Sustainability can be embodied in rice products through labeling if farmers comply with sustainable production standards and have their products certified by a third party. The success of a market-based incentive mechanism based on embodying sustainability not only depends on farmers' awareness and willingness to adopt sustainable production standards, but also crucially hinges on consumers' awareness, acceptance and willingness-to-pay (WTP) for rice certified as being "sustainably-produced." However, little is known on consumers' valuation of sustainable production labels in the rice sector, especially in Southeast Asia.

Vietnam is the world's third-largest rice exporter (FAO, 2014). Hence, its rice production significantly contributes to regional and global food security (Shrestha et al., 2016). However, the latter has

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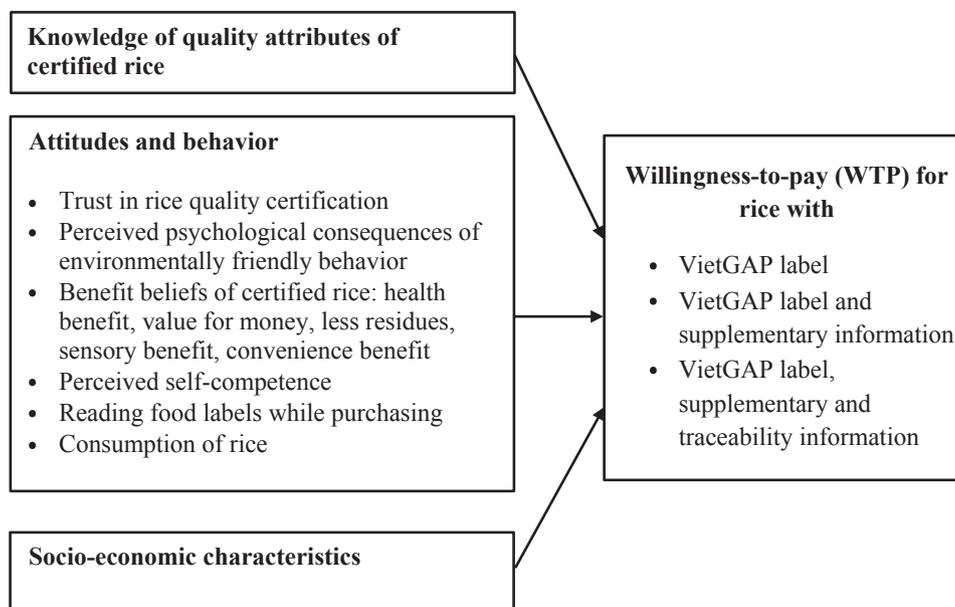


Fig. 1. Conceptual framework of the study: determinants of consumers' willingness-to-pay for sustainably-produced rice with different levels of information.

largely come at the expense of the environment, questioning the long-term sustainability of this strategy. The Mekong Delta (MKD), the primary rice-producing region supplying more than half of the national rice production and providing 90% of national rice exports (Hauge, 2016), has been identified as highly impacted by climate change<sup>1</sup> (Smajgl et al., 2015). Additionally, the MKD is reported to be suffering from negative impacts of human activities; it is facing severe environmental challenges due to overuse and misuse of agrichemicals (e.g., pesticides, fertilizers) in agricultural activities (Berg and Tam, 2012; Sebesvari et al., 2011) and subsidence and rapid coastal erosion due to negative impacts of dams' constructions in the upstream of the delta (Anthony et al., 2015). Hence, one of the important components of Vietnam's restructuring policy strategy for the agricultural sector is promoting sustainable rice production in the MKD (Demont and Rutsaert, 2017).

Demand for food quality labels is growing in the context of Vietnam's rapid economic growth and fast urbanization (Wang et al., 2014). In response to this demand, several food quality labels are appearing in the domestic food market, such as Hazard Analysis and Critical Control Points (HACCP), good agricultural practices (GAP), and organic food labels.<sup>2</sup> Due to food quality and safety concerns, the Ministry of Agricultural and Rural Development of Vietnam (MARD) issued the national sustainable production standard "VietGAP" (Vietnamese Good Agricultural Practices) in 2008, which applies to different crops and products, including rice. VietGAP certification integrates different aspects of food production including safe food cultivation practices, handling and processing, promotion of environmental sustainability and workers' welfare. GlobalG.A.P. (Global Good Agricultural Practices) is another popular GAP standard for rice in the Vietnamese food market. It is the world's most widely applied farm

certification scheme (GlobalG.A.P., 2017). Meanwhile, the organic rice market is still a niche market in Vietnam, mainly serving the metropolitan areas.

In Vietnam, the private sector tends to underinvest in labels signaling quality attributes such as food safety, traceability and sustainability of rice production (Demont and Rutsaert, 2017). To assist the private sector's investment in rice value chain upgrading towards increasing sustainability, this study investigates the feasibility of embodying sustainability through a national production standard. More specifically, we elicit domestic consumers' WTP for VietGAP-labeled rice through experimental auctions. The contribution of this study is twofold. First, to the best of our knowledge, it is the first study which provides evidence of (i) the value of sustainably-produced rice; (ii) the information attributes suppliers and value chain actors need to provide in order to capture that value; and (iii) the characteristics of the market segment of potential buyers of sustainably-produced rice in Southeast Asia.

The insights can be deployed by value chain actors and policy-makers in terms of developing a food quality certification system for sustainably-produced rice that is reliable, traceable, signals good quality, and has the ability to communicate these credence attributes effectively to consumers. Secondly, this study provides evidence on the feasibility of a market-based incentive mechanism to encourage the adoption of sustainable production standards throughout rice value chains in the context of Southeast Asia. This provides crucial information for the SRP in its mission to promote sustainability in the global rice sector and contributes to achieving the Sustainable Development Goals.

## 2. Conceptual framework

This study embeds consumer valuation of sustainably-produced rice in a conceptual framework, based on the existing literature on consumers' WTP for quality food, including rice (Fig. 1). A substantial amount of this literature is situated in the domain of organic food. Besides the information that is provided to consumers, the main determinants of WTP are related to cognitive, attitudinal and behavioral, and socio-economic factors.

First, knowledge and awareness of food quality attributes were found to positively affect WTP for quality food in several previous

<sup>1</sup> About 39% of the MKD is predicted to be flooded if there is a one-meter rise in the sea level (Schmidt-Thomé et al., 2015).

<sup>2</sup> While the HACCP scheme focuses on safety-related quality aspects, GAP schemes (e.g., VietGAP, GlobalG.A.P.) refer to more than just safety-related aspects as GAP in itself is a broader and more encompassing concept. The GAP schemes distinguish themselves from organic production by allowing the proper use of chemicals in the cultivation practices (MARD, 2008) while the use of synthetic fertilizers and pesticides is prohibited in organic farming (FAO, 1998).

studies (Akaichi et al., 2012; Demont et al., 2013a; Diagne et al., 2017; Haghjou et al., 2013; Lee et al., 2011; McFadden and Huffman, 2017; Xu and Wu, 2010; Zhang et al., 2012).

Second, a wide range of attitudinal and behavioral factors may explain WTP for quality food. Trust in the product, its origin and the certification system is an essential factor conditioning consumer behavior (Fig. 1). Trust in certification schemes was reported to influence purchase intentions towards organic food (Yin et al., 2010) or foods with safety-related labels (Liu et al., 2013) in China, and to positively affect the purchase of organic vegetables among Indonesian consumers (Slamet et al., 2016). Wu et al. (2015) found that more than 45% of Chinese consumers trust the government's food quality certification. Furthermore, Chinese consumers paid price premiums for food products certified by the government, and they were also willing to pay extra for food products when full information on traceability was provided. In a similar vein, Thai consumers' trust in international organic certification bodies was found to positively affect organic food purchase (Nuttavuthisit and Thøgersen, 2017).

Consumers' attitudes towards the environment may also explain their purchase behavior with respect to environmentally-friendly food. Environmental concerns, for example, were found to positively affect purchase intentions of organic food among young consumers in India (Yadav, 2016). Ecological motives were found to drive Taiwanese consumers' involvement in organic food, which further increased their purchase intentions of organic food (Teng and Lu, 2016). Perceived importance of environmental consequences was found to be positively associated with Vietnamese consumers' attitudes towards quality certified rice (My et al., 2017). Finally, consumers' concerns for environmental issues were found to drive the purchase of organic vegetables in Indonesia (Slamet et al., 2016).

Furthermore, there is quite some evidence that perceived health benefits are an important driver of WTP for quality food. Mondelaers et al. (2009), for example, found that consumers are willing to pay extra for vegetables with a high level of vitamin A. Similarly, De Steur et al. (2012) found that Chinese consumers are willing to pay more for genetically modified (GM) rice with health benefits. Lee and Yun (2015) revealed that consumers' perceptions of the nutritional aspects of organic food positively affect utilitarian (useful, beneficial) and hedonic (pleasant, agreeable) attitudes towards buying organic food. Other studies found that health consciousness has a positive effect on the purchase intentions towards organic food in India (Yadav, 2016) and Taiwan (Teng and Lu, 2016). Yin et al. (2010) showed that health concerns significantly affect the willingness to purchase organic food in China.

Next, consumers' price perceptions or perceived "value for money" of quality food were found to be a determining factor in purchase decisions. Van Loo et al. (2013), for example, found that frequent buyers of organic food have more positive perceptions about the price of organic food as compared to the non-buyers. Sirieix et al. (2011) observed that price is a barrier for purchasing organic food in China, and thus recommended more efforts to price quality food more competitively. Indonesian consumers who perceived that organic food is substantially more expensive than conventional food were less willing to purchase organic products (Slamet et al., 2016).

With respect to safety perceptions, Liu et al. (2013) reported that information about safe food, e.g., relating to the absence of residues or chemical hazards, significantly affects consumer behavior and food purchasing decisions in China. Consumers' beliefs that organic food is tastier were found to drive purchase intentions towards organic food (Bratanova et al., 2015). Perceived product availability in the market, which refers to convenience during purchasing, was found to boost purchase intentions towards sustainable dairy products (Vermeir and Verbeke, 2008). Consumers' perceived self-competence in choosing

quality food may emerge as another determinant of purchase behavior. Higher perceived self-competence in choosing organic food, for example, was found to significantly boost purchase intentions of organic food (Chrysochoidis, 2000). Teng and Lu (2016) observed that lower perceived self-competence and higher perceived uncertainty (e.g., lack of knowledge and low confidence in organic food choice decision-making) negatively affected Taiwanese consumers' involvement in organic food, which further eroded their purchase intentions. High perceived uncertainty (i.e., low perceived self-competence) may be due to information incompleteness to make an informed food choice and competing or contradictory preferences, for example, among different food attributes (Hassan et al., 2013).

With respect to behavioral factors, first, consumers' behavior in relation to food labels determines purchase behavior. Reading of food labels has been widely explored in the literature (e.g., McFadden and Huffman, 2017; Noussair et al., 2002; Rodríguez et al., 2009; Tegene et al., 2003). Consumers who often read food labels when buying new food products were found to be willing to pay more for both natural and organic products (McFadden and Huffman, 2017). In a similar vein, Rodríguez et al. (2009) found that reading food labels before buying has a significant influence on WTP for organic whole wheat flour and organic aromatic herbs. Food labels only act as a search characteristic when consumers are actively looking for them, though. Noussair et al. (2002), for example, failed to find a significant response to GM food labels in France, and concluded that consumers do not tend to notice labels that they are not looking for in the first place. In addition, the importance of the food product as a staple within consumers' overall diet may affect attitudes and purchase and eating behavior with respect to quality attributes. For example, per capita rice consumption and WTP for quality rice were found to be positively correlated in Cameroon (Akoa Etoa et al., 2016) and the Philippines (Cuevas et al., 2016).

Finally, consumer valuation of quality food and purchase behavior is also affected by socio-economic characteristics of the buyers. In the case of rice, mixed results have been found for these variables. Age, for example, was found to positively affect WTP in some cases (Cuevas et al., 2016; Depositario et al., 2009), negative in others (Demont et al., 2012, 2013a), while some studies failed to demonstrate any significant relationship (Akoa Etoa et al., 2016; Demont et al., 2013b, 2017; Diagne et al., 2017). Similarly, the effect of education was found to vary from neutral (Akoa Etoa et al., 2016; Demont et al., 2012, 2017; Diagne et al., 2017) to positive (Demont et al., 2013a) or negative (Demont et al., 2013b), and the direction of the relationship could vary among income classes (Cuevas et al., 2016). Also, while most studies found no evidence of a direct income effect on WTP for rice quality attributes (Akoa Etoa et al., 2016; Demont et al., 2013a, 2013b, 2017; Depositario et al., 2009; Diagne et al., 2017), some studies found a positive effect of direct (Cuevas et al., 2016; Demont et al., 2012; Peterson et al., 2013), and indirect measures of household wealth on WTP (Diagne et al., 2017). Further, depending on the context, the effect of household size was found to vary from neutral (Akoa Etoa et al., 2016; Demont et al., 2012, 2013a, 2013b; Depositario et al., 2009) to positive (Diagne et al., 2017) or negative (Demont et al., 2017), and the direction of the relationship could vary among income classes (Cuevas et al., 2016). Finally, with respect to gender, some studies found that women tend to pay smaller price premiums for quality rice than men (Demont et al., 2017; Depositario et al., 2009).

### 3. Materials and methods

#### 3.1. Experimental auction design

In this study, experimental auctions are conducted to elicit the WTP

for VietGAP rice under gradually-increasing information levels. Experimental auctions have been applied to estimate the WTP for rice in previous consumer studies (Akaichi et al., 2017; studies reviewed by Demont and Ndour, 2015; Demont et al., 2017; Depositaro et al., 2009; Lee et al., 2014; Peterson et al., 2013). Experimental auctions are preferred over stated preference methods (e.g., contingent valuation) because they are less prone to hypothetical bias and are incentive-compatible (Lusk and Shogren, 2007). In an auction, the WTP is obtained by setting up a real market environment where consumers have the opportunity to exchange real goods with real money. The Becker-DeGroot-Marschak (BDM) auction mechanism (Becker et al., 1964; Lusk and Shogren, 2007) was used to elicit consumers' WTP for rice.

BDM auctions have some advantages compared to stated preference methods and other auction mechanisms such as their ease of implementation (Feldkamp et al., 2005), transparency (Werthenbroch and Skiera, 2002), and flexibility to conduct with individuals or groups (De Groote et al., 2011; Werthenbroch and Skiera, 2002). The practical advantage of BDM auctions with individuals over other auction mechanisms with groups (e.g., Vickrey) is that BDM auctions with individuals more closely reflect real purchase situations as in reality consumers hardly ever bid against (compete) each other in a specific purchase situation (e.g., of grocery foods) as there is rarely a case of limited stocks of goods (Sichtmann and Stingel, 2007). Also, while overbidding bias has been observed in Vickrey auctions (Breidert et al., 2006), the problem seems less prevalent in BDM auctions (Breidert et al., 2006; Werthenbroch and Skiera, 2002). However, similar to other auctions, BDM may have some disadvantages too. Auctions are limited to existing products and cannot be applied for concept design and new product development as in the case of conjoint analysis (Werthenbroch and Skiera, 2002). In the context of the study of Noussair et al. (2004), for example, BDM auctions were not preferable compared to Vickrey auctions. In addition, BDM is a relatively new mechanism that has "limited experience outside the lab" (Berry et al., 2015, p.3) compared to other auction mechanisms. The choice of an appropriate auction mechanism depends on the context and objectives of the study. As "WTP is a situation-specific, individual level construct" (Voelckner, 2006, p.148), BDM is applicable at the point-of-purchase situation. As the BDM mechanism is also incentive compatible (Voelckner, 2006; Werthenbroch and Skiera, 2002), we deemed it to be the most appropriate to realize our research objectives in the local context of our study.

Supermarkets have been reported to play an important role in supplying food products with quality labels in Asia, which is partly driven by increased food safety concerns (Reardon et al., 2012). Therefore, the auction was conducted in a large supermarket in Can Tho, a large city located in the Mekong Delta in the South of Vietnam, in August 2016. This supermarket was selected as it caters a large number of food shoppers on a daily basis and has a large range of food products with quality labels, specifically for rice, compared to other supermarkets in the city. Visitors were approached in the supermarket and screened according to the following inclusion criteria: (i) being the main food shopper of the household (with the age from 23 years on); and (ii) consuming rice. Participants were asked if they had 10–15 min to participate in a small survey. At this stage, no information was provided about receiving an incentive in order to avoid influencing the participation decision. We applied non-probability quota sampling with age, income and education as quota control characteristics, in order to ensure that the sample size and composition of each treatment group matched the distribution in the population and satisfied minimum criteria for statistical analysis (i.e., the envisaged number of participants in each treatment was around 50). A total of 199 participants who satisfied the screening criteria were recruited based on judgement by the interviewers. Participants were assigned to the treatment (or control) groups by the senior researcher who monitored the fieldwork and data

collection procedure on-site. Participant recruitment and assignment to treatment groups were based on the quota control characteristics and guided by the completion rates for the different treatment groups.

The BDM auction procedure involved the following steps. Before entering the bidding stage, participants were asked to report their level of hunger. They were then informed of the opportunity to buy a one-kilogram rice package. Next, the BDM auction mechanism was carefully explained and review questions were asked to ensure that participants had a perfect understanding of it before moving to the auction proper. Participants were given enough time to visually and tactily inspect the rice. Following Lusk et al. (2004), a single bidding round was used. Participants were requested to bid a positive value or zero in case they did not want to buy the product. Next, participants were provided with the rice package and information flyer corresponding to each treatment (Fig. 2, Appendix A).

Four treatments were tested using a between-subjects design in which each consumer bids on a single one-kilogram package of rice. In the control treatment (T0), participants were presented with a plain, unlabeled rice package without supplementary information. In treatment T1, participants were introduced with a rice package labeled as "VietGAP." Treatment T2 provided consumers with the same labeled rice package as in T1, combined with a flyer presenting supplementary information on VietGAP certification (Appendix A). The information flyer of VietGAP was based on the VietGAP concept developed by the National Certification Centre of Vietnam (QUACERT, 2016). In treatment T3, participants received the same product and information as in T2, with additional traceability information (Appendix A). All the rice used in the experimental auctions was produced in accordance with the VietGAP production practices and only factual and truthful information was provided to the study participants, hence no deception was involved in the implementation of the experiment.

Then, participants evaluated the product and submitted their bid. After submitting the bid, participants drew a random price from a box to determine the market price. The randomly drawn prices ranged from the lowest price of the similar type of conventional rice observed in the market to double the average market price of the conventional rice. The randomly drawn prices were listed in absolute values and were uniformly distributed from VND7000 to VND26,000; increments of VND1000 were used. Participants purchased the rice if their bid equaled or exceeded the randomly drawn price; otherwise, no transaction took place (Feldkamp et al., 2005). Lastly, participants were administered a post-auction survey questionnaire and received a voucher of VND50,000 (US\$2.27) to compensate for their participation time.

### 3.2. Measures

According to Lancaster's consumer utility theory, consumers derive utility from the characteristics of products (Lancaster, 1966), i.e., consumers attach value to products based on the product attributes. Literature has indicated that extrinsic attributes such as production method, quality certification, origin and traceability are important in consumers' food choices (Iop et al., 2006; Ubilava and Foster, 2009). In our study, different attributes of rice are considered, including labelling and other information cues. Consumers' valuation for quality labelling (VietGAP quality certification label) and other information cues (supplementary information about the certification and traceability) on rice are elicited via experimental auctions (Lusk and Shogren, 2007). Willingness-to-pay (WTP) is likely influenced by their knowledge about quality labelling, attitudinal and behavioural factors as well as socio-economic characteristics as outlined in the study's conceptual framework (Fig. 1).

To test participants' knowledge on rice certification, they were

Treatment	“Label” <sup>a</sup>	“Information” <sup>b</sup>	“Traceability” <sup>c</sup>	Illustration
T0 (n=50)	0	0	0	
T1 (n=49)	1	0	0	
T2 (n=51)	1	1	0	 <p style="text-align: center;">See Fig. A.1</p>
T3 (n=49)	1	1	1	 <p style="text-align: center;">See Fig. A.2</p>

Fig. 2. Overview of the treatments and coding for treatment variables in the experimental auctions (n = 199). Note: <sup>a</sup>1 VietGAP label is present, 0 otherwise; <sup>b</sup>1 Supplementary information on certification is provided, 0 otherwise; <sup>c</sup>1 Supplementary information on traceability is provided, 0 otherwise.

asked to evaluate five statements related to food quality certification for rice as true or false (Appendix B). The dummy variable “Knowledge” corresponds to “1” if a participant answered all questions correctly and “0” otherwise.

Similarly to Janssen and Hamm (2012), consumers were asked to indicate how much they trust the food quality certification system for rice. Responses were scored on a 7-point interval scale with “1” indicating complete distrust and “7” complete trust. A very small proportion of the participants had low and neutral (≤4) scores for trust. Therefore, the dummy variable “Trust” has a value of “1” for those who indicated to completely trust food quality certification for rice and “0” otherwise.

The perceived psychological consequences of environmentally friendly behavior were measured on a 7-point Likert scale following Abdul-Muhmin (2007) (Appendix B, Cronbach’s α = 0.71). Benefit beliefs related to GAP-certified rice were measured by asking participants how they evaluate several attributes of GAP-certified rice compared to conventional rice (Grankvist and Biel, 2007; Steptoe et al., 1995; Van Loo et al., 2013): (i) health-related attributes (i.e., vitamins

and minerals, fiber, and nutritional contents); (ii) value for money; (iii) residue levels; (iv) sensory attributes (i.e., aroma, appearance, texture, and taste); and (v) convenience attributes (i.e., ease of cooking, cooking time, and availability). Responses were recorded on a 7-point interval scale with “1” as “much worse” and “7” as “much better.” Factor analysis and reliability tests were performed to formulate the composite variables of health (Cronbach’s α = 0.87), sensory (Cronbach’s α = 0.79), and convenience (Cronbach’s α = 0.62) attributes.

Similarly to Chrysochoidis (2000), consumers were presented with statements to measure their perceived self-competence in distinguishing and comparing a certified product from a conventional one (Cronbach’s α = 0.89) (Appendix B). Answers were recorded on a 7-point Likert scale where “1” indicates strong disagreement and “7” strong agreement.

Analogously to Tegene et al. (2003), participants were asked how often they read food labels while purchasing food. The responses ranged from “1” for “never” to “5” for “always.” The dummy variable “Read” has a value of “1” for those who indicated to often or always read food labels while purchasing food and “0” otherwise. Participants

were also asked whether or not they eat rice on a daily basis (“1” refers to daily consumption of rice; “0” otherwise).

Finally, we assessed socio-economic characteristics, including age, gender, presence of young children, education, income and household size. We also controlled for possible effects of having a housemaid (yes/no), daytime effects (morning vs. other moment of the day), and participant’s hunger level. Regarding the latter and following [Flint et al. \(2000\)](#) and [Hung and Verbeke \(2018\)](#), participants were asked to report their degree of hunger and satiety on an 11-point scale ranging from “the greatest imaginable degree of hunger” to “the greatest imaginable degree of satiety.”

### 3.3. Econometric modelling

Due to a small number of zero values in the bids (less than 4%), we adopt a linear regression model with the information treatment variables, as well as knowledge and trust, and control variables for housemaid, daytime effects and hunger level being forced into the model. As we have relatively many potential explanatory variables, we used a backward stepwise method (removal criteria of  $p > 0.1$ ) to select significant variables related to attitudes, beliefs, perceptions, behaviors and socio-economic characteristics, similarly as in [Takemoto et al. \(2017\)](#). The final model<sup>3</sup> was run using the enter method including only the variables that turned out to be significant. The Breusch-Pagan/Cook-Weisberg test was conducted to verify whether the assumption of homoscedasticity is satisfied. The model with robust standard errors should be performed in the case heteroscedasticity is present. To model the relation between the observed  $WTP_i$  and the explanatory variables  $X_i$ , we set up the following linear regression model:

$$WTP_i = \beta_0 + \beta_i X_i + \varepsilon_i \quad (1)$$

where  $WTP_i$  is the bid value for rice of the  $i$ th participant;  $X_i$  is a vector of explanatory variables including three dummy variables of treatment effects, and other variables such as the time of the day during which the auction was organized and the hunger level, attitudes and behavior in relation to quality certified rice, and the socio-economic profile of the participant;  $\beta_0$  is a constant;  $\beta_i$  is a vector of coefficients;  $\varepsilon_i$  is the residual.

The effect of the information treatments is estimated by using three dummy variables to capture the added value of incremental information provided by each of the treatments: “Label,” “Information,” and “Traceability” ([Fig. 2](#)). The control is applied when the three dummies have a value of zero. In T1, “Label” has a value of 1 indicating that the VietGAP label is present without further information. Hence, “Label” only captures the effect of the label, relative to the unlabeled, plain package. In T2, “Label” and “Information” both have a value of 1 indicating the presence of both the VietGAP label and additional VietGAP information. Since “Label” already captures the effect of the label, “Information” now captures the incremental effect of the supplementary VietGAP information. In T3, all the three dummies have a value of 1 indicating the presence of the VietGAP label, VietGAP information, and traceability information. Similarly, “Traceability” captures the incremental effect of the supplementary traceability information on top of the other pieces of information (label and VietGAP information). The data was analyzed using STATA 13.0 and SPSS 24.0 (SPSS Inc., Chicago, IL, USA).

<sup>3</sup> Only results of the final model are reported in the results section. The first model (with forced variables) and second model (with the backward stepwise method applied for the variables attitudes, beliefs, perceptions, behaviors, and socio-economic characteristics) are available upon request.

## 4. Results

### 4.1. Descriptive statistics

Descriptive statistics of the variables and characteristics of the sample are provided in [Table 1](#). The sample is dominated by women (86%), who are the main food shoppers in Vietnamese households. Participants of 23 years and older were targeted in our study, thus excluding young adults such as students who might strongly focus on cheap prices as their main purchasing criterion, e.g., owing to their limited budgets ([Mann et al., 2002](#); [Van Der Merwe et al., 2010](#)). This does not imply the assumption that people with lower income might not be interested in purchasing quality rice. From the age of 23 years on, it is more likely that people have finished their studies, have jobs, start their independent life, and have their own family ([General Statistics Office of Vietnam \(GSO\), 2009](#)).<sup>4</sup> It is observed that Vietnamese consumers at this age tend to have more experience with the purchase and evaluation of rice and are more familiar with information relating to rice purchase. Additionally, young people seem less interested in receiving food quality information in comparison to more mature adults, as food safety consciousness tends to increase with age and experience ([Berges and Casellas, 2006](#)). These characteristics are important and were taken into account because participants in experimental auctions evaluate products, and assess the products’ quality and value. By targeting the population from 23 years on, this study aims to provide more targeted recommendations and managerial implications for policy actors in terms of an effective marketing strategy for quality rice.

The average age of the study participants is 45 years. From our sample, 10%, 69%, and 21% are in the age groups  $\leq 30$ , 31–54, and  $\geq 55$  years, respectively. From the country population including those from 25 years on, 16%, 59%, and 25% are in the age groups  $\leq 30$ , 31–54, and  $\geq 55$  years, respectively ([GSO \(2014\)](#), and own calculations). Data on the age distribution of the population in Can Tho are not available.

Around 36% of the participants have a university degree or higher, 16% have a college degree (not university), 27% have a high school degree, and the remaining 21% have a secondary school degree or lower. This means an overrepresentation of higher education as compared to Vietnam as a whole, but this is fairly in line with the distribution of education levels in the population of Can Tho in specific.

Approximately 48% of the participants belong to the upper-middle income class which includes those who reported to have an income from “more than average” to “well-off.” Additionally, 64% of the participants reported to have children aged under 15 years in their household. The average household size of the study sample is more than four persons. A comparison of the sample’s characteristics and corresponding population characteristics for Vietnam as a whole and for Can Tho in specific – as far as these were available – is provided in [Appendix C](#).

### 4.2. Bids across treatments

Descriptive statistics of the bids are summarized in [Table 2](#). Results indicate that the mean values of the bids gradually increase over incremental information treatments. The plain and unlabeled package (T0) received the lowest bid, i.e., VND12,420 (US\$56). The mean WTP increases to VND13,920 (US\$63) when the package features the VietGAP label (T1), and further to VND15,630 (US\$71) when supplementary information on VietGAP certification is provided (T2), and finally to VND16,780 (US\$76) when supplementary information on

<sup>4</sup> In Vietnam, the average age for first marriage is 24.5 years for the whole country and 26.0 years for urban areas specifically. There are gender differences. Women are on average 22.8 years when marrying the first time for the country as a whole, and 24.4 years for urban areas. Similarly, this age for men is on average 26.2 years and 27.7 years, respectively ([GSO, 2009](#)).

**Table 1**  
Description of variables and descriptive characteristics of the sample ( $n = 199$ ).

Variable	Description	Unit	Mean (Std. dev.)
<i>Socio-economic</i>			
Age	Age of the respondent	Years	45.38 (10.40)
Children	Having children under 15	1 = yes; 0 = otherwise	0.64 (0.48)
Education	Education of the participant	1 = elementary and lower; 2 = secondary; 3 = high school; 4 = higher education (not university); 5 = university and upper	3.61 (1.28)
Income	Self-reported income of the respondent	1 = upper middle; 0 = otherwise	0.48 (0.50)
Household size	Number of members live in the same family	Persons	4.44 (1.72)
<i>Knowledge</i>			
Knowledge of quality attributes of certified rice	Consumers' knowledge of food quality certification for rice	1 = have all answers correct; 0 = otherwise	0.62 (0.49)
<i>Attitudes and behavior</i>			
Trust in rice quality certification Environment	Trust in food quality certification system for rice Perceived psychological consequences of environmentally friendly behavior	1 = completely trust; 0 = otherwise From 1 = strongly disagree to 7 = strongly agree	0.24 (0.43) 6.63 (0.41)
Health benefit	Belief in the health benefits of GAP-certified rice	From 1 = much worse to 7 = much better	5.84 (0.77)
Value for money	Belief that GAP-certified rice is good value for money	From 1 = much worse to 7 = much better	4.54 (1.50)
Less residues	Belief that GAP-certified rice has much less residue	1 = much better (less residue compared to conventional rice); 0 = otherwise	0.46 (0.49)
Sensory benefit	Belief in the sensory appeal of GAP-certified rice	From 1 = much worse to 7 = much better	5.54 (0.72)
Convenience benefit	Belief in the convenience of GAP-certified rice	From 1 = much worse to 7 = much better	4.51 (0.87)
Self-competence	Consumers' perceived self-competence	From 1 = strongly disagree to 7 = strongly agree	4.38 (1.37)
Read food labels	Reading of food labels while purchasing	1 = often read the label; 0 = otherwise	0.82 (0.38)
Consumption of rice	Consumption of rice	1 = daily consume rice; 0 = otherwise	0.79 (0.41)
<i>Others</i>			
Housemaid	Having housemaid	1 = yes; 0 = otherwise	0.08 (0.26)
Daytime effect (morning)	Time conduct	1 = morning; 0 = otherwise	0.41 (0.49)
Hunger level	The level of hunger of respondent	From 1 = greatest imaginable hungry to 11 = greatest imaginable of satiety	6.25 (1.27)
Gender	Gender of the respondent	1 = female; 0 = otherwise	0.86 (0.34)

Note: For sensory benefit, convenience benefit, value for money  $n = 198$ ; for health benefit  $n = 197$ .

**Table 2**  
Descriptive statistics of the bids across information treatments (in VND1000/kg).

Treatment	$n$	Mean (Std. dev.)	Min	Max	% of zero bids
T0: Control (plain package, unlabeled and no information)	50	12.42 <sup>a</sup> (3.38)	0.00	20.00	4.0
T1: VietGAP label	49	13.92 <sup>a,b</sup> (3.52)	0.00	19.00	4.1
T2: VietGAP label and supplementary information on certification	51	15.63 <sup>b,c</sup> (3.12)	0.00	25.00	2.0
T3: VietGAP label and supplementary information on certification and traceability	49	16.78 <sup>c</sup> (3.56)	0.00	26.00	2.0

Note: US\$1 = VND22,011 in August 2016. Sample size  $n = 199$ . <sup>a,b,c</sup> indicate significantly different means using ANOVA and Bonferroni Post Hoc Test.

both VietGAP certification and traceability is provided (T3). This suggests that the value of sustainably-produced rice, as perceived by consumers and revealed through their WTP, is gradually built with incremental pieces of information received.

#### 4.3. Determinants of WTP

The Breusch-Pagan/Cook-Weisberg test indicates that the assumption of homoscedasticity is not satisfied and thus robust standard errors were estimated. Results of the final model as described in the econometric modelling section with the enter method<sup>5</sup> are reported in Table 3. There is no concern of multicollinearity as the Variance Inflation Factor (VIF) values of all explanatory variables are less than 10. The dummies “Label,” “Information,” and “Traceability” are significant at the 1–10% level, confirming that each piece of incremental

<sup>5</sup> The control variables housemaid, daytime effects and hunger level were not significant in the model. Hence, these variables were not included in the final model.

information (tentatively) adds value to sustainably-produced rice (Table 3). The VietGAP label (T1) fetches a VND1168 (US\$5) or 9% price premium relative to the unlabeled package (T0), which was valued at VND12,420<sup>6</sup> (US\$56). The supplementary information on VietGAP certification (T2) further adds VND1719 (US\$8) or 14%, and traceability information tends to add another VND1204 (US\$5) or 10% to the value of the unlabeled package. The total price premium for the VietGAP-labeled package with supplementary information on VietGAP certification and traceability (T3) amounts to VND4091 (US\$19) or a premium of 33% of the value of the unlabeled package.

Table 3 provides information on the characteristics of the market segment of potential buyers of sustainably-produced rice. Interpretation of each significant variable in the model is done while holding all other variables constant. First, except for evidence of an income effect, we do not find a significant influence of socio-economic characteristics on WTP. Consumers in the upper-middle income segment are willing to pay VND894 (US\$4) or 7% more for quality rice than consumers in the

<sup>6</sup> This price of the unlabeled and plain package can be seen in T0 (Table 2).

**Table 3**  
Results of the regression of the determinants of WTP (in VND1000/kg) for sustainably-produced rice in Vietnam.

	Coefficient (Robust Standard error)	t	p-value
<i>Treatments</i>			
Label	1.168 (0.637) <sup>†</sup>	1.84	0.068
Information	1.719 (0.580) <sup>***</sup>	2.97	0.003
Traceability	1.204 (0.597) <sup>**</sup>	2.02	0.045
<i>Socio-economic</i>			
Income	0.894 (0.386) <sup>**</sup>	2.32	0.022
<i>Knowledge</i>			
Knowledge of quality attributes of certified rice	1.265 (0.497) <sup>**</sup>	2.55	0.012
<i>Attitudes and behavior</i>			
Trust in rice quality certification	1.179 (0.463) <sup>**</sup>	2.54	0.012
Environment	1.069 (0.579) <sup>†</sup>	1.84	0.067
Health benefit	0.779 (0.252) <sup>***</sup>	3.10	0.002
Value for money	0.299 (0.155) <sup>†</sup>	1.93	0.055
Read food labels	1.178 (0.698) <sup>†</sup>	1.69	0.093
Constant	-2.797 (4.229)	-0.66	0.509

Note: US\$1 = VND22,011 in August 2016. Standard errors are in parentheses. \*\*\*, \*\*, \* represent significance at 0.01, 0.05, and 0.10 level, respectively. Sample size  $n = 196$ ,  $R^2 = 0.40$ . P-values were calculated based on robust standard errors because homoscedasticity was not satisfied (Breusch-Pagan test;  $p$ -value < 0.001). The Tobit model yielded almost similar results.

medium and lower income segment, which is consistent with other studies (Cuevas et al., 2016; Demont et al., 2012; Diagne et al., 2017; Peterson et al., 2013), and with economic theory (Vandeplas and Minten, 2015).

Second, consumers who completely trust or are knowledgeable about food quality certification for rice are willing to pay VND1179–1265 (US\$5–6) or 9–10% higher price premiums than those who do not completely trust or are not fully knowledgeable about the certification system. Third, consumers' bids tend to increase by VND1069 (US\$5) or 9% for each unit increase on their 7-point belief scale of perceived psychological consequences of environmentally friendly behavior (Appendix B). Fourth, consumers who believe that sustainably-produced rice provides health benefits, are willing to pay VND779 (US\$4) or 6% more per unit increase on the 7-point scale representing the strength of their health benefit beliefs. Fifth, consumers who believe that GAP-certified rice is good value for money tend to be willing to pay VND299 (US\$1) or 2% more per unit increase on the 7-point belief scale. Finally, consumers who often or always read food labels while purchasing food tend to pay VND1178 (US\$5) or 9% price premiums relative to those who do not often or always read food labels.

## 5. Discussion and policy recommendations

### 5.1. Discussion

Little is known about consumers' valuation of sustainable production labels in the rice sector in Southeast Asia. We used BDM auctions to estimate consumers' WTP for certified sustainably-produced rice in the South of Vietnam. Our findings indicate that sustainable production labels for rice should be accompanied by supplementary information on certification and traceability to strengthen consumers' awareness and valuation of sustainably-produced rice. There is a growing interest in food products produced under environmentally friendly conditions, that meet food quality and safety standards, and promote social welfare. Our findings are consistent with previous studies indicating WTP premiums for rice that follows sustainable production methods such as organic rice (Sriwaranun et al., 2015), or eco-friendly rice (Akaichi et al., 2017; Lee et al., 2014). Our observation that domestic consumers tend to be willing to pay a premium for traceability information is similar to the finding of Wu et al. (2015). The price premiums recorded purely for the VietGAP label (i.e., without supplementary information) are lower than the ones observed in the market for certified rice

products, which vary among certification schemes (GlobalG.A.P. or VietGAP), as well as among brands. This external validity check suggests that our BDM auctions have not generated overbidding bias, which is consistent with the literature (Breidert et al., 2006; Wertenbroch and Skiera, 2002). Similar to Rodríguez et al. (2009), we find that consumers who often or always read food labels while purchasing food have a higher WTP. It is observed that currently, most certified rice labels in the Vietnamese food market still do not provide adequate and appropriate information about the certification schemes to consumers. As a result, consumers are still somewhat reluctant to purchase these rice products. Results of our study provide implications for different policy actors, including agricultural policy, communication strategies, international trade, public and private marketing strategies in Vietnam.

### 5.2. Implications for agricultural policy

This study is one of the first on consumers' preferences for rice with a sustainable label in a developing country such as Vietnam. It comes at a moment characterized by an enormous interest in increasing sustainability of the national rice sector by the Vietnamese government. Since September 2017, negative impacts of climate change and human activities are recognized by the Vietnamese government as the most important challenges for agricultural production in the Mekong Delta of Vietnam (Vgpnews, 2017a, 2017b; Vietnamnews, 2017). Thus, in this context, studies towards consumer preferences for sustainably-produced rice are relevant to provide further insights into sustainable rice value chain upgrading in Vietnam. VietGAP is a national food quality standard referring not only to quality and safety aspects, but also to sustainability aspects. This study provides evidence about the value Vietnamese consumers place on this label on the domestic market, which might be crucial in convincing farmers, suppliers and food and agriculture value chain actors to adopt more sustainable practices. Future research should address whether there are opportunities for international export markets as well (see below).

### 5.3. Implications for communication strategies

The gradual build-up of value of sustainably-produced rice has important implications for communication strategies by policymakers. Promoting sustainably-produced rice crucially hinges on providing consumers with adequate information on standards, quality assurance,

and traceability, which reduces information asymmetry and enhances consumers' trust in the product (Meyer et al., 2012). This study recommends that proper and effective information provision about food quality assurances to consumers is vital to increase their appreciation of sustainably-produced rice. Information should be meaningful, relevant, selective, trustworthy, and easy for consumers to understand and remember. To effectively provide such information, it is necessary to establish transparent and credible information channels for food quality certification that consumers can access and refer to when purchasing rice, which can further contribute to enhancing consumers' trust. In the context of unclear and inappropriate information provision on food labels for rice in Vietnam, there is a need to build a unique image or logo for the certified sustainably-produced rice that contains key attributes of the certified production processes. This quality sign (logo) should be able to signal good quality, have the ability to communicate key attributes of quality standards (the meaning of quality assurance and traceability information) effectively (i.e., meaningful, relevant, selective messages) to consumers, and demonstrate its own trustworthiness. Importantly, in order to increase consumers' trust in certified sustainably-produced rice, it is advisable to regularly monitor and strictly inspect the information related to quality certified rice being provided to consumers. Therefore, policymakers are recommended to make significant efforts to develop a mechanism that can regulate the credibility of information that is provided to consumers on food quality labels.

#### 5.4. Implications for international trade

Results of our study indicate that there may be opportunities to promote sustainably-produced rice in the domestic market. More importantly, since rice is an important agricultural export product of Vietnam, it is suggested to conduct valuation studies for quality rice not only in Vietnam but also in high-income target markets of Vietnam's rice industry such as Hong Kong and the European Union (EU). Vietnam ranked second among the major rice suppliers to Hong Kong in 2013 and Vietnamese rice amounted to 41% of the market share of rice in Hong Kong in the same year (USDA, 2014). Additionally, Vietnam's rice industry is expected to gain benefits from trade agreements between Hong Kong and Vietnam (Vietnam Business Forum, 2016). The EU is another potential market for Vietnam's rice as rice is among the top-20 agricultural commodities that EU countries import from Vietnam (EUROPA, 2017). Promisingly, the EU has offered tariff elimination for a large share of Vietnam's rice exports to the EU (EUROPA, 2016). Studies of consumers' valuation of sustainably-produced rice in potential markets such as Hong Kong and the EU can provide further insights into strategies for increasing the competitiveness of Vietnamese rice in export markets.

#### 5.5. Implications for public and private marketing strategies

Results of our study indicate that information on the food quality label plays an important role in consumers' appreciation of sustainably-produced rice. However, the private sector in Vietnam currently does not yet adequately invest in product quality standards for rice (Demont and Rutsaert, 2017). Consequently, more efforts should be done to encourage the private sector to invest in concretizing the product quality standards of sustainably-produced rice. The government is recommended to take initiatives to encourage the private sector's investment in product quality assurance by providing more incentives and support mechanisms to assist the private sector in adopting quality standards for their products. Our study shows that consumers' knowledge of food quality certifications may influence their appreciation and WTP for sustainably-produced rice. Thus, public marketing strategies that aim to improve consumers' awareness of the quality and safety standards such as VietGAP are highly encouraged. This can be done via public communication (e.g., official TV programs, talk shows, fairs)

attended by representatives from the government, experts in the field and producers sharing their knowledge about sustainable agriculture and the costs and benefits associated with good agricultural practices. The government can also organize a platform or a forum where people (government, experts, producers, consumers) can share their knowledge and ideas about sustainably-produced foods.

In terms of private marketing strategies, our results indicate that rice producers and companies should focus on adopting food quality standards for their products and properly communicate information about food quality certification to consumers (i.e., following the government regulations to apply a unified logo for sustainably-produced foods and ensuring the credibility and trustworthiness of their communication). Consistent with previous studies (De Steur et al., 2012, 2017; Mondelaers et al., 2009; Yin et al., 2010), we find that the value of sustainably-produced rice is strongly affected by consumers' belief in the health benefits of the product, such as the amount of vitamins and minerals, fiber, and its nutritional contents. In addition, consumers who are willing to pay premiums tend to be more environmentally conscious (Abdul-Muhmin, 2007; Yadav, 2016). These findings suggest that credible and properly governed health and environmental benefit claims should be incorporated in the communication messages to reinforce consumers' belief in the health and environmental benefits of certified sustainably-produced rice, and consequently increasing consumers' appreciation of sustainably-produced rice. In addition, our study shows that consumers in the upper-middle income segment are willing to pay more for sustainably-produced rice. This segment here-with emerges as a primary target group for marketers of the rice industry and their marketing strategy for quality rice.

Together with implications for policy actors in Vietnam, our study also contributes to the literature on consumer valuation and learning experiences for other countries that have primary food production areas that are vulnerable to climate change and have been negatively affected by human activities, similar as in Vietnam.

## 6. Conclusions

The findings of our study suggest that embodying sustainability in rice products through labeling is a feasible market-based incentive mechanism for increasing sustainability in rice value chains in Vietnam. This has important implications for the SRP, which may be encouraged to pilot test similar certification schemes in other Southeast Asian and South Asian rice growing countries. However, since some of these countries are major exporters, it remains to be seen whether the demand for sustainability in domestic rice markets can be large enough to trigger the adoption of sustainability standards throughout rice value chains. Supermarkets may play a market leader role in this trend (Reardon et al., 2012), which may spillover to other markets.

Our results also provide crucial insights for Vietnam's rice sector's restructuring strategy. In their quest to increase quality-competitiveness, sustainability and resilience of the sector against climate change, policymakers could partner with the SRP to train Vietnamese rice value chain actors – not only farmers – in the implementation of sustainable production practices throughout rice value chains. The willingness-to-pay among consumers – as demonstrated by the empirical findings of this study – can trigger the adoption of sustainable production practices. Policymakers and value chain actors could further inform domestic consumers about the societal benefits of sustainable rice production in the Mekong Delta and trigger demand for sustainably-produced rice. Our results suggest that consumers value sustainably-produced rice as long as they are properly informed about the certification and the origin of the product they are buying. Importantly, it is crucial to provide proper information about the certification and traceability of the product to increase the positive effect of information provision on consumers' appreciation of sustainably-produced rice.

Finally, this study has some limitations such as the higher prevalence of women in the sample compared to men; yet, women are

predominantly responsible for household food purchase. The study focused on urban consumers in a large Vietnamese city in the MKD, which limits the generalization of the results to the overall Vietnamese population. The implications of the study might be limited to our sample frame and therefore only be projected to supermarket shoppers. This study would benefit from being reproduced in other Southeast Asian and South Asian countries. Further studies on the role and effect of certification parties such as public or private standards on the WTP for quality rice are also recommended.

**Appendix A**

See Figs. A.1 and A.2.

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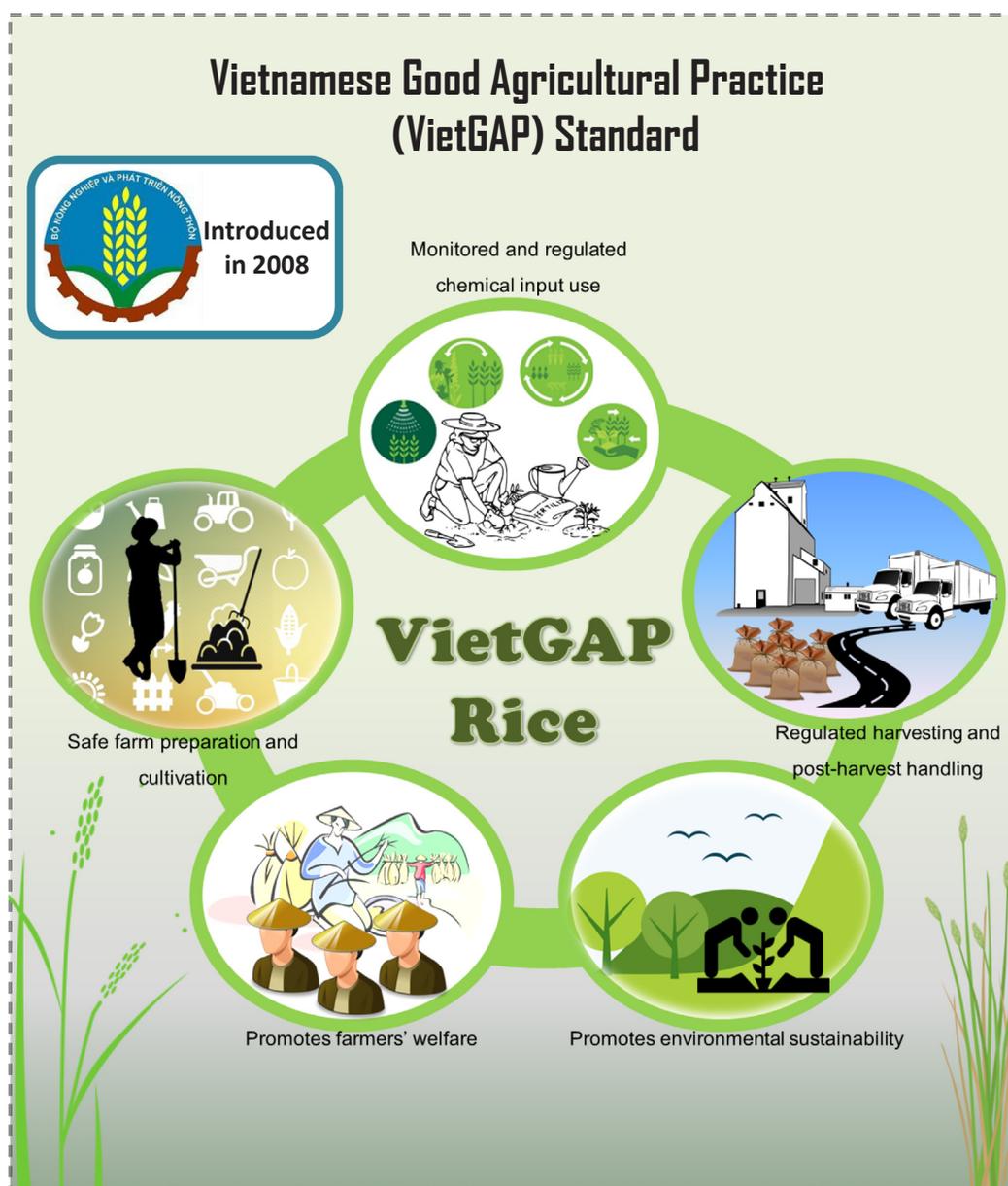


Fig. A.1. Supplementary information: VietGAP flyer.



Fig. A.2. Supplementary information: VietGAP flyer and traceability component.

**Appendix B. Detailed items for selected constructs**

Consumers' knowledge of food quality certifications for rice  
Indicate if the following statements about certified rice are true or false.

Statements	Response scale
1. Certified VietGAP rice ensures that the whole rice production process is controlled to ensure the safety for human consumption (T)	True (T) False (F)
2. Certified HACCP rice indicates that the rice is safe for human consumption (T)	No answer
3. Certified GAP rice does not take into account the welfare of the workers in the supply chain of the product (F)	
4. Certified VietGAP rice indicates that the rice is produced taking into account the negative impacts of farming on the environment (T)	
5. Certified rice standards can only be accredited by the government and not by another third party (F)	

Consumers' perceived self-competence (based on [Chryssochoidis, 2000](#))  
Indicate to what extent you agree with the following statements.

Statements	Response scale
I know a lot about certified rice products	1 (Strongly disagree) to 7 (Strongly agree)
I know how to distinguish certified from conventional rice	
Before I purchase rice I know how to look at the differences between products	

Perceived psychological consequences of environmentally friendly behavior (based on [Abdul-Muhmin, 2007](#))  
Indicate to what extent you agree with the following statements.

Statements	Response scale
I would feel a sense of satisfaction if I could separate my garbage for recycling	1 (Strongly disagree) to 7 (Strongly agree)
I would feel a sense of achievement if I can teach my children to respect the environment	
It would mean a lot to me if I could contribute to protect the environment	

#### Appendix C. Comparison of the characteristics of the sample and of the population (% , based on 2014, unless specified otherwise)

	Study sample (n = 199)	Vietnam (GSO)	Can Tho (GSO)
Gender (1000 persons)		90,729	
Male (1000 persons)		44,758	621.3 (in 2015)
Female (1000 persons)		45,971	626.7 (in 2015)
Gender (1000 persons, urban area)		30,035	833.0 (2015)
Male (n =)	27	N.A.	N.A.
Female (n =)	172	N.A.	N.A.
Age (years)	100	100 <sup>1</sup>	
≤ 30	10	16	N.A.
31–54	69	59	N.A.
≥ 55	21	25	N.A.
Education	100	100 <sup>2</sup>	100
Non-specialized	48	70	55 (in 2011) <sup>3</sup>
Specialized (have training, some college, higher education)	52	30	45 (in 2011) <sup>3</sup>

Sources: [General Statistics Office of Vietnam \(GSO\), 2014, 2015](#); N.A. = not available.

<sup>1</sup> Based on [GSO \(2014\)](#) for the population of Vietnam including those from 25 years on and own calculations.

<sup>2</sup> Education of the population of Vietnam including people from 15 years on in urban areas ([GSO, 2014](#)).

<sup>3</sup> In 2011, it was estimated that Can Tho city had about 45% of trained labor force (i.e., training, college, higher education) ([Tanh, 2013](#)). This means that the non-specialized labor force in Can Tho was about 55% in 2011. In 2016, the non-specialized labor force was expected to have decreased, while labor force with college and higher education should have increased, compared to 2011.

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