Geographical Indication for Jasmine Rice: Applying a Logit Model to Predict Adoption Behavior of Thai Farm Households[1]

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Abstract

Geographical indications (GIs) have gained increasing interest since their protection has been ensured multilaterally under the TRIPS Agreement of the World Trade Organization (WTO). Thung Kula Rong-Hai Thai Hom Mali Rice (TKR) is the first officially registered GI Jasmine rice in Thailand. This paper aims at identifying factors that predict the behavior of Thai Jasmine rice farm households in adopting GI certification. Primary data of 370 Thai Jasmine rice farm households were collected through a formal survey in two districts of the Thung Kula Rong-Hai (TKRH) area. The results of the logistic regression analysis indicate that social and human capital variables significantly influence the decision of Thai Jasmine rice farm households to adopt GI certification.

Keywords: geographical indication, certification, logit model, Jasmine rice, Thailand
JEL: O13, O34, Q18

1 Introduction

As one kind of intellectual property right, geographical indications (GIs) have gained increasing interest since their protection has been ensured multilaterally under the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement under the auspices of the World Trade Organization (WTO). In order to have GIs being protected by the TRIPS rules, WTO Member countries are required to provide a legal and institutional framework of GI protection in their own national borders (GROTE, 2009). In the fight against biopiracy and given the EU's attempt in seeking alliance for better GI protection around the globe, the Thai government has released its first specific Act on GI protection in 2003, known as "Act on Geographical Indications

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Protection B.E. 2546 (2003)". As of January 2012, totally 38 products from different regions in Thailand were registered as GIs.

Under the protection of the Act, Thung Kula Rong-Hai Thai Hom Mali Rice (TKR) is the first registered GI Thai Jasmine rice. It is traditionally being produced in the Thung Kula Rong-Hai (TKRH) region in the Northeast of Thailand, and GI certification is expected to promote its export which currently mainly goes to the EU. Stakeholders involved in the GI production line can apply for membership in a GI club which allows them to use a label on their certified product in order to reap benefits from the GI protection. In 2008, there were totally 13 TKR processors and exporters and 1,131 TKR farm households being GI certified. Thus, the proportion of the GI certified farm households is still very small accounting only for around 1.3 percent of the total TKRH farm households. The question arises why not more farmers adopt GI certification, especially against the background of price premia being generally paid to GI products (SUH and MACPHERSON, 2007; TEUBER, 2007). There should be existing factors explaining the behavior of the farmers in adopting or rejecting such new idea. Thus, it is important to understand the role of these determining factors to ensure the design of a successful introduction of new projects or policies such as GIs for rural development.

Against this background, the objectives of this paper are to: (i) identify factors that are likely to predict the behavior of Thai Jasmine rice farm households in the TKRH area in adopting GI certification; and (ii) to estimate the marginal effects of key factors on the probability of adoption. A logit model will be used to analyze the primary survey data collected from individual farm households in Northeastern Thailand. The rest of the paper is divided into five sections: (i) the literature review, (ii) the conceptual framework and model specification, (iii) the survey site and data collection, (iv) empirical results, and (v) the conclusion.

2 Literature Review

A thorough and comprehensive survey of the literature on the economics of geographical indications has been provided by BRAMLEY et al. (2009) and TEUBER et al. (2011). Empirical evidence from Europe related to the socio-economics of GIs has been reviewed by RANGNEKAR (2004). There are also quite a few policy papers discussing GIs under TRIPS calling for enhanced protection (e.g. ADDOR and GRAZIOLI, 2002; CARBOLI, 2006). However, only very few quantitative papers on GIs have been published so far. The following subsections present the theoretical and empirical literature reflecting some of the specific economic aspects of GIs being of relevance to this paper. These include the role of information, reputation, quality and price along

the value chain as well as welfare implications. The GI adoption by farm households is for example expected to depend on quality and price premia paid by final consumers and being transferred to the producers along the value chain.

2.1 Asymmetric Information, Reputation and Governance of Value Chains

Unlike information on prices, the information on quality is difficult to obtain (NELSON, 1970). In the market of high-quality goods, consumers often face the problem of asymmetric information when quality cannot be readily ascertained prior to purchasing. The experience from repeated purchases does not help the consumer to discern the product quality (MARETTE et al., 1999). In order to avoid market failure due to adverse selection, AKERLOF (1970) stressed the importance of information. He found that there will be no incentives for high quality producers to remain in the market without any means of differentiating goods, because all goods tend to be sold at the same price and quality. STIGLER (1961) and SCHMALENSEE (1978) pointed out that reputation is very important in signaling a certain level of quality. Reputation which is conveyed by a distinctive sign reduces search costs for the consumers, and the saving in search costs allows reputable goods to receive a premium on the price. SHAPIRO (1983) stressed that the quality premia resulting from reputation serve compensating the producers for their investments in the reputation. Some empirical studies e.g. of CAÑADA and VÁZQUEZ (2005) found that quality labels such as the GI label (i.e. Protected Designations of Origin (PDO) labels) can become useful means of producers to signal reputation linked to the distinctive quality of their products to the consumers.

Another issue being crucially related to quality signals is their credibility. RAYNAUD et al. (2002) stressed the importance of relationships between quality signal owners and suppliers in the value chain of many agricultural products. They hypothesized that there must be an efficient alignment between quality characteristics and governance of the value chain in order to assure the credibility of a quality signal. The results of a structural analysis of 42 case studies in three different agrifood sectors conducted in seven European countries showed that when an agent creates a quality signal whose value can be influenced by several other agents in the chains, he will design the governance of transactions in order to assure product quality and improve the credibility of his signal. BARCALA et al. (2009) used the case of fresh meat to analyze the governance aspects of the vertical chain and its impact on product quality. They concluded that the quality of end products largely depends on decisions made by economic agents at various stages of the value chain and concluded that the vertical chain could be more efficiently organized as a GI than in the case of hierarchy in order to promote high-quality products. In addition, VERHAEGEN and VAN HUYLENBROECK (2001) in their cost-benefit analysis of farmers' participation in innovative marketing channels for quality food products found that co-operation of the farmers decreases

transaction costs. Without investing excessive capital or labor, the farmers are enabled by collective initiatives to enter the pathway of quality-food production.

2.2 Consumers' Willingness to Pay for GIs

Growing attention has been paid to the questions how consumers perceive high-quality products originating from a particular region and whether quality premia exist for these goods, in particular the ones with distinctive signs like GIs. MENAPACE et al. (2011) analyzed on the Canadian olive oil market the demand for two distinct label types: country of origin (COO) and GIs. They investigated whether consumers value the informational content of a set of geographical origin labels with different levels of geographical differentiation. They found that consumers' willingness to pay varies with the oil's COO and is greater for GIs than for non-GIs. VAN ITTERSUM (2007) investigated consumers' image of regional certification labels by proposing a structural equation model that relates this image to consumers' willingness to buy and pay for protected regional products. Results suggested that consumers' image of these labels consists of a quality warranty dimension and an economic support dimension, which positively relate to consumers' willingness to pay for the protected regional product. TEUBER (2009) investigated the case of GI for coffee from the region Marcala, i.e. Café de Marcala, using a hedonic price analysis. Her results indicate that coffee from this region has on average higher quality than coffee grown in other Honduran regions and achieves on average higher prices. However, whether this GI coffee can also achieve a higher price due to an already established reputation could not be confirmed.

2.3 Welfare Analysis

Some theoretical studies considered the welfare impact of labeling policies of agricultural products with specific characteristics. ZAGO and PICK (2004) e.g. found that consumers and producers of high-quality goods are better off, while producers of low-quality goods are worse off. With high administrative regulation costs and low quality differences, the total welfare impact of the labeling policies can be negative. Findings also show that when producers of high-quality goods can exercise market power either in the form of land restrictions or joint price determination, the labeling policies could be more easily accepted by producers, but the impact on consumers would be negative. Not only theoretical studies focused on the analysis of welfare given the asymmetric information problem, as discussed in Section 2.1, also many empirical studies explored the implications of GI certification for consumer and producer welfare. LENCE et al. (2007) found that legal systems that limit the producer organizations' market power can lead to reduced social welfare and result in large technological distortions. In addition, increased fixed costs of development and marketing costs lead to an increased need for supply control to cover the fixed costs

associated with the introduction of differentiated products. Contrary to intuition, they also highlighted that stronger IPR protection for producer organizations may enhance welfare even after a differentiated product has been developed. MOSCHINI et al. (2008) found a supportive role of GI certification on a competitive provision of quality leading to clear welfare gains for consumers, though it falls short of delivering the first best outcome. Producers may also reap some benefits if production of high-quality products draws on scarce factors they own. ANDERS et al. (2009) investigated the extent to which a phased reduction of initial governmental support levels impacts farmers' price premia and welfare by using the equilibrium displacement model for markets segmented by regional-origin labeling with quality. They found that the price impacts on high-quality and low-quality segments crucially depend on substantive relationships between the markets and the advertising elasticities. Welfare implications for producers depend on costs of participation including quality control and on the co-financing mechanism between the government and producers.

LANGINIER and BABCOCK (2008) adopted the interpretation of GIs as "club goods" (nonrival, congestible, and excludable) and modeled a group of producers as a club and analyzed the certification decision of the club and its welfare implication. They found that for intermediate values of certification costs, the industry and the club of given size have divergent incentives, and there may be overprovision of certification. A conflict between the efficient outcome (that maximizes the aggregate profit of the firms) and the equilibrium may exist, which may be socially undesirable. However, in the absence of a barrier to entry, it is less likely that the club will emerge. BENAVENTE (2010) proposed a model on the welfare effects on the retrieve or so-called "claw-back" of GIs; i.e. the protection in a country (Home) of a GI of another country (Foreign). She found that although there is a loss in global welfare when fewer varieties are available in a market, results suggest that industrialized Home countries with sophisticated consumers tend to lose less from protecting Foreign GIs (e.g. Basmati rice) than developing Home countries, where the opposite is true. Since benefits and rents may be available for developed countries, for the developing countries, however, these benefits are not sustainable given the fact that they have few such claw-back GIs with strong consumer attachments based on geographic association. Scarce resources should thus be better utilized on other development strategies being more likely to yield sustainable development as discussed by KERR (2006).

Not only welfare impacts of GI certification have been studied, but also the impacts of GI certification on rural development. This strand of empirical literature has been taken up e.g. by TREGEAR et al. (2007) or CALLOIS (2004) but will not be further reviewed here.

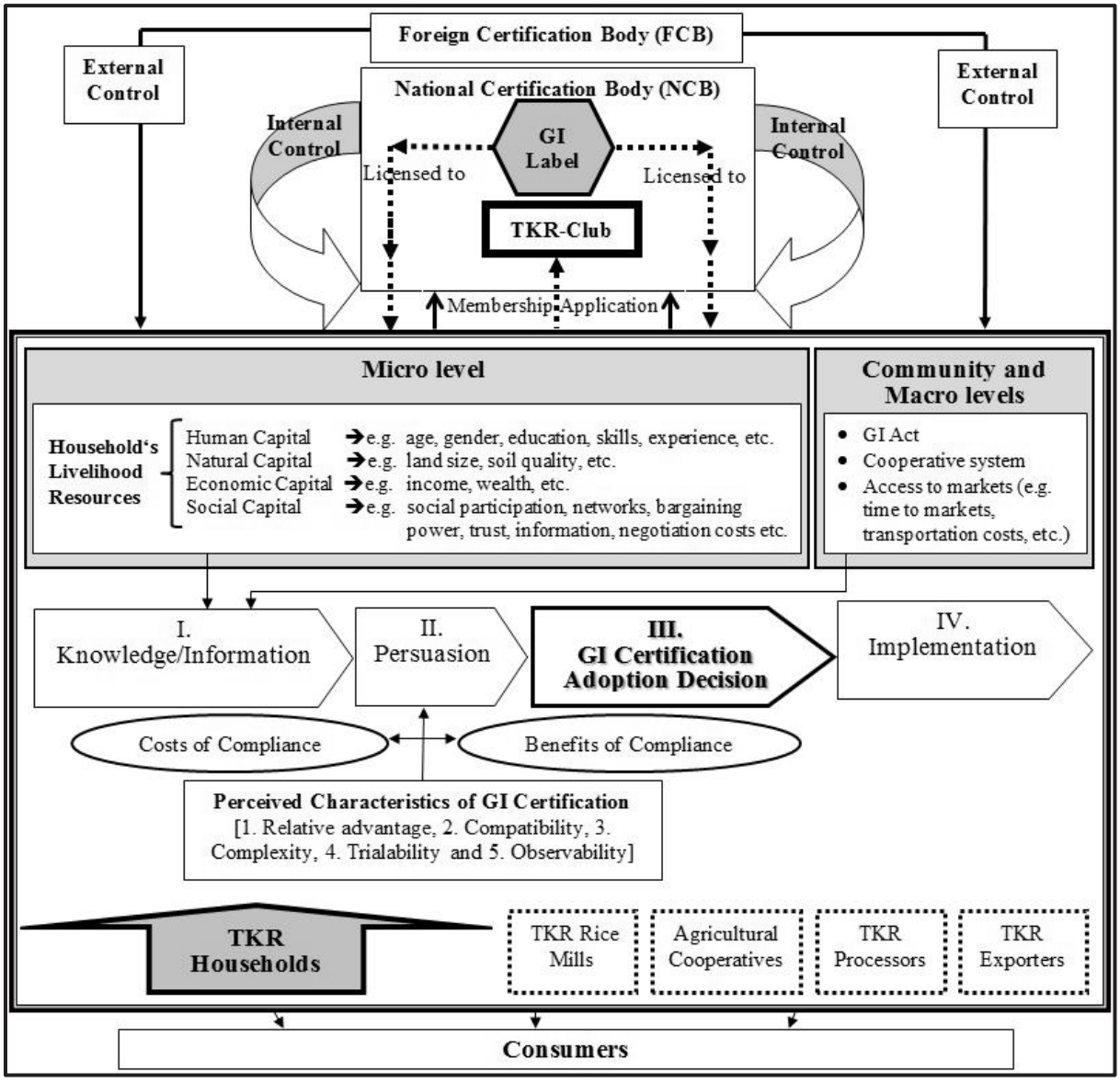
2.4 GI Certification Adoption

Studies on GI certification adoption are still missing, however, results of previous adoption studies can be a useful guidance to help selecting appropriate factors determining the GI certification adoption. Adoption studies generally focus on an innovation or a technology, mostly agricultural modern technologies such as high yielding varieties (HYVs) and the inputs associated with them (e.g. fertilizer, irrigation, and pesticides) as well as corresponding land practices. A number of constraints have been identified impeding the rapid innovation adoption like the lack of credit, limited access to information, aversion to risk, inadequate farm size, inadequate incentives associated with farm tenure arrangements, insufficient laborers, absence of farm equipment, insufficient supply of complementary inputs (e.g. seed, chemicals, and water), inappropriate transportation, or poor infrastructure (FEDER et al., 1985). However, the factors affecting farmers' adoption behavior may differ across techniques, across socioeconomic groups and over time. In addition, adoption studies may be based on different definitions of adoption as stated by FEDER et al. (1985). Thus, generalization is to be avoided.

Therefore, it is important to concentrate on adoption studies being closely related to GI certification. There are in fact a number of empirical studies which focused on the adoption of certification schemes in certain agricultural sectors. CARAMBAS (2007) studied the adoption of certification schemes e.g. for organic rice in Thailand, and DÖRR (2009) looked at the fruits sector in Brazil. Factors such as certification costs and trust have been found to play an important role in determining the adoption of certification by farm households in these two cases. ASFAW (2008) investigated the adoption of the GlobalGAP certification for vegetables in Kenya. He found that education, household wealth, access to information technologies and group membership have the positive role on the decision of the small-scale vegetables producers in adopting the GlobalGAP certification. In addition, KERSTING and WOLLNI (2011) studied the GlobalGAP certification adoption behavior of small-scale fruit and vegetable farmers in Thailand and found that age, availability of family labor, education, household wealth, farm size, intensity of irrigation use, support by exporters and farmer trainings have a significant influence on the farmer adoption decision.

The literature review highlights some major issues being also of relevance to the GI certification process. Some of these relevant factors have been incorporated in figure 1 which presents the legal and institutional process for GI registration and certification in Thailand.

Figure 1. The legal and institutional process for GI registration



Source: own presentation

How a GI certification is adopted by a decision-making unit is conceptually informed by ROGERS'S (1962) theory of diffusion of innovation. According to the theory, an innovation is an "idea, practice, or object that is perceived as new by an individual or other unit of adoption" (ROGERS, 2003: 12). GI certification is considered as an innovation since it is new to all parties in the GI region. An organizational innovation resulting from such systems is seen as a key part in disseminating knowledge and innovation on the ground and in relating quality policy to the entire value chain (CAÑADA and VÁZQUEZ, 2005). Four main stages in the innovation-decision process defined by ROGERS (2003) are related to this study: (1) knowledge, (2) persuasion, (3)

decision, and (4) implementation. In the context of GI certification adoption of TKR farm households, knowledge occurs when the farm households learn from the existence of the GI certification and gain some information and understanding of how it functions. The second stage is called persuasion. This is when the farm households form a favorable or unfavorable attitude towards the GI certification. At the third stage of the innovation-decision process is the decision which occurs when the farm households engage in activities that lead to a choice of adopting or rejecting the GI certification. The farm households decide then to apply for membership in a GI club, the TKR club, by registering their names with the GI Certification Body (CB) (figure 1). The final step of an innovation-decision process is implementation. The use of the innovation by the farm households in this context means that they follow the manuals for the TKR production received from the GI CB. This production manual is released in order to control quality of the TKR production at the initial stage of the TKR value chain.

GI certification adoption depends on the available livelihood resources or different types of capital of a farm household. These include e.g. natural, economic or financial, human and social capital (SCOONES, 1998). It is hypothesized in this study that the farm households' decision to adopt or reject a GI certification is influenced by a wide range of factors categorized into two domains as shown in figure 1. The first domain includes four types of household's livelihood resources: (i) *human capital variables* e.g. age, gender, education, and experience; (ii) *natural capital variables* such as land size; (iii) *economic capital* indicated by such variables as income or wealth; and (iv) *social capital variables* including social participation, networks, bargaining power, being member of cooperatives, trust, information and negotiation costs. The second domain includes institutional or access-related variables like time to markets and transportation costs. A number of hypotheses can be developed with respect to the importance of these factors for the adoption of GI certification for Jasmine rice by Thai farm households.

3 Conceptual Framework and Model Specification

When trying to answer the question which factors influence the decision of the farm household to adopt GI certification, decision theory tells us what the farm household may rationally prefer between choices (to adopt or to reject) (DREIER, 1996). It is presupposed that rational farm households optimize their objective function such as expected utility (DREIER, 1996; KALYEBARA, 1999) or net present value of benefits from adopting the innovation (DÖRR, 2009). However, economic theories have been criticized for providing only limited guidance on the selection of variables to explain the behavior of farmers in the adoption decision (GYAWALI et al., 2003; KALYEBARA, 1999).

Therefore, the linear random utility model is applied in this study. It provides an alternative interpretation on the individual's utility of two choices by considering the observed choice between the two revealing which one provides the greater observable utility (GREEN, 2003). Due to the fact that the farm household's perception of utility or profit, its level of risk aversion and the weights it puts on profitability, risk and subsistence requirements are difficult to estimate, the probability of adoption is predicted as a function of proxy factors that are likely to predict the expected values of the farm household's objective function (KALYEBARA, 1999). The variables selection in this study is guided by the literature review in general, and by the model of the innovation-decision process of ROGERS (1962) in particular. Furthermore, we use an econometric model of a logistic regression (logit model) to help selecting key variables which could best explain the behavior of farm households to adopt GI certification. A logit model is a probability model regressing a set of independent variables (X), which can be categorical or continuous, on the conditional expectation of the binary dependent variable (Y) (LIAO, 1994). The logit model uses a logistic cumulative distribution function to estimate the linear determinants of the logit (L_i) or the logged odds and has the following form:

$$(1) \qquad L_i(Y) = \ln\left[\frac{P_i}{1 - P_i}\right] = \beta_0 + \beta_k X$$

where (P_i /1- P_i) is the odds expressing the conditional mean or probability of an occurrence of the event relative to the likelihood of a nonoccurrence given X; β_0 is the unknown constant term or intercept, β_k is a vector of regression coefficients to be estimated and X is a set of independent variables determining the probability of the event. The model in terms of Y would then be written as:

$$(2) \qquad Y_i = \alpha + \sum_{k=1}^{K} \beta_k X_k + \varepsilon$$

where Y_i is a binary dependent variable; and Y_i equals 1 when a farm household adopted GI certification and 0 otherwise, α is the unknown constant term and β_k are regression coefficients of k independent variables to be estimated and ε is the error term. The parameter α and β_k are typically estimated by the maximum likelihood (ML) method, which is preferred over the weighted least squares approach. The key is to find β that produces the logits and the conditional mean of Y given X values that have the greatest likelihood of producing the observed data (PAMPEL, 2000).

Empirical Model Specification

The logit model of GI certification adoption (Y_i) was specified as a function of all independent variables as follows:

(3) $$Y_i = f(X_1, \ldots, X_{11}) + u$$

with X_1 to X_{11} representing the 11 independent variables (table 1) and u representing the random disturbance. Gender (X_1) is a binary variable taking on the value of 1 if the household head is male and 0 if female. Gender is known to affect the decision-making given the fact that males are more dominant, assertive, objective and realistic, while females are more affected by the environment, tend to rely more on information and dedicate more time to the decision process (LIZÁRRAGA et al., 2007). However, the expected sign of the effect of gender on the GI adoption is ambiguous. NKAMLEU and MANYONG (2005) found that a male household head has a highly significant and positive impact on the adoption of agroforestry practices. Similarly, OUMA et al. (2002) used the logit model to analyze the behavior of Kenya's farmers in adopting improved maize seed and found that gender has a significant relationship with the adoption of improved seeds. However, DOSS and Morris (2001), for instance, found no significant difference in rates of modern seed variety adoption between male and female farmers in Ghana. Similarly, CHIRWA (2005) stated that there is no significant difference between men and women plot owners with respect to fertilizer adoption. Given the fact that roles and responsibilities of gender are dynamic and respond to changing economic circumstances as discussed by DOSS (2001), gender may or may not have an influence on the household's decision-making.

Education (X_2) is a continuous variable measured by years of schooling of the household head. It is seen as an important basis for human capital creation and is often used as a proxy to indicate the ability to acquire and process information (e.g. SCOONES, 1998; FEDER et al., 1985). In general, farmers with higher education tend to possess higher capability to analyze information and knowledge being beneficial to farming operation and necessary to successfully implement a new technology (UEMATSU and MISHRA, 2010). Better educated or more literate farmers have been found to be earlier adopters of new technologies (FEDER et al., 1985; ROGERS, 2003). A positive link between education and technology adoption has been also found by KEBEDE et al. (1990). It is hypothesized that education positively affects the technology adoption.

Land size (X_3) represents the total land size owned by the farm household measured in Rai and used for agricultural production. It is hypothesized to also positively impact innovation and technology adoption. A positive relationship between land size or farm

size and innovation adoption has been already reported by some empirical studies (e.g. SAKA et al., 2005, KEBEDE et al., 1990; ROGERS, 2003).

The next variables are social capital variables: member of cooperative (X_4) is a binary variable measuring whether the farm household belongs to the cooperatives and takes on the value of 1 for membership and 0 otherwise. Participation (X_5) is a binary variable and takes on the value of 1 if the farm household participated in meetings organized in the village and 0 if otherwise. Bargaining power (X_6) is also a binary variable which takes on the value of 1 if the farm household could bargain the price and 0 if otherwise. Information (X_7) takes on the value of 1 if the farm household received information about GIs from local governmental bodies and 0 if otherwise. These four social capital variables (X_4 to X_7) are hypothesized to positively affect the adoption decision based on the following evidence: an important role of being member of associations or cooperatives for technology or innovation adoption has been reported by previous studies, e.g. of NKAMLEU and MANYONG (2005) and ASFAW (2008). Members of organizations such as cooperatives are privileged in terms of receiving managerial as well as financial support. But membership also serves as a source of skills, knowledge and information (MBURU et al., 2007; NWANKWO et al., 2009). Likewise, participation explains the adoption behavior (ROGERS, 2003). Early adopters are usually more socially involved than late adopters. With respect to the bargaining power, farmers in developing countries are typically in a weaker position than their buyers. However, participation in the quality assurance system, or the adoption of its certification system could increase their bargaining power. The work of HOBBS (2003), for instance, stated the positive effect of the participation in the GAP systems on increasing individual farmers' bargaining power vis-à-vis larger retailers or processors, especially when these farmers are members of farmers associations or cooperatives. Thus, the bargaining power can be increased not only by the quality but also by the volume of the products (LEMEILLEUR, 2011). Also the transfer of information via extension services by the government or via training courses which help overcoming the human capital constraints has been found to be crucial for the adoption decision (LONGO, 1990; KARKI and BAUER, 2004). Farmers with access to information through contacts with extension agencies will have more accurate information to do a cost-benefit analysis of such technologies or innovations (BUYINZA and WAMBEDE, 2008; SAKA et al., 2005; DOSS, 2006). In contrast, limited access to information due to a lack of well-functioning extension services negatively influences the decision making of farmers to adopt a new innovation (ZHAO, 2005; NGUYEN et al., 2007), since the farmers may be extremely uncertain about its profitability. However, observing the performance and procedures of relatives, neighbors, and friends having experimented with the innovation could be another alternative source for the farm households to access information in case the extension service has failed to provide them with the necessary information about the new innovation (FEDER et al., 1985).

The last social capital variable is trust (X_8) which is a binary variable indicating whether the farm households trust rice mills in giving correct information on rice quality in terms of moisture content. The rice moisture metering is done by the buyers, namely the rice mills and big agricultural cooperatives, without the farm households having the opportunity to control the measurement process and result. They have to accept the measurement result which determines the price. A trust-based type of contractual arrangement between buyers and producers has been found to be vital (DÖRR, 2009). This factor is hypothesized to have a positive influence on the adoption behavior of the farm households.

The economic capital variable income (X_9) is continuous representing the total annual income in Baht gained from all sources, namely (i) farm income from sales of livestock and crops including rice, and (ii) off-farm income from wage employment, from selling other valuable assets, and including pensions and remittances. ROGERS (2003) and ASFAW (2008) found a strong relationship between wealth and innovativeness. Assuming to be a proxy for wealth, income is therefore hypothesized to have a positive effect on adoption behavior.

Time to markets (X_{10}) and transportation costs (X_{11}) are continuous institutional variables. The time to markets measures the distance to the nearest market for buying or selling rice measured in hours, and the transportation costs represents the annual costs of transporting rice to the markets measured in per one unit of rice sold (Baht per ton). Negative relationships with the adoption decision are expected for time to markets and transportation costs. These hypotheses are based on the following evidence: the functioning of the GI system requires not only the availability of information about GIs, as discussed above, but also the functioning of GI markets and finally transparency of the monitoring process. The opportunity to adopt new technologies or innovations might sometimes be impeded by poorly developed institutions and infrastructure. This poor development of markets or institutions is characterized by a limited access to inputs and to markets (VANCLAY and LAWRENCE, 1994), as well as to capital and to information (YESUF and KÖHLIN, 2008). It is also characterized by high transaction costs arising from heavy search, monitoring and transportation costs, which particularly depend on the location of roads, markets and the road condition (YESUF and KÖHLIN, 2008) and may affect the response of the potential adopter (BROWN and LENTNEK, 1973). A summary of all the variables is presented in table 1.

Table 1. Definition of variables in the empirical model

Variable	Description	Values/ measure	Variable type	Expected sign
Dependent variable:				
GI certification adoption (Y_i)	Farm household adoption decision	1= yes; 0= no	Binary	
Independent variables:				
Household-level factors:				
Human capital				
Gender (X_1)	Sex of household head	1= male; 0= female	Binary	±
Education (X_2)	Schooling of household head	years	Continuous	+
Natural capital				
Land size (X_3)	Total land size for agricultural use	Rai[1]	Continuous	+
Social capital				
Member of cooperative (X_4)	Household is a member of the cooperative	1= yes; 0= no	Binary	+
Participation (X_5)	Household actively participated in meetings organized in the village	1= yes; 0= no	Binary	+
Bargaining power (X_6)	Household could bargain the price	1= yes; 0= no	Binary	+
Information (X_7)	Household got information on GIs from local governmental bodies	1= yes; 0= no	Binary	+
Trust (X_8)	Household trusted rice mills in giving correct information on rice quality	1= yes; 0= no	Binary	+
Economic capital				
Income (X_9)	Total annual income	Baht	Continuous	+
Institutional factors:				
Time to markets (X_{10})	Time to the nearest markets for rice sale	hours	Continuous	-
Transportation costs (X_{11})	Transportation costs per unit sold	Baht per ton	Continuous	-

Note: [1]1 Rai = 0.16 ha

Source: own compilation

4 Survey Site and Data Collection

In comparison with the industry sector which accounts for about 40 percent of GDP in 2008, agriculture accounts for only 8.8 percent of the GDP (National Economic and Social Development Board (NESDB, 2008)). Nevertheless, agriculture is still an important sector for Thailand's economy. Almost 15 million people are engaged in agriculture. This accounts for around 39 percent of the total labor force (NSO, 2009 and 2010). About 53 percent (or 58 million Rai) of the country's total agricultural area is used for rice cultivation. Rice is not only a major staple food for domestic consumption, but it is also one of the most important export crops in Thailand, next to sugarcane, palm oil and natural rubber (NESDB, 2008). The country has long held a reputation as the world's leading rice exporter (USDA, undated). It controls more than 30 percent of all milled rice exports and more than 50 percent of all broken rice exports (FAOSTAT, 2009). In 2008, about 10 million tons were exported. In 2009, this amount dropped to 8.6 million tons (OAE, 2008-2009) mainly due to weak demand especially from the main importing and well stocked Asian countries and due to the relatively high price of white rice in Thailand propped up by government intervention as compared to e.g. Vietnam (BANGKOK POST, 2009). Overall, also the rice export value has gone up, namely from US$ 1.6 billion (with 44.48 Baht/1 US$) in 2001 to US$ 5 billion (with 34.34 Baht/ 1 US$) in 2009. For the export year 2009, almost 40 percent of the total rice export value stems solely from exporting Thai Jasmine rice, also called Thai Hom Mali rice, which brought foreign currency of around US$ 2 billion to the country (OAE, 2008-2009). From the total cultivated area for rice, almost 70 percent can be found in Northeastern Thailand with an average major rice production of about 10.4 million tons per year and an average second rice production of about 3 million tons per year (OAE, 2010). From the total labor force of around 15 million people being engaged in agriculture, around 7 million farmers or about 2.8 million rural households are from Northeastern Thailand. At the same time, the Northeast is the poorest part of Thailand with the lowest per capita monthly income of 6,272 Baht or around US$ 183 (with 34.34 Baht/1 US$) (OAE, 2010; NSO, 2009). In 2009, the poverty incidence in the Northeast region amounts to around 14 percent, taking into account the poverty line of 1,473 Baht per capita per month (NESDB, 1988-2009).

In order to study the behavior of Thai Jasmine rice farmers, a case study was conducted in 2009 in Northeastern Thailand. The distribution of Thai Jasmine rice certified farm households in the TKRH area is shown in table 2. In order to avoid distortionary effects caused by other certification schemes, Surin province was excluded from the sample due to the presence of organic certification in the area. The two districts Kasetwisai and Rasrisalai with the highest ratio of GI certified farmers were purposively selected. Using the disproportionate stratified random sampling technique, the total population for each district was stratified into two main groups: (1)

GI group and (2) non-GI group. The total sample size is 370 farm households of which 142 farm households are GI certified and 228 farm households are not GI certified. A pilot study was a priori conducted in May 2008 in Kasetwisai District for pre-testing the questionnaire. In addition, it served to collect the list of the target population for sampling purpose. The main survey was then conducted from March to June 2009 using face-to-face interviews with a structured questionnaire. The questionnaire included sections about farm household characteristics, the production pattern, farm and non-farm income, perception about GIs, social capital such as cooperation, trust and network building, bargaining power, obstacles in the GI registration procedure, costs and benefits of certification, assets and expenditures for food and non-food consumption, shocks, borrowing and savings, and finally housing conditions of the farm households.

Table 2. Certified GI households of all provinces in the TKRH area

Province	District	No. of certified GI farmers	Certified farmers of the district/certified farmers of the province (in %)	Own sample	
				No. of GI farmers	No. of non-GI farmers
	Kasetwisai	**330**	**59.35**	**85**	**169**
	Patumrat	55	9.89		
Roi Et	Ponsai	58	10.43		
	Suwannaphoom	113	20.32		
	Total	556	100		
	Chumponburee	250	85.32		
Surin	Tatum	43	14.67		
	Total	293	100		
	Rasrisalai	**102**	**83.61**	**57**	**59**
Srisaket	Silalad	20	16.39		
	Total	122	100		
Mahasarakam	Payakkaphoompisai	90	100		
	Total	90	100		
Yasothorn	Mahachanachai	70	100		
	Total	70	100		
TOTAL		1,131		142	228

Source: own compilation based on data from DIP (2007)

5 Results and Discussion

In this section, descriptive statistics first describe the background characteristics and distribution of variables among the sample population. A logit model is then used to

examine associations between the dependent variable and the independent variables. All analyses presented in this paper relied on the design-based approach, as design features were incorporated in the analysis due to the disproportionate stratified sampling technique[2].

5.1 Descriptive Findings

The characteristics of the sample households, their farms, their economic conditions and income profile are presented in table 3. The statistics are the estimated means for the continuous variables and for their ratios. The last column represents the F statistic from the test of significance using adjusted Wald tests for comparing means of all continuous variables between GI and non-GI groups.

The rice farmers in our sample are on average 52 years old and they have a very long experience in rice cultivation with 38 years. In general, the GI farm households have larger families and own more land, and have a higher total farm income than the non-GI group. The weighted means of ratios of rice land in total owned land and jasmine rice land in total owned land reveal that almost all land (about 86 percent) in both groups is devoted to rice cultivation, namely to Jasmine rice cultivation. Accordingly, an average of 71 percent of the farm income is derived from rice cultivation. For the GI group, this share amounts to 83 percent, compared with 71 percent for the non-GI group. Considering the total annual income, around 40 percent is derived from rice cultivation for the GI group, compared with around 25 percent of the non-GI group. The total annual income does not differ between the two groups, but the ratio of rice income in the total annual income and the ratio of rice income in total farm income. On average, around 59 percent of the farm households' total annual income is derived from non-farm income, including salaries from public sector employment or remittances. In the non-GI group, 36 farm households (or 16 percent) were counted as poor with a total annual income falling below the regional poverty line, compared with 35 farm households (or 25 percent) in the GI group.

[2] Sampling weights are applied to each observation of the sample in order to correct for unequal probabilities of selection due to stratification and to obtain unbiased and consistent estimates of effects or associations (DEATON, 1997; LEE and FORTHOFER, 2006). All quantitative analyses in our study were performed using the survey (*svy*) methodology in the software package Stata (version 11). The survey methodology in Stata accounts for the effects of weights on significant tests and it also contains procedures using the Taylor Linearization Method for correctly estimating the variance when analyzing survey data with complex survey design. This method is one of the three most commonly used and available statistical approaches, besides the Balanced Repeated Replication (BRR) and the Jackknife to correctly estimate variance for regression models using survey data (JOHNSON and ELLIOTT, 1998; STURGIS, 2004; STATACORP, 2009).

Table 3. Characteristics and income profile of sample farm households

Indicators	Total (N=370)	GI (n=142)	Non-GI (n=228)	Test of Sig.
Household and farm characteristics				
Age of household head (Years)	52.25 (10.28)	54.06 (35.95)	52.18 (8.19)	1.62
Family size (Persons)	4.63 (1.38)	4.71 (5.24)	4.63 (1.09)	0.15
Total owned land[a] (Rai)	38.18 (29.45)	43.33 (110.16)	37.98 (23.39)	1.43
Total land under rice (Rai)	37.56 (29.66)	42.83 (107.57)	37.36 (23.59)	1.52
Total land under jasmine rice (Rai)	33.89 (29.61)	39.95 (108.23)	33.66 (23.54)	1.99
Ratio of land under rice in total owned land (%)	85.66 (16.70)	90.48 (105.30)	85.48 (12.61)	3.51
Ratio of land under jasmine rice in total owned land (%)	85.66 (16.70)	90.48 (105.30)	85.48 (12.61)	3.51
Experience in rice cultivation (Years)	38.46 (10.81)	38.26 (41.65)	38.47 (8.57)	0.02
Income profile				
Household total annual income (1,000 Baht)	388.20 (374.04)	393.80 (1738.53)	387.99 (293.07)	0.01
Household total annual farm income (1,000 Baht)	134.87 (256.38)	143.05 (720.61)	134.56 (205.99)	0.06
Household total annual non-farm income (1,000 Baht)	253.33 (267.08)	250.75 (1430.24)	253.43 (206.47)	0.00
Ratio of rice income in total annual income (%)	25.84 (26)	40.13 (103.78)	25.30 (20.53)	13.33***
Ratio of rice income in total farm income (%)	71.13 (34.71)	82.92 (88.82)	70.69 (27.98)	7.04**
Ratio of non-farm income in total annual income (%)	58.91 (33.81)	49.88 (111.59)	59.25 (27.07)	3.73
Annual per capita household income (1,000 Baht)	89.14 (91.97)	87.59 (337.60)	86.20 (73.16)	0.01
No. of households below poverty line	71	35	36	0.26

Note: * Significant at α=5%; ** significant at α=1%; *** highly significant at α=0.1%; Standard deviation is in parenthesis; [a] Including residential area

Source: own calculation

Table 4 shows the descriptive and comparative statistics of variables included in the model. The figures present the estimated means for the continuous variables and proportions given in percentage for the binary variables. The test of significance has been carried out by using adjusted Wald tests for comparing continuous data, and Rao-Scott corrected tests[3] for comparing categorical data between the two groups.

[3] The Rao-Scott corrected test is a Pearson chi-square statistic with the RAO and SCOTT (1984) second-order correction. After the RAO and SCOTT (1984) second-order correction, the Pearson chi-square statistic is converted into an F statistic (LEE and FORTHOFER, 2006; STATACORP (2009: 116).

Table 4. Descriptive and comparative statistics of factors affecting GI certification adoption

Variable	Mean (Std. dev.) or % for total sample (N=370)	Mean (Std. dev.) or % for GI group (n=142)	Mean (Std. dev.) or % for non-GI group (n=228)	Test of signi-ficance
Household-level factors:				
Human capital				
Gender (1=male) in %	38.54	59.87	37.74	10.41**
Education (years)	5.27 (2.81)	6.21 (11.03)	5.23 (2.22)	5.42*
Natural capital				
Land size (Rai)	36.88 (29.44)	42.60 (107.98)	36.66 (23.41)	1.79
Social capital				
Member of cooperative (1=yes) in %	67.88	81.09	67.38	5.27*
Participation (1=yes) in %	79.62	88.31	79.30	2.93
Bargaining Power (1=yes) in %	0.00046	0.60	0.03	14.48***
Information (1=yes) in %	40.97	66.48	40	15.17***
Trust (1=yes) in %	8.3	10.35	8.22	0.26
Economic capital				
Income (in thousand Baht)	388.20 (374.04)	393.80 (1738.53)	387.99 (293.07)	0.01
Institutional factors:				
Time to markets (hours)	0.86 (0.65)	0.97 (2.69)	0.85 (0.51)	1.61
Transportation costs (Baht per ton)	233.29 (430.97)	309.13 (2011.67)	230.42 (337.35)	1.08

Note: * Significant at α=5%; ** significant at α=1%; *** highly significant at α=0.1%; Standard deviation is in parenthesis

Source: own calculation

On average, around 40 percent of the rice farmers in our sample are men. Comparing the mean values between the groups clearly indicates that the GI group has a higher number of male farmers with almost 60 percent compared to that of the non-GI group with only 38 percent. The means of the two groups are significantly different ($p < 0.01$). The average education level of the household heads in our sample is quite low with only around six years of schooling and 70 percent of them having at most primary education. The adjusted Wald test indicates a significant difference in the education level of the household head between both groups at the 5 percent significance level. On average, the GI group has relatively more land (around 43 Rai) available for agricultural use than the non-GI group (around 37 Rai), but the difference is not significant.

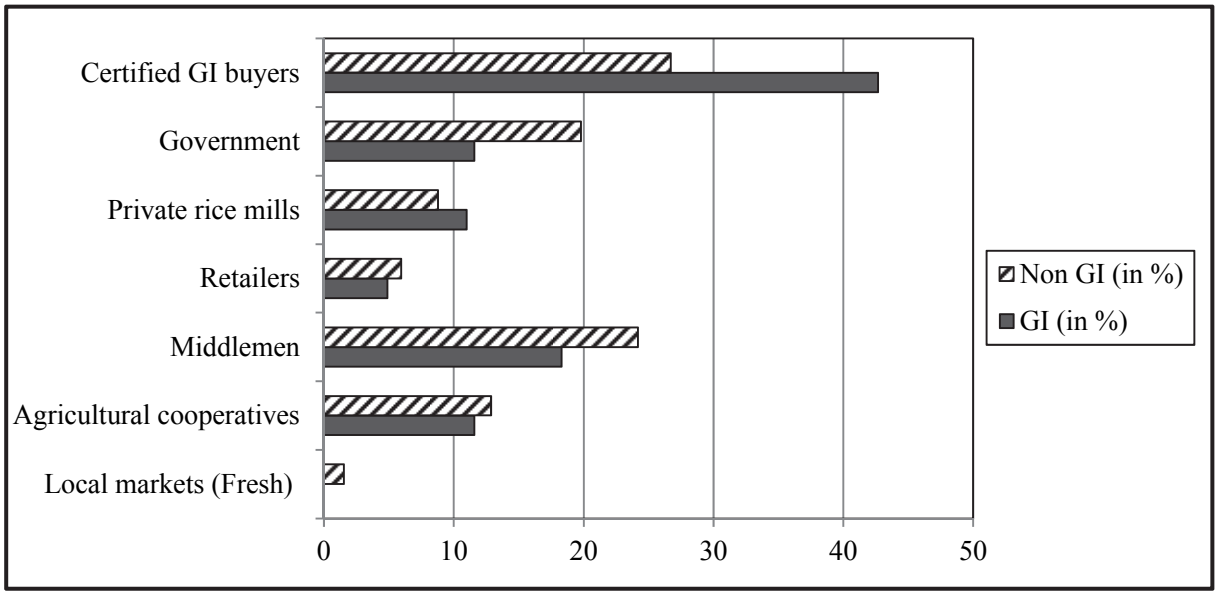
The participation in cooperatives is relatively widespread among the sampled farmers. Close to 70 percent of farm households are members of cooperatives. Comparing between groups, we find that about 80 percent of the farm households in the GI group are members of the cooperative compared to the non-GI farmers with only 67 percent. This difference is significant at the 5 percent level as can be seen from the Rao-Scott corrected test. With respect to other social capital factors, it can be seen that a high proportion (almost 80 percent) of farm households participate in meetings organized in the village. The bargaining power has been found to be negligible for the sampled farmers. Almost all of them had to accept the rice price being fixed by the buyers, even though most of the GI farm households expect to receive a price premium when adopting GI certification. Nevertheless, the mean difference is highly significant at the 0.1 percent level. Regarding information, the result shows that around 40 percent of farm households had access to information about GI from local governmental bodies. There is a significant difference between the groups. More GI farm households (66 percent) received information about GI from local governmental bodies than non-GI farm households (40 percent). When selling rice to the rice mills, a slightly higher percentage of the GI farm households (10 percent) than the non-GI farm households (8 percent) trusted rice mills in giving correct information on quality in terms of rice moisture content. This difference is, however, insignificant.

In order to sell their rice, the rice farmers face the problem of long distance to rice markets. They are widely dispersed in the huge TKRH area spending on average close to 1 hour to reach the markets which are sometimes located in the district center. They often have to make detours to reach the rice markets due to the poor road conditions. The farmers' costs of transporting the rice to the markets amount on average to 233 Baht per ton. While GI farmers pay around 309 Baht per ton, non-GI farmers pay only 230 Baht per ton.

After the rice harvesting period, the farm households have the choice to sell rice to many different buyers such as retailers in local markets, agricultural cooperatives, middlemen, private rice mills, government and/or to very few certified GI rice buyers (figure 3), however, a price premium for GI rice is only paid by certified GI buyers. Accessing GI rice markets by the GI farm households is thus associated with limited choices when they want to get a price premium and with relatively higher transportation costs since they must often travel longer distances to sell their GI rice to the certified GI buyers located in the district center. Thus, the GI farmers only sell their GI rice to the GI buying points if the price premium of 500 Baht per ton compensates for the higher transportation costs. Figure 3 confirms that while more than 40 percent of the GI farm households sell rice to the certified GI buyers, they also choose other options like middlemen, cooperatives or rice mills. Many non-GI farm households also

sell their rice to the certified rice buyers, but compared with the GI farm households they sell more often to the government (20 percent) or to middlemen (25 percent) who usually come directly to the rice field or to the village to pick up the rice. Selling rice to the government means that the farm households participate in the rice price guarantee scheme[4] of the government and store rice at home until the concessionaire, cooperative or private rice mills in the region come to their residence and take the rice. The farm households were promised that their rice will be bought at a certain price level which is normally slightly higher than the market price.

Figure 3. Rice buyers in the TKRH area



Source: own presentation

As can be seen from figure 3, private rice mills are often not the preferred points of sale. This might be explained by the observation that rice mills are known for their strict rice quality controls, as opposed to middlemen or retailers.

5.2 Logit Model Results

The results of the logit model are presented in table 5. A series of logistic regression diagnostics were applied for detecting interaction effects, correlations, multicollinearity and other specification errors. The specification link test was used to detect a specification error. Collinearity was assessed by the correlation matrix for variables in

[4] This price guarantee scheme has been now replaced by a rice pledging scheme introduced by the newly elected government in August 2011.

which optional significance levels are calculated, based on survey-based variance estimates for the correlations. Additionally, measures of tolerance and variance inflation factors (VIF) were examined. To determine whether any of the adoption variables such as information or member of cooperative was endogenous in the model, a two-stage Hausman specification test was used (HAUSMAN, 1978). The test failed to reject exogeneity at $P < 0.05$. The adjusted Wald test statistic is used to assess the model fit (LEE and FORTHOFER, 2006). For more statistical power, a goodness-of-fit test, i.e. F-adjusted mean residual test, of ARCHER and LEMESHOW (2006) was used in our analysis. The test showed that there is no lack of fit of the selected logit model using survey sample data (see also ARCHER et al., 2007). Finally, we have evaluated the predictive accuracy of our fitted model by reporting the area under the corresponding receiver operating characteristic (ROC) curves (AUC) (CLEVES, 2002) measuring how well a parameter can distinguish between two groups. The AUC of 0.7469 reveals that our model correctly predicts around 75 percent of the cases. table 5 also gives design effects of the regression coefficients. Design effects of all regression coefficients are less than 1 indicating that only very few cases would be needed to obtain the same measurement precision obtained with simple random sampling. This suggests that our complex design is statistically efficient for the given sample size (N = 370) as opposed to a simple random sample.

The regression coefficients show that information, gender, and member of cooperatives, are as earlier expected, positively and significantly related to the logged odds of GI certification adoption at the significance level of 0.1 percent, 1 percent and 5 percent, respectively. All other factors turn out to be insignificant. The marginal effects indicate the same trend as the parameter estimates. The model also predicts higher and more significant marginal effects of information, gender and member of cooperative on the GI certification adoption. The odds ratio of the information of 3.79 means that the odds of GI certification adoption are 3.79 times as large indicating that a one-unit increase in the variable (from 0 to 1) multiplies the odds of the GI certification adoption by 3.79, suggesting that receiving information about GI from local governmental bodies makes the GI certification adoption almost four times more probable. The importance of information for the adoption decision has been also found by many other studies e.g. of SAKA et al. (2005) and DOSS (2006) as discussed in Section 3.

Table 5. Parameter estimates for GI adoption model and odds ratio

Variable[a]	Coef.	Linearized std. err.	P-Value	Odds ratio	dy/dx[b]	Design Effects
Intercept	-6.5547	0.7582	0.000	NA	NA	0.3156
Gender	1.0936	0.3838	0.005	2.9850	0.0368**	0.2317
Education	0.0694	0.0566	0.221	1.0719	0.0023	0.3099
Land size	0.0051	0.0050	0.314	1.0051	0.0002	0.6259
Member of cooperative	0.9577	0.4366	0.029	2.6057	0.0322*	0.2990
Participation	0.6908	0.4719	0.144	1.9954	0.0233	0.2349
Bargaining power	1.7938	1.5565	0.250	6.0122	0.0604	0.0631
Income	-0.0000	0.0000	0.469	0.9999	0.0000	0.2378
Information	1.3336	0.3511	0.000	3.7945	0.0449***	0.2671
Time to markets	0.1148	0.2375	0.629	1.1216	0.0039	0.2370
Transportation costs	0.0006	0.0003	0.095	1.0006	0.0000	0.2656
Monitoring costs	0.4029	0.5588	0.471	1.4963	0.0136	0.2719

Note: [a] Dependent variable: certified GI ($n_1 = 142$) and non-certified GI farm households ($n_2 = 228$); N = 370.
[b] Stata reported the exact discrete change of the dummy independent variables from zero to one.[5]
* Significant at α=5%; ** significant at α=1%; *** highly significant at α=0.1%
NA = not applicable.
Except p-value, all other statistics reported herein use 4 decimal places in order to maintain statistical precision.

F-adjusted mean residual test to test a goodness-of-fit F (9, 359) = 0.676;
Prob > F = 0.731
Area under the ROC curve = 0.7469

Source: own calculation

Likewise, for gender, the odds ratio of 2.99 means that the odds of GI certification adoption are almost 3 times higher for male farmers than for female farmers. When the household heads are male, the GI certification adoption is thus made around 3 times more probable. Our result supports the findings of NKAMLEU and MANYONG (2005). Finally, the odds ratio of 2.61 for member of cooperative indicates that the odds of the GI certification adoption for farm households being members of cooperatives are 2.61 times as large. This means that being a member of the cooperative makes the GI certification adoption 2.61 times more probable. An important role of being member of cooperatives has been also found to be significant for innovation adoption by other studies e.g. of NKAMLEU and MANYONG (2005) and ASFAW (2008).

[5] The calculating procedure of the marginal effects in Stata is discussed e.g. by WOOLDRIDGE (2009: 583-584).

6 Conclusion

This paper explored the determinants which are likely to predict the behavior of farm households in adopting GI certification for Jasmine rice in the TKRH area in the Northeast of Thailand. A major finding of this study is that access to information mostly determines the probability of adoption of GI certification, followed by membership of cooperative and the personal variable gender. This finding is in line with previous adoption studies on certification in other agricultural sectors. How a GI system is successfully introduced and promoted in specific GI regions depends particularly on the information provided to the farm households and finally on the information sources. The cooperative serves as a crucial intermediary between the farm households and the government being the primary source of information about GI. Strengthening the role of the cooperatives may therefore promote the effectiveness of information dissemination.

The descriptive data in the paper indicate that the limited marketing options of GI certified rice, characterized by high transportation costs and limited availability of certified buyers, may be a potential constraint to GI adoption. A value chain analysis could reveal to what extent the access of GI farm households to their points of sale can be improved. Future research is also still needed to analyze to what extent GI certification affects the welfare of the farm households in the TKRH area; possible benefits such as price premia paid for GI Jasmine rice on the one hand and costs of certification on the other hand need to be considered. Another area that merits further research is the issue how the decision-making processes within households affect the GI certification adoption.

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