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UMK Procedia 1 (2014) 8 – 17

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International Agribusiness Marketing Conference 2013, IAMC 2013, 22-23 October  
2013, Kuala Lumpur, Selangor, Malaysia

## Adoption of fragrant rice farming: The case of paddy farmers in the East Coast Malaysia

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### Abstract

Annually, Malaysia has to import approximately 30% of rice, including fragrant rice (Basmati and Jasmine type) to meet the shortage of domestic demand. The import of this specialty rice shows an up surging trend every year with a value of RM500 million. Mas Wangi or MRQ74 that has special characteristics and 80% similar attributes to Basmati type has been officially released in year 2005. The special characteristics such as long and slender grain shape, non-sticky and aromatic rice makes it preferred by Malaysian consumers and enabling it to tap the higher-end rice market, compared to normal white rice. The fragrant rice farming is one of the government initiatives to produce fragrant rice in large areas and needs full commitment from the farmers in non-granary areas. This study seeks to determine factors that influence new rice variety, MRQ74 adoption among paddy farmers in East Coast, Malaysia including the adoption behaviour. The study involved 28 farmers in non-granary areas in two districts; Pasir Mas and Tanah Merah, Kelantan via an in-depth interview approach. The results revealed that apart from the technology characteristics, there are other significant aspects that influence the adoption decision-making of the farmers such as extension services, capital resources, social influences, and institutional factor.

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Peer-review under responsibility of Universiti Malaysia Kelantan.

*Keywords:* technology adoption; fragrant rice; paddy farmers; non-granary areas; East Coast Malaysia

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## 1. Introduction

Rice is the staple food of half the world's population that contributes to 20% of the total man caloric intake (Bhattacharjee *et al.*, 2002). Nevertheless, total caloric intake for the Asian population is around 40% to 80% where 95% of world rice production comes from Asian countries such as China, India, Indonesia, Bangladesh, Vietnam and India. World trade figures are very different to those for production, as only about 5% to 7% of rice produced is traded internationally. Due to the small volume, the price of rice can rise sharply when something happens to the major exporter countries such as the uncertainty of the climate conditions that will affect the rice production (Ghosh, 2008; Walker, 2008) and impose restricting export. Fragrant rice (Basmati and Jasmine type) shows the highest price in the world market and accounts for about 15% to 18% of world trade. According to Childs and Kiawu (2008), the rice price has hit nearly tripling price within November 2007 to May 2008. The world price for Basmati rice showed the highest value in year 2008 at USD1,077/metric ton (FAO, 2012).

Hence, Malaysia Agricultural Research and Development Institute (MARDI) as a statutory body is responsible to carry out extensive research and develop new rice varieties that give high yields and quality, including agronomic packaging to support the commercialization of the new products. Hitherto, MARDI has created 35 new rice varieties that have special characteristics such as high yields, as well as, resistant to pest and disease. One of the varieties that has been innovated by MARDI is Mas Wangi or MRQ74, which has special characteristics and 80% similar attributes to Basmati type. This variety has been officially released by former Prime Minister YAB Tun Abdullah Ahmad Badawi in 2005. In addition, MRQ74 also is one of the high-quality rice that good for health, which has less starch content and low glycemic index suitable for diabetics. The special characteristics such as long and slender grain shape, non-sticky and aromatic rice makes it preferred by Malaysian consumers (Hanis *et al.*, 2012) and enabling it to tap the higher-end rice market, compared to normal white rice. Annually, Malaysia has to import approximately 30% of rice including fragrant rice (Basmati and Jasmine type) to meet the shortage of domestic demand. The import of this specialty rice shows an up surging trend every year with a value of RM500 million. The price shows a significant price premium compared with other rice varieties because of the quality and special characteristics of the rice that can be identified by the appearance, aroma and taste. In addition, scarcity supply due to the increasing demand in the market is an important factor that affects the price of the fragrant rice. In year 2011, MRQ74 has been introduced under a new Entry Point Project (EPP) for non-granary areas. This initiative will help the country to reduce dependence on imported rice by 40% and foreign exchange about USD10 to USD27 million annually. Fragrant rice production requires a comprehensive workflow to guarantee the authenticity of the rice seeds as well as the quality of the fragrant rice during planting, harvesting and milling. Dedicated areas have to be identified for the farming of this variety to ensure no contamination by the normal white rice variety. Therefore, this study is generally to discover and determine factors that influence new rice variety, MRQ74 adoption among farmers in East Coast, Malaysia. Furthermore, this study seeks to investigate benefits that the farmers gain from MRQ74 cultivation and the adoption behaviour. The results of the study could provide information to ensure the sustainability of the fragrant rice industry in Malaysia.

## 2. Literature Review

### 2.1. Diffusion of innovation theory

Innovation is a widely discussed topic, especially in the contexts of agriculture, business, information technology, engineering, and public development. Agricultural innovation can be defined as “the idea, method, practice or technology that is considered as new by the individual or organization and play an important role in economic development”. Diffusion of Innovation Theory (DOI) is related to the technological model that depicts the innovation is connected via the specific channels from time to time in a particular social system (Rogers, 1983). The theory has been widely used to describe and explain the behavior of the organization and individual in adopting the innovation (Frambach and Schillewaert, 1999; Gopalakrishnan and Damanpour, 1994; Lin *et al.*, 2007; Lim, 2009; Marcati *et al.*, 2008). The DOI model resembles Technology of Acceptance Model (TAM), which stresses behavioral intention to adopt new technology is due to psychological and social influences of the individual (Davis, 1989). In addition, Theory of Planned Behavior (TPB) (Ajzen, 1991) also has the same features with the DOI which stated that there are three factors that affect individual acceptance of new products namely attitude, subjective norm and perceived behavioral control.

Rogers (2003) defined the adoption process as “the process through which an individual or other decision making unit passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision”. Adoption can be divided into two phases namely initiation and implementation in which the decision to adopt certain innovation or technology happens between the two phase (Gopalakrishnan and Damanpour, 1994; Zaltman *et al.*, 1973). In the initiation phase, the organizations will recognize the innovation before they form the attitude and evaluate the new products or ideas (Gopalakrishnan and Damanpour, 1994); which consist of awareness, consideration and intention phases. While, in the implementation phase, the organizations will decide whether to execute the innovation before they agreed to adopt and continued use. This decision-making phase is the beginning of the actual implementation of an innovation. It will be considered successful when the innovation is received into the organization (Rogers, 1995; Zaltman *et al.*, 1973) and the target recipients are committed to continue innovation for a long term (Bhattacharjee, 1998; Rogers, 1995). According to Rogers (1995), there are five innovation characteristics that will affect the decision to adopt the innovation namely relative advantage, compatibility, complexity, observability and triability.

### 2.2. Adoption of innovation

Adoption is a decision process of any individual or organization to make use of an innovation or new technology (Gatignon and Robertson, 1991). Based on the DOI, there are few characteristics that influence adoption of innovation such as innovation attributes. It can be classified into five categories namely relative advantages, compatibility, complexity, triability and observability. Relative advantage is “the degree of relative advantage to which an innovation is perceived as better than the idea it supersedes”. It can be measured in terms of economic benefits, cost reductions, social aspects, suitability and satisfaction. Economic factor is one of the factors that are important in affecting adoption (Carboni and Napier, 1993; Fuglie and Kascak, 2001). It is expected that the adoption level will increase when the adopters obtained the greater benefits (Jeon *et al.*, 2006; Lin *et al.*, 2007). Secondly, compatibility is the “degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters.” The potential adopters will refuse to adopt if the innovation is not compatible with the values and norms of a social system. Thirdly, complexity is the “degree to which an

innovation is perceived as difficult to understand and use.” The complicated innovation such as in aspects of skills, technology, or knowledge will cause the acceptance of adoption become slower because of these constraints (Gopalakrishnan and Damanpour, 1994; Lin *et al.*, 2007). Fourthly, triability is the “degree to which an innovation may be experimented with on a limited basis.” The potential adopters are more favorable to test the innovation on a small scale before they can decide about it. Such experience will reduce the uncertainty regarding the outcome of the innovation. Meanwhile, observability is the “degree to which the results of an innovation are visible to others.” The visibility of the innovation is positively related to the possibility of adopting an innovation. Many studies have been carried out in various fields to find out and understand the factors that influence adoption of new technology among farmers (Li *et al.*, 2010; Pannell *et al.*, 2006; Rogers, 1995).

Besides of that, individual characteristics such as demographic factors (age and education) will also influence individual’s perception and adoption decision of innovation as well as their attitudes toward farming and environment (Prokopy *et al.*, 2008). The decision to adopt innovation is related to the knowledge or information on the innovation. Once the individuals are aware and have knowledge about the innovation, the socio-economic characteristics could have significant effect on the adoption decision-making process (Knowler and Bradshaw, 2007; Rasul *et al.*, 2004; Rigby and Caceres, 2001). Marketing problems such as lack of marketing information and credit as well as insufficient information regarding the technology will also influence the adoption rate (Rasul *et al.* 2004). Therefore, role of extension services is very important to overcome this problem. In addition, institutional factors also play a role in the decision-making process as well as the economic benefits that they can gain from the innovation (Thapa and Rattanasuteerakul, 2011).

## Methodology

The intention of this study is to discover factors that affecting farmers' adoption on converting to fragrant rice farming in the East Coast Malaysia. Data were attained via in-depth interviews using a structured questionnaire consisting of open-ended questions which were to explore and describe the farmers' decision in adopting, as well as their experiences in planting the new rice variety namely, MRQ74. The study involved 28 farmers in non-granary areas in two districts; Pasir Mas and Tanah Merah, Kelantan. In the context of this study, the target respondents have been selected due to the involvement in planting this rice variety. The selections of the respondents were through convenience sampling in which it has been identified by the Department of Agriculture (DoA) extension agents. The respondents were contacted to ask their willingness to participate in the survey. The interviews consisted of 15 open-ended questions that emphasizing on factors that affect farmers' adoption on the new rice variety including their perception on the variety and adoption behavior. In addition, the respondents were asked to impart socio-demographic information, including gender, age, education level, number of years in farming and income. The interviews were between 40 to 50 minutes long. All data were analyzed based on frequencies of responses and information to the open-ended questions. For the open-ended questions, farmers' responses have been transcribed, reviewed and analysed to portray farmers' viewpoint regarding decisions in adopting fragrant rice farming.

## 3. Results and discussion

### 4.1. Socio-economic profiles of farmers

The study involved 28 farmers which 24 (85.7%) were men and 4 (14.3%) were women. All of them were adopters of new rice variety, MRQ74. The age ranges were between 33 to 70 years old, and the average age was 54 years old. Majority of the farmers (53.6%) have obtained secondary school education. Most of the farmers (42.9%) have been involved in paddy farming between 11 to 20 years. Of the 28 respondents, 15 (53.6%) of them depended on rice cultivation as a major source of income, while 13 (46.4%) farmers reported that they had other farm activities instead of rice cultivation and off-farm income. They grew Most farmers, who have high non-rice incomes, were likely to invest and adopt new technology rice as a secondary source of income due to low-income that they gained from paddy cultivation. Most of the farmers (78.6%) gained farm income less than RM1,000 per month. On average, it showed that shares of farmers non-farm income was approximately 65%. According to Davis (2003), the shares of non-farm income in Asian countries were ranged between 29% and 32% of total household income. It also showed a similar trend in Latin American countries (40%), as well as sub-Saharan Africa (30% to 42%). (Mariano *et al.*, 2012). Table 1 summarizes the results of socio-economic characteristics of the farmers.

Table 1. Socio-economic profiles of farmers

Profile	Frequency (n)	Percentage (%)
<b>Age</b>		
30 years - 39 years	1	3.6
40 years - 49 years	7	25.0
Above 49 years	20	71.4
<b>Gender</b>		
Men	24	85.7
Women	4	14.3
<b>Race</b>		
Malay	28	100.0
<b>Level of education</b>		
Not attend school	2	7.1
Primary school	9	32.2
Secondary school	15	53.6
Tertiary level	2	7.1
<b>Number of years operation</b>		
Less than 10 years	7	25.0
11 - 20 years	12	42.9
21 - 30 years	4	14.3
31 - 40 years	2	7.1
More than 40 years	3	10.7
<b>Farm size</b>		
Less than 5 hectares	20	71.4
5 - 10 hectares	5	17.9
11 - 15 hectares	2	7.1
More than 15 hectares	1	3.6
<b>Income</b>		
Less than RM 1,000	22	78.7
RM 1,000 - RM 1,999	2	7.1
RM 2,000 - RM 2,999	2	7.1
More than RM 3,000	2	7.1

Note: n = 28

#### 4.2. Factors affecting adoption of fragrant rice farming

An individual's decision to change behaviour is complex, and it involves two phases of decision-making; adoption decision and continuity of innovation. There are several factors that affect and influence a farmer's decision to use improved or new rice variety (MRQ74). The study has identified few factors that influence farmers' decision-making, including the economic and social concerns.

##### i. Technology characteristics

Technology characteristics are one of the major drivers that related to farmers' adoption decision. Twenty six farmers indicated that high yield and similar cultivation practices with the normal white rice were their reasons for switching to the new rice variety, MRQ74. In addition, 24 out of 28 farmers switched to cultivate MRQ74 due to the high selling price, resistant to pest and disease (20 farmers), low production costs (19 farmers) and high-quality rice (16 farmers). The normal white rice had higher costs compared to MRQ74, particularly in costs of herbicides and pesticides (Syahrin *et al.*, 2008). Adoption of innovation is related to the changes in input and output prices (Jarvis, 1981; Caswell *et al.*, 1990) such as

seed prices, herbicides and pesticides, as well as rice selling price. Increases of rice quality will also increase the farmers' income.

ii. Extension services

Based on the discussion with the farmers, 23 farmers revealed that the efficiency of the extension agents in disseminating and delivering technology of MRQ74 has encouraged them to switch to the new rice variety. Furthermore, participation in hands-on training as well as on farm demonstrations (22 farmers) has also influenced and assisted the farmers to make a wise decision. Exposure to such information will help farmers in making decisions due to the uncertainty about the technology (Mariano *et al.*, 2012; Feder and Umali, 1993).

iii. Capital resources

Capital resources such as credit availability, financial assistance, as well as land and labor have shown to be significant in adoption studies. The study has indicated that 23 farmers who have enough resources such as credit, land and labor were more likely to adopt new rice variety. This is in line with previous study by Feleke and Zegeye (2006) that farmers who have access to credit have a great tendency to adopt improved maize varieties.

iv. Social influences

Twenty farmers revealed that success of other farmers in cultivating MRQ74 has motivated them to adopt this rice variety. Besides that, communication among the farmers has also encouraged and influenced farmers' adoption decision-making. Generally, individuals tend to communicate with other members within the social network to help them make decisions (Burkhardt and Brass, 1990; Katz and Tushman, 1979). Previous studies have shown that non-economic factors such as social concerns have played a role in the adoption decision to farmers (Rigby *et al.*, 2001; Carlsson *et al.*, 2007).

v. Institutional factor

Institutional factor that affected conversion to the new rice variety was government policy. Guaranteed minimum price that has been set by the government has influenced 22 farmers to shift to this new variety. Rice millers bought MRQ74 rice at a higher price than the price of normal white rice from 16% to 20%. Higher price of rice has encouraged and motivated the farmers to adopt the new rice variety. Moreover, incentives of agricultural inputs also played a role in this matter. Currently, present paddy farmers received incentives of RM2,500 per hectare. According to Avellà and García-Mollá (2008), policies changed by the government will affect the adoption rate in new technology. To ensure the sustainability of the fragrant rice farming, the government should grant better incentives instead of the higher price.

#### 4.3. Post-adoption intention

Innovation adoption is a complex decision process that involves multiple stages from first awareness about the technology until the decision to continue use the innovation. All the specific criteria will be evaluated and weighed in the decision-making process. Twenty one out of 28 farmers will continue to cultivate MRQ74 in the future because they were satisfied with the benefits that they gained such as higher yield and income, as well as low production costs. However, the farmers hoped that the

government could look forward in strengthening and well-linked the supply chain of fragrant rice from the production or farming subsystem (farmer) with the post-subsystem (miller, wholesaler and consumer).

## 5. Conclusions

This study imparts a clear picture and better insight in understanding farmers' decision to adopt fragrant rice farming or specifically a new rice variety, MRQ74. Apart from the technology characteristics, there are other significant aspects that influence the adoption decision-making of the farmers such as extension services, capital resources, social influences, and institutional factor. Based on the results of this study, it is recommended that the policy makers should give attention and evaluate the performance at each level of the supply chain to ensure sustainability of the fragrant rice industry in Malaysia. The success of fragrant rice cultivation will give the benefits to all players involved due to the new market segment in Malaysia.

## Acknowledgement

The authors wish to express their gratitude to the Universiti Putra Malaysia for funding this research under the Research University Grant Scheme (RUGS Initiative 6).

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