THE POTENTIAL OF FARMERS TO ADOPT AGRICULTURAL INNOVATION IN PADDY SECTOR

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Abstract. The Malaysia Government is committed to achieve 100% self-sufficiency level of domestic rice consumption in 2020. Currently, local rice productions are insufficient to meet the growing domestic demand of 30 million of its citizens, and the international food trade drew millions of Ringgit out to foreign countries. Local paddy farmers have to increase their production by adapting innovation and technology in agriculture. System of rice intensification (SRI) is an innovation in rice cultivation practices that have the potential to increase productivity, reduce costs, reduce water usage and balance the ecosystem. SRI method underwent many field experiments in world's major rice-producing countries. However, this method is still in preliminary stage in Malaysia and not widely known. Therefore, it is important to introduce the SRI method effectively at the micro level in order to start the adoption process. This paper aims to discuss the factors that promote and accelerate the process of diffusion and adoption of innovations within the social system, particularly in the rice agriculture sector. Lastly, an effective strategy will be developed through an understanding of the characteristics of adopters of innovations to accelerate the process of innovation diffusion among farmers.

Keywords: Diffusion of Innovation Theory, Innovation Adoption, Rice, SRI

Introduction

Innovation plays an important role in the survival of human civilization. Most dictionaries give the meaning of innovation as new or changed. This meaning is considered quite loose and not very clear. Spencer (1994), describes the innovation is something that is considered new and better than the old one by an individual. Zaltman et. al (1973) and Kotler (2003) also shared the same view, saying innovation is an idea, practice or material artifact that seems new to the individual who uses it. While a more complete definition was presented by Van den Ban and Hawkins (1996) stated that ‘an Innovation was an idea, method, or object, which is regarded as new by an individual, but which is not always the result of recent research’.

Thus, by the meaning of the above scholars, we can conclude that innovation can be described as a unique, easy and valuable. Innovation is a term was used in many fields such as manufacturing, services and agriculture. Innovation in agriculture has changed the landscape of the agriculture sector, especially in the food sector by transforming self-sufficient farming to commercial farming. Rice cultivation is one of the Agri-food sectors in Malaysia, and it is vital to our country (Alam et al 2011) and Fahmi et al (2013). This is because rice is the staple food of the country's population and nearly 3.5 billion people in the world (Satyanarayana et al. 2007).

The government's commitment to develop the country's rice sector started since our country's independence day. This commitment is demonstrated through the existence of many government’s policy (National Agricultural Policy 1-3), construction of infrastructure and the establishment of agencies (MARDI, FAMA, MADA, KADA, IADA). Apart from that in recent years, the rice production sector has been listed as one of the 12 National Key Economic Areas (NKEA) which have the potential to contribute directly to economic growth.

Malaysia is one of the foods importing countries. The low productivity of rice in the country has forced the government to import rice from Thailand and Vietnam. Minister of Agriculture and Agro-based Industry Minister Datuk Seri Ismail Sabri Yaakob said that in the years 2012 and 2013, the country had to import rice at 764.878 and 658.120 tonnes valued at RM1.3 billion and RM812 million from Vietnam. This amount represents 30% of the country's rice needs for the domestic market (Straits Times, 2014).
If our nation experiencing food shortages and hunger, this situation would lead to political turmoil thus threaten national security. This scenario would have a negative impact on the development of the country in which peace and harmony in the country are the main attraction of foreign investments to be further boost economic growth.

Therefore, the adoption of innovation in rice farming is the main agenda in achieving the objectives of the Food Security Policy (DJBM) which was created on May 2, 2008 by Malaysian Prime Minister Datuk Seri Najib Tun Razak and it aims to ensure the country's food supply is adequate and at an affordable price to the consumers. The main objective of this policy is to increase the production and productivity of agriculture to meet food self-sufficiency level of 85% in 2015 (Rabu & Shah, 2013).

Malaysia paddy farmers have a great responsibility in delivering a local rice supply to 30 million Malaysians. Farmers need to make changes to improve productivity in line with the latest developments by adopting innovation. They are the target groups and user innovation in the agricultural sector fields. It is fundamental to understand the factors that promote the spread of innovation and further accelerate the adoption of innovations at the micro level.

2.0 System Rice Intensification

System of Rice Intensification (SRI) is an innovation in sustainable rice farming methods. This method manages to increase revenue, reduce input costs and contribute to sustainabilities of ecosystems (Kabir & Uphoff, 2007; Sato & Uphoff 2007; Namara et al., 2008).

SRI method is based on the philosophy and method of natural farming. The cultivation of rice by this method encourages organic input without the use of chemical inputs. According to Ishak (2011), SRI techniques reduce the use of seeds, water, fertilizers and chemical pesticides. This method is done by changing the management of plants, soil, water, and nutrients to liberate the potential of rice plants to the optimum level. Through this method, the paddy plant is grown at a young age, have a set distance, periodic soil aeration and low level of water usage.

SRI had managed to increase rice productivity by over 100%. In Tamil Naidu, India, a farmer has managed to increase productivity up to 15 tonnes per hectare by using fewer inputs compare to the conventional methods (Barah, 2009). It is also reportedly in Cambodia, where the farmers have managed to increase productivity up to 100% without using chemical inputs (Koma, 2008).

The importance of environmental awareness and sustainability of resources for future generations had increased recently. Sustainability in agriculture has been understood as an agricultural development that occurs when natural resources are controlled and managed well. However, agricultural sustainability cannot be based on one thing only that is related to the environment. The concept of sustainable agriculture must be comprehensive and does not separate economic and social factors.

Ismail (2006) explains that the concept of sustainable agriculture in Malaysia is based on three main objectives that are economic sustainability and profitability, environmental awareness and social acceptance. Most models of sustainable agriculture practices are based on organic farming or commonly referred to as ‘organic farming’. Organic farming is one method of sustainable agriculture that uses only eco-friendly input and involves no harmful chemicals to the environment.

According to Uphoff (2011), SRI is a revolution and innovation in rice farming and have been successfully adopted in 48 countries. Cornell International Institute For Food, Agriculture And Development (CIIFAD) reported that the world’s major rice-producing countries such as China, Indonesia, Vietnam and India had tried and adopted this method since 1999. Other rice producing countries have also expressed their confidence in SRI methods and is committed to expanding the use of this method in the future.

Since the emergence of SRI in the early 1980s, many countries in Asia had adopted this innovation as in Bangladesh (Muazzam, 2004; Rahman & Roy, 2006), India (Geethalakshmi, 2011; Cancer, 2009; Sivanagaraju, 2006), Thailand (Mishra & Kumar, 2011; Mishra & Salokhe, 2007; Mishra & Salokhe, 2006), Cambodia (Uphoff, 2004; Sun, 2007; Anthofer, 2004), Sri Lanka (Uphoff, 2004), China (Li, et al. , 2004), the Philippines, Indonesia, Vietnam (World Bank, 2008) and Malaysia (Othman, Othman, & Ab. Hamid, 2013). However, the adoption of SRI paddy cultivation in Malaysia...
is still lacking. Thus, it may become necessary to identify the factors that drive adoption among the target group.

3.0 Diffusion of Innovation Theory

Innovation should be communicated and adopted by the targeted group. An innovation which is not adopted by the targeted group will fail and did not achieve its goal of existence. Diffusion of Innovation Theory basically explained the process of how a given innovation is communicated through certain channels over time to the members in a social system. This is in line with the meaning of the diffusion of Rogers (2003 pp11), which stated, “… by which an innovation is communicated through certain channels over time, among the members of a social system.”

The Rogers Innovation Diffusion theory was initially developed to understand the process of innovation acceptance among farmers, but eventually this theory had been used to understand the same issues in other areas. To date, the innovation diffusion theory has been widely used in fields of study that involves an understanding of the adopters of innovation at the macro level of the organization or at the micro level of the individual. The innovation diffusion theory has been tested in more than 6000 studies in various fields and the theory is among the most reliable in the social sciences" (Robinson, 2009). "Professor Everett M. Rogers is recognized internationally for his work on the diffusion of innovation" (Singhal & Law, 1997).

Therefore, the process of innovation diffusion involves four main elements, namely: Innovation, communication channels, time and social system as shown in Figure 1:

3.1 Innovation

Innovation is something new or an improvement that will benefit all of us. However, the novelty of the innovation measured subjectively perceived by the individual who receives it. Rogers (2003) also shares the same view, saying that innovation is "an idea, practice, or object perceived as new by the individual. The nature of the 'new' does not only refer to the latest discoveries, but previous finding is also known as innovation once it discovered by the targeted group."
Innovation is a new concept to the targeted group, who have a sense of doubt, hesitation and reluctant to accept changes. According to past studies, a group of people will doubt, reluctant to try it and even reject it if the innovation does not meet their needs. Adaptation of innovation start with innovation decision making process. A person goes through different stages in the decision making process before the implementation of the innovation. They will be discussing it with friends or relatives in order to get information and greater understanding of the possible risks and benefits of the implementation. Rogers and Singhal (1996) suggested that, "A person evaluates a new idea and decides whether or not to adopt it on the basis of discussions with Peers, who have already adopted or REJECTED the Innovation.... Organizations, like Individuals, adopt an Innovation in a manner that suggests various degrees of resistance to the new ideas." (Rogers & Singhal, 1996)

One of the factors that influenced the speed of adoption of innovation is characteristics of the innovation itself. Previous studies show that the characteristics of innovation have been able to answer questions that arise and affect the speed of innovation, adaptation (Moore & Benbasat, 1991), (Fichman, 2000).

Rogers (1983) suggests there are five characteristics of innovation, namely:

- **Relative Advantage** - the extent to which the benefits of innovation to the idea, program or product that it replaces.
- **Compatibility** - What are the advantages of comparison with the values of innovation, experience and the needs of adopters of innovations.
- **Complexity** - extent of complexity in understanding and practicing the innovations introduced.
- **Triability** - is this innovation can be tested prior to use.
- **Observability** - the extent to which these innovations provide significant results.

### 3.2 Communication Channels

Channels of communication with this model refer to how a piece of information that can be conveyed by one individual to another in pursuit of common goals (Rogers, 2003). In other words, the communication channel is a tool to convey a message of innovation from its source to the receiver. It plays an important role in influencing the speed of the innovation diffusion process. This is because at every stage of the innovation decision, the individual requires a specific communication channel to obtain the relevant information. If communication is intended only to introduce innovations to an audience of many and widespread, the mass media of communication channels is more accurate, fast and efficient. If the communication was intended to change the behavior or the recipient personally, the most appropriate communication channel is interpersonal channels that include friends, relatives, change agents and opinion leaders will be discussed further in chapter social system.

### 3.3 Time

Time is an important dimension in the diffusion of innovation. This is because the time dimension is concluded of the decision making processes of innovation, the rate of adaptation and adopter category (adopter), which is an important aspect of the adaptation process. The adoption of innovation is a process of mental or behavioral changes in terms of cognitive, affective and behavior of individuals. Everyone has to go through the process of making a decision to adopt the innovation before implementation. This process is based on the time at which the level of acceptance of innovation may vary depending on individual personality traits and individual surroundings. These features are important in determining the categories of innovation adopters and adopters' speed innovation by the community. Model categories of adopters used in the conceptual framework of this study and will be discussed in more detail in the title adopters of innovation.
Innovation Decision Making Process
Rogers describes the innovation decision process as individual activities to find and process information about an innovation until he is motivated to find more about the advantages or disadvantages of the innovation that will ultimately decide whether he will accept the use of innovation or not.

The process of adaptation is preceded by identification of the existence of innovation followed by a mental process on whether to accept or reject the innovation. If the result of a mental process is to accept that there was an adaptation of innovation. Adaptation process innovation through several levels, namely knowledge that whenever the individual was aware of an innovation. The next level of assessment in which individuals begin to find answers to questions that arise to reduce uncertainty and help the decision-making process. After this stage, the individual will decide whether to accept or reject the innovation is shown in Figure 2: -

![Figure 2: Decision Making Process Innovation (Rogers, 2003)](image)

3.4 Social System
The social system is the last element in the process of diffusion of innovation. Rogers (2003) defines a social system as "a set of interrelated units that are engaged in joint problem solving to accomplish the common goals" (p. 23). The members or units of a social system may be individuals, informal groups, organizations, and/or subsystems. The social system constitutes a boundary within which an innovation diffuses. Diffusion of innovation happens in the social system and was influenced by the structure of the social system in several ways. Rogers (2003) explains, the structure is the "the patterned arrangement of the units in the system" (p. 24). This structure gives regularity and stability to human behavior in a system. He also claimed that the nature of the social system affects individual innovation, which is the main criteria to categorize adopters of innovation by their respective levels.
The structure of a social system can facilitate or impede the diffusion of innovations. The impact of social structure on diffusion is of special interest to sociologists and social psychologists, and the way in which the communication structure of a system affects diffusion is a particularly interesting topic for the communication scholars.

Katz (1961) remarked, ‘It is as unthinkable to study diffusion without some knowledge of the social structures in which potential adopters are located as it is to study blood circulation without adequate knowledge of the veins and arteries. Compared to other aspects of diffusion research, there have been relatively few studies of how the social or communication structure affects the diffusion and adoption of innovations in a system.

Two key personnel responsible for moving the process of innovation adopters among members of the community are opinion leaders and agents of change as introduced by Rogers (2003). The main function of opinion leaders and change agents is to promote and accelerate the process of innovation diffusion.

4.0 Adopter Category Classification

Researchers have found that individuals adopt innovations early have different characteristics compared to individuals who adopt the innovations at following stage (Ryan & Gross, 1943), (Kirton, 1970), (Midgley & Dowling, 1978), (Rogers, 1983, 1995, 2003), (Goldsmith, 1984), (Agarwal & Prasad, 1998) and (Goldsmith & Foxall, 2003). Thus, each individual in a social system can be categorized according to their level of innovation, thus creating smaller groups. This is important because when promoting innovation to the target group, it is necessary to understand the characteristics of the target group that will help or hinder the use of an innovation.

The concept of segmentation is to focus on a specific audience and is widely used in the fields of marketing and is based on the premise diversity of user needs (Beane & Ennis, 1987). Thus, in one group, there are several small communities that share the same criteria and requirements (Beane & Ennis, 1987). Burke (2002), says that the technology must be adapted to the needs of different customer segments and understand the impact of innovation in the categories of adopters.

In each category of adopters, its members have in common related to their tendency to accept the use of innovation. Therefore, an understanding of the needs and capabilities of each category is necessary when promoting innovation as different strategies should be used to appeal to different categories of adopters.

Rogers (2003) defines categories of adopters (adopter) as "state classification on the basis of social systems of innovation" (p.22). Classification of the social system is divided into five groups as shown in Figure 4 below and the majority generally tends to fall in the middle category.
Rogers (2003) explains that not all individuals within a social system adopt innovation at the same time. Rather, the adoption takes place in an over-time sequence that allows for classifying individuals in adopter categories, based on the time individuals first begin to use a new idea, or more accurately, they are classified based on their innovativeness. Innovativeness, according to Rogers (2003, p. 22), is the “[. . .]degree to which an individual (or other units of adoption) is relatively earlier in adopting new ideas than other members of the system.” This classification can provide the opportunity to target first specific groups of people more receptive to innovation. These groups can function as agents for innovation diffusion in their community, helping more sceptical individuals come in contact with new technology.

Rogers (2003) suggests these individual differences can be identified by their socioeconomic; personality variables and communication behaviors influence the speed of adoption of innovations as stated below:

![Diagram](image.png)

Figure 4: Variables related to rate of adoption.
• Socio-economic characteristics. Earlier adopters are no different in age from later adopters, but have more formal education, are more likely to be literate, have a higher level of upward social mobility and social status. Income, level of living, occupational prestige and self-perceived identification with a social class are some of the variables indicative of social status.

• Personality variables. Earlier adopters may be less dogmatic than late adopters. “Dogmatism is the degree to which an individual has been relative closed belief system [...] A highly dogmatic person would not welcome new ideas [...] and would instead prefer to hew in the past” (Rogers, 2003, p. 273). Moreover, earlier adopters have greater ability to deal with abstractions, more capable to deal with uncertainty and risk effectively. DOI suggests that earlier adopters have a more favourable attitude toward change and science and since innovations are usually the product of scientific research, they have a more favourable attitude toward science. Additionally, early adopters are less fatalistic. “Fatalism is the degree to which an individual perceives a lack of ability to control his or her future” (Rogers, 2003, p. 273). Individuals with a high degree of fatalism usually believe that their future is largely determined by fate; they have low self-efficacy (Bandura, 1997). Fatalism and dogmatism are negatively related to innovativeness, whereas the effect of all the other variables presented above is positive. Finally, earlier adopters have higher aspirations for formal education, occupation, higher status, etc.

• Communication behavior. Individuals in different adopter categories have diverse communication behaviors: earlier adopters have more social participation and more actively seek information about innovations (Rogers, 2003). Communication behaviors expose individuals to innovation through early awareness, discussion with colleagues, information search behavior and the use of various print media or electronic media.

5.0 Conclusion

Diffusion of innovation among paddy farmers in Malaysia is one of the crucial steps to be further increase domestic rice productivity. Paddy farmers are the targeted group to adopt the innovation of SRI method. Thus, it is necessary to understand the potential of farmers in order for them to accept changes. A good strategy should be designed based on the needs and ability of farmers to accept it. With a better understanding, it can be for the authorities to formulate appropriate policies and programs and reaching out to farmers using the most efficient means of communication to accelerate the adaptation process innovation at the micro level.

6.0 References