

## The Influence of Innovation Attributes on New Technologies Adoption by Paddy Farmers

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### *Abstract*

*Agriculture plays a vital role in Malaysian economy. Agricultural innovation is considered as an important and necessary component in the development of agricultural activities. Technology adoption would only take place if innovation is driven by farmers' need. This conceptual paper discusses the influence of innovation attributes on new technology adoption by paddy farmers. The main purpose of this paper is to examine the relationship among the relevant variables in order to enhance the conceptual framework by critically reviewing and examining the literature within paddy farming context. In strengthening the conceptual framework, it is found in the literature that innovation attributes and new technologies adoption are inter-related and play an important role in increasing paddy production and paddy quality especially in granary areas. In future study, these variables will be empirically investigated and discussed.*

**Key Words:** *Innovation, Adoption, Agriculture, Technologies.*

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### **Introduction**

Agriculture consists of soil cultivation, rearing animals and crop production. This sector has been proven as an effective medium to overcome self-sufficiency (Hayrol *et al.*, 2010). It has been reported that the agriculture sector accounted for 11.4% of the Gross Domestic Product (GDP) composition by sector (Malaysia, 2013). During the economic crises in 2007, Asian countries including Malaysia turned to agriculture as one of the pertinent sectors to generate the main income.

In Malaysia, paddy rice is the staple food for the nation and important agricultural crop beside oil palm and rubber which is grown in both peninsular and east Malaysia. While the total annual production of rice stands at 2.51 million metric tons (FAOStat, 2009). Rice cultivation area (rice bowl) is divided in to two parts: the irrigated scheme and non-irrigated scheme. Irrigated scheme could achieve higher yield as compared to the non-irrigated scheme (DOA, 2008). The management of the rice production in the rice bowl area is called Integrated Agricultural Development Authority (IADA). There are eight IADA namely (i) Muda Agricultural Development Authority (MADA) in Kedah, ii) Kemubu Agricultural Development Authority (KADA) in Kelantan. iii) Kemasin Semerak Project (PKSM) in Kelantan. iv) North-West Selangor Project (PBLs) in Selangor. v) SeberangPerai IADA in Pulau Penang. vi) Kerian Sungai Manik IADA in Perak vii) Seberang Perak in Perak viii) KETARA in Besut, Terengganu. According to Ministry of Agriculture and Agro-based Industry, IADA as the main paddy producer, that meets 72% of the demand of this country (MARDI, 2010).

Furthermore, it was expected that in 2010, paddy will generate RM 988 million (DOStat, 2013) But, if we compare paddy with other agriculture commodities, there is still lot to be done to intensify paddy as the main agriculture sector in Malaysia. Hence, paddy plantation needs to be cultivated by new ideas and methods.

Innovation is an idea or practice that is new by an individual (Rogers, 2003). According to Sunding & Zilberman (2001) agricultural innovation is considered as an important and necessary component in the development of agricultural activities. Innovation may be new varieties of seeds, new types of pesticides or fertilizer for adoption which results to enhanced yield of the crop for upcoming scenario, for instance, the rice dryer which helps to reduce grain loss and increase rice production (Toung *et al.*, 2004).

Furthermore, the nature of the processes through which innovations are discovered is through technology-push-approaches. Hence, a complementary approach to innovation discovery and diffusion forwarded by the proponents of “farmers first” (e.g. Chambers *et al.*, 1989; Jiggins & Zeeuw, 1992). These hypothesized that adoption would only happen if innovations are driven by farmers’ need. Bijker and law (1997) framed the word of innovation being about simultaneously “shaping technology and building society”.

The characteristics of innovations amongst the farmers could give an indication to their rate of adoption. Five such characteristics of importance are discerned: 1) The relative advantage reflects how the innovation is subjectively perceived superior to the previous idea; 2) Compatibility reflects how the innovation is perceived “consistent with the existing values, past experiences, and needs of potential adopters”; 3) Complexity reflects the perceived difficulty to understand and use the innovation; 4) Trialability is “the degree to which an innovation may be experimented with on a limited basis”; and 5) Observability reflects how the results of an innovation are visible to others.

The main challenges in agriculture are the inefficiencies of new technologies to farmers. On the other hand the commercialization of agricultural activities, modern farming practices, post-harvest handling, processing and marketing are the main focuses that need to be intensified to boost this sector (Hayrol *et al.*, 2013). According to Colin (2012), only 72% of rice is being produced in Malaysia, while the yield is lower than those under comparable conditions elsewhere. On the other hand cost of production is considerably higher due to this farmers are not able to adopt innovations. The objective is to provide insights on an issue that is still not fully resolved in the innovation diffusion of new technologies among farmers. It also encounters the extent of their adoption and awareness on improved technologies to increase crop yield in Malaysian paddy sector. Next section discusses the innovation attributes followed by relative advantage, compatibility, complexity, observability and trialability and its relationship with perceived adoption.

## Literature Review

The diffusion of innovation attracts studies from multidisciplinary prospective (Carter *et al.*, 2001; McGrath & Zell, 2001). The studies mostly stem from Rogers (2003). Diffusion of Innovation (DOI) theory. He defined the diffusion of innovation theory as the process by which an innovation is communicated through certain channels over time among the members of social system. DOI tends to describe the pattern of adoption; explain the mechanism and helps in predicting the success of new innovations adopted (Rogers, 2003). A study conducted by Feloor & Bahaman (2011) which emphasized the role of social influence and innovation characteristics in the adoption of Integrated Pest Management (IPM) practices by paddy farmers. In his study he stated that during the past decades, the introduction of yield increasing innovations in agricultural production was a key factor in improving productivity. However, research comparing the factors affecting the different innovation diffusion stages-adoption and implementation still limited and demand for further investigation (Grover & Goslar, 1993; Farah & Bahaman, 2013).

## Innovation Attributes

Attributes of innovation that helps to decrease uncertainty about the innovation and increase rate of adoption. It consists of five characteristics of innovation. i) Relative advantage, ii) Compatibility, iii) Complexity, iv) Trialability, v) Observability. He noted that there is a lack of research on the effect of the perceived characteristics of innovations on the perceived adoption. The theory of perceived attributes is based on the notion that individuals adopt an innovation if they perceive that the innovation to add value, easy to use and compatible with their existing infrastructure. According to Lemuria & Belanger (2005) perceived relative advantage and compatibility are significant elements of adoption. It is suggested that relative advantage, compatibility and ease of use are the most relevant construct to adoption. Innovation attributes are most measured as the perceptions by potential adopters of the characteristics associated with a particular innovation.

Rogers (2003) defined relative advantage as “the degree to which an innovation is seen as better than the idea it replaces or supersedes” (p229). The elements of relative advantage are cost and social status motivation aspects of innovation. To increase the perception of adopting innovations and to make relative advantage more effective, direct or indirect financial payment incentives may be used to support the individuals of a social system in adopting an innovation. Diffusion scholars have found relative advantage to be one of the best predictors of an innovations perception of adoption. The sub-dimensions of relative advantage include the degree of economic profitability, low initial cost, a decrease discomfort and effort. The relative advantage of an innovation is positively related to adoption and awareness. Furthermore (Joo & Kim, 2004; Miller & Meek, 2004 & Liao & Lu, 2008) studied the relative advantage of IPM practices found that additional IPM practices benefits such as economic profitability, decreasing production cost and effort saving influence farmers’ decision.

Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experience and needs of potential adopters (p.15). An innovation can be compatible with social norm, previously introduced ideas and client need for innovation. If an innovation is incompatible with the grower’s social values and beliefs, it will not be adopted as rapidly as an innovation that is compatible. In past studies, compatibility appears to have a significant impact on willingness to adopt and aware of technologies, for example a study by Sarel & Marmorstein (2003) showed significantly positive relationship between compatibility and perception for adoption. Hence, if an innovation is compatible with an individual needs, then uncertainty will decrease and the awareness and adoption of the innovation will increase. Thus, compatibility is an important part of innovation.

Complexity is the degree to which an innovation is perceived as relatively difficult to understand or use (Rogers, 2003). New ideas that are simpler to understand by members of a social system are adopted more rapidly than innovations that require the adopter to develop new skills and understanding. A low level of complexity lead to higher adoption rate or complexity increases the rate of rejection (Rogers, 2003; Sarel and Marmorstein, 2003). Following Rogers (2003) & Teo (2003) findings illustrated a negative relationship between complexity and perception of adoption and awareness.

Trialability, on the other hand, refers to the degree to which an innovation may be experimented on a limited basis (Rogers, 2003). For example he argues that latent adopters, who are invited to experiment an innovation for trials, would feel more comfortable to adopt innovations. However, it is positively related to perception of adoption and awareness. Furthermore, according to Kolodinsky *et al.*, (2004) sometimes trialability provides farmers the ability to evaluate innovation benefits. Consequently, if farmers are given the opportunity to try the innovation certain fears of the unknown and inability to use can be reduced.

The last element observability is the degree to which innovations are visible to others (p.16). The results of some ideas are easily observed and communicated to other, whereas some innovations are difficult to observe or to describe with others. Role modeling is the key motivational factor in the adoption and

diffusion of technology (Parisot, 1997). Hence, there is a positive relationship between observability and perception for adoption and awareness.

Technology adoption by farmers is crucial to increasing agricultural productivity (Shahrina *et al.*, 2014; Sinja *et al.*, 2005). Perceived adoption is the relative ability with which an innovation is adopted by members of a social system (Rogers, 2003). Adoption passes through various stages which includes awareness, interest, trial and finally adoption. Awareness defines as the individuals are exposed to innovation but incomplete information about it. Awareness is the initial step for adoption. Interest leads to an individual to become interested in new ideas and seeks additional information about new technologies. Trial means the individuals would want to make full use of the innovation. And finally the individuals decide to continue the full use of the innovation that is adoption.

### Conceptual Framework

Based on the above discussion, a conceptual framework is proposed. It is conceptualized that innovation attributes (in terms of relative advantage, compatibility, complexity, trialability and observability) will predict perceived adoption. Figure 1 shows the proposed conceptual framework of the study.

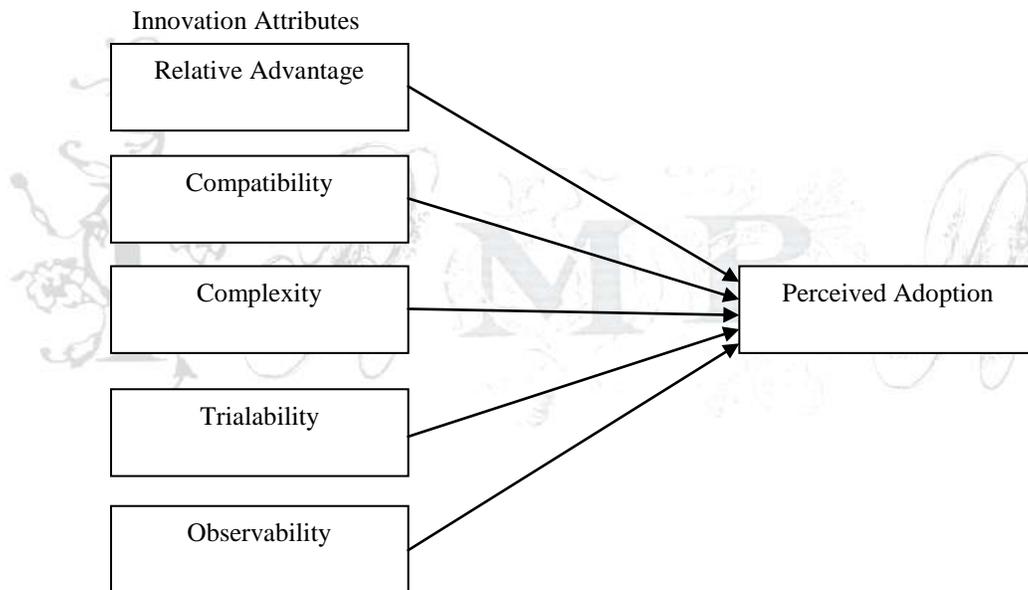


Fig. 1: Conceptual Framework of the study

Based on the above framework, five hypotheses are proposed to be tested in future research.

- H1. There is a positive relationship between relative advantage and perceived adoption.
- H2. There is a positive relationship between relative compatibility and perceived adoption.
- H3. There is a positive relationship between complexity and perceived adoption.
- H4. There is a positive relationship between trialability and perceived adoption.
- H5. There is a positive relationship between observability and perceived adoption.

As one of the major goals of literature review is to outline the direction of research and shows the development of knowledge. Based on the literature review the researcher develops a conceptual framework of the study. This study will examine the relationship between these dependent and independent variables.

## Conclusion

This conceptual paper provides insights into the diffusion of innovation (DOI) theory from different principle of new technology in the Malaysian paddy sector. The analysis will utilize data describing new technology in paddy farming among farmers to increase paddy production. The practical implication of the study is to contribute knowledge and awareness in the area of diffusion of innovation in paddy sector.

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