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The role of social influence and innovation characteristics in the adoption of Integrated Pest Management (IPM) practices by paddy farmers in Iran

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***Abstract*—The purpose of this study is to explore the effect of social influence and innovation characteristics in adoption of integrated pest management (IPM) practices by paddy farmers in three provinces of Iran. A total of 190 paddy farmers were selected by using proportional stratified sampling. Data collection was done by a set of questionnaires that was administrated through personal interview. Validity of the questionnaire was confirmed by a panel of experts. To assess the reliability of the questionnaire, Cronbach's alpha was used. The results of structural equation modeling showed that the hypothesized model fit the data. There are positive and direct relationship between social influence, compatibility and trialability of and adoption of IPM practices.**

Keywords-Adoption; Social influence; Characteristics of Innovation; Integrated Pest Management (IPM); Innovation.

I. INTRODUCTION *(HEADING 1)*

One of the challenges in development of sustainable agriculture in Iran is achieving wide spread adoption of IPM practices aimed at increasing the productivity of rice and decrease or eliminate use of pesticides. The IPM technologies are still not widely adopted in Iran. The majority of farmers are still relying on use of chemical pesticide for rice crop.

During the past decades, the introduction of yield increasing innovations in agricultural production was a key factor in improving productivity. The adoption of these technologies was also accompanied by a massive increase in the utilization of polluting inputs. In addition to environmental damages related to the use of these inputs, the monetary cost of pesticides for Iranian farmers was estimated at $ 120 million each year [1]. This position has lead researchers to shift their attention toward the development and adoption of innovations or technologies that utilize fewer or 'cleaners' chemicals or reduce environmental pollution. Implementation IPM strategy by FFS method can be classified in that group, for its ability to reduce environmental pollution. In fact, understanding factors that influence technology adoption and the environmental implications of such decisions is critical for governments as well as private companies involved in the agricultural sector. Therefore, for a new and rapidly expanding technology such as IPM, there is an urgent need to understand factors that are driving its rapid diffusion.

The adoption of new technology has got wide attention from researchers in different context [2-17].

Generally, researches and extension agents are often frustrated by slower than expected adoption levels for agricultural innovations. Slower rates of adoption causes a loss of potential benefit of sustainable practices to growers and the public. This is a main reason why so much attention has been given to try and understand what drives adoption of new technology among farmers [18, 19]. The current study is guided by a review of a review of literature and the development of a conceptual framework based upon the diffusion of Innovations theory [19] and theory of reasoned action [20]. The purpose of this study is to explore the influence of social influence and innovation characteristics on Iranian paddy farmers' new technology adoption. This research contributes to an increased understanding of Iranian paddy farmers' new technology adoption by determining the key antecedents that influence acceptance of IPM practices, as well as providing research and extension organization strategies.

II. MATERIALS AND METHODS

A. Diffusion of Innovation Theory (DOI)

An innovation is an idea or practice which is perceived as new by an individual or other unit of adoption [19]. Rogers defined the diffusion of Innovation theory (DOI) as the process by which an innovation is communicated through certain channels over time among the members of a social system. It is the process by which the innovation spreads from its source of innovation to its ultimate users or adopters. According to DOI, diffusion rates determines by four main elements: the characteristics of innovation, the effectiveness of communication channels. time involved in the innovation decision process relative to the innovativeness of the individual or other decision making unit and the surrounding social system[19].

The first element in the diffusion of innovations theory that determines the adoption rate is the characteristics of the innovation. This is comprised of five components (i.e. relative advantage, compatibility, observability, trialability, and complexity). Rogers' (2003) literature proposed that innovations which are perceived by individuals as having greater relative advantage, compatibility, trialability, observability, and less complexity will have a greater adoption rate than other innovations. To look more closely, this study will elaborate the issue of these attributes in the following sections.

Relative Advantage (RA)

The relative advantage of IPM practices reflects the extent to which Iranian paddy farmer' perceive advantages factors for using and implementation these practices. Studies of the relative advantage of IPM practices found that additional IPM practices benefits such as economic profitability, decreasing the production cost, decrease discomfort, social prestige, time and effort saving influence farmers' decision [12, 21, 22].

Compatibility (COM)

Compatibility is the extent to which Iranian paddy farmer' perceptions of implementation IPM practices are consistent with their existing values, beliefs, past experiences and needs. If an innovation is incompatible with a grower's social values and beliefs, it will not be adopted as rapidly as an innovation that is compatible [19]. In previous studies, compatibility appears to have a significant impact on willing to adopt [23] stated that compatibility appears to have a significant impact on willing to adopt.

Observability (OBS)

Observability of an innovation like IPM according to Rogers (2003) describes the extent to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. Such visibility stimulates peer discussion of a new idea, as friends and neighbors of an adopter often request innovation evaluation information. Observability is an important founding principle of Extension Education, which has often used demonstration models and field days to promote change among growers [22, 24].

Trialability (TR)

Trialability is the degree to which an innovation maybe experimented with on a limited basis. The more trialable the innovation, the more likely it will be adopted. Trying an innovation on a limited basis allows adopters to become familiar with how it works and to evaluate its effectiveness while minimizing the risk of full adoption. Rogers (2003) argues that potential adopters who are allowed to experiment with an innovation will feel more comfortable with it and more likely to adopt it. According to[16] sometimes, trialability provides customers the ability to evaluate innovation benefits. Consequently, if consumers are given the opportunity to try the innovation certain fears of the unknown and inability to use can be reduced.

Ease of Use vs. Complexity (EOU)

This attribute has many synonyms like usability or complexity and ease of use. Complexity is the degree to which an innovation is perceived as relatively difficult to understand or use [19]. New ideas that are simpler to understand by members of a social system are adopted more rapidly than innovations that are require the adopter to develop new skills and understandings. A low level of complexity or a high level of ease of use lead to higher adoption rates [19]. In other words, complexity increases rejection rates [19, 23]. Rogers illustrated a negative relationship between complexity and adoption rates. Additional diffusion studies confirm the relationships posited by Rogers. For instance, [25] study showed a negative and insignificant relationship.

B. Theory of Reasoned Action (TRA)

Ajzen and Fishbein developed the Theory of Reasoned Action (TRA) in 1975. It is designed to explain human behavior and consists of the two factors that affect behavioral intention; attitude towards behavior and subjective norms. According to TRA, a person's attitude toward a particular behaviour is a product of the strength of beliefs and the corresponding evaluations of the consequences. Normative influences have to do with one's perceptions that referent groups and individuals believe certain behaviours should (or should not) be performed. The role of social influence in shaping high adoption decisions is further reviewed.

Social Influence

According to the Theory of Reasoned Action (TRA), a subjective norm is defined as an individual's perceptions of what significant others think about the individual performing a specific behavior [26]. TRA suggests that subjective norms are influenced by the individual's perception that specific others think that the behavior should or should not be performed and by the individual's motivation to comply with the wishes of others. This relationship is suggested because people may choose to perform a behavior even if they are not favorable towards it as long as it is favorable to the referent group. The term 'social influence ' is used to refer to the extent to which members of a reference group influence one another's behavior and experience social pressure to perform particular behaviors [17, 27].

Theories of Reasoned Action recognize the importance of social norms in influencing individual behavior in general. Given the importance of social aspects of technology adoption, the following is proposed:

Based on the above review of literature and proposed research model, we hypothesized that:

H1: There is a positive relationship between relative advantage and adoption of IPM practices.

H2: There is a positive relationship between observability and adoption of IPM practices.

H3: There is a positive relationship between compatibility and adoption of IPM practices.

H4: There is a positive relationship between trialabilitye and adoption of IPM practices.

H5: There is a positive relationship between simplicity and adoption of IPM practices.

H6: There is a positive relationship between the role of significant others and adoption of IPM practices.

III. RESEARCH METHODOLOGY

A cross sectional survey research method was used for this study. Face-to-face interviews were conducted to collect data with the aid of a questionnaire containing closed ended questions.

The paddy farmers in three provinces of Iran including Gilan, Mazandaran, and Esfahan were the target population for this study. The population framed was obtained through Iran's Ministry of Jihad-agriculture. The sample obtained through proportional stratified sampling (n= 190). The questionnaire was pre-tested using a sample of 30 paddy

farmers. The questionnaire was improved based on the pilot study results. A panel of experts confirmed the validity of the questionnaire.

IV. Results and Discussion

Structural equation modeling (SEM) was used to test the relationships among the theoretical constructs. First, the confirmatory factor analysis (CFA) was conducted to assess the model fit of the constructs with multiple indicators (including relative advantage, compatibility, trialability, ease of use, observability, social influence and adoption of IPM practices). CFA results showed a good fit of the model to the data (X^2= 483, df= 413, CMIN/DF= 1.17, GFI= .90, IFI= .95, TLI= .94, CFI= .95, RMSEA=.03). All the factor loadings were significant at the .05 level and all items had associated factor loadings (χ) of more than .50; thus, convergent validity was achieved.

The hypothesized research model (Fig. 1) was tested with maximum likelihood estimation. The regression weights and p-values of the proposed model are presented in Table I.

TABLE I. Regression weights and *P*-values for the proposed model.

Hypothesis	*Path coefficient*	*S.E.*	*p-value*	*Supported*
H1	.06	.075	.415	No
H2	.21	.078	.007	Yes
H3	.27	. 08	.001	Yes
H4	.21	.226	.348	No
H5	.20	.198	.296	No
H6	.41	.105	.001	Yes

Hypothesis 1 (perceived relative advantage of IPM practices positively influence adoption) indicates support (β= .06, p> .05). Hypothesis 2 (perceived observability of IPM practices positively influence adoption) is supported (β= .21, p<.05). Hypothesis 3 (compatability of IPM practices positively influence adoption) (β=. 27, p<.05) is supported. Hypothesis 4 (perceived trialability of IPM practices positively influence adoption), Hypothesis 5 (perceived simplicity of IPM practices positively influence adoption) are also not supported (β=.21, p>.05), is not supported (β= .20, p>.05), and Hypothesis 6 (social influence) (β=. 41, p<.05) is also supported.

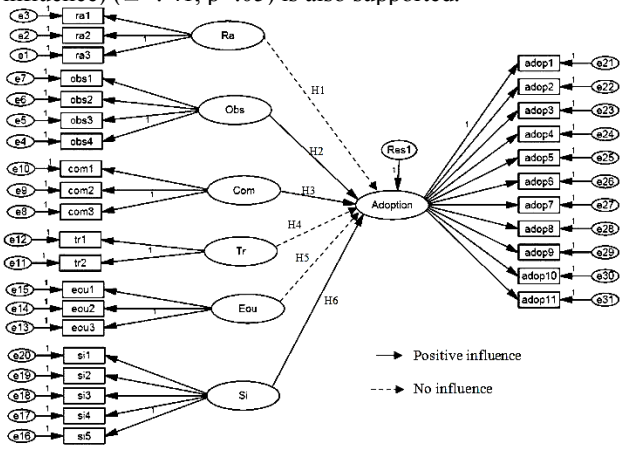

Figure 1. Research Model

As hypothesized, our findings indicate that Iranian paddy farmers' compatibility positively influence their adoption of IPM practices. This suggests that the new technology which is compatible with the paddy farmers' lifestyle obtained the desired results. This finding is consistent with these of other innovation studies [12, 22, *24*].

Our findings suggest that the observability of new innovation influence the acceptance of new agricultural technology in Iran. This result is consistent with previous findings that observable results of innovation influence new technology adoption [23, 28,31]. Also, our study finds that relative advantage, ease of use, and trialability of new technology no direct impact on adoption of IPM practices.

In addition, our findings suggest that the role of significant others continues to influence the acceptance of IPM practices. In fact, Iranian paddy farmers who perceive positive attributes of pest management practices are likely to be influenced by relevant others (subjective norms) when considering the decision. This result is consistent with the previous findings [29, 30, 32] that strong social norms influence individual decision to adopt new technology.

V. Conclusions

The results of this investigation signify a relationship between paddy farmers' perceptions of the characteristics of the IPM practices, more specifically, paddy farmers' perceptions of the observability and compatibility of the IPM practices. In addition, this study, along with work of Dopson and Colleagues [33] and Fitzgerald and Colleagues [34] suggest that the social context in which the adoption occurs shapes the adoption process. Further, it seems to indicate that the innovation adoption process has a social element, and community interactions and discussions may facilitate the process. These results could be valuable for extension agents, researchers, and innovation developers in innovation adoption planning. The practical implication of this study is as a contribution to knowledge in the area of diffusion on innovation in developing countries. It emerged there is a need to integrate the innovation characteristics together with social communication channels by which IPM characteristics are communicated to the social network.

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