

Theories of Adoption, Determinants and Constraints

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The ultimate goals of agricultural innovation project are to rekindle the spirit of the farmers to adopt improved technologies. The transfer of technology and knowledge from the builder to farmers will bring about development. Adoption is a mental process which an individual passes through from the first time of hearing about a new idea to the complete and full incorporation of the idea into the total system of his behavior. Therefore, to adopt innovations, farmers must be aware and undergone series of adoption stages called adoption process. In the light of this, this paper used available literature to review the following; the

concept of adoption, stages/steps in adoption of innovations, determinants of adoption, constraints to adoption and theories of adoption. This study recommends that for extension agents to achieve their targets in a rural setting, the roles of extension agent in collaboration with the proper knowledge of the adoption theories, constraints to adoption and the determinants of adoption should be articulated into the social system of the farmers.

Keywords: Determinants, constraints, adoption theories

INTRODUCTION

The basic goal of agricultural development organizations is to influence farmers to adopt agricultural innovations (Agbamu, 2006). Transfer of innovation and knowledge from research unit to farmers will trigger development. Therefore, the basic role of agricultural extension agent in the transfer of technology is to assist farmers in putting the blue prints or readymade technologies into practice, despite the fact that they may not be appropriate (Agbamu, 2006).

Understanding the determinants of adoption of agricultural technologies is essential in planning and executing technology related programmes for meeting the challenges of food production in developing countries. Agricultural technology embodies a number of important characteristics that may influence adoption decisions. Literatures on agricultural technology adoption are enormous and somewhat difficult to summarize closely. Conventionally, analysis of agricultural technology adoption focused on imperfect information, risk, uncertainty, institutional constraints, human capital, input availability, and infrastructure as potential explanations for adoption decisions (Obayelu *et al.*, 2017).

According to Adekoya and Tologbonse, (2011), adoption is regarded as a decision to make full use of

an innovation or technology as the best course of action available. Adoption of an innovation is the decision made by an individual or group to use an innovation. Majority of farmers passed through several logical problem-solving processes known as adoption process when considering new technology. Agbamu, (2006) opined that each farmer has characteristics that influence how he or she receive information, processes it and either uses or discards it. However since adoption involves decision making after communication between extension workers and farmers or after farmer to farmer communication, a good starting point of any discussion on adoption process is understanding the context in which farmers operate their farms and make daily decisions.

Akubailo *et al.* (2005) expressed adoption of innovations as a decision to make full use of a new idea as the best course of action available and involves a change in the orientation and behaviour of the farmer from the time he/she become aware of the innovation to its adoption. So the extent of adopting and using innovation by the farmers is complex which involves a consequence of thoughts and actions. According to Ani, (2007) adoption is a mental process which an

individual passes through from the first time of hearing about a new idea to the complete and full incorporation of the idea into the total system of his behaviour. Adekoya and Tologbonse, (2011) have shown that a farmer's decision about whether to adopt or not to adopt a recommended agricultural practice occurs over a period of time in stages rather than being instantaneous. Therefore, to adopt the innovations, farmers must become aware and undergo series of adoption stages.

In view of the above, adoption is a decision of an individual or group to make full use of an innovation introduced into a social system as the best course of action available. Therefore, adoption is a mental decision process an individual or group encountered in the bid to make full use of an innovation as the best course of action available. For a farmer or farmers to be acclimatized with an innovation, different mental decision processes have to be taken into consideration. Based on this, Rogers and Karyn, (1997) conceptualized a cumulative series of five stages in the process; from awareness (first knowledge of the new idea); to interest (gaining further knowledge about the innovation); to evaluation (gaining a favourable or unfavourable attitude towards the innovation) to small-scale trial and to an adoption or rejection decision.

According to Oxford Advanced Learners' dictionary 6th edition, the concept "diffusion" is derived from the verb "diffuse" which means spreading over a wide area. Diffusion is a process of information exchange or flow between other units among a group of people (Adekoya and Tologbonse, 2005). However, the quality and speed of flow depend on the topical nature of the information, model employed and management of the process by extension professionals. Agbamu, (2006) defined diffusion as a process by which an innovation spreads from its source of development to its ultimate adopters. Diffusion process involves four essential elements: the innovation, its communication from one individual or group to another, a social system within which innovation spreads, and a time period over which the diffusion process occurs. With respect to this, diffusion process starts gradually with a few farmers who adopt a new technology for one or two years. Thereafter, the spread of diffusion increased as other farmers observe good performance of an agricultural innovation in on-farm trials and as interaction between innovators and other farmers and between change agents and farmers take place. After some years the speed of diffusion reaches a peak and then starts to decrease (Agbamu, 2006). The above concept presents clear pictures which can be used to understand and analyze the diffusion process and adoption. Diffusion and adoption are inextricably linked that discussing diffusion separately from adoption will create a vacuum in the mind of the clientele. In the

same way, diffusion and rejection are parallel just like adoption and diffusion aforesaid. Discussing diffusion without rejection will also impose gaps in the memory of the clientele. Therefore, in diffusion of an innovation/idea an innovator should be conscious of either accepting or rejecting his/her idea being communicated to the prospective users. Therefore, diffusion of an innovation is in the realms of probabilities of the potential users. In the light of the above, Adekoya and Tologbonse, (2005) opined that process of diffusion is seen as a precursor to adoption but not necessarily always ending up with the adoption. Because of this, we can deduce that diffusion not necessarily ends up with adoption but paves ways for adoption or rejection of an innovation therein.

Stages/steps in Adoption of Innovation

The logical, problem-solving process through which farmers passed when assessing any new technology is called adoption process. However, adoption of a technology can be examined in the context of adoption by farmers or group of farmers within a geographical area. According to Adekoya and Tologbonse, (2011), adoption process has five stages or steps that an individual goes through in adopting an innovation;

Awareness stage

This is a stage at which an individual becomes aware or hear about an innovation for the first time. The individual at this stage does not have enough information concerning both the benefits and cost of the innovation.

Interest stage

This is when an individual pick up interest on an innovation and actively make more investigation about the technology. The investigation could be how it works as well as the potentialities associated with the products.

Evaluation stage

This is when the individual weighs up the advantages and the disadvantages of using it by going through a mental evaluation by asking self questions such as "is it worth it"? "Can I do it?" Do I have enough resources? Will it be beneficial to me and my family? If the advantages outweigh the disadvantages especially with regard to the capital outlay against what else they might do with the same amount of money and the

satisfaction they will get from these alternatives. Therefore, evaluation stage is terminated when an individual makes a decision to reject or accept the innovation.

Trial stage

This involves testing an innovation on a small-scale to determine the relevance and usefulness of the innovation.

Adoption stage

This is the final stage when the individual apply the innovation on a large scale and continue to use it in preference to old methods.

With reference to the above, Adekoya and Tologbonse (2011) opined that the adoption process stated above does not always follow the sequence in practice and actively depends on the technology and the individual in question. On a practical note, a farmer may not alone decide to adopt an innovation as the adoption process model suggested. The decision to adopt is usually taken in situations where farmers are in groups with members influencing one another. This is also in addition to activities of extension agents pushing the innovation. Therefore, the process of adoption can be seen through the following perspective represented by the four basic stages.

Knowledge

Awareness of the idea and perceived benefit of it.

Persuasion

one's Convinced of the value of the innovation. At this stage, peers can have a great deal of influence.

Decision

Judgment to adopt the innovation samples or trials at this phase can have a positive effect on the chances of the innovation being adopted.

Confirmation

Engagement of positive activities which may lead to eventual acceptance.

In reality, Adekoya and Tologbonse, (2011) suggested that innovation – decision process precedes these stages and even goes beyond them, this is where the human perspective comes in with all the complexities and uncertainty.

Determinants of adoption

The government and farmers in Nigeria are faced with the challenge of increasing agricultural production to

cater for the increasing population. There is increasing demand for food, fibre and wood from the limited land area which calls for cooperation and integrated approach to agricultural innovation (Ochiaka, 2013).

According to Agbamu (2006), various factors have been identified to influence the adoption of an innovation. Those factors could be broadly classified as follows: (a) age, family size, farm size, gender, economic status, educational level, social participation, leadership status, proximity to research station or university, contact with extension agents, cosmopolitaness, mass media exposure, knowledge of recommended practice and years of farming experience. (personal characteristics of farmers) (b) cost of innovation, complexity and technicality, compatibility with cultural norms and farming system, (c) psychological factors – level of aspiration to socio-economic good, fear and anxiety, perceived risk and uncertainty/suspicion (d) situational constraints-insecure land tenure, lack of access to credit, lack of access to ready markets and inaccessibility to localities (hill places), inability to obtain specific inputs. Wabbi, (2002) grouped the factors influencing technology adoption as follows:

- (a) Economic Factor – farm size, cost of technology, level of expected benefits and off- farm hours.
- (b) Social factors – age of adopter, education and gender concerns.
- (c) Institutional Factors – Information and extension contacts.

According to Agbamu, (2006) there is a negative relationship between size of cassava farm and adoption in a study of rural areas of Oyo and Ondo states. He was of the view that, the larger the cassava farms the less they are worried about farm innovation, since they are still in a good position to meet their family demands for cassava. Agbamu, (2006) also stated that there is a positive relationship between farm size and adoption of soil management practices. However, this relationship was not significant. In another study, large commercial farmers in Ayamelum Local Government Area of Anambra State, Nigeria adopted high yielding rice varieties more rapidly than small holders. Wabbi (2002) was of the view that farmers operating larger farms tend to have greater financial resources and chances of receiving credit higher than those of smaller farms. Therefore, with respect to farm size, technology adoption could be explained by measuring the proportion of total land areas suitable to the new technology.

According to Adekoya and Tologbonse, (2011), technologies desired for adoption are those that are compatible, relatively advantageous, and accessible by farmers. Technologies will most likely be assimilated and utilized when the benefits can be quickly realized.

Agbamu, (2006) asserted that the relationship between formal education and adoption of technologies is inverse. He was of the view that formal education enables farmers to accept new farm technologies more readily to increase their income than those farmers without a formal education. However, educated farmers tend to be more flexible in their decision to adopt new ideas. Generally, education creates a favourable mental attitude for the acceptance of new ideas and practice. Therefore, formal education enables a farmer to obtain useful information from bulletins, newsletters and other sources (Agbamu, 2006).

Age is seen as a major latent characteristic in adoption of technologies. It has positive influences on the adoption of new technologies. According to Agbamu (2006), some older farmers rejected the use of fertilizers claiming that fertilizers could change the taste and other properties of crops.

On the other hand, experience has shown that adoption of technologies could be influenced by the following factors; governmental policy, seasonality, directors' policy, culture and norms of a social system, speed and frequency of the innovation, stability and fluctuation of the innovation.

Constraints to adoption of technologies

There are several constraints to the adoption of technologies by farmers. An attempt has been made to outline the major constraints to adoption. Guerin and Guerin, (1994) identified the constraints as: the extent to which the farmers find new technologies complex and difficult to comprehend, how readily observable the outcomes of an adoption are; its financial cost, farmers beliefs and options towards the technology, the farmer's level of motivation; farmer's perception of the relevance of the new technology and farmer's attitudes towards risk and change.

According to Rolings and Pretty, (1996) one major reason for non-adoption of technologies is because they are finalized before farmers get to see them. Technologies that are not compatible to a particular farmer's condition or need are usually rejected. On the other hand, Adhikarya, (1996) opined that non-adoption of recommended technology is caused by non technological factors such as social, psychological, cultural and economic problems. However, farmers reject available technologies not because they are conservative or ignorant but because they rationally weigh the changes, incomes and risks associated with the given technologies under their natural and economic circumstance before they take any decision.

Feder *et al.* (1985) summarized the vast amount of empirical literature on adoption and showed that the

constraints to the adoption of a new technology may arise from many sources such as lack of credit, inadequate farm size, unstable supply of complementary inputs, and limited access to information, uncertainty and so on. In the same vein. Mbanaso, (2010) asserted the major constraints to adoption of sweet potato as production/processing complexity problems, economic problems, poor technical information and pathological problems. He further indicated that adoption of sweet potato technologies was significantly influenced by household size, labour, land, health, age, marital status and access to credit. However, Schultz, (1995) indicated that the probability of adopting a new technology will depend on the difference in profitability between the new and old technologies and the ability of the farmers to perceive the advantage and efficiently utilize the new technology.

A study conducted by Asadu, (2011) on adoption of gender specific innovation by women groups in Enugu North agricultural zone indicated those factors such as lack of capital, lack of incentives from government and high cost of adequate processing equipment to be the major constraints to the adoption of technologies. She also attributed age, education, household size, primary occupation, credit availability and income to significantly influence the adoption of improved cassava technologies by the women.

Kebede *et al.* (1990) conducted a study on adoption of new technologies in Ethiopian agriculture in Tegulet-Bulga district, Shoa province and found that education level of farmers had positive effect on the adoption of new technologies in Ethiopian agriculture. Degnet and Belay, (2001) underlined those factors such as age of the farmers, frequency of contact with extension workers, annual on-farm income level and farmers knowledge of fertilizer use and its application rate to significantly affect farmers adoption decision. Tiamiyu *et al.* (2009a and 2009b) indicated that technology adoption is affected significantly by farmers level of education, extension visits, credit use and level of rice commercialization. Saka and Lawal, (2009) also indicated that frequency of extension contact, land area cultivated and yield rating of the improved rice variety significantly determined farmers decision to adopt improved rice varieties. However, Fashola *et al.* (2007) found that membership of association, level of education were important contributors to adoption decision of farmers. This study also showed that frequency of extension contact and the attribute of the technology in terms of productivity significantly contributed to the adoption of improved varieties among farmers. Similarly a study by Omonona *et al.* (2005) on adoption of improved cassava varieties in Edo State Nigeria showed that sex, age, access to extension agents, access to inputs and crop yield were significant variables positively influencing adoption of

improved cassava varieties. Therefore, it is pertinent to say that extension contact and basic attributes of improved varieties are significant motivating factors for adoption of improved varieties among crop farmers. Chilot, (1994) showed that the adoption of improved wheat seed is positive and significantly influenced by the wealth status of the farmers, farmers contact with extension agents and availability of fertilizer on time. He also asserted that the distance to an extension office from a village was negative and significantly influenced the adoption of improved wheat seed. He also said that the higher the incremental net benefit of the improved technology over the traditional practice, the higher the probability of adoption. However, the effect of the other factors like area cultivated, literacy, livestock ownership and farmers' years of experience were not significant. According to Negash, (2007), participation in extension events and access to credit were important variables which positively and significantly influenced adoption and intensity of improved haricot bean production package.

In view of the above, Rogers and Scott, (1997), suggested that innovation with greater relative advantage, compatibility, triability, observability and less complexity will be adopted more rapidly than other innovations. Therefore, the characteristics of an innovation as perceived by the members of a social system determine its rate of adoption. With respect to the above, constraints to adoption of innovations could be stated as the inappropriateness of the following:

Communication channel

Here, it is observed that mass media has direct, immediate and powerful effect on the mass audience, mass media channels are more effective in creating knowledge of innovations, whereas interpersonal channels are more effective in forming and changing attitude towards a new idea, and hence in influencing the decision to adopt or reject a new idea.

Opinion leaders

These have directly affected the tipping of an innovation. A powerful way for change agents to affect the diffusion of an innovation is to affect opinion leader attitude. Opinion leaders usually conform closely to the norms of their social system. They make use of unbiased and technically accurate sources of information, and they are better equipped than their followers, in terms of knowledge, insight and judgment to put innovations to practical use. Opinion leaders are usually cosmopolitan in their attitudes and they mix well with other people, are of relatively high social status and tend to be more innovative than their

followers. Therefore, the personal influence of opinion leader is very important in the persuasion stage of the innovation-decision process.

Homophily and Heterophily

Homophily is the degree to which pairs of individuals who communicate are similar. The similarities can be things like beliefs, education, socio-economic status etc. Heterophily is also the degree to which pairs of individuals who interact are different in certain attributes. More so, homophilous individuals engage in more effective communication because their similarities lead to greater knowledge gain as well as attitude or behavioural change. However, most participants in the diffusion of innovations are heterophilous, meaning they speak different languages. But the problem is that diffusion requires a certain degree of heterophily, if two individuals are identical, no diffusion occurs because no new information can be exchanged. Therefore, an ideal situation would involve two individuals who are homophilous in every way, except in knowledge of the innovation. Thus, homophily and heterophily are one of the major constraints in the adoption of innovation. Other constraints are climatic factor, drought, poor soil fertility and pest attack.

Theories on adoption

The decision of farmers to adopt innovation is a complex process with a wide number of influencing factors. A key question in trying to determine the future of adoption with the technology environment is determining why an individual would adopt one technology while resisting another (Kathryn, 2010). Therefore, in terms of this research, user acceptance is the willingness of farmers to use innovations. With respect to the above, interest is focused to identify the factors that influence the adoption of technologies by users who have some degree of choice. However, due to the wide ranging issues of why some farmers would accept or reject a technology it is unlikely that a single variable explanation could account for this decision (Dillon, 2004). Based on this, a number of theories have been developed to help understand and explain adoption process of end users. Adoption is not one step process, that means it takes time for adoption to be complete. Agricultural extension can be said to be effective and efficient when farmers adopt improved technologies (Aphunu, 2011). Adoption is therefore similar to diffusion except that it deals with psychological process an individual goes through, rather than the physical process.

Diffusion theory

This theory is the brainchild of Everett Rogers who

defined diffusion as the process by which an idea is communicated through certain channels over time among members of a social system (Rogers, 1995). The theory however, predicts that an innovation will initially be adopted by small group of innovative farmers and later diffuse to other farmers within the social system (Stephenson, 2003). The central objective of diffusion research is on the means of adopting agricultural innovations such as herbicides, hybrid seeds, pesticides, fertilizers and modern agricultural practices are meant to help improve their standard of living. According to Surry, (1997 in Aphunu, 2011), the most important fact to consider in discussing diffusion theory is that it is not a well-defined uniform and comprehensive theory. A large number of theories from a wide variety of discipline each focusing on a different element of the innovation process, combine to create a meta-theory of diffusion. Four of the most widely used theories of diffusion of innovation discussed by Rogers are innovation decision process, individual innovativeness, rate of adoption and perceived attribute of innovation (Surry, 1997 in Aphunu, 2011).

Innovative decision process theory

This theory suggests that prospective adopters of a technology progresses over time via five stages, from the 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 to confirmation of this decision (Wikipedia, 2010). On the other way round, the theory proposes that the possible adopters of agricultural technology progresses with time in five stages, that is from the awareness stage to the final stage of adoption of the technology. Therefore, these are the earlier terminologies of the stages: awareness, interest, evaluation, trial and adoption.

With respect to the above theory, it is clear that not all adopters of innovation pass through all the above stages prior to acceptance of an innovation. Agbamu, (1998) confirm that rice farmers in Japan and Philippines pass through only three stages of awareness, trial and adoption. Therefore, in disseminating agricultural technology extension agents should be conscious of this shortfall in order to discharge their duty effectively.

Individual innovativeness theory

This theory says that farmers who are predisposed to being innovative will adopt an innovation earlier than those who are less predisposed (Surry, 1997 in Aphunu, 2010). This means that farmers who are innovative in nature tend to adopt an innovation faster

than those who are not innovative. In Rogers' diffusion model, it categorizes and groups users according to the speed in which they adopt new technology (Kathryn, 2010). These categories include:

Innovators who are the experimenters, who have technology as a central interest in their lives and pursue new technology as soon as it appears no matter what its function is. The early adopters are the "visionaries" who blend an interest in technology with a concern for significant professional problems and tasks. The early majority is the "pragmatists". Although fairly comfortable with technology in general, their focus is on the concrete professional problems rather than on the tools (technology or otherwise) that might be used to address them. The late majority is the "conservatives or skeptics" they share the attitude of the early majority, though being less comfortable with technology. The laggards are the most likely never to adopt at all (Kiljander, 2004). Therefore this theory is based on who adopts the innovation and when (Yates, 2001). This theory imposes blame-bias on individuals for their non-adoption of released technology. However, the nature, custom and the characteristics of the innovation released to individuals might influence some farmers to be laggards. The laggards may fully understand the features of the innovation but do not find it compatible with their values and norms. Laggards might want to adopt an innovation but at the same time be financially incapacitated to do so or it might be that laggards do not have a good opportunity to adopt because the innovation is not at their own disposal. For example, if a farmer is not mentally composed on a particular idea, he may find it difficult to adopt it. Moreover, it is an interesting fact to know that adopters often fall within different categories for different innovation in that a current laggard for an innovation today can as well turn to be early adopter in the next innovation.

Rate of adoption theory

This states that an innovation goes through a period slowly and gradually before experiencing a period of relatively dramatic and rapid adoption. The theory also states that following the period of rapid growth, the innovations rate of adoption will gradually stabilize and eventually decline (Surry, 1997). Therefore, rate of adoption is the relative speed with which members of a social system adopt an innovation and is usually measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation. The theory is the similarity of individual innovativeness but has a disparity in classifying adopters within a social system based on the relative speed with which members adopt an innovation. For theory of individual innovativeness, it gives a blanket

classification of adopters irrespective of the situation and innovation under consideration.

Theory of perceived attribute

This says that potential adopters judge an innovation based on their perception with regard to five attributes of the innovation, which are relative advantage, triability, observability, complexity and compatibility. This simply says that potential adopters place judgment on an innovation based on their perception with reference to the five attributes of the innovation listed above. The theory also holds that an innovation will witness an increased rate of adoption if potential adopters perceive that the innovation; can be tried on (a) limited basis before adoption (b) offers observable result; (c) has an advantage relative to other innovation; (d) is not complex and (e) is compatible with existing practices and values (Surry 1997, Hillmer, 2009). With reference to the above, it is vital to know that perception is attitudinal and changes with individual adopters, therefore, it is unfair to classify some individuals as low adopters since what one perceives as important may be less important to the other. In other words, what farmer A perceives as important may be perceived less important by farmer B in the social system.

Theory of reasoned action (TRA)

This theory states that an individual's intention to adopt an innovation is influenced by his attitude toward the behaviour and subjective norm (Tooraj and Sahel, 2011). A person's behaviour is determined by his intention to perform the behaviour. The attitude towards performing the behaviour is an individual's positive or negative belief about performing the specific behaviour. Therefore attitudes are the beliefs a person accumulates over his lifetime. This theory also opines that the intention to perform behaviour depends upon the product of the measures of attitude and subjective norms (Hillmer, 2009). If a person perceived that the outcome of behaviour is positive, he will have a positive attitude towards performing that behaviour and vice versa. Subjective norm is beliefs about what others will think about the behaviour; in other words, the perceived influences of social pressure on an individual to perform or not perform the behaviour. The person believes that specific individual or groups think he should or should not perform the behaviour and his motivation to comply with the specific references (Tooraj and Sahel, 2011). Therefore, if societies see behaviour as positive, individual will be motivated to meet up with the expectation of the societies, then a positive subjective norm is expected.

Theory of planned behavior

TPB is one of the most widely used models in explaining and predicting individual behavioural intention and acceptance of technology. TPB is an attitude – intention-behaviour model, which says that an individual's behaviour is determined by perceived behavioural control and intention. An attitude, subjective norm, and perceived behavioural control, in turn determine intention (Tooraj and Sahel, 2011). The TPB proposed that an individual's intention to perform an act is affected by his attitude towards the act, subjective norms and perceived behavioural control (Ozdemir and Trott, 2009). According to theory of planned behaviour (TPB), an individual behaviour is determined by behavioural intention and perceived behavioural control, and behavioural intention is determined by attitude towards behaviour, subjective norm and perceived behaviour control. Attitudes towards behaviour reflect one's favourable or unfavourable feeling of performing behaviour. Subjective norm reflects one's perception of others relevant opinions on whether or not he or she should perform a particular behaviour. Therefore, perceived behavioural control reflects one's perception of the availability of resources or opportunities necessary to perform behaviour (Haghighinasab, 2009). In line with the above, it is observed that the difference between this theory and TRA is the addition of behavioural intention and perceived behavioural control therein. However, Kathryn, (2010) employed the behavioural approach to understand rice farmers' technology adoption decisions in Indonesia.

Technology acceptance model (TAM)

This model states that an individual's perceived usefulness and perceived ease of use of a particular information system influences his attitude towards using that system, which affects the intention to use the system and in turn their actual use of the information system (Hillmer, 2009). According to Tooraj and Sahel, (2011) the goal of TAM is to explain what determines acceptance and behaviour across a broad range of end-users. However, TAM employed the TRA model to the domain of user acceptance of information technology and replaced the TRA model's attitudinal determinants with two beliefs; (a) perceived ease of use – means the degree to which a person believes that using a particular system would be free of effort. (b) Perceived usefulness – means the degree to which a person believes that using a particular system would enhance his or her performance (Yahyapour, 2008) However, TAM was found to be a simpler, easier to use and more powerful model to uncover what determines user acceptance of information technology (IT) while both models satisfactorily predicted an

individual's attitude (satisfaction) and behavioural intention. TAM is popularly used in business management literature to interpret the adoption of computers, internet use, e-commerce and other technologies. Study of Huang *et al.* (2007) disclosed that TAM model worked very well in determining adoption of mobile learning by students. The study further shows that perceived usefulness (PU) and perceived ease of use (PEOU) are key determinants of user perception of m-learning; however, the usefulness of mobile technology was a vital characteristic of adoption.

Economic theory of adoption

This theory of adoption can be regarded as the theory of maximization of utility and is used to explain the response of farmers towards a newly introduced technology (Adesina and Seid, 1995; Adesina 1996 in Aphunu, 2011). This theory states that farmer will adopt a given technology if the utility derived from the new technology exceeds that of the previous (old) one. This theory is also based on the assumption that a farmer or potential adopter makes choice or selection with respect to the satisfaction that may be derived from the technology. He could also make choice on the maximization of the expected utility subject to prices, policies, personal characteristics and natural resource.

Conclusion and Recommendation

The basic roles of agricultural extension agent in the technology transfer are to assist farmers in putting readymade technologies into practice, to facilitate agricultural transformation building. Therefore, adoption is regarded as a decision to make full use of an innovation as the best course of action available. Adoption of an innovation is the decision made by an individual or group to use a technology. However, owing to the different roles of adoption in agricultural sector, the study used analytical method to review the following issues: The concept of adoption, stages/steps in adoption of innovations, determinants of adoption, constraints to adoption and theories of adoption. This study therefore, recommended that for extension agents to achieve their targets in a rural setting, the roles of extension agent in collaboration with the proper knowledge of the adoption theories, constraints to adoption and the determinants of adoption should be articulated into the social system of the farmers.

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