



**AN ECONOMIC INQUIRY IN TO THE EMPIRICS OF THE  
DETERMINANTS OF DEMAND FOR TECHNOLOGY: AN  
EXPLORATIVE RESEARCH**

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**Abstract**

*An understanding of the processes leading to the adoption of new technologies by smallholders has been important to the planning and implementation of successful research and extension programs. This study is thus meant for surveying, being an explorative research, empirical findings of researches on determinants of demand for adoption of agricultural technologies. The survey has underscored that no single conclusion has been drawn with respect to the key factors which favor or impede adoption decision. This is because a variable at a given time and place becomes less impotent or even induce an impediment on the adoption behaviors of farmers when actually it is a detrimental factor for adoption at another time and place.*

*Key words: Technology, Demand, and Adoption*

**INTRODUCTION**

The population of Ethiopia is estimated to be growing at a rate of 3% per annum. In order to feed the rapidly growing population, the only means of increasing agricultural production is through agricultural intensification (increasing the productivity of area under production). Agricultural intensification can be achieved through better farm management practices and increased use of improved technologies like chemical fertilizers, high yielding varieties, pesticides and organic mineral. Improved crop varieties are crucial to increase agricultural productivity. Agronomists believe that improved seeds are the nucleus of all improvements where the potential impact of other farm inputs depends. The use of good quality seeds of adopted and improved varieties is widely recognized as fundamental to ensure increased crop production and productivity for centuries (EEA/EEPRI, 2007). One of the main causes for low productivity of Ethiopia agriculture is the low level of improved technology utilization. Thus, in view of the ever-increasing population and limited availability of arable land, intensification of agricultural production appears to be the only option to increase



productivity in Ethiopia. The use of improved technologies helps to increase productivity and shift the production function upwards thereby playing a great role in the nation's attempt to attain food security. This is especially more so in a situation where both labor and land productivities are at a very low level. (Bezabih, 2003; Nigsse and Mulat, 2003; Abebe and Mulat, 2003; Azam, 1996).

Agricultural intensification, however, does not only solve the food security problem of the nation but it is also a basis for its industrial expansion. Almost for two and a half centuries, industrial expansion has been considered as an engine of economic growth, and favorable change in agricultural productivity has been regarded as the major factor determining the size and growth of industrial sector (J,steuart, 1767; Paulos, 2005)

### **STATEMENT OF THE PROBLEM**

A vast majority of rural smallholders in developing countries depend on traditional and subsistence farming, the characteristic features of which are, among others, low productivity and low marketed surplus. These smallholder subsistence farmers are most likely to be among the poorest and most vulnerable of all groups. They remain mostly outside the mainstream exchange economy for lack of marketable surplus whose main cause may be attributable to failure to adopt technologies. Hence, it is important to identify and address underlying factors leading to adoption of improved seed

Furthermore it is very well noticeable and not far away from intuition that, small holder farmers differ in their level of adoption. The causes of the diversity are attributable to various demographic, social, economic, or institutional factors. Furthermore literatures on adoption studies have varied and sometimes opposing results. This study is meant for exploring determinants of demand for technologies and outlining the various detrimental factors on which there is shared agreement among researchers in the study subject.

### **OBJECTIVES OF THE STUDY**

The main objective of this paper is to explore and or survey literatures so much so that the determinants of household decision to adopt agricultural technologies will be identified

### **RESEARCH QUESTION**

Empirical studies on the adoption and diffusion of innovations were conducted by a number of researchers. The empirical investigation has been useful to investigate and find answers to the following set of questions:

- What decision-making pathways do individuals follow when considering whether or not to adopt an innovation?
- Which sources of information are important?



- What are the differences among people who adopt innovations quickly or slowly?
- How do potential users communicate among themselves about these innovations?
- Who plays the important role of opinion leader in the communication process?
- And how does an innovation diffuse through a society over time?

## **RESEARCH HYPOTHESES**

It is hardly possible to draw general trend among variables in so far as demand for adoption is concerned, the pertinent context, the type of technology and the prevailing environment matters most than the intuitively expected result.

## **METHOD**

Be this as it may, however, review of empirical works is important for various reasons. First, it helps to assess the present state of knowledge of the adoption process. Second, it helps to enhance the interpretation of empirical models and their results and its implications as against the conceptual or theoretical models.

This research is an exploratory research. The main purpose of such studies is that of formulating a problem for more precise investigation or of developing the working hypotheses from an operational point of view or an attempt probe a more rigorous research question. As such the research design appropriate for such studies must be flexible enough to provide opportunity for considering different aspects of a problem under study. The study, has thus, employ an extensive survey of related literatures, conduct an expert opinion pool, delve on a priory knowledge of the subject matter and previous researches conducted by the researchers

### ***Survey of Empirical Studies on the Adoption of Agricultural Technologies***

Because of these, different peoples have conducted a number of empirical studies. A hell lot of empirical research on adoption of innovations and detailed analyses of differences between adopter categories with respect to a host of personal, social and cultural and institutional characteristics have been conducted. Views and findings are not, however, consistent with respect to the role of these factors on adoption behavior of farmers and the subject is of considerable controversy around the globe. Thus review of empirical works is important for various reasons. First, it helps to assess the present state of knowledge of the adoption process. Second, it helps to enhance the interpretation of empirical models and their results and its implications as against the conceptual or theoretical models. For ease of grouping, the variables so far identified as having relationship with adoption are categorized as household personal and demographic variables, socio-economic factors, technology related factors, and institutional factors. (Feder et al., 1985; Mulugeta, 2009, Workneh; 2007, (Rogers, 1983).



### **Household's personal and demographic variables**

Household's personal and demographic variables are among the most common household characteristics which are mostly associated with farmers' adoption behavior. From this category of variables age, sex, education, family size and farming experience were reviewed in this study. Age of the household is usually considered with the assumption that older farmers will have more knowledge and skill with farming which enables them to easily understand the benefits of the technology better than others. However, with regard to age different studies report different results. For example a study conducted by Motuma (2008) on explaining disadoption of agricultural Technologies (the Case of improved maize seed in Central Western Ethiopia) revealed that younger farmers were more likely to adopt and the effect of age on the probability of adoption is significant. Similarly, Pedro et al (2009) on their study on improving technology adoption in agriculture through extension services in Uruguay and Techane (2003) in his study on fertilizer use and marketing in Ethiopia reported that age had a negative effect on the adoption of technologies. However, there are also others who reported positive relationship of age with adoption. For instance, Edilegnaw (2003) on the study conducted on the opportunity cost of growing traditional wheat varieties (implications for the design of targeting principles of adoption of improved varieties in Ethiopia) reported positive relationship between age and adoption. This is also confirmed by the studies of Mauricer et al (2009) on production risk and farm technology adoption in Rain-Fed, Semi-Arid Lands of Kenya. There are also other groups of researchers who identified that there was no relationship between age and technology adoption. For example, adoption of old coffee stumping technology and improved onion seed and age of the household are unrelated (mulugeta, 2009; Tadesse 2008). Thus the role of age in explaining technology adoption is somewhat controversial. It is usually considered in adoption studies with the assumption that older people have more farming experience that helps them to adopt new technologies. On the other side, because of risk averting nature older age farmers are more conservative than the youngest ones to adopt new technology. (Mulugeta, 2009)

Gender differentials are one of the most important factors influencing adoption of improved agricultural technologies. Due to long history of cultural and social grounds in many societies of developing countries, women have less access to household resources and also have less access to institutional services. Regarding the relationship of household's sex with adoption of agricultural technologies, many previous studies reported that household's gender has positive effect on adoption in favor of males. For example, Mulugeta (2009), in his study on determinants of intensity of adoption of old coffee stumping technology in Dale Wereda found that male headed households are more likely to adopt fertilizer than female headed households. Similarly Tadesse (2008) on his study on farmers' evaluation and adoption of improved onion production package in Forger District reported that gender differentials among the farm households positively influenced adoption and intensity of adoption of technology use.

With regard to education, there is a general agreement that education is positively associated with adoption because education is believed to increase farmers' ability to obtain, and analyze information that helps him to make appropriate decision. Studies conducted by Motuma (2008); Tewodaj et al. (2009); Mauricer et al. (2009); dessalegn.



(2008); Tadesse. (2008) and Tesfaye et al. (2001) have reported that education had positive relationship with adoption.

Family size is one of the other important household demographic variables which have influence on farmers' adoption behavior. Large family size usually implies availability of labor provided that majority or all of the family members are within the age range of active labor force (15-64 years). In most studies, family size had positive relationship with adoption of improved agricultural technologies. For instance, Dessalegn (2008) on the study he conducted on social network and diffusion of agricultural technology of sorghum production reported positive and significant relationship of family size with adoption. Similarly, Tewodaj et al(2009), reported positive effect of family size on adoption of technology. Others, for instance, Tadesse (2008) and Basant et al (2007) have also reported similar results.

#### **Farm characteristics**

Farm related variables such as farm size and other farm characteristics influence farmers' adoption behavior as farm is an important unit where agricultural activities take place. Concerning farm size, different studies reported its effect differently. For example, a study by Basalt et al (2007); Ira et al (2007); Ramato (2007) and Aloyce et al (1998) indicated positive relationship between farm size and adoption. Contrary to this, a study conducted by workneh (2007) on the adoption of improved box hive in Atsbi wemberta district of eastern zone (Tigray) reported that farm size will not affect technology adoption. Thus the type of technology being adopted and its requirement of land size determines as to how land size can affect technology adoption.

#### **Household's economic characteristics**

Economic factors influence household's adoption decision of agricultural technologies. According to Mulugeta (2009) economic factors such as household's resource ownership and economic objectives play a great role in determining the willingness and ability to invest in the adoption of agricultural technologies. In rural context, livestock holding is an important indicator of household's wealth position. Livestock are also an important income sources which enables farmers to invest on the adoption of improved agricultural technologies. No doubt that in most cases, livestock holding has positive contribution to household's adoption of agricultural technologies. This is evident from many of the past adoption studies which have reported positive effect of livestock holding on adoption. To mention some of them, for instance, Aloyce et al (1998); Ramato (2007); Tadesse (2008) Techane (2002) revealed that livestock holding has positive influence on adoption of improved agricultural technologies.

Households' income position is one of the important factors determining adoption of improved technologies. In the context of rural households, annual farm income obtained from sale of crop and/or livestock, off-farm and non-farm income are important income sources. Regarding annual farm income, almost all empirical studies reviewed show the effect of farm income on household's adoption decision is positive(Tadesse, 2008; Ramato,2007) Participation in off-farm activities is believed to have a bearing on the income of households. Additional income earned through participation in these activities



improves farmers' financial capacity and increases the ability to adopt new technology. Off-farm activities are the other important activities through which rural households get additional income. The income obtained from such activities helps farmers to purchase farm outputs. Review of some of the past empirical studies shows that the findings regarding the influence of off-farm/ non-farm income on adoption vary from one study to the other. However, the majority of the studies reported positive contribution of off-farm and/ or non-farm income to household's adoption of improved agricultural technologies. For instance, a study conducted by Fufa and Hassan (2006); Tadesse (2008) indicated positive relationship between off-farm / non-farm income and adoption. Contrary to this, (Makokha et al 2007) on their study on adoption of dairy technologies in Kenya reported the negative influence of participation in off-farm income on farmers' adoption of dairy technologies. Like wise Techane (2002) in his study on determinants of fertilizer adoption in Ethiopia reported the negative influence of participation in off-farm income on farmers' adoption of chemical fertilizer.

Availability of household labor is the other important variable which in most cases has an effect on household's decision to adopt new technologies. Several studies reported the positive effect of household labor availability on adoption of improved agricultural technologies. For instance, Shiferaw and Tesfaye(2006) in their study on adoption of improved maize varieties in southern Ethiopia found positive effect of household's labor availability on adoption of improved maize varieties. Similarly the studies of Fufa and Hassan (2006) on determinants of fertilizer use on maize in eastern Ethiopia revealed household size, which is a proxy for labor availability is positively related with adoption probability.

### **Institutional factors**

Farmers make decisions within a broader environment or context. Institutional factors are part of such broader environment which affects farmers' adoption decision of agricultural technologies. Institutional factors in the context of this study include support provided by various institutions and organizations to enhance the use of improved technologies such as extension and credit services and other inputs. (Mulugeta, 2009)

Extension provides farmers with information related to agricultural technologies. In collaboration with other organizations or alone, it can also channel credits and other incentives to the farming community to enable them improve production and productivity. The relationship between farmers' access to extension services and adoption has been repeatedly reported as positive by many authors. For example, study conducted by Mulugeta (2009) revealed that visit by extension agents had a positive influence on the adoption of old coffee stumping technology in Dale Wereda of SNNPR of Ethiopia. Similarly Ramato (2007) in his studies on determinants of adoption of improved haricot bean production package reported that visit by extension agents had positive influence on technology adoption. Many other authors such as Tadesse (2008) also reported positive relationship between access to extension and adoption of (2007) Shiferaw and Tesfaye (2006), Aloyce et al (1998) and Techane (2002); Adeogun agricultural technologies.



Mass media also play the greatest role in provision of information in the shortest possible time over large area of coverage. The adoption process of agricultural technologies depends primarily on access to information and on the willingness and ability of farmers to use information channels available to them. The role of information in decision -making process is to reduce risks and uncertainties to enable farm household to make right decision on adoption of agricultural technologies. Many studies reported positive relationship of mass media with adoption of agricultural technologies (Mulugeta 2000; Ramato, 2007).

The other institutional support that farmers need to get to improve production and productivity is, credit service and other inputs. Capital and risk constraints are key factors that limit the adoption of high value crops by small scale farmers because these crops generally are much more costly to produce than traditional crops and most growers require credit to finance their production. In line with this, study conducted by Shiferaw and Tesfaye (2006) on the adoption of improved maize varieties in southern Ethiopia indicated that credit availability significantly affected adoption of improved maize especially of resource poor households. Similarly, other authors who conducted studies on adoption of agricultural technologies revealed the same result.(Ramato,2007; Workneh2007; Tadesse,2008; Pashupati and Atsushi, 2008; Ira et al ,2007) .They all have revealed that there is positive relationship of credit with adoption of improved technologies by farmers. Timely availability of inputs, input and output prices, relevant information, access to road and distance from a near market are institutional factors which are expected to have influence on household's adoption behavior. (Ira et al, 2007; Mulugeta, 2009)

### **Implication**

An understanding of the processes leading to the adoption of new technologies by smallholders has been important to the planning and implementation of successful research and extension programs. At one level, a number of farm-household factors are typically associated with adoption, such as:

- Age, education and personal characteristics of the household head
- Size, location and tenure status of the farm
- Availability of cash or credit for farm investment
- Access to markets for farm produce; and so on

However, at the village level and beyond, more interesting and significant issues often arise. Views and findings are not, however, consistent with respect to the role of these factors on adoption behavior of farmers and the subject is of considerable controversy around the globe. No single conclusion has been drawn with respect to the key factors which favor or impede adoption decision. This is because a variable at a given time and place becomes less impotent or even induce an impediment on the adoption behaviors of farmers when actually it is a detrimental factor for adoption at another time and place.

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