The influence of intervening variables and subjective norms on the adoption behavior of small scale farmers in South Africa and Lesotho

By

Charles Annor-Frempong

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The influence of intervening variables and subjective norms on the adoption behavior of small scale farmers in South Africa and Lesotho

ABSTRACT

The main research problem is the low productivity of small scale maize farmers largely as a result of low adoption rates of recommended practices that could enhance yield levels and improve their incomes and livelihoods, and the inability of extension workers to effectively influence farmers' decision making process by their lack of appropriate predictive extension planning tools. The problem faced by extension workers is the lack of understanding of the wants and needs of farmers, their preferences and behavioral inclinations towards agricultural innovations.

In order to contribute to the understanding of farmers' behavior change, the study sought to compare the relative influence of personal and social characteristics of farmers with intervening variables as conceptualized by Düvel and Ajzen's subjective norms, with the objective of determining their predictive potential of farmers behaviors for extension program planning purposes. A secondary objective was to search for additional variables to explain farmer's adoption behavior by exploring the predictive value of the subjective norm concept

The study was carried out in the Leribe and Maluti-a-Phofung districts of Lesotho and South Africa respectively. A structured questionnaire with a Sotho translation was used to collect data from 107 farmers randomly selected from the districts and administered by trained extension staff. The data collected was analyzed using the social sciences (SPSS). In determining the relationships between the independent and dependent variables, Chi-square test of independence, correlation and regressions analysis were used.

In all 10 independent and nine intervening variables were selected for the study. The independent variables were location of the farm, membership of farmers association, gender, age, level of education, experience in farming, off-farm income, amount of time spent farming, total farm size and area under maize cultivation. The intervening variables were efficiency perception, need

compatibility, need tension, awareness and prominence constituted cognitive aspects derived from Düvel's Model and the social dimensions adapted from Ajzen's subjective norm concept were, important people, extension agents, close friends and membership of farmers association.

The results suggest that farm size and area under maize cultivation were the only variables that showed any consistent influence with adoption of recommended maize agronomic practices namely: use of improved seeds, lime and fertilizer applications. The association between the remaining variables seems to be more dependent on the type of recommended practice. For example location was found to be significantly associated with the adoption of fertilizer and top-dressing practices but not with lime and the use of improved seed. All the remaining independent variables gender, age, educational level, experience and time spent on the farm appear not to have any significant influence on the adoption of the recommended practices at five percent level of probability. Compared to the independent variables, five out of the nine intervening variables, namely: prominence, awareness, need compatibility, efficiency perception and need tension were consistently found to be highly significantly associated with the adoption of all the four recommended maize agronomic practices at 5% level of probability. On the other hand, the subjective norm variables did not show any consistent association with adoption behaviors of respondents

In general the analysis suggest a lower than expected contribution to variation as the results contradicts the hypothesis that farm and farmer characteristics influence adoption behavior. This is supported by the fact that, except for top- dressing where the characteristics of the farmer and farm contribute about 40% to the explanation to total variation, the rest all fall below 20 %. In contrast, the evidence shows that the intervening variables – those with cognitive dimensions, showed a high degree in explaining variation in the adoption behavior in all the production practices studied. The power of explanation ranged from 49% in the case of adoption of improved seed practices to 77.7% for the use of lime. The results provide strong evidence in support of the contention that, the intervening variables of cognitive in nature, are the likely precursors of decision making through which the influence of independent variables become manifested in behavior. The results also show that need, perception and knowledge related variables mediate between intentions, personal variables and the environment and decisions on

adoption. This study confirms and opens the way for the search for more intervening variables with the potential to extend the epistemology of extension science.

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List of Abbreviations

Aw	Awareness
FAO	Food and Agriculture Organization
LAN	Ammonium Nitrate
NAFU	National Agricultural Farmers' Union
NC	Need Compatibility
NT	Need Tension
PBC	Perceived Behavioral Control
SN	Subjective Norm
SPSS	Statistical Program for Social Sciences
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TRA	Tractor Owners Association

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

In Lesotho, a predominantly small scale farming country, the average yield for maize is about 0.5tons/ha whilst the national average in South Africa is 2.73 tons/ha all very much lower than in most parts of the world (FAO, 2005). There are indications that farmers in Lesotho can increase their yields by about 100% by adopting hybrid maize seeds and other yield enhancing technologies such as fertilizers and liming. According to the FAO (2005) whilst most small scale farmers in South Africa achieve yields of about 4 t/ha others in Kwazulu-Natal who apply recommended technologies under rain-fed conditions have consistently obtained yields in excess of 8 t/ha with yields of 11 t/ha on some selected fields (FAO, 2005).

The causes of the wide variation in productivity could be traced to climatic conditions where total annual precipitation and distribution is a factor and can hardly be controlled except by irrigation. While greater parts of the maize growing region in South Africa is less endowed with adequate water resources, Lesotho on the other hand is relatively well endowed with water resources yet lacks the infrastructure and resources to develop good irrigation systems. Soils in both countries are extremely vulnerable to various forms of degradation and have low resilience (recovery potential). Very little fertilizer is applied among small scale farmers, for various reasons, leading to exhaustive cropping and soil fertility decline. Because yields are low, the annual amounts of nutrients removed, are small, but the long term effects are large.

Maize crop is selected for this study due to its dominance on the farming scene of the two countries – Lesotho and South Africa. It is the most important grain crop, being both the major staple food for the majority of the population especially the poor, and a major feed grain. Maize serves as a raw material for the manufactured products such as paper, paint, textiles, medicines and food. The maize industry is important in the economy both as an employer and earner of foreign currency. It is expected that the demand for maize for animal feed will increase as the domestic poultry industry expands and the domestic demand may expand by approximately 30%

in the medium term if the production of bio-ethanol from maize commenced. The selection of maize and the associated improved farm practices of seed and soil fertility enhancing innovations of lime and fertilizer application for the study domain is deliberate and purposive because of the potential effect these soil ameliorants can have on yields when adopted by farmers and consequently contribute to incomes and livelihoods.

1.2 STATEMENT OF THE PROBLEM

The main research problem is the low productivity of small scale maize farmers largely as a result of low adoption rates of recommended practices that could enhance yield levels and improve their incomes and livelihoods, and the inability of extension workers to effectively influence farmers, decision making process by their lack of appropriate predictive extension planning tools. The problem faced by extension workers is the lack of understanding of the wants and needs of farmers, their preferences and behavioral inclinations towards agricultural innovations

The situation of small scale farmers described in the background section has major implication for agricultural extension workers whose main function is to ensure that improved practices are applied (Mosher 1976; Rivera, 2011). The inability of extension workers to influence farmers' behaviors is problematic and the study is design to contribute to a better appreciation of farmers' motive for adoption and establish a basis by which extension workers can predict upfront and plan appropriately to address the concerns of farmers.

A number of studies have shown that the use of agricultural innovation by farmers results in significant improvements in yields and productivity on the farm through efficiency gains (Henderson & Gomes, 1982; Byerlee, Alex & Echeverria, 2002; Marsh, Pannell & Lidner, 2004). Consequently, many governments, particularly in developing countries have made investments in agricultural research and extension with the expectation that the adoption of agricultural innovations by farmers (Marsh, et al, 2004,) will lead to positive changes on the farm with beneficial impacts on the livelihoods of the farming population and the national gross domestic product (Henderson & Gomes, 1982; Byerlee et al, 2002).

In Europe, on the other hand, the emphasis of extension programs in recent times has not been the same as in developing countries, but more towards environmental issues. According to Burton (2004), policy makers in the 1980's sought to dissuade farmers from over production through voluntary measures to diversify their businesses to reduce environmental impacts of agriculture. Issues in agriculture within the developed nations and less developed are not the same (Rivera, 2011) but the approach of communicating to farmers are largely similar – through extension program.

Rivera (2011: 115) describes extension as the *"engine of innovation"*. Although the organizational structure and operational systems may differ from country to country, he argues that *'the main challenge is for extension to operate in a context where new knowledge and technology, when appropriate, are applied'* (Rivera, 2011: 116). Extension organizations and the individuals who make up the organization have to contend with behavioral change of the users of the knowledge and technology in order to fulfill their mission of ensuring its application. Simply put, a technology or knowledge cannot be applied unless there is a behavioral change.

Extension methodology around the globe therefore, has to contend with changing the behavior of farmers to improve the adoption of either a policy measure (in the case of Europe) or improved farm practices (in the case of developing countries). Behavioral change is thus required to make any meaningful change on the farming scene and has therefore become a major concern for research. As Burton (2004: 359), noted: *"The failure of such measures to induce widespread changes to the farming industry is one factor that has led to an increase in the importance of understanding individual response of individual actors to policy measures"*.

It is only through the utilization of new practices that policy changes or agricultural productivity can be measured and the objectives realized. Understanding how farmers decide or what motivates farmers to change their behaviors is therefore of primary interest to policy makers and development workers. To social scientists, the challenge is to provide answers to enable development workers prepare strategic intervention measures.

Farmers' adoption behavior, however, is multi-faceted and reflects a rational choice to social, technical and the economic environment that surrounds the individual (Frank, 1997; Guehlstorf, 2008; Veen, 2010; Asrat, Yesuf, Carlsson & Wale, 2010). Other researchers such as Düvel (1998), on the other hand, distinguish between the social, environment and personal characteristics and classify these as independent factors which are difficult to change and could only be measured ex-post and are therefore not useful in predicting behavioral change ex-ante for planning purposes. Rather, they argue that causal factors, such needs, perception and knowledge have a much more predictive value for planning extension programs. Thus it is possible to use these variables to predict the behavioral intentions of farmers in order to cause a change in the production practices. Düvel (1991) refers to these factors as "intervening variables" as they mediate between the independent variables such as personal characteristics and the effect – behavioral change.

Other studies (Habtemariam & Düvel, 2004; Msuya & Düvel, 2007) provide further support to the importance of the intervening variables as being the likely precursor of adoption behavior and production efficiency and through which the influences of independent variables become manifested. The conclusions of these studies, although lend support to Düvel's (1991) model of behavior analysis and intervention, they all recommended further verification in different settings and further search for potentially important intervening variables.

Another intervening variable proposed by Ajzen (1985) in his theory of "Planned Behavior" is the subjective norm. According to the theory, people are influenced in their behaviors if they think that significant others want them to perform the behavior (subjective norm), which becomes a motivational force for them to change their behaviors. Thus intentions are converted to action through the influence of the subjective norm. A high correlation of attitudes and subjective norms and subsequent behaviors has been found by many studies in advertising, public relations and health care.

Attitude, Subjective norm and Perceived behavioral control are the proximal determinants of intention which in turn is a proximal determinant of behavior. Intention therefore mediates between the three primary proximal determinants and behavior. The relative influence and

importance of each of the determinants however is a function of the intention under investigation. For example, it is quite possible that social influence may play a greater role in the intentions of a farmer to adopt an innovation than attitude and perceived behavioral control.

This study proposes to continue the search for other important variables by investigating in addition to the intervening variables, subjective norm, a term coined by Ajzen & Fishbein, (1980) to describe the belief that decisions made by individuals are influenced by important members of the community. This has been a subject of research within the health sector its role in the adoption of agricultural practices is unknown.

1.3 STUDY OBJECTIVES

The objectives of the study are: (i) to compare the relative influence of personal and social characteristics of farmers with the intervening variables in order to determine their predictive potential of farmer behaviors for extension program planning purposes, and (ii) to complement earlier works by Düvel (1991), Habtemariam & Düvel (2003, 2004, Msuya & Düvel, 2007) in search of additional variables to explain farmer's adoption behavior by exploring the predictive value of the subjective norm concept in comparison with the intervening variables.

1.4 HYPOTHESES OF THE STUDY

The hypothesis framing is based on evidence about the relationships of behavior change from available literature. The main hypotheses of the study are stated as follows:

Hypotheses 1: The adoption of recommended farm practices by farmers is influenced by the socio- demographic characteristics of the farmer and farm.

1.1 **$H_{11}a$** The adoption of recommended farm practices by farmers is influenced by location of the farm

1.2 **$H_{11}a$** The adoption of recommended farm practices by farmers is influenced by age of the farmer

1.3 **$H_{11}a$** The adoption of recommended farm practices by farmers is influenced by Gender of the farmer

1.4 **H_{11}a** The adoption of recommended farm practices by farmers is influenced by membership of farmers association

1.5 **H_{11}a** The adoption of recommended farm practices by farmers is influenced by level of education of the farmer

1.6 **H_{11}a** The adoption of recommended farm practices by farmers is influenced by experience in farming

1.7 **H_{11}a** The adoption of recommended farm practices by farmers is influenced by off-farm income

1.8 **H_{11}a** The adoption of recommended farm practices by farmers is influenced by size of farm land

1.9 **H_{11}a** The adoption of recommended farm practices by farmers is influenced by area under maize cultivation

Hypotheses 2. The adoption of recommended farm practices is influenced by the intervening and subjective norm variables.

2.1 **H_{11}a** The adoption of recommended farm practices by farmers is influenced by efficiency perception farmers

2.2 **H_{12}a** The adoption of recommended farm practices by farmers is influenced by need compatibility regarding practice adoption

2.3 **H_{13}a** The adoption of recommended farm practices by farmers is influenced by need tension situation of the farmers

2.4 **H_{14}a** The adoption of recommended farm practices by farmers is influenced by awareness of the new practice by farmers

2.5 **H_{15}a** The adoption of recommended farm practices by farmers is influenced by the prominence attributed to the new practice.

2.6 **H_{16}a** The adoption of recommended farm practices by farmers is influenced by important people within the community

2.7 **H_{17}a** The adoption of recommended farm practices is influenced by extension agents

2.8 **H_{18}a** The adoption of recommended farm practices is influenced by close friends

2.9 **H_{19}a** The adoption of recommended farm practices by farmers is influenced by members of farmers association.

1.5 RELEVANCE OF THE STUDY

The study is intended as a contribution to earlier works by Düvel, (1991); Habtermariam & Düvel (2004) and Msuya & Düvel (2007) to determine the factors that influence farmers' adoption behaviors and provide tools for extension workers. In addition, the effect of subjective norm on farmers behavior change will also be explored to determine its predictive value. Thus this study will contribute to our theoretical underpinnings for the motivation of farmers and inform the formulation of agricultural policies and extension strategies. The agricultural advisor operating at the individual farm level will become aware of the reality and complexity of the behavioral context. The behavioral perspective may indicate the extent to which farmers are likely to diverge from the outcome of profit maximization approach. Policy measures such as promotion of a particular farm enterprise, commercialization and profit orientation, subsidization of inputs and inputs or adoption and diffusion of innovations will greatly benefit from insight on farmers behavioral orientations. In addition to the theoretical relevance, the study has several practical implications among which are:

- Contribute to the understanding of how to increase the cognitive well-being of farmers in the promotion of agricultural innovations;
- Help direct priority setting for extension, policy makers and development workers in general, and what needs to be focused upon in order to increase adoption rate;
- Increase knowledge of extension workers on the relationships between intervening variables, subjective norm and farmers behavioral in response to innovations.

1.6 OUTLINE OF THE REPORT

The report of the study is divided into nine chapters and annexes. Chapter 1 is a presentation of the background to the study, the motivation behind it, objectives and hypotheses. This is followed by chapter 2 which is a synthesis of the literature reviewed and the conceptual framework for the study. The literature covers research findings as they relate to the main subject of the study, factors that influence or affect adoption of farm practices as reported by other researchers and categorised into farmer and farm characteristics, environmental, and intervening. The section that follows is a description of the conceptual framework – the model of behavior

analysis by Düvel (1991). The methodology employed is presented in Chapter 3. The results are outlined in the next five chapters following the methodology chapter. The relationship between efficiency perception and production efficiency is reported in Chapter 4 whilst the relationship between the dependent, intervening variables and the adoption of recommended practices of seed, fertilizer, top dressing and lime follow in the remaining chapters. The last chapter is the summary of the research carried out, conclusions of the results and recommendations for further research

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is a review of literature relevant to the study. The discussion is on variables contributing to and which influences farmers' behavior change leading to the use of recommended practice. The body of knowledge on adoption process is diverse and originates from several disciplines. Diffusion research which spurred the beginnings of investigations into the adoption process particularly in the farming setting was conducted by several scientific disciplines including anthropology, sociology, geography, medicine, marketing and education among others (Rogers, 1983). According to Röling (1988), 'resistance to change' became the overriding concern of rural sociologists, social psychologists and anthropologists in the early 1950s and 1960s. Economists and other allied disciplines joined the fray, all with the intention to understand the "change processes".

It is generally acknowledged that farmers' adoption behavior is influenced by a large range of variables (Düvel, 1991; Willock, Deary, Gregor, Sutherland, Edward-Jones, Morgan, Dent, Grive, Gibson & Austin, 1999). Factors which constrain the rapid adoption of technologies include lack of credit, limited access to information, risk aversion, farm size, inadequate incentives associated with farm tenure arrangements, insufficient human capital, absence of equipment, chaotic supply of farm inputs, and inappropriate transportation and infrastructure (Feder, Just & Zilberman, 1985).

Düvel (1991) following up on earlier works by Lewin, (1951) categorized the causes of adoption behavior into: (i) those that are personal to the adopter and include the characteristics of the farmer and the farm and; (ii) environmental which describes social, economic and political influences on the farmer and farm (Fig 2.1). The personal and environment variables are the indirect causes of behavior with the intervening variables being the direct precursor to behavior change (Ajzen & Fishbein, 1980; Düvel, 1991).

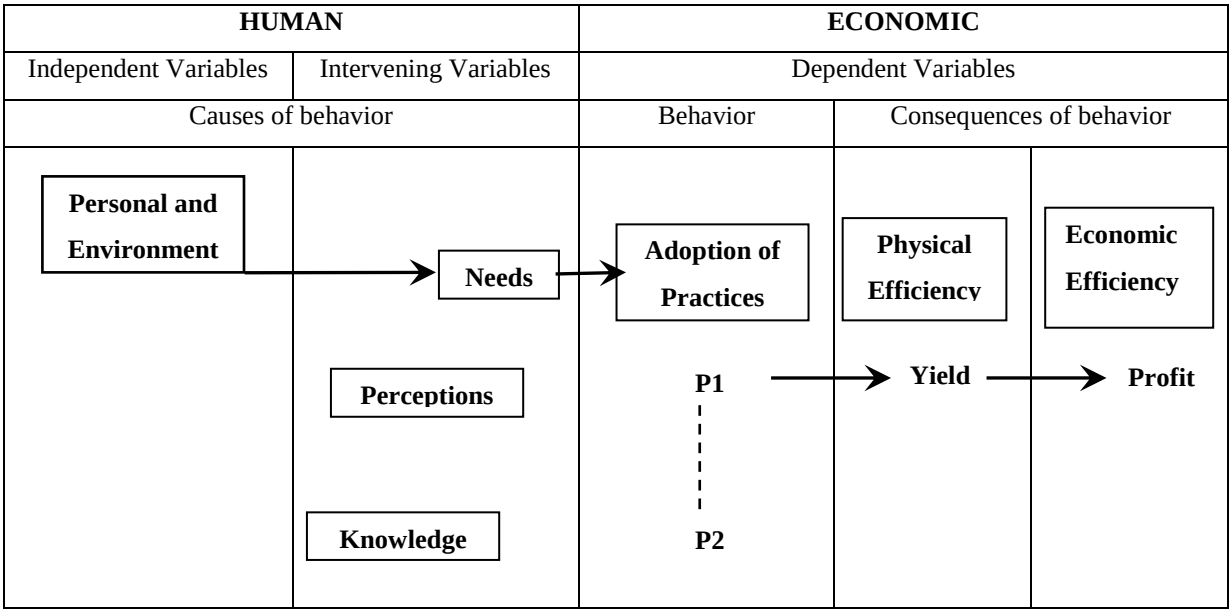

Figure 2.1: The Relationship between behavior-determining and behavior-dependent variables in agricultural development (Düvel, 1991)

To summarize the vast amount of empirical studies on factors influencing the adoption behavior of farmers, this chapter is organized along the same classification proposed by Düvel (1991) in discussing relevant influences in relation to the study on farmers' adoption behavior.

2.2 FARMER AND FARM CHARACTRISTICS AND ADOPTION BEHAVIOR

A general conceptual framework proposed by Düvel (1991) on the causes of behavior and consequences of behavior represented by Fig 2.1, distinguishes between the anticipated benefits of adoption of technologies (behavioral response/change) namely; physical and economic efficiency and their causes which are the personal and environmental and the intervening variables. The assumption embodied in the frame work is that there is an overall efficiency gain by adopting improved agricultural technologies. The characteristics of the farmer and farm includes, the location of the farm, age, gender, education, experience of the farmer, off-farm income, membership of farmers association, size of land and farm among others are discussed below.

2.2.1 *The location of farm*

Agricultural production is affected by the farms physical location as well as edaphic and biotic endowments. These include fixed factors such as topography, rainfall and soils on one hand and the presence of variables such as weeds, pests and diseases. The success of any intervention is determined by the extent to which the technical alternative can overcome some of these factors. In addition, the location of the farm, to some extent, influences the type of agricultural service due to accessibility, state of infrastructure including markets for both inputs and farm produce (Lapar and Ehui, 2004) and therefore influence adoption decisions (Isgin, Bilgic, Forster & Batte, 2008). In a study conducted in Nepal, Ransom Paudyal & Adikharil (2003), found that adoption was related to closeness of the farmers to an agricultural research station which may have contributed to early exposure and easy access to information. Although Chirwa (2005) reported that distance to markets was negatively associated with farmers' decisions to adopt fertilizer or hybrid maize technologies

2.2.2 *Age*

The resource endowments of young and adult farmers are very often different. The interest, experience and expectations can also differ. Diederen, Meijl, Wolters & Bijak (2003) argued that older farmers have a lower level of education may have a shorter time horizon and thus less inclined to invest in new technologies. Lawal, Saka, Oyegbami &. Akintayo (2005) found age to be an important factor that influenced the adoption of improved maize seeds in south western Nigeria. Using age as a proxy for experience Sall, Norman & Featherstone (2000) explained that knowledge gained over time may help in evaluating information thereby influencing their adoption decision. Chirwa (2005) however, found that the adoption hybrid seed is negatively associated with age and that older farmers were less likely to adopt hybrid seeds as they preferred the characteristics of the local maize to the improved varieties. Other studies carried out in Ethiopia also indicate that age is not an influencing factor to the adoption of fertilizers (Croppenstedt, Demeke & Meschi, 2003).

2.2.3 *Gender*

The roles and responsibilities of female and male farmers may differ from one culture to the other and may also influence resource endowments and access to services. In some societies female farmers concentrate on food crops for the household whilst their male counterparts cultivate cash crops. In some cases, access to extension services by female farmers are constrained as male extension workers are not permitted by the norms of the society to interface directly with the opposite sex in the absence of their husbands. Some studies have found gender is not a significant determinant of adoption of seeds and fertilizers and that female and male headed households with the same resource endowments do not differ in their adoption and intensity of fertilizer use (Croppenstedt et al, 2003; Chirwa, 2005).

2.2.4 *Farmers' Associations*

Organizations provide networks within which information is passed around and evaluated, according to Roling (1988) farmers' associations also provide inputs, credit, marketing and other services besides technological information. Farmers in cooperative societies easily adopt technologies that require collective effort or may adopt a recommended practice due to peer pressure. Farmers associations in South Africa are known to be well structured and function efficiently (FAO, 2005). They typically invite experts to address the group on topics related to technology, conduct their own demonstrations to test new products or technology. Chirwa (2005) however, found that membership of farmers association did not influence farmers decision to adopt hybrid maize in Malawi.

2.2.5 *Land and farm size*

Size of arable land and total farm size and or area devoted to a particular enterprise tends to affect adoption behavior (Isgin et al, 2008) and could also be an indicator of the wealth status of the farmer. The relationship between farm size and adoption behavior is affected by factors such as fixed adoption cost, risk preferences, education, credit constraints, tenure arrangements etc. Reed & Salvacruz (1995) concluded that large farmers have a greater margin of risk-taking and greater access to credit which enables them to adopt new practices faster than smaller farmers. These factors determine whether a technology is relevant and available to a household. The literature suggests that larger fixed costs cause a reduced tendency to adopt and slower rate on

smaller farms from the point of view of relative advantage (Chirwa, 2005). In a similar study, Ransom, Paudyal & Adhikaril, (2003) found that for every 1ha of rice land in Nepal results in a corresponding increase in adoption rate of improved maize varieties by 13.5 percent. Although Croppenstedt et al (2003) found that small scale farmers use fertilizers more intensively than larger farms and that additional hectare of land decrease demand for fertilizer by 4.9kg in Ethiopia. Sall et al (2000) also concluded that farm size did not influence the adoption of improved rice varieties.

2.2.6 *Education*

Formal education is thought to be associated with adoption behavior and that the level of education required to handle processes have to be comparable. Lapar & Ehui (2004) concluded in a study conducted in Philipines that farmers' education has a significant positive influence in the adoption of forages. They concluded that better educated farmers are more likely to recognize the benefits of adopting forage species from the point of view of soil conservation and sustainable farming, and as additional source of feed for livestock. Evidence of the positive role of education in the adoption of technologies has been reported from other studies (Doss and Morris, 2001; Chirwa, 2005). Other studies, however (Isham, 2002), did not find any significant role of education in the adoption of technologies by farmers. Asfaw & Admassie, (2004) contend that the role of education is diminished by factors such as mass media and input dealers.

2.2.7 *Experience in farming*

The number of years in farming is thought to affect adoption behavior as it is assumed that the adoption of one technology predisposes the farmer to adopt other technologies. Ransom et al (2003) found in their study that years of fertilizer use had a minor positive impact on the rate of adoption of improved seeds and explained that farmers with more experience with technologies, in general, are more likely to test and adopt new and improved varieties. Ransom et al (2003) found that every one year of experience in fertilizer application leads to an increased adoption of improved open pollinated maize variety by one percent. Sall et al (2000) also found a significant relationship between adoption of improved rice varieties and experience and accessibility to information. In another study on decision making in soil conservation in Sri-Lanka by Illukpitiya & Gopalakrishnan (2004), concluded that personal characteristics such as farming experience

and education indicated a strong positive investment decision on soil conservation. Feder & Umali (1993, p 216) described an innovation as *"a technological factor that changes the production function and regarding which there exists some uncertainty, whether perceived or objective (or both)".* They concurred with Hiebert (1974) explanation that the uncertainty diminishes over time through the acquisition of experience and information and the production function itself may change as adopters become more efficient in the application of the innovation.

2.2.8 *Off-farm Income*

It is believed that off farm income has a positive effect on adoption behavior as they provide ready and available source of finance for farm inputs. It is therefore expected that part-time farmers who have additional source of income will adopt technologies compared to full time farmers whose main source of income is dependent on the farm. However, Ransom et al (2003) found that large changes in off-farm income are needed to create significant increases in adoption of improved varieties. The study found that for every 1000 Rands increase in off-farm income, adoption of improved open pollinated maize varieties increased by 0.2 percent. Chirwa (2005) also recorded significant association between adoption of fertilizer and hybrid seeds and attributed this to increase in affordability.

2.3 THE ENVIRONMENT AND ADOPTION BEHAVIOR

The environmental influences on farmers' behavior as depicted in Fig 2.1, refers to all factors which influences farmers' behaviors other than the farmer and farm characteristics discussed above. These include attributes of the innovation itself, economic and socio-psychological influences and are discussed in the next section

2.3.1 *Attributes of innovations as a factor influencing adoption behavior*

The farmer and farm characteristics have influenced research on the "people" differences in determining the characteristics of the different adopter groups and to a lesser extent on the how the properties of the innovation itself affect adoption (Rogers, 1983). According to Rogers

(1983) it is an oversimplification and dangerous to consider all innovations as equivalent units for study and analysis for the reason that some innovations fail whilst others succeed.

Rogers (1983, p 212), went on further to argue that the importance of the attributes of the innovation in adoption behavior lies in the fact that *"it is the receivers perception of the attributes of the innovations not the attributes as classified by experts or change agents, that affect their rate of adoption"* and its usefulness is mainly to predict future rate of adoption. On the basis of past research five main attributes of innovation were described: (i) relative advantage; (ii) compatibility; (iii) complexity; (iv) triability; and (v) observability. These attributes are empirically interrelated but conceptually distinct.

The attributes of innovations as described by Rogers (1983) are deemed to be broad with several sub-dimensions. For example, relative advantage which is defined by Rogers (1983) as the degree to which a new idea is better than an existing practice seeks to address issues such the degree of economic profitability, low initial cost, decrease in discomfort, savings in time and effort, immediacy of the reward and social approval.

In a study among relatively prosperous farmers, Fliegel & Kivlin (1966) concluded that innovations perceived as most rewarding and less risky were most rapidly adopted while high cost, complexity and pervasiveness had no effect on the adoption. Sall et al (2000), also found that farmers' perception of crop cycle length, cooking qualities, height and resistance of improved rice varieties influenced farmers decision to adopt

Fliegel & Kivlin (1966) identified five main design problem associated with the study of adoption based on attributes of the innovation. The difficulties are: (i) in controlling for the effects of personal, social and situational factors known to influence the diffusion process in order to permit explicit focus on variability among innovations; (ii) determining which aspects or attributes of innovation might be relevant; (iii) maximizing variability in the focal area by including as many innovations as possible in the study design; (iv) measuring the selected attributes of innovation; and (v) working out a method for considering the effects of each attribute, since presumably no single attribute completely described an innovation. In certain

cases, the technologies are introduced as packages that include several components, for example, the high yielding varieties, fertilizers and land preparation practices and under such circumstances, it may be difficult to disaggregate and assign adoption to an attribute of one of the technologies making it difficult to predict future adoption rates as indicated by Rogers (1983).

2.3.2 *Economic Considerations*

Behavioral scientists have long studied decision making processes and analyzed the consequences of decisions in an attempt to discover regular relationship between classes of observable events so that causal relationships can be established in behavior outcomes. According to Burton (2004), early attempts to understand farmers' decision making processes were based largely on economic models until Simons (1975) 'satisficing' concept emerged. The assumption of 'rational behavior' is fundamental to economic theory whereby rationality is related to the maximization of self-interest such that an individual is driven to obtain the greatest material gain with least possible effort and subject to the availability of credit and other constraints (Feder, Just & Zilberman, 1985). Simons' 'satisficing' concept, however, acknowledged that people do not necessarily yield to economically optimal decision-making, but instead optimize.

In a study conducted among farmers in Ireland, Gilmore (1986) collaborated the view that income maximization is not the leading goal of farmers. In all the three areas where the study was conducted, making maximum income was considered to be substantially of less importance than making a satisfactory income. Farmers in both England and Ireland showed strong preferential attachment to agriculture ranking "doing the work they liked" first among all other value systems (Gilmore, 1986).

Consequently, non-economic factors such as goals, values, cultural, social and psychological aspects were studied and found to influence the rational decision making models. According to Gasson (1973) values are cultural products held by all members of a social system, they are not in born with them but learned, mainly in childhood, through social interaction, with parents,

peers, colleagues. Although they are relatively stable, they are immutable and cannot be changed with time.

In another such study among farmers in Cambridgeshire, it was observed that farmer groups irrespective of resource endowment and size subscribe predominantly to intrinsic orientation to work, over expressive orientation, instrumental or social dimensions of their occupation. This can be taken to support the non-economic values in farming.

2.3.3 *Social Influences on adoption behavior*

Subjective norm, according to Ajzen & Fishbein (1980), Ajzen (2005), refers to a specific behavioral prescription attributed to a generalized social agent, that is, a belief that individuals take into account the normative expectations of various others in arriving at a decision. The referents include parents, friends, spouses, close friends depending on the behavior involved (Ajzen, 2005). Rogers (1983) reports of a number of studies where diffusion and adoption of innovations by individuals are influenced directly by the social system. The social system according to Rogers (1983) may be individuals, informal groups and or organizations. Opinion leaders and change agents tend to influence other individuals attitudes and overt behavior informally in a desired way with relative frequency (Rogers, 1983). The theory assumes that behavior is under volitional control although it does not discount the influence of external variables such as demography, personality traits or institutions which can influence behavior indirectly (Ajzen and Fishbein, 1980).

Fishbein & Ajzen (1980), postulated a Theory of Reasoned Action (TRA) to explain human behavior. The theory simply indicates that behavior is an outcome of intentions and is based on the assumption that human beings usually behave in a sensible manner, that they take account of available information and implicitly or explicitly consider implications of their actions. According to Ajzen (1988), intentions are a function of two basic determinants, one personal in nature (attitude towards the behavior) and the other social influence (which is the person's perception of social pressure to perform or not to perform the behavior under consideration. He termed this subjective norm since it deals with the perceived normative prescriptions. Figure 2.2 is a schematic representation of the processes leading to behavior change.

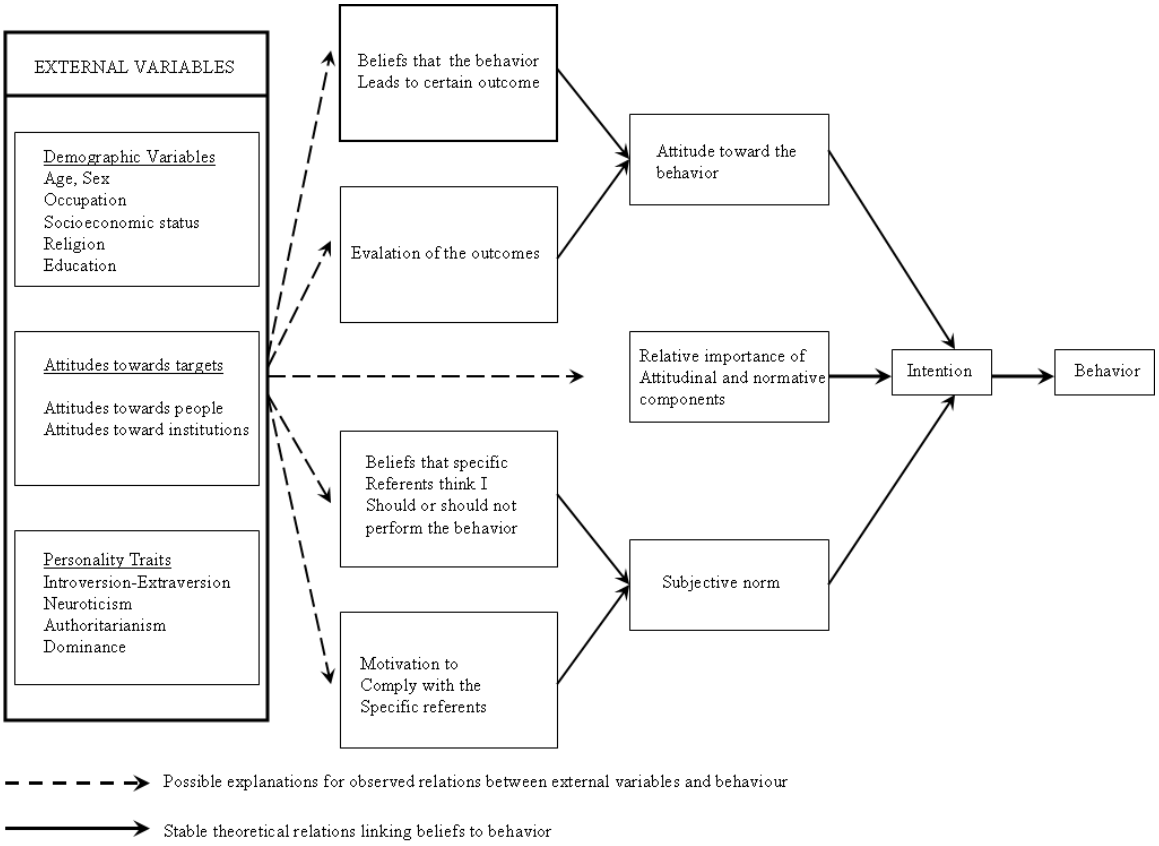

Figure 2. 2: Indirect effects of external variables on behavior
Source: Ajzen and Fishbein 1980

The Theory of Planned Behavior (TPB) is based on the assumption that human beings are rational who weigh the consequences of their actions before embarking upon them (Ajzen & Fishbein, 1980; Ajzen 2005). Both models postulate that behavior is predicted by intentions. The TRA holds that intentions are influenced by attitudes and subjective norms towards behavior. The TPB, according to Aizen (2005), human behavior is a function of three basic determinants, namely: (i) attitude which is personal in nature is the overall personal evaluations of performing the behavior; (ii) subjective norm reflects the overall social influence on the individual to perform or not to perform the behavior and; (iii) perceived behavioral control which the individual's ability to exercise control over behavior – self efficacy. By adding the perceived behavioral control (PBC), the TPB is able to explain behaviors that require skills, resources or opportunities not freely available to the individual (Cook, Moore & Steel, 2005).

The TPB is a well-researched model that has been shown to predict behaviors across a variety of settings. Hagger & Chatzisarantis (2005) tested the model on data from two different health behaviors, exercise and dieting. The study found that attitude, subjective norm and perceived behavioral control all exhibited discriminant validity and a second order factor analyses also exhibited a confirmatory fit for both behavioral domains. The study also showed that the differentiated TPB components were independent predictors of intention and have different pattern of influence across the behavioral domains therefore using a differentiated component model enables a researcher to identify the specific component that accounts for changes in intention in target behaviors.

In a similar study Rhodes, Blanchard & Matheson (2006) investigated the predictive structure of multi components of attitude, subjective norm and an alternative measure of perceived behavioral control in the exercise domain and reported that all concepts indicated significantly ($p < .05$) better fit when modeled as separate component of TPB constructs. They thus concluded a discriminant validity in the measurement of all domains of the TPB components.

Some studies have, however, concluded that controlling for attitude and, subjective norm contributes relatively little directly to the prediction of exercise behavior (Trafimow & Finlay 2001; Rhodes et al 2006). Latimer & Ginis (2005) explains that the poor performance of subjective norms is due largely to the predominant use of single item measures of constructs, and that correlation between subjective norm and intention increase with multiple scale items. It has been suggested that injunctive and descriptive norm "create' or 'form' a variable of subjective norm that equally predicts exercise behavior compared to their separate constructs (Rhodes et al, 2006). It has also been suggested that the other individual variables moderate the effect of subjective norm (Latimer & Ginis, 2005; Rhodes et al 2006).

Latimer & Ginis (2005) in a study to identify other moderators found subjective norm as a better predictor of intentions for people who are concerned with others' approval than for people who are not particularly concerned with social approval. Bagozzi, Moore & Leone (2004) found that subjective norm and PBC combined multiplicatively to influence decision to diet whilst Viki,

Culmer, Eller & Abrams (2006) also reported subjective norm concerning cooperation with police investigations was mediated by quality of previous contact with the police.

Success is seen as instrumental in gathering esteem and respect while failure is a standard way of losing esteem. Consequently, people will go to great lengths to avoid failures especially if the action has any probability of not succeeding. The outcome of adoption of an innovation is not always positive and can elicit negative social consequences for individuals. Adoption behaviors are thus influenced by perceived social approval by significant others (Rimal & Real, 2005).

According to Miller & Brickman (2004), individuals engage in actions that they believe will result in desirable consequences such as increased knowledge, rewards, status and affiliation and will avoid undesirable consequences such as loss of status, or loss of affiliation. By implication, individuals being rational will anticipate and reflect upon the consequences of their actions before embarking to act or not to act.

2.4 INTERVENING VARIABLES AND ADOPTION BEHAVIOR

According to Düvel (1991), Tolman (1967) was perhaps the first individual to conceptualize the term 'intervening variable', a cognitive concept which mediates between independent (person and the environment) variables and behavior (Ajzen & Fishbein, 1980). Bandura (1977) postulates that cognitive processes mediate change, and motivation which is primarily concerned with activation and persistence of behavior, is also partly rooted in cognitive activities.

Following up on earlier works by Lewin (1951) and Tolman (1967), studies on perception by Düvel (1991), is regarded as a path breaking empirical research on farmers adoptive behavior using cognitive constructs. It has proved to be very influential work, inspiring and shaping further studies on farmers' adoption behaviors. He developed a model of technology transfer in agricultural development in 1994 based on the Tolman's concept of 'intervening variables' (Düvel, 1994). Subsequent studies found that the farmers' characteristics and other environmental factors are independent variables while psychological factors such as needs and

perception are the intervening variables while the adoption of practices and efficiency are the dependent variables (Duvel, 1991, Msuya and Duvel, 2007).

2.5 CONCEPTUAL FRAMEWORK FOR THE STUDY

The review of the literature so far shows several attempts to analyze observed adoption patterns by focusing mostly on the relationships of key variables to adoption behavior. The contribution of these variables is enhanced if their implications are interpreted against Düvels (1991) Model for Behavior Analysis and Change (Fig. 2.3), the conceptual model used for this study. The model is derived from Lewin's (1951) field theory and Tolman's (1967) model. It offers practical guidelines for the systematic and scientific analysis of adoption behavior.

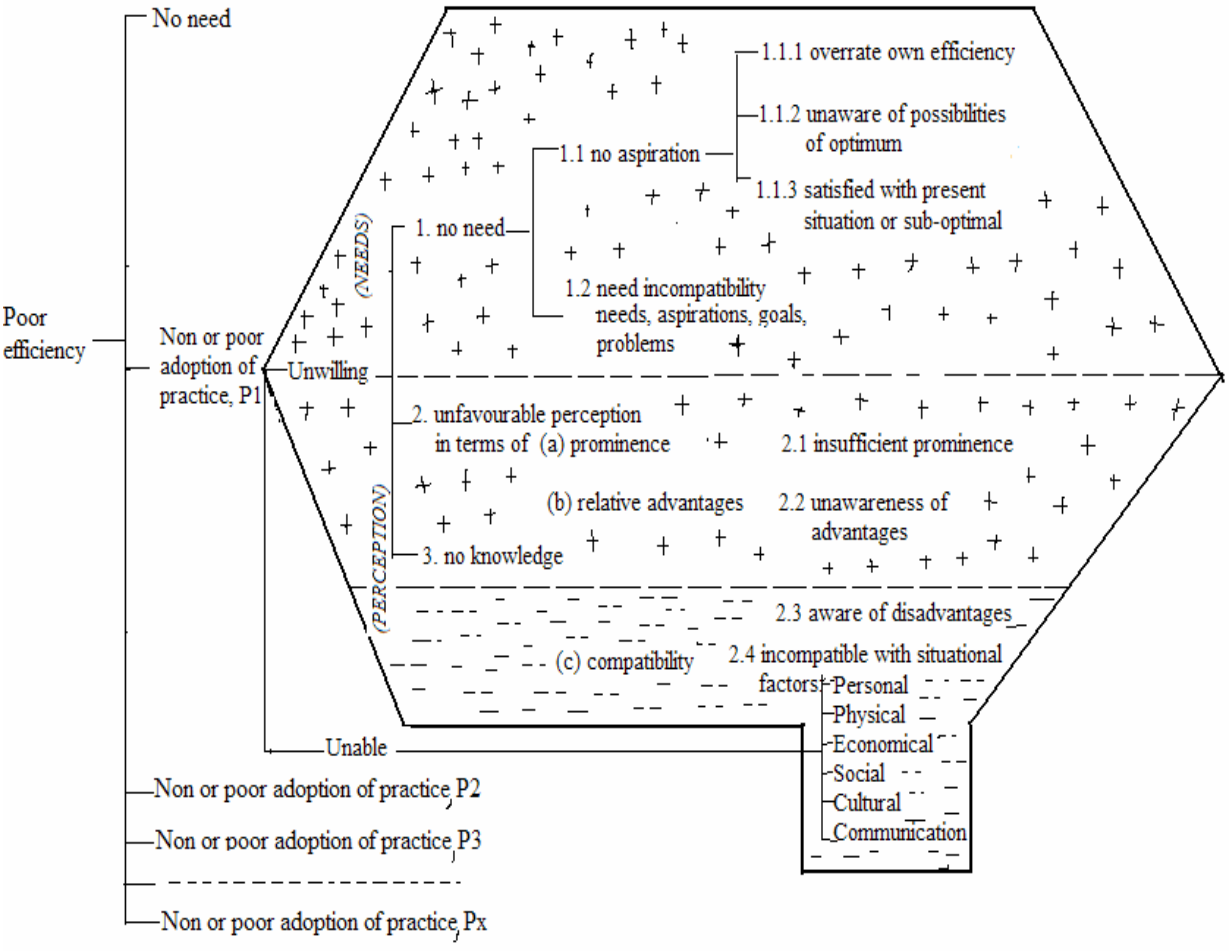

Figure 2. 3: Model for behavior analysis as conceptualization framework in situation analysis
Source: Düvel 1991

The Model for Behavior Analysis and Intervention by Düvel (1991) alludes to needs as the motivational factor that incites individuals to action. Needs are treated in the model as all-encompassing to include concepts such as drives, motives, incentives goals and even problems. Düvel (1991; 1998), argues that a need creates a disequilibrium leading to a system in tension. The tension is thought to exist between a location within the individual and a goal object located in the environment. It stands to reason that a reduction in the need tension leads to the accomplishment of a goal-object. Although it is acknowledged that need tension can be reduced or eliminated leading to the fulfillment of a goal object and a consequent behavioral change, the perceived consequences of the behavioral change and how these are factored into the decision making processes of the individual is not explained by the model.

Düvel (1991), traced non-adoption behaviors to two main causes: (i) unwillingness of an individual to adopt which is directly related to lacking the need and related aspects of knowledge and perception; and (ii) incapability or inability to adopt resulting from a broad category of personal and environmental variables. Although the motivation for behavior change as provided by Düvel (1991, p 79) does not explicitly include social influences, there is acknowledgement in the following statement that social influences do play a role in behavioral change, *"a form of self-expression based on the individuals self-importance and his need to prove it to himself and to others is regarded as the most fundamental need"*. This statement seems to support the conclusion by Ajzen (1988) that perception of social pressure is an important determinant of behavior. The broad concepts of needs, perceptions and knowledge which have been found to be associated with human behavior and depicted in Fig 2.3 are discussed below.

2.5.1 *Needs*

Needs is a cognitive construct and according to Düvel (1991) creates tension within the individual and a goal-object situated in the environment as a result of some form of deprivation resulting in disequilibrium. The goal object assumes a positive character if it is perceived by the individual as having the potential need-satisfying capacity, and a negative valency when found to threaten further deprivation. Research has shown that compatibility of a practice with farmers' needs is one of the most important pre-requisites for adoption (Düvel, 1982; Chaudry, 1984). According to Düvel's model, the causes of need can be related to the following:

(i) ***No aspiration*** (1.1) This is a situation where an individual does not aspire to adopt a practice due to one of the following reasons:

- Overrating or underrating own efficiency (1.1.1), where an individual perceives own practice to be better or worse than an existing practice. In the case of overrating individuals do not aspire to adopt as they perceive their own practice to be superior and therefore have a reduced need tension. Underrating results where individuals perceive their own practice to be inferior to existing practice, thus creating a positive need tension and a therefore a need-satisfying capacity
- Unaware of possibilities or the optimum (1.1.2) is a situation where the individual is oblivious or is not familiar with a new practice and thereby having a zero need tension and therefore does not aspire to change

- Being satisfied with the present situation or having sub-optimal aspiration (1.1.3). Lacking aspiration can also be attributed to instances where individuals are simply satisfied with the status quo and therefore have no intention to change or for some reason are unable to overcome a perceived huddle/challenge leading to frustration or resignation on the part of the individual.

Various studies (Habtermariam & Düvel, 2004 and Msuya & Düvel, 2007) all found lack of aspiration to be associated with the use or no use of agricultural practices.

2.5.2 *Need Tension*

According to Düvel (1991) need tension is defined as the perceived difference between ‘what is” (present situation) and “what can be” (desired situation). It is the perceived discrepancy between the present situation and the desired level of aspiration. Several studies have reported a positive relationship between adoption behaviors and need tension (Düvel & Botha, 1999; Düvel & Scholtz 1986; Msuya & Düvel 2007). Others such as Habtermariam & Düvel (2004) found a negative relationship. The negative relationship is due to some poor adopters overrating themselves; resulting in many cases in lower need tension which approaches that of good adopters whose need tension may no longer be high because it has been eroded by the high current need efficiency.

Need Compatibility (1.2) refers to a situation where in the case of adoption, a practice or specific innovation is a solution to an identified need in such a way as to cause a reduction in the need tension. The reverse, where the identified solution is incompatible with the individual's needs or aspiration and therefore does not fit the psychological field will lead to non-adoption. However, it has also been established that non-adoption is not always simply that they are irrelevant to the farming needs. Flett, Alpass, Humphries, Massey, Morriss & long (2004), found in a New Zealand study that nearly 60% of farmers not using a particular innovation reported at least the innovation has some importance to their needs. They concluded that perceived utility and perceived usefulness are distinct decision-making processes associated with adoption and use. Farmers and for that matter individuals consider the usefulness of an innovation separately from the ease of use and other attributes (Choi & Price, 2005).

2.5.3 *Awareness*

Awareness is related to information availability to the decision maker. It refers to the extent to which the decision maker is aware of the recommended solutions or the optimum achievable in terms of efficiency. In this study, awareness refers to the extent to which respondents are aware of the recommended fertilizer, lime and seed varieties. Studies conducted so far have reported positive correlation between adoption (Düvel, 1991; Düvel 2004; Msuya & Düvel, 2007).

2.5.4 *Perception*

Ellis and McClintock (1994: 1) defines perception broadly as *"information which is taken in by the senses, processed by the brain, stored in memory and produces some form of physical or mental response"*. Information is gained through the interaction of our five senses of hearing, sight, touch, taste and smell with the environment. According to Steinberg cited above, a characteristic of perception is that it is a personal process which provides individuals with a unique view of the world and it does not always provide us with accurate representation of the world. The two major causes of perceptual distortions are perceptual inaccuracies and the element of subjectivity in the perception process.

Düvel (1991) refers to perception of attributes of the innovation and although similar to Rogers' (1983) classification of innovation attributes is different in the sense that the former is more specific whilst the latter is broad with unspecified categories. An individual must have a favorable or unfavorable perception of an innovation to adopt or not to adopt. The willingness or otherwise to adopt arising out of the perception construct may be due to the following:

(i) ***Prominence*** (2.1) is defined by Düvel (2004) the degree to which an innovation is perceived as being better than the idea it supersedes. Adoption is better when the innovation is seen to be relatively better than the original practices of the farmer. In the study by Sall et al (2000), they concluded that the perception of the characteristics of the technology by the respondents was an important factor in the adoption process in so far as they these characteristics are perceived to be attractive relative to other alternatives.

(iii) ***Efficiency Perception***

Efficiency perception is the extent to which individuals rate their production efficiency (Düvel, 1991). According to Düvel, individuals have the tendency to overrate or underrate their efficiency in cases of high and low adoption situation respectively.

2.5.5 *Knowledge (3)*

Düvels' model categorizes knowledge into three main domains in as far as they relate to practice adoption or innovation. These are:

- Basic knowledge or knowledge of principles
- Knowledge associated with the awareness of relative advantages and;
- Knowledge in respect of the application of an innovation or practice

2.6 CONCLUSION

The review of the literature covered available and recent discourse on the subject under scrutiny, namely factors contributing and or which influence the adoption behavior of farmers. This covered the area of personal and farm attributes, environmental and the mediating variables with the objective of synthesizing current information in order to inform the hypothesis formulation

and the selection of appropriate dependent and independent variables. The review shows clearly that enormous amount of information from various academic disciplines pointing to the complexity of behavior change and the multiplicity of contributory factors. The interplay of multiple factors creates a design problem for research – that is to identify, control and measure the real causal factors. To overcome this problem, the study focused on the ability of the factor to predict behavior change supported by the information gathered. The focus of the study Need Tension, Need Compatibility, Awareness and Perception as well as the subjective norms selected extension agents, close associates, members of farmers association and important people within the community were guided by this assumption – capability to predict and also yielding to easy identification, control and measurability. Finally the conceptual framework adopted for the study fitted well with the concept of "intervening variable" and has been tested and proved worthy by other research.

CHAPTER 3
METHODOLOGY

3.1 INTRODUCTION

This chapter is a presentation of the processes involved in gathering data and its analysis. The process started with the selection of the research area, the identification of the population, sampling, questionnaire development, pre-testing and training of enumerators, administering the questionnaire and data processing techniques.

3.2 THE STUDY AREA

The study was conducted in two adjoining districts of Southern Africa, in the Maluti-a-Phofung Local Municipality of the Orange Free State and Leribe Local Government area in Lesotho. The two districts, although in different districts, share similar geographic, climatic and soil conditions where maize cultivation features predominantly in the agricultural practices of small scale farmers. In additions the peoples in the two districts share a common cultural identity of being Sotho speaking.

3.2.1 *Maluti-a-Phofung Local Municipality*

Maluti-a-Phofung Local Municipality is located in the Orange Free State of the Republic of South Africa. It is one of the administrative areas in the Thabo Mofutsane District of the Free State Province and is named after the Maluti mountains with which it shares boundary with Leribe District of Lesotho. The greater majority of the population, about 60 percent, may still be dependent on subsistence farming and backyard gardens as characteristically is the case with an agricultural landscape and a topology of the Municipality. The agricultural sector is responsible for 18% of the GDP, however, it only employs 5% of the total employed workforce. Farming is a relatively new activity for the small scale farmers and started during the 1986 to 1994 when commercial farms were expropriated from white commercial farmers.

3.2.2 *Leribe District*

Leribe District is situated in the north eastern part of Lesotho and is bordered by Botha-Bothe in

the north, Mokhotlong in the east and Berea and Thaba-Tseka to the south, the western by Maluti-a-Phofung in the Republic of South Africa. The district covers an area of 282,810 ha. Consistent with the country's topography it has 42% of lowlands (below 1.800 m), 28% foothills (between 1.800 m – 2.300 m) and 30% mountain (above 2.300 m) areas. Most of this land area is non-arable but suitable for livestock grazing. Fifteen hectares of the land area are covered by forest. According to the 2006 National Census, the District of Leribe has a total population of 298.352.

3.3 RESEARCH DESIGN

According to Ajzen & Fishbein (1980) and Ajzen (2006), behavioral outcomes can be measured by direct observation or through self-report. Many behaviors, however, are not directly accessible to the observer and in the context of adoption of innovations studies, self-report has been the general strategy as most of the events occur before the studies are conducted. Moreover, cognitive constructs such as the intervening variables are not observable therefore the study relied on self-report measures to gather relevant data using standard scaling procedures to test the hypotheses. Measurement scales for this study were adapted from other relevant studies whose scales have been tested for reliability and validity. A questionnaire was developed and translated into the local language – Sotho, to facilitate data collection.

3.3.1 *Determination of the farmer population and sampling*

The study focused on small scale farmers in Lesotho and South Africa in general. However, due to limited resources, a decision was made to restrict the study to two adjoining districts of the two countries. The two districts selected are noted for maize production and also accessible to the researcher. A list of small scale farmers cultivating maize was obtained from extension agents and farmers associations in the two districts. The total number of small scale farmers obtained from the two districts was 214. Half the total population was randomly selected out of which 107 responded to the questionnaires. Of those who responded, 40 were from South Africa with the remaining 67 from Lesotho.

3.3.2 *Data Collection*

The data was collected over a period of three months using a validated, pre-tested structured questionnaire (Appendix 1). There was one data collection team (enumerators) for each country made up of one supervisor and two enumerators. Secondary data were obtained from books, journals, reports and other documents from the University of Pretoria Library, agricultural extension offices of the two districts as well as the internet.

The enumerators and supervisors went through a two day training workshop to prepare them for the survey. To ensure quality, interviewer performance was monitored by post checking and observing interviews throughout the fieldwork.

3.4 VARIABLES AND THEIR MEASUREMENT

3.4.1 *Independent variables*

The independent variables include socio-economic and demographic characteristics of farmers such as location of farm, membership of farmer's association, gender, age, formal education, farming experience, time spent on the farm, farm size, and area under maize.

3.4.1.1 Farm location

The study was conducted among small scale farmers in both South Africa and Lesotho, consequently farmers were classified according to the location of their farms by their respective countries as 1 -South Africa; 2- Lesotho.

3.4.1.2 Farmers Association

Farmers were grouped according to the main farmers association they belong. Three categories were identified, as follows: 1-National Farmers Union; 2- Tractor Owners Association; and 3 - those who belonged to neither but several other associations which were categorized as other.

3.4.1.3 Gender

Respondents were requested to indicate whether they were 1-male or 2-female.

3.4.1.4 Age

Farmers were asked to indicate their chronological age. They were then categorized into three main age groups namely: 1-young (less than 40 years); 2-mid-life (40-60 years); post mid-life (more than 60 years).

3.4.1.5 Formal education

Respondents stated their level of formal educational attainment which was categorized as follows:

(i) Up to seven years of formal education (Primary level);

(ii) Up to twelve years of formal education (secondary level); and

(iii) More than 12 years of formal education (post-secondary).

3.4.1.6 Farming experience

This variable refers to the total number of years a farmer has been engaged in farming as an occupation. Responses were categorized into three main classes namely: 1-beginners (less than 10 years); 2-stabilizers (10-20 years); and 3-experienced (more than 20 years).

3.4.1.7 Time Spent on Farm

In order to identify whether respondents were full or part-time farmers, they were requested to state the percentage of their time they spent either in farming. They were then grouped into three main categories as follows: 1-part-time farmers (less than 50 percent of time); 2-up and coming farmers (50 – 75 percent of time); and 3-full-time farmers (more than 75 percent of time).

3.4.1.8 Farm size

Farm size was determined by asking the respondents to indicate their total land area used for both maize and other farm enterprise. Although all the farmers irrespective of their location are classified as small scale farmers there were big differences in the size of land they owned. The total land area was grouped into three categories as follows: 1-Small <20ha; 2 Medium- 20-60 ha and Large 3- >60 ha. Farm sizes were initially measured in acres for Lesotho and converted to hectares to correspond to the unit of measurement in South Africa.

3.4.1.9 Area under maize:

This refers to the part of farm land devoted exclusively to maize cultivation. The categories used were 1-small (<=10ha), 2- medium (10-60ha) to large (>60ha).

3.4.2 Intervening variables

Intervening variables are psychological constructs that are the more immediate precursors of behavior and thus variables through which the more independent variables become manifested in behavior (Habtermariam & Düvel 2004). Various studies carried out by Düvel, 1975; Louw & Düvel, 1993; Düvel & Scholtz, 1986; Botha, 1986; Düvel & Botha, 1999; and Habtemariam & Düvel, 2004 have confirmed a valid relationship between intervening variables and adoption behaviors of farmers.

The intervening variables considered in this study are need and perception related. The need related are Efficiency Perception (EP), Need Tension (NT), Need Compatibility (NC), Awareness (Aw), and Prominence (Pr) and Subjective Norm (SN).

3.4.2.1 Efficiency Perception (EP)

Farmers were asked to estimate their own efficiency on scales developed for the various practices used in the study. The enumerator also rated the farmers on the basis of the extent to which farmers have adopted the practice in its entirety or not. The scales used were for liming: 1-12; basal application 1- 7; top dressing 1- 8 and for improved seeds 1-4. The formula used in calculating the farmer's EP is as follows:

EP = A-B

Where

A = represents enumerators assessment

B = represents farmer's own assessment

Based on this calculation farmers were categorized into three groups as: 1- under rating representing positive numbers or respondents who rated themselves below their actual level of adoption practice; 2- no perception discrepancy representing respondents whose rating were the

same as the enumerator; and 3 over-rated represented by negative numbers or respondents who rated themselves higher than their level of adoption practice.

3.4.2.2 Need Tension (NT)

Farmers were asked to indicate their present and aspired level (or goals) of practice adoption. It is expected that the higher the goal or level of aspiration the higher the need tension. Farmers were then grouped into three categories namely: 1-low; 2-medium; and 3-high need tension.

3.4.2.3 Need Compatibility (NC)

Need compatibility is a measure of whether the recommended solution fits into the need situation of an individual or contributes towards the attainment of his/her need This variable was measured by requesting the respondents to estimate the level of production efficiency they would have attained if they had used (or not used) the recommended practices. The percentage changes in production efficiency were then calculated using the formula below. Respondents were categorized into: 1-low, 2-medium and 3-high need compatibility based on the results obtained.

A=C –B/B*100

Where

A = percentage change in production efficiency

B=Current production efficiency

C=Production efficiency respondents would have attained if they had used or not used the recommended practice.

3.4.2.4 Awareness (Aw)

Awareness refers to the farmers' knowledge of recommended practice in the area and it was measured by requesting respondents to state the recommended practice. This was scored on a nominal scale of 1-correct answer and 2-wrong answer

3.4.2.5 Prominence (Pr)

Respondents were asked to indicate what they regarded as the best practice relative to their own practices. They were then categorized into low prominence, medium prominence and high prominence

3.4.3 Subjective Norm

Ajzen & Fishbein (1980) define subjective norm as a person's belief that important others think a task should or should not be performed. This implies that individuals take into consideration the normative expectations of various others within the environment in their decision making processes.

The scale for the measurement of the subjective norm in this study follows procedures outlined by Ajzen (1980, 2006) to identify (i) the salient referent; and (ii) motivation to comply. Subjective norm was measured by similar items suggested by Aizen (2006) on a 7-point Likert-type scale that ranged from: 1 (extremely likely) to 7 (extremely unlikely). These were (i) 'Important people who are important to me think I should apply fertilizer during planting'; and (ii) 'In general how much do you want to do what important people, who are important to you think you, should do'.

3.5 DEPENDENT VARIABLES

These include production efficiency and recommended maize practices

3.5.1 Production efficiency (PE)

Yield in terms of yield per hectare for a normal year season was used to measure the production efficiency.

3.5.2 Recommended maize production practices

3.5.2.1 Liming Practice

Respondents were asked to state whether they have ever applied lime, type of lime used, rate of application, method of application, frequency of application, and how land should be prepared for the application of lime. The categorization used was as follows:

(i) ever applied lime: 1-Yes; No – 2;

(ii) type of lime: 1- don't know; 2- dolomite; 3 – Calcite;

(iii) rate of application: 1-above one t/ha; 2-one t/ha; 3- two t/ha; 4-five t/ha;

(iv) method of application: 1 – split; 2- once off;

(v) frequency: 1-every year; 2 -2-3 years; 3- 4-5years; and

(vi) Land preparation: 1-applied before land is prepared; 2- disc; 3-plough; 4 – disc and plough; 5- rip.

3.5.2.2 Total lime application package

The recommended liming practice for the study area includes all the practices above. The scale used to assess the adoption of liming as a whole, consisted of a summation of all the scores and the following categorization were used: (1) low adoption (<9 score); (2) Medium adoption (9-15 scores); (3 High adoption (>15 scores).

3.5.2.3 Basal Application of Fertilizers

The questions asked included whether respondents apply basal fertilizer, type applied, rate of application, time of application, and method of application. The categories were:

(i) apply: 1 = sometimes; 2 = No; and 3 = Yes;

(ii) type: 1 = 4:2:1; 2 = 3:2:1 (32); and 3 = 3:2:1 (25);

(iii) rate: 1 = 50kg/ha; and 2 = up to 300kg/ha

(iv) time: 1 = before planting; 2 = after planting; 3 = during planting; and

(v) method: 1 = broadcast; 2 = furrow; and 3 = band placing;

3.5.2.4 Total basal fertilizer application package

The recommended basal fertilization package for the study area includes the use of all the practices discussed above. The scale used to assess the adoption of fertilization as a whole, consisted of a summation of all the scores and the following categorization were used: 1= low adoption (<5 score); 2 = Medium adoption (5-8 scores); and 3 = High adoption (>8 scores).

3.5.2.5 Top Dressing

The questions asked included whether respondent apply top dressing, type applied, rate of application, time of application, and method of application. The categories were:

(i) apply: 1 = sometimes; 2 = No; and 3 = Yes;

(ii) type: 3:2:1 (32); 2- Urea; 3- ANO (21); and 4-LAN (28);

(iii) rate: 1 = 250kg/ha; and 2 = up to 150kg/ha;

(iv) time: 1 = 4 weeks after planting; 2 = 3 weeks after planting; and 3 = 4 weeks after planting; and

(v) Method: 1 = broadcast; 2 = on top of soil; and 3 = beneath soil level.

3.5.2.6 Total top dressing fertilization package

The recommended top dressing package for the study area includes all the practices discussed above. The scale used to assess the adoption of fertilization as a whole, consisted of a summation of all the scores and the following categorization were used: 1 = low adoption (<6 score); 2 = Medium adoption (6-10 scores); and 3 = High adoption (>10 scores).

3.5.2.7 Improved Maize varieties

This variable was measured by asking the respondents to indicate the maize varieties they use, and source of seed. Most of the respondents cultivated replanted hybrid, local varieties and recommended hybrids and so the categorization was according to the variety used and source of seed.

3.5.2.8 Total use of improved maize variety package

The recommended for the use of improved variety for the study area includes all the practices discussed above. The scale used to assess the adoption of fertilization as a whole, consisted of a summation of all the scores and the following categorization were used: 1 = low adoption (<2 score); 2 = Medium adoption (3 scores); and 3 = High adoption (>3 scores).

3.6 DATA ANALYSIS

The data collected through means of coded questionnaires was – captured, cleaned and analyzed using the statistical package for social science (SPSS). Descriptive statistics such as frequencies, percentage and means were done as a first step towards determining the distribution of the variables (general findings). Graphics like bar charts were used to summarize large amounts of

information while correlation, chi-square, and regressions were used to determine the relationship between the independent and the dependent variables.

Chi-square analyses were used in combination with two-dimensional contingency tables to establish whether significant differences occurred between the various categories or groups. This also allowed for the identification of relationship other than linier correlations, which are normally not detected with correlation analyses.

Bivariate correlation analyses were employed to assess the existence, magnitude (strength or degree) and kind (negative or positive) of relationship that exist between the independent and the dependent variables. This was achieved by computing the correlation coefficients and significance or probability. According to De Vos (1998), Morgan & Grego (1998), Mallery & George (2003), correlation coefficient, range in value from -1 to + 1. A correlation coefficient of +1 designated a perfect positive relationship implying that one variable is precisely predictable from the other variable and as the one increases in value (or decreases) the other similarly increases (or decreases).

A correlation coefficient of 0 indicates no relationship between two variables whatsoever, while that of -1 represent a perfect, negative correlation. Negative indicate that as one variable increases in value, the other variable decreases in value.

Mallery & George, (2003) assert that perfect correlation (positive or negative) exist only in mathematical formula and direct physical or numerical relations. The non-perfect positive ($0<r<1$) and non-perfect negative ($-1<r$) are common types of correlation or relationship that exist between two variables. In the interpretation of analyses a probability of less than 5 percent ($p<0.05$) was interpreted as statistically significant.

Multiple linear regression analyses were used to investigate the effect of various independent variables (predictors) on the dependent variable. The regression analysis is also an indicator of how well one or more independent variables predict the value of a dependent variable (Howitt & Cramer, 2005). Due to this fact the model was also used to assess the degree to which the

various independent and intervening variables contributed towards explaining the dependent variable variance. According to Howitt & Cramer (2005), the regression model is based on the following formula:

$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3$

Where Y is the predicted score on criterion variable

a is the intercept constant

bX is the regression coefficient x predictor score

CHAPTER 4

THE RELATIONSHIP BETWEEN PERSONAL AND FARM CHARACTERISTICS AND PRODUCTION EFFICIENCY

4.1 INTRODUCTION

This chapter is a description of the demographic characteristics (independent variables) of respondents and a descriptive analysis of the relationship between the independent variables and production efficiency. It is simply to show how the personal and farm characteristics relate to production efficiency without ascribing any causal relationship. For this purpose only descriptive statistics, tables and diagrams and Chi-square test of independence to show differences in attainment of production efficiency are used to provide insight into the nature of the sampled population.

4.2 INDEPENDENT VARIABLES

4.2.1 *Location and production efficiency*

A total number of 107 farmers responded to the administered questionnaire. Figure 4.1 shows that 70 percent of the respondents were from Lesotho whilst the remaining 30 percent were South Africans.

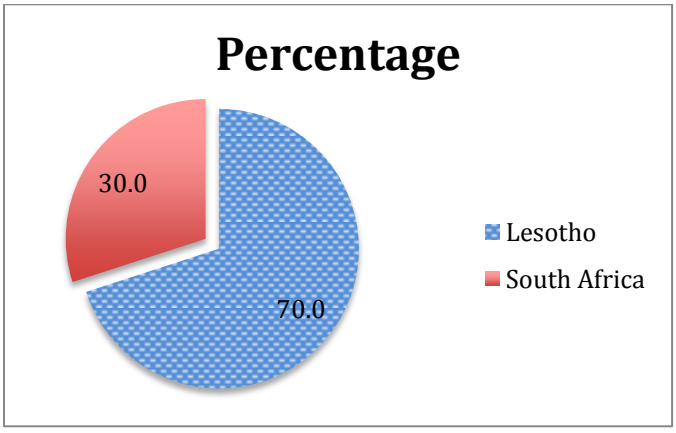

Figure 4. 1: Distribution of respondents by Country

Table 4.1 below is the distribution of respondents by country and their production efficiency. The mean yield for the total respondents was 2124.8kg/ha with a range of 460kg/ha to 4324kg/ha. The mean yields for farmers in Lesotho were 1819 kg/ha which is lower than their counterparts in South Africa with a mean yield of 2609kg/ha.

Table 4. 1: Distribution of respondents by country and production efficiency

	Current production efficiency (kg/ha)									
	<1000		1001 – 2000		2001 – 3000		>3000		Total	
	n	%	n	%	n	%	n	%	N	%
South Africa			13	40.6	14	43.8	5	15.6	32	100
Lesotho	18	24	24	32.0	17	22.7	16	21.3	75	100
Total	18	16.8	37	34.6	31	29.0	21	19.6	107	100

$\chi 2 = 11.976$, df = 3, p = 0. 007

Table 4.1 shows that 21.3 percent of respondents from Lesotho obtained yields in excess of 3000kg/ha compared to 15.6 percent of their counterparts from South Africa who obtained similar yields. Results of the chi-square analysis show significant difference between respondents from the two countries in regards to production efficiency ($\chi 2 = 11.976$, df = 3). It is therefore concluded that production efficiency is higher for respondents in South Africa compared to Lesotho respondents.

The results show that South African farmers have higher production efficiencies compared to the Basotho counterparts and the observed disparity in production efficiency could be due to enhanced support services and markets for farmers, which help boost farming activity. The difference in production efficiency between the two countries can further be explained by the fact that farmers in South Africa are inclined to use recommended hybrid seeds and recommended cultural practices compared to the use of composite seeds, a lower yielding seed variety commonly used in Lesotho. It became evident during the data collection process that farmers in South Africa are also better served by the private sector, credit facilities and seeds than their counterparts in Lesotho who were largely dependent on public extension services for the provision of seeds and subsidized fertilizers. South Africa has a much better infrastructure

(FAO, 2005), including well developed markets which tend to influence adoption rates as reported by Lapar & Ehui (2004).

4.2.2 *Farmers' Association and production efficiency*

The respondents were categorized into four main groups based on their responses to whether they belonged to any farmers' association. About 60% of the total number of farmers belonged to the Tractor Owners Association (TOA) based in Lesotho, 24% were members of the National Agricultural Farmers' Union (NAFU) of South Africa, whilst 14% belonged to other farmers associations (other than the two main ones mentioned above) and a mere 1.9 percent did not belong to any association. (Figure 4.2)

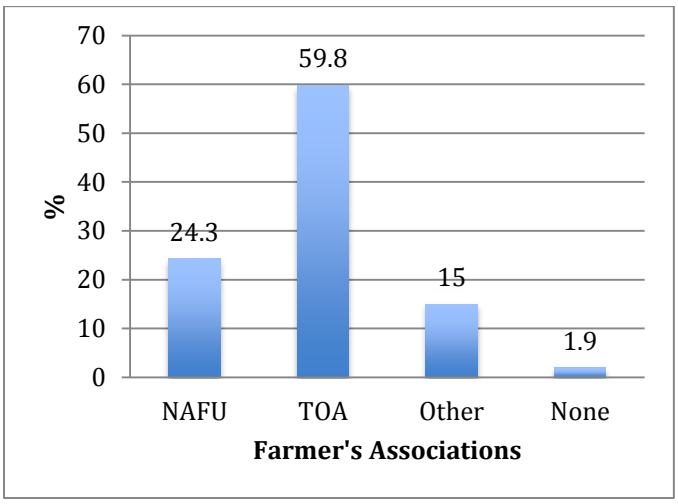

Figure 4. 2: Percentage Distribution of Farmers by type of Association

Table 4.2 shows that a combined total of 70.3 percent of the respondents who belonged to a recognized farmers' association had production efficiencies above the total average (2124.8kg/ha) compared to 33 percent for those who belonged to other associations or none. Similarly, close to 70 percent of NAFU members compared to slightly over 45 percent of members of TOA obtained over 2000kg/ha.

Table 4. 2: Distribution of respondents by farmers' association and production efficiency

	Current production efficiency									
	<1000 kg/ha		1001 – 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
NAFU	0.0	0.0	8	30.8	13	50	5	19.2	26	100
TOA	16	25	19	29.7	13	20.3	16	25	64	100
Other	2	13.3	8	53.3	5	33.3	-	-	15	100
None	-	-	2	100	-	-	-	-	2	100
Total	18	16.8	37	34.6	31	29	21	19.6	107	100

$\chi 2 = 22.499$; df = 9; p = 0.007

The study found significant differences between respondents the various farmer association groups at a 5 percent level of significance (p = 0.007).

4.2.3 *Gender and production efficiency*

Figure 4.3 below illustrates the distribution of respondents by gender. The results show that 21 percent and 79 percent of the respondents were females and males, respectively.

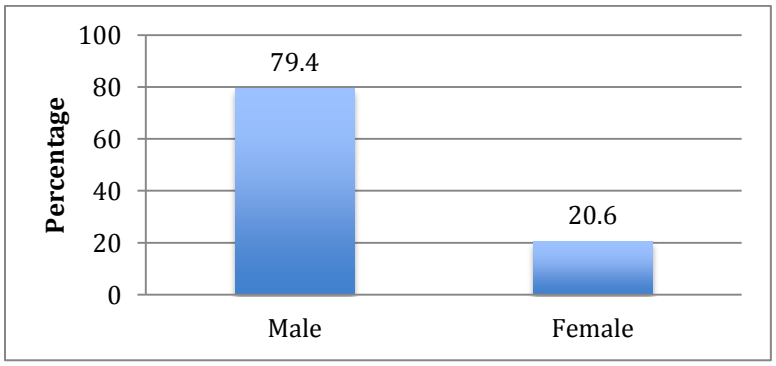

Figure 4. 3: Percentage Distribution of Farmers by gender

The distribution of gender by production efficiency categories indicates that a relatively higher percentage of males had production efficiency above the mean total for the group than their female counterparts.

Table 4. 3: Distribution of respondents by gender and production efficiency

	Current production efficiency									
	<1000 kg/ha		1001 – 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	n	%
Males	13-	15.3-	29	34.1	25	29.4	18	21.2	85	100
Female	5	22.7	8	36.4	6	27.3	3	13.6	22	100
Total	18	16.8	37	34.6	31	29	21	19.6	107	100

$\chi 2 = 1.133$; df = 3 ; p = 0.308

A total of 50.6 percent male and 40.9 females respondents currently produces more than 2000kg/ha and although it would appear that males obtained higher production efficiencies, the study found no significant difference between gender and production efficiency at 5 percent significance level (p = 0.308). Studies by Croppenstedt, Demeke and Meschi (2003), argues in their study that adoption which is related to production efficiency is not gender dependent, rather gender becomes a factor when it comes to access to production factors and services which indirectly affects production efficiency.

4.2.4 *Age and production efficiency*

The study sought to determine the age of respondents and categorized them as: (i) "young" – respondents who were less than 40 years; (ii) "mid-life" – respondents between 40 to 60 years and; (iii) "post mid-life" – respondent who are above 60 years as presented in Fig 4.4. The findings (Fig 4.4) show that those who were above 40 years of age constituted the majority of the respondents, 51.4 percent are in their mid-life, followed by post mid-life farmers 38.3 percent while young farmers constituted only 9.3 percent.

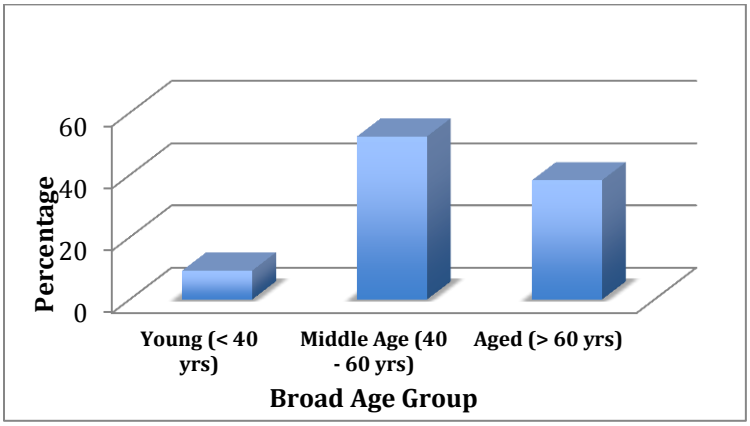

Figure 4. 4: Percentage Distribution of Farmers by Broad Age Group

The distribution by age and production efficiency is illustrated in Table 4.4 below.

Table 4. 4: Distribution of respondents by age and production efficiency

	Production efficiency									
	<1000 kg/ha		1001 – 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
Young (<40yrs)	2	20.0	1	10.0	3	30.0	4	40.0	10	100
Mid-life (40-60)	7	12.5	20	35.7	18	32.1	11	19.6	56	100
Post midlife (>60yrs)	9	22.0	16	39.9	10	24.4	6	14.6	41	100
Total	18	16.8	37	34.6	31	29	21	19.6	107	100

$\chi 2 = 6{,}456$; df= 6; p = 0.374

A comparison between the age groups shows that there is a slight tendency for production efficiency to decrease with age as 70 percent young, 51.7 percent midlife and 39 percent post midlife group obtained efficiencies above the total mean of 2000kg/ha but these differences are not significant at 5 percent level of probability ($\chi 2 = 6{,}456$; df= 6;p = 0.374).

4.2.5 *Formal Education and Production Efficiency*

Respondents were asked to indicate the level of their educational attainment. All the respondents in both countries had had a formal education and although they may not have completed the initial seven years of primary education they could be considered literate as they could read and write in local languages.

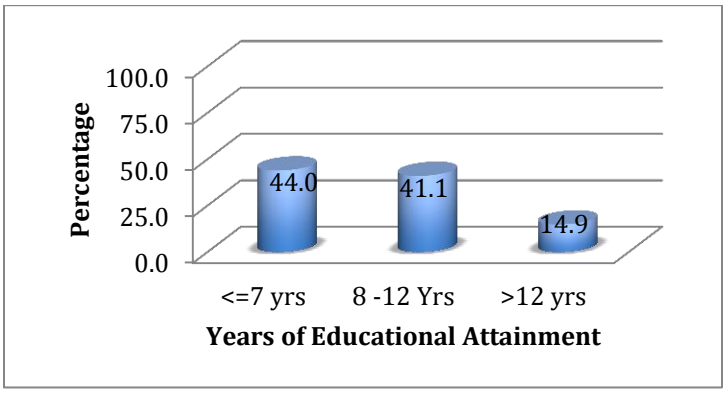

Figure 4. 5: Percentage Distribution of Farmers by years of Educational Attainment

A summary of the various age groups and their production efficiencies is shown in Figure 4.5 and Table 4.5. According to the table below only 41.1 percent had an education of between 8 and 12 years.

Table 4. 5: Distribution of respondents by educational attainment and production efficiency

	Current production efficiency									
	<1000 kg/ha		1001 – 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
<=7yrs	8	17.0	18	38.3	12	25.5	9	19.1	47	100
8-12yrs	9	20.5	17	38.6	13	29.5	5	11.4	44	100
>12 yrs	1	6.3	2	12.5	6	37.5	7	43.8	16	100
Total	18	16.8	37	34.6	31	29	21	19.6	107	100

$\chi 2 = 10.941$; df= 6; p = 0.090

Table 4.5 shows that 43.8 percent of respondents with education of more than 8 years obtained production efficiencies of more than 3000kg/ha compared to 11.4 percent of 8-12 years of education and 19.1 percent of respondents with less than 7 years of education. The results of chi-square test of independence, however, did not confirm any significant differences between the education level categories (p = 0.09). However, according to the production efficiency levels of 2000kg/ha – 3000kn/ha there is a linear increase with those with less than 7 years of education (25.5 percent) to 37.5 percent for those with above 12 years of formal education.

4.2.6 *Experience in farming and production efficiency*

Farmers are known to experiment and their current production practices are expected to be influenced by their past experience in farming. The survey sought to examine the influence of experience from the perspective of the number of years that respondents have been engaged in farming and therefore solicited information regarding this variable by the number of years they have been engaged in farming. The study found that:

(i) only 2.8 percent of the respondents had been in farming for less than 10 years and are classified as beginners;

(ii) 46.7 percent belonged to a group classified as experience in transition and have been in farming for between 10-20 years; and

(iii) The remaining 50.5 percent, the highest group, classified as experienced farmers have been in farming for more than 20 years. Figure 4.6 below shows the number of years respondents have spent in farming as their main occupation.

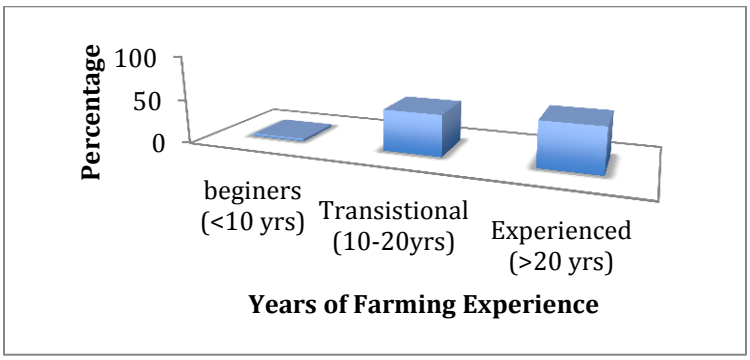

Figure 4. 6: Percentage Distribution of Farmers by years of Farming Experience

In terms of the association between experience and production efficiency, a relative higher proportion of experienced farmers had higher production efficiencies compared to the beginners. In contrast to 100 percent of beginners in South Africa with production efficiency of not more than 2000kg/ha, all their counterparts in the same category from Lesotho obtained higher production efficiencies (Table 4.6). However, the number of beginner respondents was very small (3).

Table 4. 6: Distribution of respondents by experience in farming and production efficiency

	Current production efficiency									
	<1000 kg/ha		10001– 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
Beginners (>10yrs)	0.0	0.0	1	33.3	1	33.3	1	33.3	3	100
Transitional (10-20yrs)	9	18.0	14	28.0	18	36.0	9	18.0	54	100
Experienced (.20yrs)	9	16.7	22	40.7	12	22.2	11	20.4	54	100
Total	18	16.8	37	34.6	31	29	21	19.6	107	100

$\chi 2 = 3.858$; df =6, p = 0.696

The results did not show any significant difference between the various experience groups ($\chi 2 = 3.858$, df = 6, p = 0.696). The trend was generally in favor of the beginners with 66.6 percent obtaining production efficiency at the 2000 – 3000kg/ha compared to 64 percent for the transition group and 63.6 for the experienced respondents.

4.2.7 *Off-farm income and production efficiency*

Respondents were asked to indicate whether they were full time farmers or have other occupation other than farming which provides them with additional income**.** Fifty nine percent of respondents indicated that they had no other job apart from farming whilst the remaining 41 percent indicated they are engaged in other activities in addition to farming.

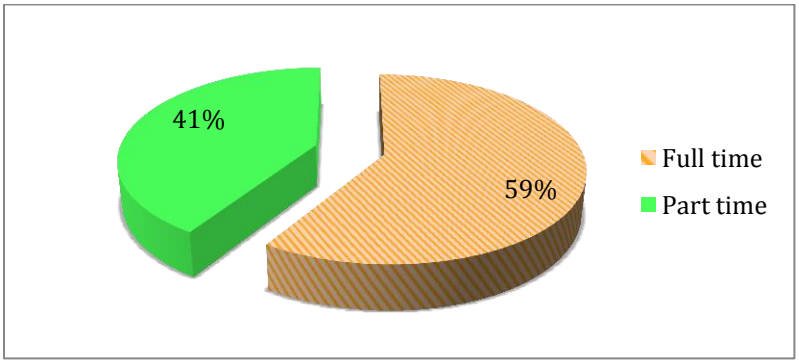

Figure 4. 7: Percentage Distribution of Farmers by Type of Occupation

Table 4.7 shows the respondents by off-farm income and production efficiency. A relatively higher proportion of the respondents (55.6 percent) who are full time farmers, reported higher

production efficiencies of more than 2000kg/ha compared to 48.8 percent of those who were part-time famers.

Table 4. 7: Distribution of respondents by off-farm income and production efficiency

	Current production efficiency									
	<1000 kg/ha		1000 – 2000 kg/ha		2000 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
Full time	8	12.7	20	31.7	20	31.7	15	23.8	63	100
Part-time	10	22.7	17	38.6	11	25.0	6	23.8	44	100
Total	18	16.8	37	34.6	31	29.0	21	19.6	107	100

$\chi 2 = 3.678$, df= 3, p = 0.298

However, the Chi Square analysis showed no significant difference in the production efficiency of part time and full time farmers ($\chi 2 = 3.678$, df 3, p = 0.298).

4.2.8 *Time Spent in Farming and Production efficiency*

The influence of amount of time devoted to farming on production efficiency was also examined. The variable, time-spent, could be related to occupation as full time farmers are more likely to spend all their time farming whereas part time, by the nature of having a second occupation, are bound to spend less amount of time on their farms. The respondents were asked to indicate the amount of time spent on farming. Figure 4.8 shows the distribution of respondents by the time they spend in farming.

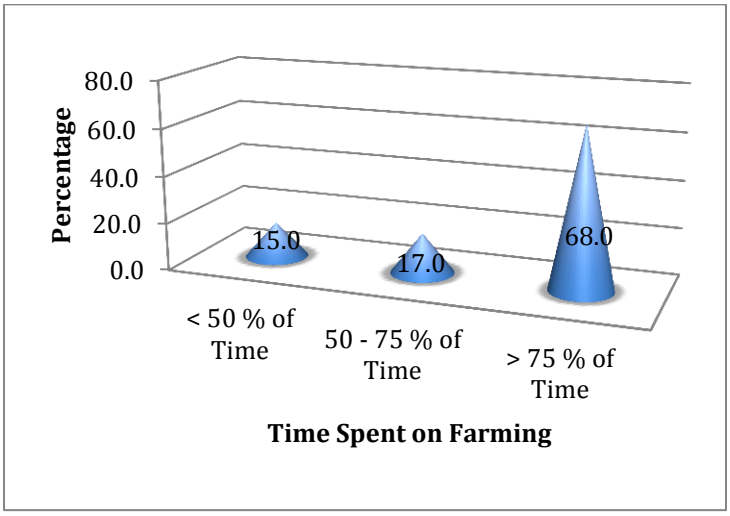

Figure 4. 8: Percentage Distribution of Farmers by Time Spent on Farming

The results shows a higher percentage of respondents (68%) spend more than 75 percent of their time on farming.

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Table 4. 8: Distribution of respondents by time spent and production efficiency

	Current production efficiency									
	<1000 kg/ha		1001 – 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
<50% of time	5	31.3	6	37.5	2	12.5	3	18.8	16	100
50-75%of time	4	22.2	4	22.2	3	16.7	7	38.9	18	100
>75% of time	9	12.3	27	37	26	35.6	11	15.1	73	100
Total	18	16.8	37	34.6	31	29	21	19.6	107	100

$\chi 2 = 11.858$, df = 6 p=0.065

The results of a comparison between time spent and production efficiency did not show any appreciable difference in the amount of time spent and production efficiency between the 3 groups ($\chi 2 = 11.858$, df = 6 p=0.065). There is an indication that more farmers (38.9 percent) spending between 50-75 percent of their time on the farm are producing more that 3000kg/ha against only 15.1 percent of farmers spending more that 75 percent of time on the farm.

4.2.9 *Total farm size and production efficiency*

Figure 4.9 shows the distribution of respondents by their corresponding total farm size. The farm size range from 1.34 ha to 400ha with a mean of 60ha. About 50 percent of the farms were classified as small-scale – less that 20 hectares, another 20 percent were medium-scale and the rest of large-scale. A relatively higher proportion was "small farms".

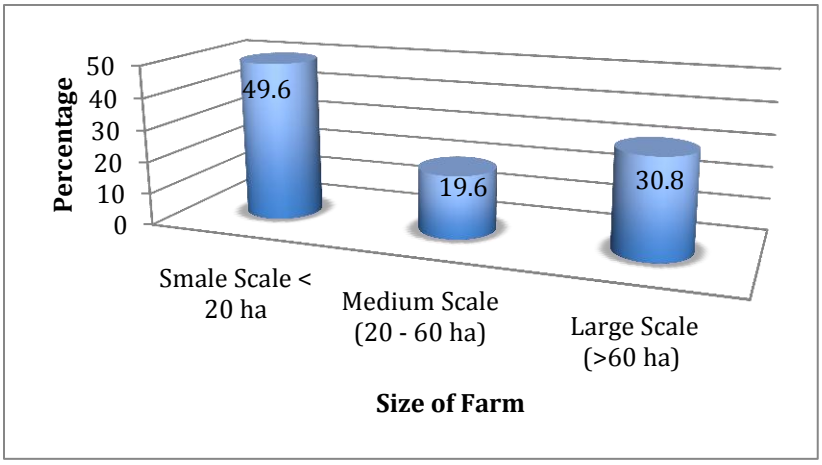

Figure 4. 9: Percentage Distribution of Farmers by size of Farm

A summary of distribution by farm size and production efficiency is shown in Table 4.9. Large farms appear to have higher production efficiencies than small size farms. Seventy five percent of respondents from Lesotho and 65 percent from South Africa had production efficiency of more than 2000kg/ha compared to 41.5 percent of small-scale farmers.

Table 4. 9: Distribution of respondents by farm size and production efficiency

	Current production efficiency									
	<1000 kg/ha		1001 – 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
Small scale (<20ha)	13	24.5	18	34.0	13	24.5	9	17.0	53	100
Medium scale(20-60ha)	5	23.8	8	38.1	3	14.3	5	23.8	21	100
Large scale (>60ha)	0.0	0.0	11	33.3	15	45.5	7	21.2	33	100
Total	**18**	**16.8**	**37**	**34.6**	**31**	**29**	**21**	**19.6**	**107**	**100**

$\chi 2 = 13.565$, df = 6, p =0.229

The differences in production efficiencies among small and large scale farms was, however not significant at 5 percent level of probability from the results of the Chi-square test of independence (p=0.229). However, 45.5 percent of the large scale farmers produce between 2000-3000kg/ha against only 24.5 percent of small scale and 14.3 percent of medium scale farmers.

4.2.10 *Size of maize farm and production efficiency*

In general farmers in the study area, devote 50 percent of their land to maize cultivation. The maize farm sizes range from 0.4ha to 200ha with a mean of 60ha.

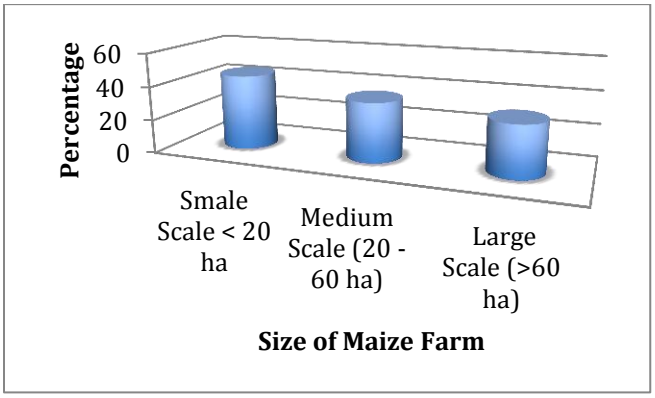

Figure 4. 10: Percentage Distribution of Farmers by Size of Maize Farm

Seventy percent of the large farms in South Africa had a production efficiency of more than 2000kg/ha. A higher percentage of small- scale farms in Lesotho (47.9 percent) compared to 34.2 percent of medium size farms from the same country had a production efficiency of more than 2000kg/ha.

Table 4. 10: Distribution of area under maize cultivation and production efficiency

	Current production efficiency									
	<1000 kg/ha		1001 – 2000 kg/ha		2001 – 3000 kg/ha		>3000 kg/ha		Total	
	n	%	n	%	n	%	n	%	N	%
Small scale (<10ha)	12	25.0	13	27.1	13	27.1	10	20.8	48	100
Medium scale(10-60ha)	6	15.8	18	47.4	8	21.1	6	15.8	38	100
Large scale(>60ha)	0.0	0.0	6	28.6	10	47.6	5	23.8	21	100
Total	18	16.8	37	34.6	31	29	21	19.6	107	100

$\chi 2 = 12.171$, df = 6, p = 0.058

Although there is no clear discernible picture from Table 4.10, the study found a significant difference in production efficiencies between farm sizes at 6 percent probability level ($\chi 2$ = 12.171, df = 6, p = 0.058), whereby 47.9 percent of small-scale maize farmers produce more that 2000kg/ha against 36.9 percent of medium-scale farmers and 71.7 percent of large-scale farmers.

4.3 CONCLUSION

This chapter presented the characteristics of the respondents in the survey area and related these variables to their production efficiency. The results indicate significant differences in production efficiency by location and membership of farmers association at 5 percent level of probability. Area under maize production also came close with a p=0.058 significant level also establishing a relationship. It can be concluded that production efficiency is related to location and membership of farmers association.

CHAPTER 5

THE RELATIONSHIP BETWEEN INDEPENDENT, INTERVENING AND SUBJECTIVE NORM VARIABLES AND THE ADOPTION OF RECOMMENDED SEED PRACTICES

5.1 INTRODUCTION

Seeds play a major role in agricultural development and improved seeds contribute substantially to yields and labour productivity in farming (O'Gorman & Pandey, 2010). Farmers are encouraged to use improved seed and planting materials for reasons of higher yield, pests and disease resistance, tolerance to drought, maturity period, and grain quality among others (Gonsalves, Lee &Gonsalves, 2007). The main improved varieties for maize are the composites and the hybrids and more recently the genetically modified seeds and these are readily available to farmers in most countries. It has been argued that improved seeds are required to increase farmers' productivity, enhance economic growth and improve food security (Scoones and Thompson, 2011).

This chapter examines the relationship between the adoption of improved maize varieties and independent variable, intervening variables and subjective norms, on the other. The objective is to determine the most important variable which influences the adoption behaviors of farmers in so far as maize varieties are concerned. The recommended practice in both South Africa and Lesotho is for the farmers to use hybrid seeds, and for that matter, ensure that the seed is purchased every season as opposed to keeping seeds for re-planting as is done for most local and composite varieties. The emphasis on total adoption practice therefore is on the type of seed and the source which are the two main variables used in the study of the adoption of maize varieties.

5.2 INDEPENDENT VARIABLES

5.2.1 *Location*

Production efficiency and adoption of recommended farm practice are not only affected by the physical location of the farm but also by the availability and type of support services due to accessibility, state of infrastructure and markets (Lapar and Ehui, 2004). The study examined the

influence of the location of the respondents with respect to their adoption behavior of recommended seed practices and the results are summarized in Table 5.1. The results found no significant difference in the adoption of the recommended seed practices by location ($\chi 2 = 4.195$; $p=0.123$) but a significant correlation ($r = -0.197$; $p = 0.043$). The hypotheses stating that the adoption of recommended farm practices is influenced by the location of the farm is therefore accepted.

Table 5. 1:Relationship between location and adoption of recommended seed practices

Location of Farm	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
South Africa	1	3.1	4	12.5	27	84.4	32	30.2
Lesotho	12	16.2	12	16.2	50	67.6	74	69.8
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 4.195$; df =2; $p = 0.123$; $r = -0.197$; $p = 0.043$

The implication of the negative relationship is that the adoption of recommended seed practices is higher in South Africa than in Lesotho. Approximately 84 percent (84.4%) of South African farmers compared to 67.7% of farmers from Lesotho had adopted the recommended maize seeds. The result is to be expected as South Africa has better infrastructure for the production, distribution and marketing of improved seeds compared to Lesotho. Although it also entirely possible that farmers in Lesotho prefer the composite varieties for characteristics other than yield. For example, Degu, Mwangi, Verkuijly & Wondimu (2000) found that majority of the farmers in the low lying areas of Ethiopia preferred the local varieties for their early maturity and high yield and the major obstacle to the adoption of improved varieties was the cost rather than the location of the farm.

5.2.2 *Farmers' association*

The survey recorded a higher percentage of respondents who belong to a farmers' association in the high adoption category namely, about 81 percent (80.8%) of members of the National Farmers' Union [NAFU] in South Africa, 66.7 percent of Tractor Owners Association [TOA] members in Lesotho, 86.7% for those in other farmer associations and 50 percent for those who do not belong to any association. The results of the statistical analysis with respect to the adoption of recommended seed practices and farmers behavior is reported in Table 5.2. Although there is a higher percentage of respondents from the established farmers association within the

high adoption categories, the results neither established significant differences between the groups nor a relationship between membership of farmers association and adoption ($\chi 2 = 7.638$; p=0.266; r = -0.056; p = 0.572) of the recommended maize varieties.

Table 5. 2: Relationship between membership of farmers' association and adoption of recommended seed practices

Farmers association	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
NAFU	1	3.8	4	15.4	21	80.8	26	24.5
TOA	10	15.9	11	17.5	42	66.7	63	59.4
Other	2	13.3	0	0.0	13	86.7	15	14.2
None	0	0.0	1	50.0	1	50.0	2	1.9
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 7.638$; df = 6; p = 0.266; r = -0.056; p = 0.572

Belonging to a farmers' association in spite of all the advantages associated with it as reported by Roling (1988) may not necessary lead to the adoption of a recommended seed. This finding does not support the hypothesis that the adoption of recommended seed practices is influenced by the being a member of a farmers' association.

5.2.3 *Gender*

The roles and responsibilities of male and female farmers in farming may differ from one culture to the other and may also influence resource endowments and access to services (Croppenstedt et al, 2003). The study found no significant differences between male and female respondents in the adoption of recommended seed by gender (Table 5.3). There was also no significant correlation between gender and adoption behavior implying that gender is not a major contributory factor to the adoption of seed practices and rejects the hypotheses for the study.

Table 5. 3: Relationship between gender and adoption of recommended seed practices

Gender	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Male	8	9.5	12	14.3	64	76.2	84	79.2
Female	5	22.7	4	18.2	13	59.1	22	20.8
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 3.355$; df = 2; p = 0.187; r = -0.177; p = 0.070

Given that 76.2 percent of males compared to 59.1 percent of females were in the high adoption category, it could be deduced from the results that there is a reasonable amount of correlation by gender at 10 percent probability. Similar results were obtained by Msuya (2007). A total of 40.9 percent of female respondents indicated a low to medium rate of adoption against 23.8 percent of male respondents. There is therefore more room for improvement among female respondents to adopt improved seeds.

5.2.4 *Age*

The interest, experience and expectations of different age groups differ and is a factor which can influence adoption as found by Lawal et al (2005). It has been suggested that young people are more likely to adopt innovations because they possess attributes which enable them to be ambitious, active and are less risk averse (Rogers, 1983; Van den Ban and Hawkins, 1996). Table 5.4 shows a relatively steady increase in the proportion of respondent adopting the recommended seed with the age of the respondents from the young to post-midlife. Sixty percent of those below 40 years were found in the high adoption category and increased to 70.9 percent for mid-life group and 78 percent for post-midlife group, respectively, an indication the older the respondents, the higher the adoption rate.

Table 5. 4: Relationship between age and adoption of recommended seed practices

Age	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Young (<40yrs)	1	10.0	3	30.0	6	60.0	10	9.4
Mid-life(40-60yrs)	7	12.7	9	16.4	39	70.9	55	51.9
Post Mid-life (>60)	5	12.2	4	9.8	32	78.0	41	38.7
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 2.764$; df = 4; p = 0.598; r = 0.071; p = 0.471

However, the differences between the age groups in their adoption behaviors was not statistically significant at 5 percent level of probability (p=0.598) neither was age correlated to the adoption of recommended seed practices (p = 0.471). Other studies by Croppenstedt et al (2003) and Li, Liu & Deng (2010), also did not find any significant influence of age in the adoption of rice varieties. It is likely that other factors compound the effect of age on adoption in spite of their youthfulness and their inclination to court risk. The results affirm the hypothesis that age does not influence the adoption of farm practices.

5.2.5 *Education level*

Formal education has been found to be associated with adoption and more so when the practice is complex in nature (Rogers, 1983) by reason that they are able to weigh the costs against the benefits (Lapar & Ehui, 2004). The study found significant difference in the adoption of recommended seed practices among the various educational level groups as summarized in Table 5.5 at 5 percent level of probability (p = 0.044). None of the respondents with more than 12 years of education fell within the low adoption category.

Table 5. 5: Relationship between level of education and adoption of recommended seed practices

Education Level	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
<=7yrs	3	6.4	6	12.8	38	80.9	47	44.3
8-12 yrs	10	23.3	6	14.0	27	62.8	43	40.6
> 12yrs	0	0.0	4	25.0	12	75.0	16	15.1
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 9.793$; df = 4; p = 0.044; r = -0.081; p = 0.407

Conceding that there is a significant difference among the educational level categories, the relationship between adoption behavior of recommended seed practices and educational level was however, not significant at 5 percent degree of probability (p = 0.407) supporting the hypothesis that education does not influence the adoption of recommended practices. Seed itself as a technology cannot be said to be one of the complex technologies that will require a higher educational level to adopt as has been reported in the literature (Rogers, 1983; Lapar and Ehui, 2004). The influence of education in the adoption of seed could not be established although other studies (Paudel, Shrestha and Matsuoka, 2009; Idrisa, Shehu, and Ngamdu, 2012), found education to significantly influence the adoption of improved maize seed. The conflicting results from various studies suggest the lack of consistency in the use of education as a factor influencing adoption of recommended maize seeds. However, the fact that 80.9 percent of respondents with less than 7 years of education indicated high adoption rate is an indication that a qualification/education is not necessarily a pre-requisite for adoption and any willing person can be capacitated to adoption recommended seed practices,

5.2.6 *Experience in farming*

According to Johl and Kapur (2001), experience is the basis for progress and success in many businesses and the lack of it has been linked to low production and income by farmers (Adekoya, 2005). It is considered to be the accumulation of human capital and the expectation is that those who have spent more time farming, for example, have considerable knowledge and information about the risks and benefits of farm practices and will be willing to make investments for better outcomes. The study examined the relationship between the number of years respondents have been in farming and their adoption of recommended seeds and found no difference in the adoption behaviors of the respondents and experience in farming as summarized in Table 5.6.

Table 5. 6: Relationship between experience and adoption of recommended seed practices

Experience	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Beginners (<10yrs)	0	0.0	1	33.3	2	66.7	3	2.8
Transitional (10-20yrs)	8	16.3	7	14.3	34	69.4	49	46.2
Experienced (>20yrs)	5	9.3	8	14.8	41	75.9	54	50.9
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 2.276$; df = 4; p = 0.685; r = 0.079; p = 0.423

The relationship between adoption of recommended seed practices and experience in farming was also not significant at 5 percent level of probability, suggesting that the number of years a farmer has been farming is not a factor in the adoption of recommended seed varieties, confirming hypothesis used for the study. It can be argued that farmers just like entrepreneurs prefer learning through concrete experiences (Livonen, Kyto, Mynttinen, Sarkka-Tirkkonen & Kahiluoto, 2011) and are more likely to base their decision of the use of seed on experiences of their own or others. Both experienced and beginners are therefore likely to adopt improved seeds based on their own experience or that of others. The high adoption rate among the various experience groups which are 66.7 percent for beginners, 69.4 percent for transitional group and 75.9 percent for experienced groups is consistent with this argument.

5.2.7 *Off-farm income*

Off-farm income provides available sources of income for farm investments. It is therefore expected that part time farmers will readily adopt recommendations which require initial capital outlay due to affordability as the cost of new farm practices have been found to be an obstacle to adoption (Degu, Mwangi, Verkuijl & Wondimu, 2000). Whilst close association between off-farm income and adoption was found in a study by Chirwa (2005), Ransom et al (2003) had earlier reported that large changes in off-farm income were needed to create a significant increase in adoption.

The survey explored the relationship between respondents' off-farm income and adoption of recommended seed varieties. Off-farm income was defined by whether respondents' main activity/job or source of income is farming and a comparison was made between full-time and part-time farmers' in respect of their adoption of recommended seed. Table 5.7 is a presentation of respondents according to source of additional income and their adoption of recommended seed practices. The study found no significant differences between fulltime and part time farmers in the adoption behaviors at 5 percent degree of probability (p = 0.365), although 77.4 percent of full time farmers compared to 65.9 percent of part-time farmers were found in the high adoption category.

Table 5. 7 Relationship between off-farm income and adoption of recommended seed practices

Off-farm income	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Full time	7	11.3	7	11.3	48	77.4	62	58.5
Part time	6	13.6	9	20.5	29	65.9	44	41.5
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2$= 2.017; df =2; p = 0.365; r = -0.098; p = 0.317

The study also found no significant relationship between the adoption of the recommended seed practices and off-farm income at 5 percent level of probability (p= 0.317) supporting the study hypothesis that off farm income does not influence the decision to adopt recommended farm practices. Studies that had reported experience to be a factor influencing adoption had measured a previous experience in the usage of the practice (Sall, Norman & Featherstone ,2000; Ransom

et al ,2003) rather than experience in farming in general as was the case for this study and could account for the disparities in results.

5.2.8. *Time spent in farming*

A summary of the relationship between adoption and time spent in farming was examined and the results are presented in Table 5.8. The study found no significant differences between time spent and adoption behaviors at 5 percent degree of probability (p = 0.108). As can be seen from Table 5.8, about 73 percent of those who spent less than 50 percent of their time on the farm were in the high adoption category which is about roughly the same percentage (74 percent) for those who spent more than 75 percent of their time on the farm.

Table 5. 8: Relationship between time spent in farming and adoption of recommended seed practices

Time spent in farming	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
(<50% of time)	4	26.7	0	0.0	11	73.3	15	14.2
(50-75% of time)	1	5.6	5	27.8	12	66.7	18	17.0
(>75% of time)	8	11.0	11	15.1	54	74.0	73	68.8
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 7.589$; df = 4; p = 0.108; r = 0.074; p = 0.451

The results of correlation analysis as shown in the above table indicate that the amount of time spent on the farm does not influence farmer's adoption decision rejecting hypothesis.

5.2.9 *Farm Size*

Reed and Salvacruz (1995) found that large farms have a greater margin of risk-taking and greater access to credit which enables them to adopt new practices faster that small-scale farmers. Sall, Norman & Feathestone (2000), however, reported that farm size did not influence the adoption of improved rice varieties. Msuya and Düvel (2007) also found that although farmers with bigger farms tended to follow the recommended practice more closely, the relationship between adoption and farm size was not significant.

The study examined the relationship between farm size and the adoption of recommended maize seed and found significant differences ($\chi 2 = 11.525$; df = 4; p = 0.021) between small and large farms in the adoption of recommended practices at 5 percent degree of probability. Table 5.9

shows that 84.8 percent of the large farms compared to only 62.3 percent of small farmers were among the high adoption category.

Table 5. 9: Relationship between farm size and adoption of recommended seed practices

Farm size	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Small Scale(<20% ha)	12	22.6	8	15.1	33	62.3	53	50.0
Medium Scale(20-60% ha)	0	0.0	4	20.0	16	80.0	20	18.9
Large Scale(>60% ha)	1	3.0	4	12.1	28	84.8	33	31.1
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 11.525$; df = 4; p = 0.021; r = 0.278; p = 0.004

The correlation between farm size and adoption behaviors for recommended seed practices was also found to be significant (r = 0.278; p = 0.004) implying that farm size is a factor in the adoption of seed practices, thus the hypotheses that adoption of recommended practice is influenced by the total farm size is accepted. Although the results contrasts with other studies cited earlier, other studies by Tura, Aredo, Tsegaye, La Rovere, Tesfahun, Mwangi and Mwabu (2010) found a relationship between farm size and the adoption of maize seed specifically.

5.2.10 *Area under maize cultivation*

Although one of the variables under study was total area of land available to the respondent, the study also examined the relationship between the actual area of land under maize cultivation in relation to adoption of recommended practices. The results presented in Table 5.10 below show significant differences in the adoption of recommended seeds between respondents with small and large maize farms. Whereas none of the large scale maize farmers was found within the low adoption category while 25.5% of the small scale maize farmers were found within the same category. A higher percentage of respondents (90.5%) of large scale maize farmers were found within the high adoption category compared to 59.6% of small scale maize farmers. The difference in adoption behavior between the farm small and large scale maize farmers was found to be highly significant at 5 percent degree of probability ($\chi 2 = 15.140$; df = 4; p = 0.004)

Table 5. 10: Relationship between area under maize cultivation and adoption of recommended seed practices

Area under maize cultivation	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Small (<20 ha)	12	25.5	7	14.9	28	59.6	47	44.3
Medium (20-60 ha)	1	2.6	7	18.4	30	78.9	38	35.8
Large Scale(>60% ha)	0	0.0	2	9.5	19	90.5	21	19.8
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 15.140$; df = 4; p = 0.004; r = 0.332; p = 0.000

The correlation between maize farm size and adoption behaviors for recommended seed practices was also found to be highly significant (r = 0.332; p = 0.000) implying that maize farm size is a factor in the adoption of recommended maize seed practices which is consistent with the hypotheses which states that the size of maize farm influences the adoption of recommended farm practice.

5.3 TOTAL INFLUENCE OF INDEPENDENT VARIABLES

The contribution of the independent variables to the adoption of the recommended seeds was determined using a multiple regression analysis and the results are presented in Table 5.11. The results show that all the ten variables do not show any significant influence on the adoption of the recommended seeds supporting the main hypothesis (2) that the adoption of recommended farm practices is not influenced by the socio-demographic characteristics of the farmer and farm

Table 5. 11: Regression analysis of the influence of independent variables on the adoption of recommended seed practices

	Independent Variables	Standardized Coefficients	T	Sig.
1	(Constant)		2.566	.012
	location of farm	-.147	-.691	.491
	Membership of farmers association	.066	.570	.570
	Gender	.141	1.354	.179
	Age	-.097	-.951	.344
	Education	-.120	-1.157	.250
	Farming Experience	.152	1.586	.116
	Off-farm income	.075	.416	.678
	Time Spent Farming	-.070	-.455	.650
	Farm Size	.138	.610	.543
	Area Under Maize Cultivation	.195	1.060	.292

$R^2 = 0.191$, $p = 0.020$

The ten independent variables together account for 19.1 percent of the variation in the adoption of the recommended seed practices. The model is significant at 5 percent level of probability (p=0.020). This is an indication that other factors other than the characteristics of the farm and farmer may offer better explanation to adoption of recommended practice

5.4 RELATIONSHIP BETWEEN INTERVENING AND SUBJECTIVE NORM VARIABLES AND THE ADOPTION OF RECOMMENDED SEED PRACTICIES

Intervening variables as noted by Düvel (2007) are immediate causes of a particular behavioral action. The results of the relationship between five intervening variables (Need Tension, Efficiency Perception, Need Compatibility, Awareness and Prominence) and four subjective norm variables (Important People, Extension Agents, Close Friends and Membership of farmers Association) on the adoption of recommended seed were examined and the results are presented in the section which follows.

5.4.1 *Intervening variables*

5.4.1.1 Efficiency Perception

Farmers' perception of the efficiency of a practice has been found to influence the adoption behavior regarding that practice (Düvel & Botha, 1999; Habtermariam & Düvel, 2003; Msuya &

Düvel, 2007). The study assessed the relationship between efficiency perception and the adoption of recommended seeds. Table 5.12 is a summary of the results of the analysis of the efficiency perception of respondents and shows a significant difference in the adoption behavior among the categories of those who overrate and those who underrate their efficiencies at 5 percent degree of probability (p = 0.000). Majority of respondents (91.7%) who underrate their own efficiency were found to be within the high adoption category compared to 8.8% of those who overrate their efficiency.

Table 5. 12: Relationship between efficiency perception on the adoption of recommended seed practices

Efficiency Perception	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Underrating	1	1.4	5	6.9	66	91.7	72	67.9
Correct Assessment	0.0	0.0	10	55.6	8	44.4	18	17.0
Overrating	12	75.0	1	6.3	3	8.8	16	15.1
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 95.973$; df = 4; p = 0.000; r = -0.734 p = 0.000

The correlation analysis also indicate a close negative relationship between efficiency perception and the adoption of recommended maize seeds at 5 percent level of probability (p=0.000) thus accepting the hypothesis that efficiency perception influences the adoption of recommended farm practices. The results collaborate with earlier reports by Msuya & Düvel (2007) that farmers who overrate their efficiency have a lower motivation to adopt a recommended practice.

5.4.1.2 Need Compatibility

Need compatibility is the degree to which a practice fits into the individual's psychological field with its needs, aspirations or goals (Düvel, 1991). Gonsalves et al, (2007) attributed the high and fast adoption of the genetically modified papaya by Hawaiian farmers to the fact the variety "*addressed a problem that farmers themselves found to be critically important to their livelihoods*'. Other studies by Kuo & Lee (2011) also found perceptions of usefulness and compatibility as significant predictors of behavior. The study sought to identify whether the adoption of the recommended maize seeds fit within their motive for engaging in farming and whether there is a relationship between the adoption decision making and need compatibility.

Table 5. 13: Relationship between Need Compatibility and the adoption of recommended seed practices

Need Compatibility	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Low	4	20.0	3	15.0	13	65.0	20	18.9
Medium	4	15.6	9	34.6	13	50.0	26	24.5
High	5	8.3	4	6.7	51	85.0	60	56.6
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 15.583$; df = 4; p = 0.005; r = 0.266; p = 0.006

A summary of the need compatibility and relationship with adoption is shown in Table 5.13 which indicates that 85 percent of the respondents with high need compatibility were in the high adoption category while the percentage for the low need compatibility group was only 65 percent. The Chi-square test results also show a significant difference between those with high and low need compatibility at 5 percent degree of probability (p = 0.005). The results of the correlation analysis indicate that need compatibility influence the adoption of the recommended seed (r = 0.266; p = 0.006) confirming the hypothesis that need compatibility influences the adoption of recommended farm practices.

5.4.1.3 Need Tension

Studies by Düvel (1991), and Düvel and Botha (1999) found a close relationship between need tension, that is, perceived difference between a desired goal and current situation and the adoption of recommended practices. Table 6.14 below is a presentation of the results of the Chi-square and correlation analysis of the relationship between the adoption of recommended seeds and need tension.

The indication from the analysis is that there is a highly significant difference between respondents with high and those with low needs tension in the adoption of the recommended maize seeds at 5 percent level of probability. Slightly over 93 percent (93.4%) of respondents with high need tension were found within the high adoption category compared to only 12.5 percent of those with low need tension within the same high adoption category.

Table 5. 14: Relationship between Need Tension and the adoption of recommended seed practices

Need Tension	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Low	10	62.5	4	25.0	2	12.5	16	15.1
Medium	1	7.1	9	64.3	4	28.6	14	13.2
High	2	2.6	3	3.9	71	93.4	76	71.7
Total	13	12.3	16	15.2	77	72.4	106	100.0

$\chi 2 = 84.940$; df = 4; p = 0.000; r = 0.754; p = 0.000

The study also established and affirmed the results of other studies that need tension influences adoption of recommended practices, in this particular instance, the adoption of recommended maize seeds (r = 0.754; p = 0.000) at 5 percent level of probability. The hypothesis that need tension influence adoption of recommended farm practices is therefore affirmed.

5.4.1.5 Awareness

Awareness refers to the respondents' familiarity with the advantages and disadvantages of a practice or recommendation (Düvel, 1991). In other words, the in-depth knowledge a farmer has about a particular recommendation beyond just knowing about the practice. It is an indication as to whether respondents have had prior information regarding the usefulness of the recommended seed and whether they have made informed decision about its potential contribution to production efficiency. Table 5.15 is a presentation of the results of the analysis between awareness and adoption and the indications are that, there is a highly significant difference in the adoption behavior of respondents who were aware and those who were not of the recommended practices ($\chi 2 = 15.608$; df = 2; p = 0.000).

Awareness	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Aware	6	7.0	11	12.8	69	80.2	86	18.9
Not Aware	7	35.0	5	25.0	8	40.0	20	81.1
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 15.608$; df = 2; p = 0.000; r = 0.384; p = 0.000

Twice as many of those who were aware of the practice (80 percent) were in the high adoption category. Similarly, the influence of awareness and adoption behavior of farmers was found to be significantly less than 1 percent level of probability (r = 0.384; p = 0.000), which confirms the hypotheses that awareness influences the adoption of recommended farm. It is reasonable to suggest that awareness about the full implications of a practice by a prospective user enhances adoption

5.4.1.6 Prominence

Prominence is another intervening variable and refers to the extent to which a practice is perceived to be better than others and largely coincides with what Rogers (1983) defines as relative advantage. Perceived usefulness has been linked to adoption in other studies (Düvel and & Duvel, 2007; Rezaei & Bagheri, 2011). The findings relating to the relationship between prominence and the adoption of the recommended seed practices is presented in Table 5.16. It shows that 83.3 percent compared with 54.2 percent of respondents with high and low prominence were in the high adoption category. The Chi-square analysis also showed a highly significant differences at 1 percent level of probability between those who perceived the practice to be either low or high prominence ($\chi 2 = 15.263$; df = 4; p = 0.004).

Table 5. 15: Relationship between Prominence and the adoption of recommended seed practices

Prominence	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Low	6	25.0	5	20.8	13	54.2	24	22.6
Medium	1	6.3	6	37.5	9	56.3	16	15.1
High	6	9.1	5	7.6	55	83.3	66	62.3
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 15.263$; df = 4; p = 0.004; r = 0.295; p = 0.002

The results of the correlation analysis collaborate with other research findings which found that prominence influences adoption behaviors of farmers. The results of the correlation analysis was again highly significant at 1 percent level of probability (r = 0.295; p = 0.002). Beyond knowing about the practice – its advantages and disadvantages, adopters must be convinced that the practice is better than their own and will lead to better production efficiency.

5.4.2 Subjective Norm Variables

5.4.2.1 Important people

The influence of people who are important to the respondents was one of the four subjective norm variables included in this study. It refers to the extent to which respondents decisions are influenced by the expectations of people they consider important to them. Table 5.17 summarizes the results of the study and shows no significant difference among the respondents ($\chi 2 = 3.278$; df = 4; p = 0.512).

Table 5. 16: Relationship between Important People and the adoption of recommended seed practices.

Important People	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Unlikely	11	16.2	11	16.2	40	67.6	68	64.2
Neither	1	5.6	2	11.1	15	83.3	18	17.0
Likely	1	5.0	3	15.0	16	80.0	20	18.8
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 3.278$; df = 4; p = 0.512; r = 0.154; p = 0.115;

Eighty percent of the respondents who reported they were likely to be influenced by important people were found in the high adoption category compared to 83.3 percent and 67.7 percent of those who were neither or unlikely to be influenced. The correlation .analysis also confirmed the hypothesis that important others are unlikely to influence the adoption behaviors of farmers as the results were found not significant at 5 percent level of probability. ($r = 0.154$; $p = 0.115$). It can be inferred that farmers are not influenced by the people they consider as important in their decision to adopt seed practices.

5.4.2.2 Extension agents

Studies found in the literature reports of positive influence by extension agents on the adoption behaviors of farmers (Yila & Thapa, 2008). The analysis of the results of the influence of extension agents on the adoption of recommended seeds is summarized in Table 5.18. The results found no significant difference among the respondents of those who are likely or unlikely to be influenced by extension agents in their decision to adopt the recommended practice at a 5 percent level of probability ($p = 0.217$).

Table 5. 17: Relationship between Extension Agents and the adoption of recommended seed practices

Extension Agents	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	n	%
Unlikely	7	10.1	11	15.9	51	73.9	69	65.1
Neither	2	8.0	4	16.0	19	76.0	75	23.0
Likely	4	33.3	1	8.3	7	58.3	12	11.3
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 5.769$; $df = 4$; $p = 0.217$; $r = -0.129$; $p = 0.186$

The correlation analysis shows that extension agents per se do not influence the decision of respondents to adopt the recommended practice ($p = 0.186$).

5.4.2.3 Close friends

It is assumed that close friends influence each other's decisions making and by implication influence the adoption behaviors of farmers. The study therefore examined the influence of friends in the adoption of recommended seeds and found no significant difference among the respondents who were likely or unlikely to be influenced by their close friends ($\chi 2 = 3.593$; $df = 4$; $p = 0.464$) although, about 89.9 percent of the respondents who are likely to be influenced by

their close friends compared to 68.3 percent of those unlikely to be influenced by their close friends were found in the high adoption category (Table 5.19).

Table 5. 18: Relationship between Close Friends and the adoption of recommended seed practices

Close Friends	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Unlikely	9	15.0	10	16.7	41	68.3	60	56.6
Neither	3	11.1	5	18.5	19	70.4	27	25.5
Likely	1	5.3	1	5.3	17	89.9	19	17.9
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 3.593$; df = 4; p = 0.464; r = 0.154; p = 0.116

The study also examined the influence of close friends of the adoption behavior of respondents. The results of the correlation analysis indicate that close friends do not influence the decisions to adopt the recommended maize practice at 5 percent degree of probability.

5.4.2.4 Members of association

Farmers associations provide networks within which information is passed around and evaluated (Roling, 1988). Table 5.20 shows the results of the analysis of the influence of members of association on their members' adoption behavior of recommended seed.

Table 5. 19: Relationship between Membership of Association and the adoption of recommended seed practices

Membership of Association	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Unlikely	10	11.1	13	14.4	67	74.4	90	84.9
Neither	2	20.0	2	20.0	6	60.0	10	9.4
Likely	1	16.7	1	16.7	4	66.7	6	5.7
Total	13	12.3	16	15.1	77	72.6	106	100.0

$\chi 2 = 1.165$; df = 4; p = 0.884; r = -0.097; p = 0.332;

The study found no significant difference among the respondents in respect of those who are likely or unlikely to be influenced by members of their farmers association and their choice to use recommended seed ($\chi 2 = 1.165$; df = 4; p = 0.884)

The influence of members of association on respondents' adoption behaviors was also examined. The results shows that the influence of members of association on the decision making of respondents to adopt recommended seed was found not to be significant at 5 percent level of probability (p = 0.332) and supports the hypothesis that membership of farmers association does not influence adoption behaviors. The results collaborate with a similar finding by Chirwa (2005) that membership of farmers association was not a criteria for the adoption of hybrid maize.

5.5 TOTAL INFLUENCE OF INTERVENING VARIABLES

Table 5.21 below shows the results of the multiple regression analysis to assess the total contribution of the intervening variables on the adoption of the recommended seed. This was to help identify the important variables contributing to the variation in the adoption of the recommended practice.

Table 5. 20: Regression analysis of the influence of intervening variables on the adoption of recommended seed practices

	Intervening and Subjective Norm Variables	**Beta**	**t**	**p**
1	(Constant)		2.936	.004
	Prominence	0.518	3.014	.003
	Awareness	-.485	-5.526	.000
	Need Compatibility	.028	.350	.727
	Efficiency Perception	.191	2.199	.030
	Need tension	.027	.346	.730
	Close friend	.045	.414	.680
	Members of association	-.089	-.904	.368
	Important people	.139	.246	.806
	Extension agent	-.134	-.233	.816

R^2 = 0.490, p = 0.000

According to Table 5.21 the intervening variables in total explain 49 percent of the variation in adoption (R^2 = 0.490, p = 0.000) of the recommended seed at 5 percent level of probability The most significant individual variable contributing to this variation is Prominence (Beta 0.518, p = 0.003), followed by awareness (Beta = -0.485 p = 0.000) and efficiency perception (Beta =

0.191, p = 0.030). These three account for the 49 percent of the variation out of five intervening and subjective norm variables entered into the regression

5.6 CONCLUSION

It was shown in Table 5.11 that the contribution of the independent variables to the explanation of adoption behavior amounted to 19.1 percent of the total compared to 49 percent recorded for the intervening variables. It can be concluded that intervening variables exert greater influence on the adoption behavior of respondents for recommended seed practices than the independent variables. The correlation coefficients also showed greater relationship than the independent variables.

CHAPTER 6

THE RELATIONSHIP BETWEEN INDEPENDENT, INTERVENING AND SUBJECTIVE NORM VARIABLES AND THE ADOPTION OF RECOMMENDED BASAL FERTILIZER PRACTICES

6.1 INTRODUCTION

Fertilizer applied in proper amounts, the right time and using the right method enhance the production of good crops including maize. It replenishes lost soil nutrients to support plant growth. Farmers all over the world are encouraged to apply fertilizer to their soils, to replenish lost soil nutrients and to enhance plant growth (Bationo, 2008; Rehm & Lamb, 2008). South Africa and Lesotho farmers are no exception, and the recommendation for maize cultivation is to use (i) either NPK 3:2:1 (25) or 3:2:1 (32); (ii) at the rate of 250kg/ha; (iii) during planting and; (iv) band placed along the seed. These four recommended agronomic practices are deemed necessary for good maize production efficiency

The section that follows discusses the results of the empirical analysis to ascertain the influence of independent and intervening variables on the adoption behavior of respondents for the recommended total fertilizer practice.

6.2 INDEPENDENT VARIABLES

6.2.1 *Location*

The influence of location of respondents with respect to their adoption behavior of recommended fertilizer practices was investigated and the results of the analysis shown in Table 6.1 indicates a significant difference in the adoption of recommended fertilizer practices by the location of respondents ($\chi 2 = 11.839$; df = 2; p = 0.003). It also reveals a significant negative correlation between the adoption of recommended fertilizer practices and location of respondents **(**r = -0.326; p = 0.001).

Table 6. 1: Relationship between location of farm and the adoption of recommended basal fertilizer practices

Location of Farm	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
South Africa	0	0.0	3	9.4	29	90.6	32	30.2
Lesotho	6	8.1	26	35.1	42	56.8	74	69.8
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 11.839$; df = 2; p = 0.003; r = -0.326; p = 0.001**.**

Further evidence of the influence of locality is that among the South African respondents 90.6 percent were in the 'high adoption' category compared to 56.8 percent of their counterparts from Lesotho. The influence may not necessarily be the location per se but linked to access, resources, better service provision, better infrastructure and other agricultural support (Lapar & Ehui, 2004) as was explained in the preceding chapter.

6.2.2 *Membership of farmers' association*

The study also investigated the hypothesis that membership of farmers association does not influence the adoption of fertilizer practices. Table 6.2 is a summarized presentation of the Chi-square and correlation analysis of the relationship between membership of farmers association and adoption of recommended fertilizer practices. The result of the analysis shows a significant difference at 5 percent level of probability between memberships of the various groups ($\chi 2 = 14.678$; df = 6; p = 0.023**)**. About 92 percent (92.3 percent) of the 26 farmers who are NAFU members compared to 58.7 percent of the 63 farmers who are TOA members, and 53.3 percent of farmers who belong to other organizations, while the two Farmers who reported to have not belonged to any association were found in the high adoption group.

Table 6. 2: Relationship between membership of farmers association and the adoption of recommended basal fertilizer practices

Farmers Association	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
NAFU	0	0.0	2	7.7	24	92.3	26	24.5
TOA	6	9.5	20	31.7	37	58.7	63	59.4
Other	0	0.0	7	46.7	8	53.3	15	14.2
None	0	0.0	0	0.0	2	100	2	1.9
Total	6	5.7	27	27.4	71	67.0	106	100.0

$\chi 2 = 14.678$; df = 6; p = 0.023; r = -0.182; p = 0.063.

The inference is that there may be other factors other than membership that contributes to the high adoption among all the groups under investigation. The correlation coefficient shows a non-significant influence of membership on adoption at 5 percent level (p=0.063) of probability.

6.2.3. *Gender*

The role of gender in the adoption of recommended fertilizer practices was also examined and the results are presented in Table 6.3. The percent distribution in the high adoption group was 67.9 percent and 63.6 percent for males and females respectively, which statistically was not significant at 5 percent level of probability ($\chi 2 = 2.441$; df = 2; p = 0.295**).**

Table 6. 3: Relationship between gender and the adoption of recommended basal fertilizer practices

Gender	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Male	6	7.1	21	25.0	57	67.9	84	79.2
Female	0	0.0	8	36.4	14	63.6	22	20.8
Total	6	7.1	29	36.4	71	67.0	106	100

$\chi 2 = 2.441$; df = 2; p = 0.295; r = 0.020; p = 0.839

The relationship between gender and adoption of fertilizer practices was also not significant at 5 percent level of probability (r = 0.020; p = 0.839) supporting the hypothesis that gender does not influence the adoption of recommended fertilizer practices. It can be deduced that male and female farmers are equally responsive to proven fertilizer practices provided and could have equal access to resources and other support services.

6.2.4. *Age*

In regards to age and the adoption of recommended fertilizer practices, the analysis of the data presented in Table 6.4 shows that the proportion of respondents in the high adoption category declines with age, 80 percent for those below 40 years; 66.1 for the mid-life and 65 for the post-mid-life. However, the Chi-square analysis yielded a non-significant difference at 5 percent (p = 0.857).

Table 6. 4: Relationship between age and the adoption of recommended basal fertilizer practices

Age	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Young (<40yrs)	0	0.0	2	20.0	8	80.0	10	9.4
Mid-life(40-60yrs)	3	5.4	16	28.6	37	66.1	56	52.8
Post Mid-life (>60)	3	7.5	11	27.5	26	65.0	40	37.7
Total	6	5.7	29	27.4	71	67	106	100.0

$\chi 2 = 1.326$; df = 4; p = 0.857; r = -0.086; p = 0.378.

The conclusion of the hypothesis that age does not influence the adoption of the recommended fertilizer practice was supported by the correlation analysis which was also not significant at 5 percent probability (r = -0.086; p = 0.378). It can therefore be established from the results that age, just like gender, is not a major influencing factor in the adoption of recommended fertilizer practices. It could well be that the limited variation in the respondents as only 9.4 percent were within the young group could also explain the absence of any relationship between age and the adoption of recommended maize practices.

6.2.5. *Formal* education

Attainment of formal education is deemed to be associated with prudent farm decision-making and is based on the assumption that education increases "the ability to perceive, interpret and respond to new events" (Schultz, 1981). The role of education could also be compromised or diminished in an environment where farmers have access to the media and agro-chemical dealers (Asfaw & Admassie, 2004). The study sought to establish the relationship between level of education and adoption of recommended fertilizer practices. The survey findings summarized in Table 6.5, point to a significant difference in the different educational level groups at 5 percent probability level ($\chi 2 = 9.763$; df = 4; p = 0.045). A high proportion of respondents 76.6 percent of those with less than 7 years of education compared to 43.8 percent with those with higher educational level attainment of more than 12 years were found to be in the high adoption category.

Table 6. 5: Relationship between level of education and the adoption of recommended basal fertilizer practices

Education	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
<=7yrs	3	6.4	8	17.0	36	76.6	47	44.3
8-12 yrs	3	7.0	12	27.9	28	65.1	43	40.6
> 12yrs	0	0.0	9	56.3	7	43.8	16	15.1
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 9.763$; df = 4; p = 0.045; r = -0.156; p = 0.110;

However, the results of the correlation analysis reveal that the level of education does not influence the decision to adopt the recommended fertilizer practice as the correlation coefficient was not significant at 5 percent level of probability (p = 0.110).. Since all the respondents had formal education, it was not possible to make a comparison between them and those who have had no formal education. Most studies have compared those with formal and those without and have reported a relationship of formal education with adoption (Rogers, 1983). It is likely that ability to read and write (attainment of basic literacy) which all the respondents were able to do, in an era of mass media and agro-input providers, is sufficient for the adoption of the recommended fertilizer practices.

6.2.6. *Experience in farming*

Farmers are known to conduct experiment and their current production practices are expected to be influenced to some extent by their experience with the past. The survey sought to examine the influence of experience from the perspective of the number of years respondents have been farming and therefore solicited information regarding this variable. These findings are summarized in Table 6.6 below

Table 6. 6: Relationship between experience and the adoption of recommended basal fertilizer practices

Experience	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Beginners (<10yrs)	0	0.0	2	66.7	1	33.3	3	2.8
Transitional (10-20yrs)	4	8.2	15	30.6	30	61.2	49	46.2
Experienced (>20yrs)	2	3.7	12	22.2	40	74.1	54	50.9
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 4.637$; df = 4; p = 0.327; r = 0.165; p = 0.091.

In summarizing the survey findings, Table 6.6 shows that as years of farming experience increase, farmers have more tendencies to adopt the recommended fertilizer practices. The Chi square analysis to determine statistical differences between the three groups was, however, not significant at 5 percent level of probability (p = 0.327). The correlation analysis could not establish any relationship between years of experience and the adoption of recommended fertilizer practices. There is an increase from the beginners to the experienced ((>20yrs) from 33.3 percent to 61.2 percent for the transition and to 74.1 percent for the experienced farmers. A possible explanation for the non-significance could be the limited variation, and more specifically the fact that only 2.8 percent of the respondents have less than 10 years of farming experience.

6.2.7. *Off-farm income*

Off-farm income was defined by whether respondents' main activity/job or source of income is farming and a comparison was consequently made between full-time and part-time farmers. A summary of the findings is presented in Table 6.7.

Table 6. 7: Relationship between off-farm income and the adoption of recommended basal fertilizer practices

Off-farm income	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Full time farmers	4	6.3	10	15.9	49	77.8	63	59.4
Part farmers	2	4.7	19	44.2	22	51.2	43	40.6
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 10.321$; df = 2; p = 0.006; r = -0.207; p = 0.034;

The results of the analyses of the data obtained shows a relative higher proportion of respondents who are full time farmers (77.8%) within the high adoption category compared to 51.2 percent of part-time farmers within the same category and the Chi-square is significant at 5 percent level of probability (p = 0.006). The correlations analysis also indicates that experience influences the adoption of the recommended fertilizer practice at 5 percent level of probability (p = 0.034). It would appear that full-time farmers are likely to adopt the recommended practices more than part-time farmers. The conclusion that full-time farmer's whose sole activity and perhaps income is dependent on farming, are more inclined to adopt the recommended fertilizer practices and to invest more on proven practices to increase their yields and subsequent incomes is justified.

6.2.8. *Time spent in farming*

The influence of amount of time devoted to farming in relation to the adoption of recommended fertilizer was also examined and the results are presented below. The variable, time-spent, could be related to occupation as full time farmers are more likely to spend all their time farming whereas part time by the nature of having a second occupation are bound to spend less amount of time on their farms. The study was interested in determining whether the amount of time spent specifically on farm activities had any bearing on adoption. The results of the analyses of the relationship presented in Table 6.8 shows that there is no significant difference between those who spend all their time and those who spend less time on their farms ($\chi 2 = 2.136$; df = 4; p = 0.711).

Table 6. 8: Relationship between time spent in farming and the adoption of recommended basal fertilizer practices

Time Spent in farming	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
<50% of time	2	12.5	3	18.8	11	68.8	16	15.1
50-75% of time	1	5.6	5	27.8	12	66.7	18	17.0
>75% of time	3	4.2	21	29.2	48	66.7	72	67.9
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 2.136$; df = 4; p = 0.711; r = 0.036; p = 0.717

The influence of time spent as indicated by the results of the correlation analysis confirms the absence of any association between time spent in farming and adoption of the recommended fertilizer practice by respondents at 5 percent level of probability (r = 0.036; p = 0.717). It can be concluded that time spent on farming may not be a factor influencing the adoption of recommended maize practices.

6.2.9. *Farm Size*

Table 7.9 presents the distribution of respondents according to total farm size and their adoption of recommended fertilizers practices. Total farm size in essence is the available land owned by the respondent for the purpose of agricultural activity of which all or part of it is devoted to maize cultivation. The study found that adoption (adoption category) was higher for those with large farm sizes with 90.9 percent in the high adoption categories compared to 55.5 percent of respondents with farm sizes below 20 hectares. The differences in adoption of the recommended

fertilizer practice among the large, medium and small scale farmers was also found to be significant at 5 percent probability (p = 0.012).

Table 6. 9: Relationship between size of land area and the adoption of recommended basal fertilizer practices

Farm size	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Small Scale (<20 ha)	4	7.7	19	36.5	29	55.8	52	49.1
Medium Scale (20-60 ha)	2	9.5	7	33.3	12	57.1	21	19.8
Large Scale (>60 ha)	0	0.0	3	9.1	30	90.9	33	31.1
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 12.802$; df = 4; p = 0.012; r = 0.302; p = 0.002.

The positive and linear association between farm size and adoption is also manifested in the correlation coefficient (r = 0.302; p = 0.002). This denotes that respondents with large farm sizes are more likely to adopt recommended practices than those with small size farms and that adoption rate tends to increases as farm sizes also increase.

6.2.10. *Area under maize cultivation*

It was noted in Chapter 4 that, in general, respondents devote approximately 50 percent of their total land area to the cultivation of maize. The results of the analysis on the influence of area under maize cultivation on the adoption of recommended fertilizer practices followed a similar trend as that of total farm size described under section 6.2.9. A summary of the results is presented in Table 6.10 and signifies significant differences among the various farm size categories ($\chi 2 = 13.000$; df = 4; p = 0.011). The large-scale farmers were found to have higher adoption category with 95.2 percent in the high adoption category compared to 53.7 percent of small-scale farmers.

Table 6. 10: Relationship between area under maize cultivation and the adoption of recommended basal fertilizer practices

Area under maize cultivation	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Small (<20 ha)	5	10.6	17	36.2	25	53.2	47	44.3
Medium (20-60 ha)	1	2.6	11	28.9	26	68.4	38	35.8
Large (>60 ha)	0	0.0	1	4.8	20	95.2	21	19.8
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 13.000$; df = 4; p = 0.011; r = 0.333; p = 0.000

The linear and highly significant correlation is also an indication that adoption behavior of respondents is influenced by the size of maize farm (r = 0.333; p = 0.000). The larger area under cultivation, the higher the tendency to adopt recommended maize practices.

6.3 TOTAL INFLUENCE OF INDEPENDENT VARIABLES

All the independent variables were entered into a regression model to determine their individual and total influence on the adoption behavior regarding recommended fertilizer practices. The results of the regression analysis are presented in Table 6.11.

Table 6. 11: Regression analysis of the influence of independent variables on the adoption of recommended basal fertilizer practices

l	Independent Variables	Beta	t	Sig.
1	(Constant)		2.752	.007
	Location of farm	-.173	-.798	.427
	Farmers association	.048	.401	.690
	Gender	.136	1.287	.201
	Age	-.073	-.712	.478
	Level of Education	-.112	-1.068	.288
	Farming Experience	.136	1.401	.164
	Off-farm income	.086	.477	.634
	Time Spent Farming	-.068	-.436	.664
	Farm Size	.108	.470	.639
	Area Under Maize Cultivation	.191	1.029	.306

R^2 = 0.173; p = 0.044

The results of the regression analysis shows that none of the independent variables' contribution was found to be statistically significant in the regression analysis at 5 percent level of significance and in total they contributed a mere 17.1 percent of the total variation. This implies that factors other than the selected independent variables are more important in explaining adoption behavior of respondents.

6.4 RELATIONSHIP BETWEEN INTERVENING AND SUBJECTIVE NORM VARIABLES AND THE ADOPTION RECOMMENDED FERTILIZER PRACTICES

The presentation that follows is the result of the statistical analyses to determine the influence intervening variables on the adoption behavior of respondents.

6.4.1. *Intervening variables*

6.4.1.1 Efficiency Perception

Table 6.12 is a summary of the analysis of the relationship between efficiency perception and the adoption of recommended fertilizer practices. The outcome of the analysis indicates a highly significant difference in the adoption behaviors based on respondents perception of their efficiency ($\chi 2 = 35.800$; df = 4; p = 0.000).

Table 6. 12: Relationship between efficiency perception and the adoption of recommended basal fertilizer practices

Efficiency perception	**Low Adoption (<4)**		**Medium Adoption (4-8)**		**High Adoption (>8)**		**Total**	
	n	%	n	%	n	%	N	%
Underrated	0	0.0	1	50.0	1	50.0	2	1.9
Assess Correctly	2	2.2	20	21.7	70	76.1	92	86.8
Overrated	4	33.3	8	66.7	0	0.0	12	11.3
Total	6	5.7	71	27.4	71	67.0	106	100.0

$\chi 2 = 35.800$; df = 4; p = 0.000; r = 0.506; p = 0.000

There is also a highly significant correlation between efficiency perception and the adoption of recommended practices at 5 percent level of probability(r = 0.506; p = 0.000), signifying that efficiency perception influences the adoption of recommended fertilizer practices which confirms the hypotheses that efficiency perception influences adoption of recommended fertilizer practices. Majority of the respondents, approximately 87 percent were assessed as being objective in their perception of the recommended practices. Respondents who overrate their efficiency had low adoption rates as evidenced from Table 6.12 with 33.3 percent and 66.7 percent within or below the medium adoption categories.

6.4.1.2 Need Compatibility

Need compatibility is the degree to which a practice fits into the individual's psychological field with its needs, aspirations or goals (Düvel, 1991). This implies that an individual is more likely to adopt a practice when it is perceived to fit into the psychological need situation. Table 6.13 summarizes the results of the analysis to determine the relationship between adoptions of recommended fertilizer practices and need compatibility.

Table 6. 13: Relationship between need compatibility and the adoption of recommended basal fertilizer practices

Need Compatibility	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Low	3	20.0	7	46.7	5	33.3	15	14.2
Medium	2	5.6	16	44.4	18	50.0	36	34.0
High	1	1.8	6	10.9	48	87.3	55	51.9
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 25.675$; df = 4; p = 0.000; r = 0.453; p = 0.000

The indications are that a high proportion of the respondents 87.3% who are in the "high adoption" category have high need compatibility and therefore perceive the recommended fertilizer practices to fit into their psychological need situation and consequently adopted the recommendations. The highly significant correlation (r = 0.453; p = 0.000) is evidence in support of the close relationship between adoption behaviors and need compatibility.

6.4.1.3 Need tension

Need tension as defined earlier is the perceived difference between the present and the desirable situations (Düvel, 1991) and it is one of the intervening variables which have been found to associated with adoption of recommended practices (Msuya & Düvel, 2007)). Table 6.14 below presents the findings of the study related to need tension and adoption behavior.

Table 6. 14: Relationship between need tension and the adoption of recommended basal fertilizer practices

Need tension	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Low	5	55.6	4	44.4	0	0.0	9	8.5
Medium	1	2.7	23	62.2	13	35.1	37	34.9
High	0	0.0	2	3.3	58	96.7	60	56.6
Total	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 93.077$; df = 4; p = 0.000; r =0.781; p = 0.000

Many studies, including Düvel (1991); Düvel and Botha (1999) and Msuya and Düvel (2007) found a close relationship between need tension and adoption. The results shown in Table 6.14 support the findings by a highly significant difference between the three different adoption categories of respondents with regard to need tension at 5 percent probability (p = 0.000) and also

a highly significant correlation t (r =0.781; p = 0.000). This is in support of the hypotheses that need tension influences the adoption of recommended basal fertilizer practices The results is an indication of the close relationship between need tension and the adoption of recommended fertilization practices, and that need tension is a good predictor of adoption behavior.

6.4.1.4 Awareness

The study assessed the association between respondents' awareness of the recommended fertilization and adoption. Table 6.15 summarizes the findings of the study and indicates that 86.3 percent of the respondents, who were aware, fully adopted the practice as opposed to 24.2 percent of those who were not aware. There is a significant difference in the adoption response between those who were aware and those who were not ($\chi 2 = 42.33$; df = 2; p = 0.000)

Table 6. 15: Relationship between awareness and the adoption of recommended basal fertilizer practices

Awareness	**Low Adoption (<4)**		**Medium Adoption (4-8)**		**High Adoption (>8)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Aware	0	0.0	10	13.7	63	86.3	73	68.9
Not Aware	7	18.2	19	57.6	8	24.2	34	31.1
Total	7	6.5	29	27.1	71	66.4	107	100.0

$\chi 2 = 42.333$; df = 2; p = 0.000; r =- 0.628; p = 0.000

The relationship between awareness and the adoption of recommended fertilizer practices (r =- 0.628; p = 0.000) is also highly significant, indicating that adoption is associated with awareness, in the sense that an adoption is hardly possible without awareness, although awareness will not necessarily lead to adoption.

6.4.1.5 Prominence

The findings regarding the influence of prominence on adoption behavior are presented in Table 6.16 and confirm that high adoption is associated with a perceived high prominence. For example 69.6 percent of the respondents in the high adoption category had a high-perceived prominence, which means that in their view the recommended fertilization had a high prominence relative to other alternatives and was thus perceived as better than other alternatives. None of the respondents with a perceived low prominence adopted the fertilization practices as

recommended. This close relationship between prominence and adoption finds support in the significant correlation coefficient (r = 0.247; p = 0.011).

Table 6. 16: Relationship between prominence and the adoption of recommended basal fertilizer practices

Prominence	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Low prominence	0	0.0	2	100	0	0.0	2	1.9
Medium prominence	1	50.0	1	50.0	0	0.0	2	1.9
High prominence	5	4.9	26	25.5	71	69.6	102	96.2
TOTAL	6	5.7	29	27.4	71	67.0	106	100.0

$\chi 2 = 14.310$; df = 4; p = 0.006; r = 0.247; p = 0.011; Cramer's V = 0.260

It can be concluded that if a practice is perceived to be superior to an existing practice, it is more likely to be adopted.

6.4.2 *Subjective Norm*

6.4.2.1 Important people

Table 6.17 is a summary of the relationship between the influences of important people who are important to the respondent and the adoption of recommended fertilizer practices. Although 64.2 percent of total respondents indicated the likelihood of being influenced by people they consider important, the statistical analysis showed no significant difference between the three categories of respondents as presented in Table 6.17 ($\chi 2 = 4.511$; df = 4; p = 0.341).

Table 6. 17: Relationship between important people and the adoption of recommended basal fertilizer practices

Important people	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Likely	5	7.4	22	32.4	41	60.3	68	64.2
Moderately likely	0	0.0	3	16.7	15	83.3	18	17.0
Unlikely	1	0.9	4	20.0	15	75.0	20	18.9
Total	6	5.7	29	27.4	71	67.0	106	100

$\chi 2 = 4.511$; df = 4; p = 0.341; r = 0.150; p = 0.125

The correlation analysis also showed no significant relationship between the influence of people who are important to the respondents and their adoption behavior at 5 percent probability (p = 0.125) and leads to the conclusion that this subjective norm is not an important determinant of adoption behavior.

6.4.2.2 Extension agent

Another subjective norm variable included in the survey was the influence of extension agents on the adoption behavior of the respondents. The findings shown in Table 6.18 follow the same trend as the influence of people who are important to the respondents. There is no statistical difference between the adoption groups in regard to the influence of extension agents in respondents' decision making at 5 percent probability (p = 0.427).

Table 6. 18: Relationship between extension agents and the adoption of recommended basal fertilizer practices

Extension agents	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Likely	5	4.7	24	22.6	64	60.4	93	87.7
Moderately Likely	0	0.0	1	0.9	4	3.8	5	4.7
Unlikely	1	0.9	4	3.8	3	2.8	8	7.5
	6	5.7	29	27.4	71	67.0	106	100

$\chi 2 = 3.849$; df = 4; p = 0.427; r = -0.140; p = 0.153

The correlation analysis (r = -0.140; p = 0.153) also confirms the lack of a relationship between the influence of extension agent in decision making of respondents with respect to the adoption of fertilizer practices although a significantly high proportion of respondents 87.7 percent indicated that they are likely to be influenced by the extension agent in their adoption of recommended fertilizer practices. The possible influence of extension agents should therefore not to be under-estimated.

6.4.2.3 Close friends

The influence of close friends on adoption decision-making was also examined and the results show 56.6 percent of the respondents indicated that they are likely to be influenced by their close friends in using the recommended fertilizer (Table 6.19). However, there is no statistically significant discrepancy between the various respondent categories ($\chi 2 = 2.667$; df = 4; p = 0.615)

Table 6. 19: Relationship between close friends and the adoption of recommended basal fertilizer practices

Close friends	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Likely	5	8.3	17	28.3	38	63.3	60	56.6
Moderately Likely	0	0.0	7	25.9	20	74.1	27	25.5
Unlikely	1	5.3	5	26.3	13	68.4	19	17.9
	6	5.7	29	27.4	71	67.0	106	100

$\chi 2 = 2.667$; df = 4; p = 0.615; r = 0.086; p = 0.383;

The association between the influences of close friends on farm decision-making was also statistically not significant (r = 0.086; p = 0.383) suggesting that the adoption of recommended fertilizer by respondents is not likely to be influenced by close friends.

6.4.2.4 Farmers' Association Members

Table 6.20 is a summary of the results of the influence of members of farmers association on the adoption behavior of respondents with respect to recommended fertilizer practices. There is a statistically significant distinction in the adoption pattern ($\chi 2 = 13.595$; df = 4; p = 0.009) as 84.9 percent of the respondents indicated that they were likely to be influenced in their adoption decisions by members of their associations.

Table 6. 20: Relationship between members of farmers association and the adoption of recommended basal fertilizer practices

Farmers Association	Low Adoption (<4)		Medium Adoption (4-8)		High Adoption (>8)		Total	
	n	%	n	%	n	%	N	%
Likely	5	5.6	22	24.4	63	70.0	90	84.9
Moderately Likely	0	0.0	2	20.0	8	80.0	10	9.4
Unlikely	1	16.7	5	83.3	0	0.0	6	5.7
	6	5.7	29	27.4	71	67.0	106	100

$\chi 2 = 13.595$; df = 4; p = 0.009; r = -0.227; p = 0.020

The findings show a close and linear negative relationship between the influence of members of farmers association and adoption of recommended fertilizer practices as depicted by the correlation coefficient (r = -0.227; p = 0.020).

6.5 TOTAL INFLUENCE OF INTERVENING AND SUBJECTIVE NORM VARIABLES

The preceding sections examined the influence of individual intervening variables on the adoption of recommended fertilizer practices. Chi square tests were used to determine differences among different categories within each variable, whilst correlation analyses were used to point out relationships. The next part of this chapter explores the influence of all the intervening and subjective norm variables on the adoption of recommended fertilizer practices and their contribution to variation using regression analysis.

Table 6. 21: Regression analysis of the influence of intervening and subjective norm variables on the adoption of recommended basal fertilizer practices

	Intervening and Subjective Norm Variables	Beta	T	p
1	(Constant)		3.600	.001
	Prominence	.012	0.214	.831
	Awareness	-.332	-5.5280	.000
	Need Compatibility	.143	2.414	.018
	Efficiency perception	.018	0.282	.778
	Need tension	.600	9.419	.000
	Close friends	-.045	-0.613	.541
	Members of association	-.025	0.317	.752
	important people	.111	.1.506	.135
	Extension agent	-.013	-0.162	.872

$R^2 = 0.744$, $p = 0.000$

According to Table 6.21 the intervening and subjective norm variables explain 74.4 percent of the variation in adoption ($R^2 = 0.744$, $p = 0.000$). The most significant individual variable contributing to this variation is need tension (Beta 0.600, $p = 0.000$), followed by awareness (Beta = -0.332 $p = 0.000$) and need compatibility (Beta = 0.143, $p = 0.018$). The influence of subjective norm variables was insignificant.

6.6 CONCLUSION

It was shown in section 6.2.11 that the contribution of the independent variables to the explanation of adoption behavior amounted to 17 percent of the total compared to 74.4 percent recorded for the intervening variables whilst the influence of the subjective norm variables was very low. It can be concluded that the intervening variables exert much greater influence on the

adoption behavior of respondents for the recommended fertilizer practices than the independent variables and the subjective norm variables and are thus better predictor of adoption.

CHAPTER 7

THE RELATIONSHIP BETWEEN INDEPENDENT, INTERVENING AND SUBJECTIVE NORM VARIABLES AND THE ADOPTION OF RECOMMENDED TOP DRESSING PRACTICES

7.1 INTRODUCTION

As is in the case of basal application of fertilizers, top-dressing or additional nitrogenous fertilizer (in the right amounts, time and method) is a booster for good maize growth and yield. The recommended practice is to apply Ammonium Nitrate, commonly referred to as LAN at a rate of 100kg/ha when the crop is between 3-4 weeks old (at knee high) and worked into the soil. In this chapter, the results of the analysis of the influence of independent and intervening variables on the adoption of the recommended top dressing application practices are discussed. In general the adoption of additional fertilizer by farmers in the study area was found to be low. Only 65 out of a total of 107 respondents apply additional fertilizer after the basal application at planting.

7.2 INDEPENDENT VARIABLES

7.2.1 *Location*

Table 7.1 highlights the results of the analysis of the relationship between adoption of recommended nitrogenous fertilizer and the location of respondents. The results show a significant difference in the adoption of the recommended practice between respondents from the two countries – South Africa and Lesotho, ($\chi 2 = 9.961$; df = 2; p = 0.007). While 18.2 percent of the South African respondents were found within the high adoption category, only 1.9 percent of their counterparts from Lesotho were found in the same group.

Table 7. 1: Relationship between location of farm and adoption of top dressing fertilizer practices

Location of Farm	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
South Africa	0	0.0	9	81.8	2	18.2	11	16.9
Lesotho	20	37.0	33	61.1	1	1.9	54	83.1
	20	30.8	42	64.6	3	4.6	65	100

$\chi 2 = 9.961$; df = 2; p = 0.007; r = -0.375; p = 0.002

The hypothesis testing that location of respondent influences the adoption of the recommended nitrogenous fertilizer is accepted as the correlation analysis was indicative of a significant relationship between the adoption of the recommended practice and the adoption of the recommended practice at 5 percent level of probability (p = 0.002). Yu, Nin-Pratt, Funes & Gemessa (2011) found the use of fertilizer in Ethiopia to be concentrated in few location which have suitable natural resources for production and roads liking major cities. It has been argued earlier in Chapter 5 that, South Africa is endowed with better infrastructure which could explain the differences.

7.2.2 *Membership of Farmers' Association*

Membership of association was investigated in relation to seeds and basal fertilizers and reported under chapters 5 and 6. The results showed significant differences in between membership of farmers association and the adoption of recommended seed and basal fertilizer. Uaiene, Arndt and Masters (2009) also found that membership of a farmers' association influences adoption of fertilizers.

Table 7.2, which is a summary of the results of the relationship between farmers association and adoption of, recommended nitrogenous fertilizer shows a significant difference between the various groups of farmers association ($\chi 2 = 14.106$; df = 6; p = 0.028) similar to that obtained for basal fertilizer.

Table 7. 2: Relationship between membership of farmers association and adoption of recommended top dressing fertilizer practices.

Farmers' association	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
NAFU	0	0.0	7	77.8	2	22.2	9	13.8
TOA	17	35.4	31	64.6	0	0.0	48	73.8
Other	2	33.3	3	50.0	1	16.7	6	9.2
None	1	50.0	1	50.0	0	0.0	2	3.1
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 14.106$; df = 6; p = 0.028; r = -0.229; p = 0.066

The study similarly failed to establish a relationship between membership of farmers association and adoption of recommended nitrogenous fertilizers as the correlation analysis was not

significant at 5 percent level of probability like in the case of basal fertilizer. (r = -0.229; p = 0.066). An indication of the inconsistent relationship between membership of association and the adoption of recommended fertilizer practices.

7.2.3 *Gender*

In the case of gender and adoption of top dressing fertilizers, the results as presented in Table 7.3 shows that 5.9 percent of male respondents were found in the high adoption category, while none of the female respondents were found in the same group. These differences are, however, not statistically significant ($\chi 2 = 1.867$; df = 2; p = 0.398; r = 0.046; p = 0.714**).**

Table 7. 3: Relationship between gender and the adoption of recommended top dressing fertilizer practices.

Gender	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Male	17	33.3	31	60.8	3	5.9	51	78.5
Female	3	21.4	11	78.6	0	0.0	14	21.5
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 1.867$; df = 2; p = 0.398; r = 0.046; p = 0.714

The results of the correlation analysis also rejected the hypothesis that the adoption of the top dressing fertilizers is not influenced by gender, as the correlation coefficient was not significant at 5 percent level of probability

7.2.4 *Age*

It was hypothesized that age influences the adoption of recommended top dressing fertilizers and a test was conducted to ascertain the validity of the statement. The results as presented in Table 7.4 supports the statement as the correlation coefficient was found to be significant at 5 percent level of probability (r = -0.537; p = 0.000). Age therefore is associated with the adoption of top dressing fertilizer. The linear relationship shows a decreasing tendency from the young to post mid-life in the use of top dressing fertilizers.

Table 7. 4: Relationship between age and the adoption of recommended top dressing fertilizer practices.

Age	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Young (<40yrs)	1	16.7	3	50.0	2	33.3	6	9.2
Mid-life (40-60yrs)	3	9.1	29	87.9	1	3.0	33	50.8
Post Mid-life (>60)	16	61.5	10	38.5	0	0.0	26	40.0
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 31.244$; df = 4; p = 0.000; r = -0.537; p = 0.000

With 33.3 percent of the young followed by 3 percent of the mid-life and zero percent for the post midlife found within the high adoption category. This difference between the various age groups is also confirmed by the highly significant differences in adoption by the different age groups ($\chi 2 = 31.244$; df = 4; p = 0.000).

7.2.5 *Education Level*

The results of the Chi-square analysis on the relationship between education level and the adoption of top dressing fertilizers yielded no significant differences between the three main groups of educational level attained by respondents at 5 percent level of probability (p=0.618). For instance 3.7 percent of those who had less than 7 years were found in the high adoption category compared with 4 percent for educational levels 8-12 and 7.7 percent for those with above 12 years of education.

Table 7. 5: Relationship between education and adoption of recommended top dressing fertilizer practices.

Education	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
<=7yrs	8	29.6	18	66.7	1	3.7	27	41.5
8-12 yrs	10	40.0	14	56.0	1	4.0	25	38.5
> 12yrs	2	15.4	10	76.9	1	7.7	13	20.0
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 2.649$; df = 4; p = 0.618; r = 0.089; p = 0.479

The correlation coefficient was also not significant (r = 0.089; p = 0.479) at 5 percent level of probability rejecting the hypothesis that educational level does influence the adoption of the recommended practice. The results collaborates those found for the adoption of seeds and basal fertilizers reported under Chapters 5 and 6, respectively.

7.2.6 *Experience in Farming*

One of the expectations with of experience in farming is the assumption that experienced farmers may be influenced by their previous experience on the question of adoption and not necessary on any other sources of information or influences. The study sought to examine this assertion and hypothesized that experience does not influence the adoption of recommended top dressing fertilizers. According to Table 7.6, which is a presentation of the statistical analysis, there is no significant difference between the beginners, transitional and the experienced groups at 5 percent degree of probability (p=0.223).

Table 7. 6: Relationship between experience and adoption of recommended top dressing fertilizer practices.

Experience	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Beginners (10yrs)	0	0.0	3	100.0	0	0.0	3	4.6
Transitional (10-20yrs)	11	35.5	17	54.8	3	9.7	31	47.7
Experienced (>20yrs)	9	29.0	22	71.0	0.0	0.0	31	47.7
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2$ = 5.701; df = 4; p = 0.223; r = -0.083; p = 0.510

The correlation coefficient does not supports the hypotheses that experience influences the adoption of the recommended top dressing fertilizers at 5 percent level of probability (p=0.510). Ajewole (2010) found that farming experience negatively influenced the adoption of organic fertilizers in Nigeria and concluded that older farmers are probably the most experienced and may not see any reason to make additional investments in fertilizers.

7.2.7 *Off-farm Income*

Paudel, Shrestha & Matsuoka (2009) found that off-farm income was important in obtaining additional income to meet the cash requirements for investments in improved technologies. Table 7.7 shows the results of the analysis of the relationship between off-farm income and the adoption of recommended top dressing fertilizer practices.

Table 7. 7: Relationship between off-farm income and adoption of recommended top dressing fertilizer practices

Off-farm income	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Full time	7	21.2	24	72.7	2	6.1	33	50.8
Part time	13	40.6	18	56.3	1	3.1	32	49.2
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 2.976$; DF = 2; p = 0.226; r = -0.209; p = 0.095

The study found no significant differences between those who have other sources of income in relation to the adoption of the top dressing fertilizers. The correlation coefficient was not significant at 5 percent level of probability (r = -0.209; p=0.095) in the adoption of recommended top dressing fertilizer. It is worth noting that farm income was found to influence the adoption of seeds but not for the top dressing fertilizers. This is a reflection of inconsistency of the influence of the variable on the adoption behaviors of farmers.

7.2.8 *Time Spent in Farming*

A summary of the relationship between time spent in farming and adoption of recommended top dressing practices is shown in Table 9.8.

Table 7. 8: Relationship between time spent and adoption of recommended top dressing fertilizer practices

Time spent in farming	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
<50% of time	3	37.5	5	62.5	0	0.0	8	12.3
50-75% of time	5	33.3	10	66.7	0	0.0	15	23.1
(>75% of time	12	28.6	27	64.3	3	7.1	42	64.6
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 1.875$; df = 4; p = 0.759; r = 118; p = 0.348

The result collaborates those found for seed and basal fertilizers reported in Chapters 5 and 6 and reject the hypotheses that time spent on farming does influence adoption of top dressing fertilizers. Neither the Chi-square test of independence nor the correlation coefficient was significant at 5 percent level of probability ($\chi 2 = 1.875$; df = 4; p = 0.759; r = 118; p = 0.348).

7.2.9 *Farm Size*

The results of the investigations into the relationship between farm size and the adoption of recommended top dressing fertilizers are presented in Table 7.9 and results show that there are no significant differences between the 3 categories of farm sizes investigated as the Chi-square test was not significant at 5 percent level of probability.

Table 7. 9: Relationship between farm size and adoption of recommended top dressing fertilizer practices

Farm size	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Small Scale (<20% ha)	14	37.8	22	59.5	1	2.7	37	56.9
Medium Scale (20-60% ha)	5	35.7	9	64.3	0	0.0	14	21.5
Large Scale (>60% ha)	1	7.1	11	78.6	2	14.3	14	21.5
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 7.602$; df = 4; p = 0.107; r = 283; p = 0.022

However, the study found a relationship between farm size and the adoption of the recommended top dressing fertilizer. The results concur with other studies by Chirwa (2005) and Ben-Houasa (2011) who found similar relationships in their studies. Table 7.9 shows a relatively higher percentage of large-scale farmers (14.3%) in the 'high adoption' compared to 2.7% from the small-scale farmers. The implication is that large-scale farmers are more likely to adopt top dressing fertilizers than small-scale farmers.

7.2.10 *Area under maize cultivation*

Chapters 5 and 6 explored the relationship between area under maize cultivation and its influence on the adoption of recommended seeds and basal application of fertilizers and concluded, based on the evidence that indeed area under maize cultivation influences adoption of top dressing fertilizers. Msuya and Düvel (2007) found a similar relationship between area under maize cultivation and adoption of hybrid seeds. This section is the results of the investigation into the influence of area and adoption of top dressing fertilizers.

Table 7. 10: Relationship between area under maize cultivation farm and the adoption of recommended top dressing fertilizer practices

Area under maize cultivation	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	%	n	%	n	%	N	%
Small (<20 ha)	14	42.4	18	54.5	1	3.0	33	50.8
Medium (20-60 ha)	6	25.0	17	70.8	1	4.2	24	36.9
Large Scale (>60% ha)	0	.0.	7	87.5	1	12.5	8	12.3
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 6.756$; df = 4; p = 0.149; r = 309; p = 0.012

According to Table 7.10 there was no significant difference between the small, medium and large farms with respect to their adoption of top dressing fertilizers. The correlation between area under maize cultivation was found to be statistically significant at 5 percent level of probability (p=0.012). The results follow the same trend as the ones found for seeds and basal fertilizers Saka &Lawal (2009) also found similar relationship with land cultivated to rice and fertilizer adoption by farmers. The finding supports the hypotheses that area under cultivation influences the adoption of recommended top dressing fertilizer practices.

7.3 TOTAL INFLUENCE OF INDEPENDENT VARIABLES

The independent variables were entered into a regression model to determine their individual and total influence on the adoption behavior regarding recommended fertilizer practices. The results of the regression analysis are presented in Table 7.11.

Table 7. 11: Regression analysis of the influence of independent variables on the adoption of recommended top dressing fertilizer practices

l	**Independent Variable**	**Beta**	**t**	**Sig.**
1	(Constant)		3.217	0.002
	Location of farm	-0.261	-1.084	0.283
	Farmers association	0.013	0.099	0.921
	Gender	0.077	0.645	0.522
	Age	-0.462	-3.871	0.000
	Formal Education	0.121	0.935	0.354
	Farming Experience	0.025	0.205	0.838
	Off-farm income	-0.050	-0.248	0.805
	Time Spent Farming	0.026	0.138	0.891
	Farm Size	0.015	0.065	0.948
	Area Under Maize Cultivation	0.081	0.398	0.692

$R^2 = 0.399$; p = 0.001

The regression analysis shows that age response is about the only variable that influences the adoption of the recommended practices at 5 percent level of significance. The independent variables' contribution was found to be statistically significant in the regression analysis at 5 percent level of significance and in total contributed 39.9 percent of the total variation. This implies that factors other than the selected independent variables are more important in explaining adoption behavior of respondents.

7.4 THE RELATIONSHIP BETWEEN SUBJECTIVE NORM AND THE ADOPTION OF RECOMMENDED TOP DRESSING FERTILIZER PRACTICES

7.4.1 Intervening variables

7.4.1.1 *Efficiency Perception*

This section is a presentation of the relationship between EP and the adoption of top dressing fertilizers. Chapters 5 and 6 reported the results of the investigations into the relationship between efficiency perception and the adoption of recommended seeds and basal fertilizers. The results confirmed that EP does influence adoption, which collaborates other studies by Habtermariam and Düvel (2003) and Msuya and Düvel (2007). The results of this investigation are summarized below in Table 7.12. The study found that none of the respondents who overrated their efficiencies adopted the recommended practice.

Table 7. 12: Relationship between efficiency perception and adoption of recommended top dressing fertilizer practices

Efficiency Perception	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Underrating	11	68.8	5	31.3	0	0.0	16	24.6
Correct Assessment	9	18.4	37	75.5	3	6.1	49	75.4
Overrating	0	0.0	0	0.0	0	0.0	0	0.0
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 14.587$; df = 2; p = 0.001; r = 0.257; p = 0.039

The result also indicates a highly significant difference ($\chi 2 = 14.587$; df = 2; p = 0.001) in the adoption behaviors based on the respondents' perception of their efficiency. The influence of EP on the adoption of recommended top dressing fertilizer is expressed in the highly significant

positive correlation (r = 0.257, p = 0.039) confirming the hypothesis that EF influences adoption of the recommended practice.

7.4.1.2 *Need Compatibility*

Table 7.13 is a summary of the analysis of the relationship between need compatibility and the adoption of recommended top dressing fertilizers practice. The outcome of the analysis indicates that a higher proportion of respondents (50.0 percent) with perceived high need compatibility are the high adoption category compared to zero percent of those with low need compatibility.

Table 7. 13: Relationship between need compatibility and adoption of recommended top dressing fertilizer practices

Need Compatibility	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Low	16	64.0	9	36.0	0	0.0	25	38.5
Medium	3	8.3	32	88.9	1	2.8	36	55.4
High	1	25.0	1	2.4	2	50.0	4	6.1
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2$ = 41.596; df = 4; p = 0.000; r = 0.567; p = 0.000

The differences between those with high, medium and low need compatibility was found to be highly significant at 5 percent level of probability (p=0.000). The study also found significant and positive correlation (r = 0.567, p = 0.000) between need compatibility and adoption behavior. This shows a linear relationship between adoption behavior and adoption of recommended top dressing fertilizer practices.

7.4.1.3 *Need Tension*

Need tension is documented by other researchers to be associated with adoption (Düvel and Scholtz, 1986; Düvel 2004; Msuya and Düvel 2007). The results of the study on the relationship between NT and adoption behavior is presented in Table 7.14. The indications are that the majority of respondents with low need tension (85 percent) were poor adopters of the recommended top dressing fertilizer practices. The highly significant chi-square at 5 percent level of probability is an indication of the significant differences between the three needs tension groups, low, medium and high.

Table 7. 14: Relationship between need tension and adoption of recommended top dressing fertilizer practices

Need Tension	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Low	17	85	3	15.0	0	0.0	20	30.8
Medium	2	5.0	38	95.0	0	0.0	40	61.5
High	1	20	1	20.0	3	4.6	5	7.7
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 78.813$; df = 4; p = 0.000; r = 0.754; p = 0.000

The highly significant positive correlation (r = 0.754; p = 0.000) is an indication that adoption of recommended top dressing fertilizers increases with need tension. The study therefore established the influence of need tension on the adoption of recommended top dressing fertilizers and therefore confirming the hypothesis for the study.

7.4.1.4 *Awareness*

Results of the analysis of the relationship between awareness and the adoption of recommended top dressing practices, shown in Table 7.15, indicates a highly significant difference in adoption behaviors ($\chi 2 = 15.390$; df = 2; p = 0.000) between respondents who are aware and those who are not. The majority of the respondents who were aware of the recommended practices (64.6 percent) adopted the practices as against 35.4 percent who were not aware of the recommended practice.

Table 7. 15: Relationship between awareness and adoption of recommended top dressing fertilizer practices

Awareness	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Aware	6	60.9	34	81.0	12	4.8	42	64.6
Not aware	14	14.3	8	34.8	1	4.3	23	35.4
Total	20	30.8	42	64.6	13	4.6	65	100

$\chi 2 = 15.390$; df = 2; p = 0.000; r = 0.421; p = 0.000

The results are similar to those obtained for the investigations into the relationship between seeds and basal fertilizers in Chapters 5 and 6, respectively. The correlation coefficient was highly significant at 5 percent level of (p = 0.000) signifying that awareness influences adoption behavior of farmers and that is a good predictor of adoption practice.

7.4.1.5 *Prominence*

This section is a report of the findings on the relationship between prominence, defined earlier in Chapter 3, and its influence on the adoption behavior of farmers in regards to recommended top dressing fertilizers and the results are presented in Table 7.16. A total of 49.2 percent perceived the recommended practice to be better than their own practice compared to 46.2 percent and 4.2 percent reporting to be of medium and low prominence perception.

Table 7. 16: Relationship between prominence and adoption of recommended top dressing fertilizer practices

Prominence	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Low	1	100.0	2	66.7	0	0.0	3	4.6
Medium	1	50.0	29	96.7	0	0.0	30	46.2
High	18	29.0	11	34.4	3	9.4	32	49.2
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 26.492$; df = 4; p = 0.000; r = 0.317; p = 0.000

The Chi-square analysis showed a significant difference between the categories at 5 percent level of probability (p=0.000). Similarly, the correlation coefficient was highly significant at 5 percent level of probability (p=0.000), indicating that prominence does influence the adoption of recommended top dressing fertilizers. The hypothesis that prominence does influence adoption of top dressing fertilizers is accepted.

7.4.2. Subjective norm variables

7.4.2.1 *Important people*

The analysis of the influence of important people on the adoption behavior of respondents with respect to the recommended top dressing fertilizer is presented in Table 7.17. A total of 73.8 percent indicated that they were unlikely to be influenced by the important people within their community compared to 10.8 percent who were ambivalent and 15.5 percent who were likely to be influenced by the expectations of important people within the community. The trend showed a decreasing percentage of respondents from likely to unlikely within the high adoption category and the chi-square analysis showed a significant difference between the respondent groups at a 5 percent level of probability (p=0.025).

Table 7. 17: Relationship between important people and the adoption of recommended top dressing fertilizer practices

Important people	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Likely	1	30.8	42	70.0	2	20.0	10	15.4
Neither	3	42.9	3	42.9	1	14.3	7	10.8
Unlikely	16	33.3	32	66.7	0	0.0	58	73.8
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 11.188$; df = 4; p = 0.025; r = 0.274; p = 0.027

The study also found a close relationship between the influences of important people on the adoption behavior of respondents with respect to top dressing fertilizers as the correlation coefficient was significant at 5 percent level of probability (r = 0.274; p = 0.027). This implies that important people within the community are likely to influence the decisions of farmers to adopt the recommended top dressing fertilizer practice.

Extension Agents

The influence of extension agents on adoption behavior of recommended practice was analyzed and the results are summarized in Table 7.18. Over eighty percent (84.6 %) of the respondents indicated that their adoption behavior of the recommended practices is not likely to be influenced by extension agents.

Table 7. 18: : Relationship between extension agent and the adoption of recommended top dressing fertilizer practices

Extension agent	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Likely	4	50.0	3	37.5	1	12.5	8	12.3
Neither	1	50.0	1	50.0	0	0.0	2	3.1
Unlikely	15	27.3	38	69.1	2	3.6	55	84.6
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 3.851$; df = 4; p = 0.426; r -0.099; p =0.434

The difference in responses from likely through neither to likely was found to be statistically not significant at 5 percent level of probability. The results of the study does not supports the that extension agents influence the decision of farmers to adopt top dressing fertilizers as the correlation analysis was not significant at 5 percent level of probability (p 0.434) implying that

extension agents per se are unlikely to influence the decisions of respondents to adopt the practices.

7.4.2.2 *Close friends*

Another social variable likely to influence some people are close friends but close friends may not necessarily share the same occupation and are therefore unlikely to influence decisions related to work environment such as farming. The study therefore hypothesized that close friends do not influence the adoption of recommended top dressing fertilizers.

Table 7. 19: : Relationship between close friends and the adoption of recommended top dressing fertilizer practices

Close friends	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Likely	3	37.5	4	50.0	1	12.5	8	12.3
Neither	3	23.1	9	69.2	1	7.7	13	20.0
Unlikely	14	31.8	29	65.9	1	2.3	44	67.7
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2 = 2.570$; df = 4; p = 0.632; r = 0.065; p = 0.607

The results of the investigation are reported in Table 7.19. The Chi-square analysis did not find any significant differences between those who were likely and those who were ambivalent or unlikely at 5 percent level of probability. The correlation analysis was not significant at 5 percent level of probability (p=0.607).

7.4.3 Influence of farmers' association members

The results of the analysis of the influence of members of farmers association on the adoption of recommended top dressing fertilizers shows that the majority of the respondents (81.5 percent) indicated that their decision to adopt recommended top dressing fertilizer practices is likely to be influenced by members of their farmers association (Table 7.20). The study also found highly significant differences in the adoption behaviors of those whose decisions are likely to be influenced and those who are not likely to influenced ($\chi 2 = 41.596$; df = 4; p = 0.000).

Table 7. 20: : Relationship between farmers association and the adoption of recommended top dressing fertilizer practices

Members of farmers' association	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Likely	14	26.4	37	69.8	2	3.8	53	81.5
Neither	2	33.3	3	50.0	1	16.7	6	9.2
Unlikely	4	66.7	2	33.3	0	0.0	6	9.3
Total	20	30.8	42	64.6	3	4.6	65	100.0

$\chi 2$ = 41.596; df = 4; p = 0.000; r = 0.567; p = 0.000

There was also a highly significant correlation between the adoption of recommended practices and influence of members of farmers association as shown by the correlations values (**r = 0.567; p = 0.000)** implying that that farmers adoption behaviors for the recommended practice is likely to be influenced by members of their association and therefore the hypothesis accepted.

7.5 TOTAL INFLUENCE OF INTERVENING AND SUBJECTIVE NORM VARIABLES

Table 7.21 is a regression analysis and shows that the intervening variables explain 74.3 percent of the variation in adoption (R^2 = 0.743, p = 0.000). This is comparable to the contribution of the intervening variables for the adoption of basal application of fertilizer reported in Chapter 6. The most significant individual variable contributing to this variation is need tension (Beta 0.576, p = 0.000), followed by awareness (Beta = 167 p = 0.038), need compatibility (Beta = 0.184, p=0.040) all at 5 percent level of probability.

Table 7. 21: Regression analysis of the influence of intervening and subjective norm variables on the adoption of recommended top dressing practices

	Intervening and Subjective Norm Variables	Beta	t	P
1	(Constant)		-1.211	0.231
	Prominence	0.129	1.715	0.092
	Awareness	0.167	2.130	0.038
	Need Compatibility	0.184	2.108	0.040
	Efficiency Perception	0.131	1.776	0.081
	Need tension	0.576	7.204	0.000
	Close friend	0.005	0.051	0.960
	Members of association	-0.161	-1.902	0.062
	Important people	0.090	0.931	0.356
	Extension agent	0.139	1.891	0.064

R^2 = 0.743; p = 0.000

7.6 CONCLUSION

It was shown in section 7.2.11 that the contribution of the independent variables to the explanation of adoption behavior amounted to 17 percent of the total compared to 74.4 percent recorded for the intervening variables. It can be concluded that intervening variables exert greater influence on the adoption behavior of respondents for recommended fertilizer practices than the independent variables.

CHAPTER 8

THE RELATIONSHIP BETWEEN INDEPENDENT, INTERVENING AND SUBJECTIVE NORM VARIABLES AND THE ADOPTION OF RECOMMENDED LIME PRACTICES

8.1 INTRODUCTION

Most crops grow best in soils with pH between 6 and 7 and do poorly on very acid soils. The low pH soils also reflect their poor fertility status and possibly heavy metal toxicity that lead to extreme phosphorus deficiency. Lime is applied to soils to reduce the acid content, promote microbial activity and availability of plant food. Due to high acid content of soils in Lesotho and South Africa, it is recommended that: (i) Calcite lime is applied at (ii) 2500kg/ha**;** (iii) all in one season; (iv) Every 4-5 years and; (v) after the land has been ripped to ensure penetration into sub-soil. This chapter examines the five main recommendations in the application of lime and the influence of independent, intervening and subjective norm variables on the adoption behavior of farmers. The following sections are the results of farmers' responses to lime application. A total of 51 out of the 107 respondents, less than half of the sample population, responded to the questionnaire.

8.2 INDEPENDENT VARIABLES

8.2.1 *Location*

The study examined the influence of location on the adoption of application of lime on farms and the results are presented in Table 8.1. A total of 20.8 percent of farmers from Lesotho compared with 66.7 percent from South Africa were found in the high adoption category, however, the Chi-square analysis did not establish any statistical difference between the two countries in their adoption of lime practice at 5 percent level of probability (p=0.181)

Table 8. 1: : Relationship between location and the adoption of recommended lime practices

Location of Farm	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
South Africa	1	33.3	0	0.0	2	66.7	3	5.9
Lesotho	30	62.5	8	16.7	10	20.8	48	94.1
Total	31	60.8	8	15.7	12	23.5	51	100

$\chi 2 = 3.416$; df = 2; p = 0.181; r = -0.210; p = 0.139.

A total of 60.8 percent of the respondents were in the low adoption category indicating the use of the recommended lime practice is quite low in the two locations. The results of the correlation analysis also did not establish any significant relationship between location and the adoption of lime practice at 5 percent level of probability (p=0.139). The implication is that location does not influence the adoption of recommended lime practice.

8.2.2 *Membership of farmers' association*

A summary of the results of the relationship between farmers association and the adoption of recommended lime practices is presented in Table 8.2. The study found no significant difference between members and non-members of farmer associations, in regards to the adoption of the recommended lime practices at 5 percent level of probability (p=0.407).

Table 8. 2: Relationship between farmers association and the adoption of recommended lime practices

Membership of farmers Association	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
NAFU	1	33.3	0	0.0	2	66.7	3	5.9
TOA	24	58.5	7	17.1	10	24.4	41	80.4
Other	4	80.0	1	20.0	0	0.0	5	9.8
None	2	100.0	0	0.0	0	0.0	2	3.9
Total	31	60.8	8	15.7	12	23.5	51	100

$\chi 2 = 6.142$; df = 6 ; p = 0.407 ; r = -0.289 ; p = 0.040

The results of the correlation analysis, however, established a relationship between membership of farmers association and the adoption of recommended practices. The correlation coefficient was significant at 5 percent level of probability (p=0.04).

8.2.3 *Gender*

This section is the report on the analysis of the results of the influence of gender on the adoption of lime practice. It was hypothesized that gender influences the adoption of recommended lime practice. The results are presented in Table 8.3 and show that 22 percent males and 30 females had high adoption category but the Chi-square test of independence did not establish significant differences between male and female respondents (.$\chi 2 = 0.607$; df = 2; p = 0.738)

Table 8. 3: Relationship between gender and the adoption of recommended lime practices

Gender	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Male	26	63.4	6	14.6	9	22.0	41	80.4
Female	5	50.0	2	20.0	3	30.0	10	19.6
Total	31	60.8	8	15.7	12	23.5	51	100

$\chi 2 = 0.607$; df = 2; p = 0.738; r = 0.102; p = 0.478

Similarly, the correlation coefficient also did not establish any relationship between gender and the adoption of recommended lime practice at 5 percent level of probability (p=0.478) which therefore rejects the hypothesis that gender influences adoption of the recommended practice. In the previous 3 chapters, the study similarly failed to establish a relationship between gender and adoption. This finding is thus consistent with earlier findings in this report.

8.2.4 *Age*

The investigation into the relationship between age and the adoption of recommended lime practices was undertaken as part of the study with the hypothesis that age does not influence the adoption of the practice. Table 8.4 is a summarized presentation of the results. Majority of all the different age groups were found in the low adoption category, 66.7 percent for the young, 56.5 percent for mid-life and 64.0 percent for post mid-life. There is no discernible pattern in the results and the Chi-square test of independence failed to establish a significant difference between the age groups at 5 percent level of probability (p=0.711).

Table 8. 4: Relationship between age and the adoption of recommended lime practices

Age	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Young (<40yrs)	2	66.7	1	33.3	0	0.0	3	5.9
Mid-life (40-60yrs)	13	56.5	3	13.0	7	30.4	23	45.1
Post Mid-life (>60)	16	64.0	4	16.0	5	20.0	25	49.0
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 2.132$; df = 4; p = 0.711; r = -0.031; p = 0.828.

The result does not support the hypothesis, as the correlation coefficient is not significant at 5 percent level of probability (p=0.828). Age therefore does not influence the adoption of recommended lime practices.

8.2.5 *Education Level*

The study also examined the relationship between education and adoption of recommended lime practices. The analysis found no significant difference between the three educational level categories as shown in Table 8.5.

Table 8. 5: Relationship between education level and the adoption of recommended lime practices

Education	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
<=7yrs	13	65.0	2	10.0	5	25.0	20	39.2
8-12 yrs	12	54.5	4	18.2	6	27.3	22	43.2
> 12yrs	6	66.7	2	22.2	1	11.1	9	17.6
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 1.735$; df = 4; p = 0.784; r = -0.036; p = 0.805.

Similarly, the correlations analysis also suggest that the adoption of recommended lime practice is not influenced by the educational level of respondents as the coefficient was not significant at 5 percent level of probability (p=0.805) rejecting the null hypotheses

8.2.6 *Experience*

Experience as it relates to the number of years respondents have been in farming and its influence on the adoption of lime practices was one of the objectives of the study. The results of the hypothesis testing that experience influences the adoption of recommended lime practices and the analysis to determine the veracity of this assertion is presented in Table 8.6.

Table 8. 6: Relationship between experience and the adoption of recommended lime practices

Experience	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Beginners (>10yrs)	0	0.0	1	100.0	0	0.0	1	2.0
Transitional (10-20yrs)	14	53.8	4	15.4	8	30.8	26	51.0
Experienced (>20yrs)	17	70.8	3	12.5	4	16.7	24	47.0
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 7.196$; df = 4; p = 0.126; r = -0.193; p = 0.174

The study found no significant difference between the various experience groups of respondents and the adoption of the recommended lime practice at 5 percent level of probability (p = 0.126) **.** Similarly, the study could not establish a relationship between experience in farming and the adoption of the recommended lime practice as the correlation coefficient was not significant at 5 percent level of probability affirming, thus the hypotheses is rejected. The result is consistent with those found for seeds, basal and top dressing fertilizers reported in the previous chapters.

8.2.7 *Off-farm income*

Off-farm income as reported in the literature review in Chapter 2 is deem to exert its influence on adoption behaviors primarily due to the additional purchasing power for those who are able to obtain additional income outside the farm. The study therefore sought to establish whether respondents who have additional off-farm income adopt recommended lime practice. A summary of the results to ascertain the hypothesis that off-farm income influences the adoption of lime practice is presented in Table 8.7.

Table 8. 7: Relationship between off-farm and the adoption of recommended lime practices

Off-farm income	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Full time	14	56.0	4	16.0	7	28.0	25	49.0
Part time	17	65.4	4	15.4	5	19.2	26	51.0
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 0.604$; df = 2; p = 0.739; r = -0.108; p = 0.450.

The study found no significant difference in adoption of recommended lime practice between those who are full time or part-time farmers and therefore obtain addition income outside their farms, although 28 percent of full-time farmers against 19.2 percent were found in the high

adoption category. The correlation analysis did not support the hypotheses that off-farm income influences the adoption of recommended lime practice, as the coefficient was not significant at 5 percent level of probability (p=0.450).

8.2.8 *Time Spent on Farm*

A summary of the relationship between time spent farming and adoption of recommended lime practices is shown in Table 8.8. The results suggest no significant difference among the amount of time spent on the farm ($\chi 2 = 2.381$; df = 4; p = 0.666).

Table 8. 8: Relationship between time spent on farm and the adoption of recommended lime practices

Time spent on farm	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
<50% of time	5	55.6	2	22.2	2	22.2	9	17.6
50-75% of time	8	57.1	1	7.1	5	35.7	14	27.5
>75% of time	18	64.3	5	17.9	5	17.9	28	54.9
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 2.381$; df = 4; p = 0.666; r = -0.089; p = 0.534

In a similar vein, the results of the correlation analysis was also not significant at 5 percent level of probability indicating that the amount of time spent on the farm does not influence the decision of respondents to adopt the recommended lime practice, rejecting the hypotheses and confirming the results obtained for seed, basal fertilizers and top dressing fertilizers. There is therefore a consistency in the lack of influence of amount of time spent on farming on adoption of recommended practices.

8.2.9 *Farm Size*

Table 8.9 shows the distribution of respondents by size of farm and the adoption of recommended lime practices by respondents. Fifty percent (50 percent) of large scale farmers compared to 38.5 percent of medium-scale farmers and 12.5 percent of small scale farmers were in the high adoption category and shows a linear decreasing adoption percentage from large to small, however, the results of the statistical analysis found no significant differences between the various farm sizes of respondents at 5 percent level of probability (p=0.122).

Table 8. 9: Relationship between farm size and the adoption of recommended lime practices

Farm size	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Small Scale (<20% ha)	21	65.6	7	21.9	4	12.5	32	62.7
Medium Scale (20-60% ha)	7	53.8	1	7.7	5	38.5	13	25.5
Large Scale (>60% ha)	3	50.0	0	0.0	3	50.0	6	11.8
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 7.266$; df = 4; p = 0.122; r = 0.245; p = 0.083.

The hypothesis for this section of the study, that size of farm does not influence the adoption of recommended lime practice was also confirmed by the correlation analysis. The correlation coefficient was not significant at 5 percent level of significance. However, the study found a significant linear relationship between farm size and the adoption of recommended practice albeit at 10 percent level of probability. Fifty percent of large-scale farmers compared to 35.5 percent and 12.5 percent of the respondents were in the high adoption category showing an increasing trend towards large farmers. It appears that large-scale farmers are more likely to use lime than their small-scale counterparts.

8.2.10 *Area under maize cultivation*

The area specifically devoted to crops is of particular interest to the adoption of recommended practices as some researchers argue that, small size of farms offers the possibility of intensifying production as farmers can afford to make investments on small areas rather than large farms. Others argue that large farms are relatively wealthy and therefore are able to make investments on their farms. The study sought to test the hypotheses that maize farm size influences the adoption of recommended lime practice. The result of the analysis of area under maize cultivation and the adoption of recommended lime practices is presented in Table 8.10. The results show that there is no significant difference between the farm sizes of respondents and the adoption of recommended lime practices ($\chi 2 = 3.517$; df = 4; p = 0.475).

Table 8. 10: Relationship between area under maize cultivation and the adoption of recommended lime practices

Area under maize cultivation	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Small (<20 ha)	20	64.5	6	19.4	5	16.1	31	60.8
Medium (20-60 ha)	9	56.3	2	12.5	5	31.3	16	31.4
Large Scale (>60% ha)	2	50.0	0	0.0	2	50.0	4	7.8
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 3.517$; df = 4; p = 0.475; r = 0.181; p = 0.203.

The relationship between area under maize cultivation and the adoption of recommended lime practice was also examined using the correlational analysis. The results rejected the hypothesis that area under maize cultivation does influence the adoption of recommended lime practice, as the correlation coefficient was not significant at 5 percent level of probability (p = 0.203).

8.3 TOTAL INFLUENCE OF INDEPENDENT VARIABLES

The contribution of the independent variables to the adoption of the recommended lime practices was determined using a multiple regression analysis and the results are presented in Table 8.11. The results show that all ten variables do not show any significant influence on the adoption of the recommended seeds supporting the main Hypothesis 1, that the adoption of recommended farm practices is not influenced by the socio-demographic characteristics of the farmer.

Table 8. 11: Regression analysis of the influence of independent variables on the adoption of recommended lime practices

l	Independent Variables	Beta	t	Sig.
1	(Constant)		1.593	.119
	Location of farm	-.136	-.585	.562
	Farmers association	-.245	-1.382	.175
	Gender	.263	1.622	.113
	Age	.128	.766	.448
	Formal Education	-.052	-.300	.765
	Farming Experience	-.305	-1.894	.065
	off-farm income	.233	.958	.344
	Time Spent Farming	-.204	-.858	.396
	Farm Size	.185	.626	.535
	Area Under Maize Cultivation	.047	.167	.868

$R^2 = 0.173$; p = 0.325

The regression analysis shows that none of the independent variables has any discernible influence in the adoption of the recommended lime practice at 5 percent level of significance. The independent variables' contribution was not significant at 5 percent level of significance and in total, contributed a mere 17.3 percent of the total variation. This implies that factors other than the selected independent variables are more important in explaining adoption behavior of respondents.

8.4 THE RELATIONSHIP BETWEEN INTERVENING, SUBJECTIVE NORM VARIABLES AND THE ADOPTION OF RECOMMENDED LIME PRACTICES

8.4.1 Intervening variables

8.4.1.1 Efficiency Perception

As can be deduced from Table 8.12 below, the analysis of the relationship between efficiency perception and adoption of recommended lime practices indicate that none of the respondents who overrated their efficiency adopted the recommended lime practice compared to 44 percent who assessed their perception correctly and 3.8 percent with low perception found within the high adoption category. The difference between the efficiency perception groups was found to be significant at 5 percent level of significance ($\chi 2 = 11.431$; df = 2; p = 0.003).

Table 8. 12: Relationship between Efficiency Perception and the adoption of recommended lime practices

Efficiency Perception	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Underrating	20	76.9	5	19.2	1	3.8	26	51.0
Assess correctly	11	44.0	3	12.0	11	44	25	49.0
Overrating	0	0.0	0	0.0	0	0.0	0	0.0
Total	31	60.8	8	15.7	12	23.5	51	100

$\chi 2 = 11.431$; df = 2; p = 0.003; r = 0.435; p = 0.001.

The close relationship between efficiency perception and adoption of recommended lime practice is also expressed in the highly significant positive correlation (r = 0.435; p = 0.001). There is the tendency of adoption rates to decrease with increasing overrating of efficiency perception and this result is consistent with results obtained for seeds, basal and top dressing fertilizers reported in the previous chapters. The ability of efficiency perception to predict

adoption behaviors of farmers is established by this study as the results of all the correlation analysis were highly significant at 5 percent level of probability.

8.4.1.2 Need Compatibility

The study found a significant difference among respondents with low, medium and high need compatibility in relation to their adoption of recommended lime practices, as depicted in Table 8.13. Seventy five percent (75%) of the respondents with high need compatibility compared with 4.8 percent with low need compatibility were found in the high adoption category.

Table 8. 13: Relationship between Need Compatibility and the adoption of recommended lime practices s

Need Compatibility	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Low	19	90.5	1	4.8	1	4.8	21	41.2
Medium	11	50.0	6	27.3	5	22.7	22	43.1
High	1	12.5	1	12.5	6	75.0	8	15.7
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2 = 22.224$; df = 4; p = 0.000; r = 0.598; p = 0.000.

The study also found significant and positive correlation (r = 0.598, p = 0.000) between need compatibility and adoption behavior. This shows a linear relationship between adoption behavior and adoption of recommended top dressing fertilizer practices. The fit between psychological aspirations (Duvel, 1991) is therefore a requirement for farmers to adopt the recommended lime practices.

8.4.1.3 Need Tension

Table 8.14 is a summary of the results of the relationship between adoption behaviors and need tension among respondents. The indications are that, higher percentage of respondents (83.3 percent) with high need tension were in the high adoption category compared to 3.6 percent of respondents with low need tension and 9.1 percent of medium need tension found within same category.

Table 8. 14: Relationship between Need Tension and the adoption of recommended lime practices

Need Tension	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Low	27	96.4	0	0.0	1	3.6	28	54.9
Medium	2	18.2	8	72.7	1	9.1	11	21.6
High	2	16.7	0	0.0	10	83.3	12	54.9
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2$ = 66.025; df = 4; p = 0.000; r = 0.791; p = 0.000

The result of the Chi-square test of independence confirms a highly significant difference between the three different need tension categories at 5 percent level of probability (p = 0.000). The highly significant correlation coefficient (p=0.000) also confirms that need tension influences the adoption of recommended lime practices. The result is quite consistent with other results by Msuya and Düvel (2007) in regards to need tension and adoption behaviors.

8.4.1.4 Awareness

A summarized result of the analysis of awareness of the recommended lime practices and adoption behavior is shown in Table 8.15. The Chi-squares test of independence did not establish a significant difference between those who are aware and those who are not aware of the lime recommended practice at 5 percent level of probability (p=0.073) although there is a discernible difference among those in the low and high adoption categories. A higher proportion of the respondents who were aware of the recommended practices (46.2 percent) compared to 15.8 percent who were not aware were found in the high adoption category. Similarly, a higher percentage of those who were not aware 64.4 percent were in the low adoption category compared to 38.5 percent of those who were aware.

Table 8. 15: Relationship between Awareness and the adoption of recommended lime practices

Awareness	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Aware	5	38.5	2	15.4	6	46.2	13	25.5
Not aware	26	64.4	6	15.8	6	15.8	38	74.5
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2$ = 5.227; df = 2; p = 0.073; r = -0.406; p = 0.035

The correlation analysis of awareness and adoption behaviors was significant (r = 0.406; p = 0.035**)** implying that awareness influences the adoption of the recommended lime practice and is therefore a good predictor of adoption practice.

8.4.1.5 Prominence

The findings of the study with respect to the relationship between prominence and adoption of recommended lime practice is presented in Table 8.16. The results show highly significant differences among the respondents at 5 percent level of probability ($\chi 2$ = 16.452; df = 4; p = 0.002). About 35.3 percent who perceived the recommended practice to be better than their own practice were in the high adoption category compared to zero percent of those who had low and medium prominence for the practice. All those who perceived the practice otherwise (100 percent) were in the low adoption category.

Table 8. 16: Relationship between Prominence and the adoption of recommended lime practices

Prominence	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Low	3	100.0	0	0.0	0	0.0	3	5.9
Medium	14	100.0	0	0.0	0	0.0	14	27.5
High	14	41.2	8	23.5	12	35.3	34	66.7
Total	31	60.0	8	15.7	12	23.5	51	100.0

$\chi 2$ = 16.452; df = 4; p = 0.002; r = 0.491; p = 0.000.

The correlation analysis also confirmed a close and linear relationship between prominence and adoption behaviors (r = 0.491; p = 0.000). The hypotheses is therefore accepted that prominence influences adoption of the recommended lime practices.

8.4.2 Subjective Norm variables

8.4.2.1 Important people

The analysis of the influence of important people on the adoption behavior of respondents with respect to the recommended lime practice is presented in Table 8.17. A total of respondents 60.8 percent were in the low adoption category and 60 percent of those in the high adoption category, indicated that they were unlikely to be influenced by important people within their community, only 20 percent within the same category were likely to be influenced to adopt the recommended

lime practice. There was relatively bigger percentage (40 percent) within the medium adoption category who were likely to be influenced by important people within the community compared to 15 percent within the same category who were unlikely to be influenced.

Table 8. 17: Relationship between important people and the adoption of recommended lime practices

Important people	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Likely	0	0.0	2	40.0	3	20.0	5	9.8
Neither	5	83.3	0	0.0	1	16.7	6	11.8
Unlikely	26	65.0	6	15.0	8	60.0	40	78.4
Total	31	60.8	8	15.7	12	23.5	51	100

$\chi 2 = 9.654$; df = 4; p = 0.047; r = 0.290; p = 0.039

The difference between respondents in the three categories was significant at 5 percent level of significance (p = 0.047)

The correlation analysis also found a linear and highly significant relationship between the influence of important people and the decision of respondents to adopt recommended lime practice (p = 0.039) also at 5 percent level of significance.

8.4.2.2 Extension Agents

The influence of extension agents on adoption behavior of recommended practice was analyzed and the results are summarized in Table 7.18. The study found 80 percent of the respondents indicated that the farmers' adoption behavior of the recommended practices is likely to be influenced by extension agents within a low adoption category. None of those who are likely to be influenced by extension group was found in the high adoption category. Among all the three categories, 35.7 percent of those unlikely to be influenced by extension agents in the adoption of lime practice were found in the high adoption category against, 11.1 percent for medium respondents.

Table 8. 18: Relationship between extension agent and the adoption of recommended lime practices s

Extension Agent	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Likely	4	80.0	1	20.0	0	0.0	5	9.8
Neither	12	66.7	4	22.2	2	11.1	18	35.3
Unlikely	15	53.6	3	10.7	10	35.7	28	54.9
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2$ =5.760; df = 4; p = 0.218; r = 0.265; p =0.060

The difference in the adoption behaviors was not significant at 5 percent probability (χ^2=5.760; df = 4; p = 0.218**)**. The influence of extension agents on the adoption of recommended lime practices was also not significant at 5 percent level of probability (r = 0.265; p=0.060) implying that extension agents are unlikely to influence the decisions of respondents to adopt the practices which rejects the hypotheses.

8.4.2.3 Close friends

The study found neither differences between adoption behavior of the categories of respondents nor a correlation between the influence of close friends on decision to adopt recommended practices and adoption behaviors as shown in Table 8.19

Table 8. 19: Relationship between close friends and the adoption of recommended lime practices

Close Friends	Low Adoption (<6)		Medium Adoption (6-12)		High Adoption (>12)		Total	
	n	%	n	%	n	%	N	%
Likely	3	75.0	1	25.0	0	0.0	4	7.8
Neither	5	50.0	1	10.0	4	40.0	10	19.6
Unlikely	23	62.2	6	16.2	8	21.6	37	72.5
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2$ =3.439; df =4; p = 0.653; r = -0.011; p = 0.939.

The results found no significant differences between the groups of respondent at 5 percent level of probability. Similarly, the correlation analysis also found no significant influence of close friends on the adoption of recommended lime practices by respondent at 5 percent level of probability (p=0.939).

8.4.2.4 Farmers' association

Majority of the respondents (76.5 percent) indicated that their decision to adopt recommended top dressing fertilizer practices is unlikely to be influenced by members of their farmers association against 7.8 percent who were likely to be influenced. The study did not find any significant difference in the adoption of the recommended lime practice among those who were likely neither or unlikely to be influenced at 5 percent level of probability (of those whose decisions are like to be influenced and those who are not likely to influenced **(**$\chi 2$ =5.995; df4 =; p =0.200)

Table 8. 20: Relationship between membership of association and the adoption of recommended lime practices

Membership of Association	**Low Adoption (<6)**		**Medium Adoption (6-12)**		**High Adoption (>12)**		**Total**	
	n	**%**	n	**%**	n	**%**	N	**%**
Likely	1	25.0	2	50.0	1	25.0	4	7.8
Neither	5	62.5	0	0.0	3	37.5	8	15.7
Unlikely	25	64.1	6	15.4	8	20.5	39	76.5
Total	31	60.8	8	15.7	12	23.5	51	100.0

$\chi 2$ =5.995; df4 =; p =0.200; r = 0.152; p = 0.288.

There was also no significant correlation between membership of an association and the adoption of the recommended lime practices at 5 percent level of probability (p=0.288)**.** This implies that farmers' adoption behavior for the recommended lime practice is not likely to be influenced by members of an association.

8.5 TOTAL INFLUENCE OF INTERVENING AND SUBJECTIVE NORM VARIABLES

The preceding sections examined the influence of individual intervening and the subjective norm variables on the adoption of recommended lime practices. Chi-square tests were used to determine differences among different categories within each variable, whilst correlation analyses were used to point out relationships. The next part of this chapter explores the influence of all the intervening and subjective norm variables on the adoption of recommended fertilizer practices and their contribution to variation using the regression analysis.

Table 8. 21:Regression analysis of the influence of intervening variables and subjective norm on the adoption of recommended lime practices

	Intervening and Subjective Norm Variables	Beta	t	p
1	(Constant)		-2.430	0.020
	Prominence	0.262	2.989	0.005
	Awareness	-0.007	-0.082	0.935
	Need Compatibility	0.234	2.552	0.015
	Efficiency perception	0.168	1.943	0.059
	Need tension	0.478	4.562	0.000
	Close friend	-0.038	-0.366	0.716
	Members of association	0.175	1.767	0.085
	Important people	0.070	0.743	0.462
	Extension agent	-0.031	-0.376	0.709

$R^2 = 0.777$; $p = 0.000$

According to Table 8.21 the intervening and subjective norm variables explain 77.7 percent of the variation in adoption ($R^2 = 0.777$; $p = 0.000$) at 5 percent level of probability. The most significant individual variable contributing to this variation is need tension (Beta 0.478; p=0.000); prominence (Beta 0.0.262; p = 0.005); need compatibility (Beta 0.234; p = 0.015), and efficiency perception (Beta 0.168; p = 0.059).

8.6 CONCLUSION

It was shown in section 8.2.11 that the contribution of the independent variables to the explanation of adoption behavior amounted to 17.4 percent of the total compared to 77.7 percent recorded for the intervening variables It can be concluded that intervening variables exert greater influence on the adoption behavior of respondents for recommended fertilizer practices than the independent variables and is therefore a better predictor of adoption.

CHAPTER 9
SUMMARY CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

Agriculture is not only the main stay of most economies of the world, but most importantly it is the main source of food for human sustenance. It is the main source of employment for majority of developing countries as well. Increasing the productivity of farms and producers to keep pace with population growth to continue to provide adequate nutrition to the population is a matter of necessity and not by choice. Improvements in agricultural productivity are enhanced when farmers decide to adopt new farm practices. The decisions are largely voluntary and often a result of the farmers comparing the uncertain benefits and the cost associated with the adoption of the new farm practice. Understanding the context within which farmers change their farming practices is essential for policy makers as well as those who have been tasked to produce new technologies and has been the subject of scientific research for many years from many disciplinary and theoretical perspectives.

In the literature review (Chapter 2), an attempt was made to categorise the body of current knowledge on the factors which influence the adoption of new practices into those that are external in nature to the farmer, such as the characteristics of the practice, social influences and; those that are personal characteristics of the farmer and the farm. Considerable attention and resources have been devoted to the study of these factors and has yielded a world of information which is the basis for theoretical underpinnings of most extension work and programs. These studies were criticized for being ex-post and could not provide the type of evidence that could be used for planning purposes. A third category of factors reviewed in the literature were the "intervening variables" or "mediating variable" which from the literature has been found to predict behaviors and therefore could be used in planning agricultural extension programs. These variables, cognitive in nature, have been studied under various settings and reported to be highly correlated with farmers' behavioral change. This study, in addition to the personal and farm characteristics, the intervening variables (cognitive), also included the subjective norm (social)

variables proposed by Ajzen (1985, 1988) to test its potential to predict adoption behavior of farmers.

The study is thus in line with the current wave of research to identify determinants of adoption which can be used for extension program planning. The model developed by Düvel (1991) thus was used as the conceptual model and together with relevant information from the literature formed the basis for the development of the hypotheses that the adoption of recommended farm practices (seeds, basal fertilizer, top dressing fertilizer and lime practices) are influenced by (i) socio-demographic characteristics of the farm and farmer; (ii) mediating variables and; (iii) subjective norm. The objective was to compare and identify which of the variables best predict farmers, adoption behavior.

The study was carried out in the Leribe and Maluti-a-Pofung districts of Lesotho and South Africa respectively. A structured questionnaire with a Sotho translation was used to collect data from 107 farmers randomly selected from the districts and administered by trained extension staff. The data collected was analyzed using the SPSS program. In determining the relationships between the independent and dependent variables, Chi-square test of independence, correlation and regressions analysis were used. The following section summarises the conclusions and recommendations of the study.

9.2 CONCLUSION

The main thrust of the study investigated three major dimensions of influences on adoption behaviors of farmers, namely: (i) personal attributes of the farmer and the farm; (ii) the intervening variables which are cognitive in nature and; (iii) the subjective norm – basically social influences. The conclusions derived from the quantitative analysis presented in the preceding Chapters 5, 6, 7, and 8 are presented below.

9.2.1 Hypothesis 1: The adoption of recommended farm practices by farmers is influenced by the socio- demographic characteristics of the farmer and farm.

To appreciate the extent of the relationship between the socio-demographic characteristics of the farmer and farm, a summarized results of the correlation analysis is presented in Table 9.1 The results suggest that location influences the adoption of fertilizer (p = 0.001), top dressing (top dressing fertilizer) (p = 0.002) and seeds (p = 0.043) but not lime practices. Membership of farmers association influences the adoption of only lime (p = 0.040) whilst Off-farm-income was found to be associated with the adoption of fertilizer (p = 0.034). The results for the relationship between areas under maize production was closely linked to total land area as the two all correlated well with fertilizer, top dressing and seeds but not lime practices. Farm size correlation coefficients were, fertilizer (p=0.002). Top-dressing (p=0.004) and seeds (p=0.004) whilst that of area under maize cultivation were, fertilizer (p=0.000), top-dressing (p=0.000) and seeds (p=0.000).

Table 9. 1: Correlations between Independent Variables and Adoption of Recommended Maize Agronomic Practices

Variable	Lime		Basal Fertilizer		Top-dressing		Seed	
	r	p	r	p	r	p	r	P
Farm location	-0.210	0.139	**-0.326**	**0.001**	**-0.375**	**0.002**	-0.197	0.043
Farmers assoc	**-0.289**	**0.040**	-0.182	0.063	-0.229	0.066	-0.056	0.572
Gender	0.102	0.478	0.020	0.839	-0.046	0.714	-0.177	0.070
Age	-0.031	0.828	-0.086	0.378	-0.537	0.000	0.071	0.471
Education	0.036	0.805	-0.156	0.110	-0.089	0.479	-0.081	0.407
Experience	-0.193	0.174	0.165	0.091	0.083	0.510	0.079	0.423
Off-farm income	-0.108	0.450	**-0.207**	**0.034**	-0.209	0.095	-0.098	0.317
Time Spent	-0.089	0.534	0.036	0.717	0.118	0.348	0.074	0.451
Farm size	0.245	0.083	**0.302**	**0.002**	**0.283**	**0.022**	**0.278**	**0.004**
Maize area	0.181	0.203	**0.333**	**0.000**	**0.309**	**0.012**	**0.332**	**0.000**

The results suggest that farm size and area under maize cultivation were the only variables that showed any consistent influence with adoption of recommended maize agronomic practices namely: use of improved seeds, fertilizer and fertilizer top-dressing practices. The association between the remaining variables seems to be more dependent on the type of recommended

practice. For example location was found to be significantly associated with the adoption of fertilizer and top-dressing practices but not with lime and the use of improved seed. All the remaining independent variables gender, age, educational level, experience and time spent on the farm appear not to have any significant influence on the adoption of the recommended practices at 5 percent level of probability.

9.2.1.1 Contribution of farmer and farm characteristics to total variation

A summary of the regression analyses to determine the total influence of the independent variables is presented in table 9.2. It shows the limited contribution of the independent variables on the adoption of recommended maize agronomic practices.

Table 9. 2: Contribution of Independent variables to total variation

Variable	Lime			Basal Fertilizer			Top Dressing			Seeds		
	Beta	t	sig	Beta	t	Sig	Beta	t	Sig	Beta	T	sig
Constant		1.593	0.119		2.752	0.007		3.217	0.002		2.566	0.012
Farm Location	--0.136	0.585	0.562	-0.173	-0.798	0.427	-0.261	-1.084	0.283	-0.147	-0.691	0.491
Farmers Assoc	-0.245	-1.382	0.175	0.048	0.401	0.690	0.013	0.099	0.921	0.066	0.570	0.570
Gender	0.263	1.622	0.113	0.136	1.287	0.201	0.077	0.645	0.522	0.141	1.354	0.179
Age	0.128	0.766	0.448	-0.073	-0.712	0.478	**-0.462**	**-3.871**	**0.000**	-0.097	-0.951	0.344
Education	-0.052	-0.300	0.765	-0.112	-1.068	0.288	0.121	0.935	0.354	-0.120	-1.157	0.250
Experience	-0.305	-1.894	0.065	0.136	1.401	0.164	0.025	0.205	0.838	0.152	1.586	0.116
Off-farm income	0.233	0.958	0.344	0.086	0.477	0.634	-0.050	-0.248	0.805	0.075	0.416	0.678
Time Spent	-0.204	-0.858	0.396	-0.068	-0.436	0.664	0.026	0.138	0.891	-0.070	-0.455	0.650
Farm Size	0.185	0.626	0.535	0.108	0.470	0.639	0.015	0.065	0.948	0.138	0.610	0.543
Maize Area	0.047	0.167	0.868	0.191	1.029	0.306	0.081	0.398	0.692	0.195	1.060	0.292
	R^2=0.173; p0.325			**R^2=0.173; p0.044**			**R^2=0.399; p0.001**			**R^2=0.191; p0.020**		

In general the analysis suggest a lower than expected contribution to variation as the results contradicts the hypothesis that farm and farmer characteristics influence adoption behavior. This is supported by the fact that, except for top- dressing where the characteristics of the farmer and farm contribute about 40% to the explanation to total variation, the rest all fall below 20 %. Hypothesis 1 is therefore rejected in the face of the available evidence. This is an indication that factors other than the selected independent variables could account for the adoption behavior of the respondents. The results are not entirely unexpected as the literature has revealed absence of consistency of the influence of socio-demographic on farmers' adoption behaviors across countries and type of recommended farm practice.

9.3 Hypothesis 2. The adoption of recommended farm practices is influenced by the intervening and subjective norm variables.

One of the objectives of the study was to compare the personal and farm characteristics of the farmer and intervening variables to determine which one among them can best predict farmers' adoption behavior. The findings and conclusions of the personal variables were presented in the preceding section 9.2. The other part of the comparison relates to the intervening variables and subjective norm and the results are presented in Table 9.3. The intervening variables mediate between the independent and the dependent variables and those considered for this study were efficiency perception, need compatibility, need tension, awareness, prominence which are cognitive factors and the social dimensions of behavior influences – the subjective norm of which the variables were important people, extension agents, close friends and farmers association.

Compared to the independent variables, five out of the nine intervening variables, namely: prominence, awareness, need compatibility, efficiency perception and need tension were consistently found to be highly significantly associated with the adoption of all the four recommended maize agronomic practices at 5% level of probability (Table 9.3).

Table 9. 3: Correlations Between Intervening and Subjective Norm Variables on the Adoption of Recommended Maize Agronomic Practices

Variable	Lime		Basal Fertilizer		Top-dressing		Seed	
	r	p	r	p	r	p	r	P
Prominence	**0.491**	**0.000**	**0.247**	**0.011**	**0.317**	**0.010**	**0.295**	**0.002**
Awareness	**0.406**	**0.035**	**0.628**	**0.000**	**0.421**	**0.000**	**0.384**	**0.000**
Need Compatibility	**0.598**	**0.000**	**0.453**	**0.000**	**0.567**	**0.000**	**0.266**	**0.006**
Efficiency Perception	**0.435**	**0.001**	**0.506**	**0.000**	**0.456**	**0.001**	**-0.734**	**0.000**
Need Tension	**0.791**	**0.000**	**0.781**	**0.000**	**0.754**	**0.000**	**0.754**	**0.000**
Close Friends	-0.011	0.939	0.086	0.383	0.065	0.607	0.154	0.116
Members of assoc	0.152	0.288	**-0.227**	**0.020**	0.567	0.000	-0.097	0.332
Important people	0.290	0.039	0.150	0.125	0.274	0.027	0.154	0.115
Extension	-0.265	0.060	-0.140	0.153	-0.099	0.434	-0.129	0.186

Membership of an association which is a subjective norm variable was found to influence the adoption of fertilizer practices. Except for the membership of association whose influence on farmers behavior change, the rest of the variables found to be associated with behavior change were all cognitive (psychological) in nature and their r-values were also comparatively high. This is an indication that the cognitive variables stand in close causal relationship with behavior

change compared to the social-related variables. This applies in particular to needs tension with r-values of 0.791 for lime, 0.781 for fertilizer, 0.754 for top dressing and 0.607 for the use of improved seeds.

9.3.1.2 Contribution of intervening and subjective norm variables to the total variation

Table 9.4 is a summary of the regression analyses to determine the total influence of the intervening and subjective norm variables in the adoption of recommended agronomic practices.

Table 9. 4: Regression Analysis of the Influence of Intervening and Subjective Norm Variables on the Adoption of Recommended Maize Agronomic Practices

Variable	Lime			Basal Fertilizer			Top Dressing			Seeds		
	Beta	t	Sig	Beta	t	Sig	Beta	t	Sig	Beta	T	sig
Constant		-2.430	0.020		3.600	0.001		-1.211	0.231		0.309	0.758
Prominence	0.478	4.562	0.000	0.012	0.214	0.831	0.129	1.715	0.092	0.024	0.299	0.766
Awareness	-0.007	0.082	0.935	-0.332	-5.5280	0.000	0.167	2.130	0.038	0.133	1.622	0.108
Need Compatibility	0.234	2.552	0.015	0.143	2.414	0.018	0.184	2.108	0.040	0.051	0.642	0.522
Efficiency Perception	0.168	1.943	0.059	0.018	0.282	0.778	0.131	1.776	0.081	0.354	4.493	0.000
Need Tension	0.478	4.562	0.000	0.600	9.419	0.000	0.576	7.204	0.000	0.495	5.071	0.000
Close Friend	-0.038	-0.366	0.716	-0.045	-0.613	0.541	0.005	0.051	0.960	0.001	0.006	0.995
Members of Assoc	0.175	1.767	0.085	-0.025	0.317	0.752	-0.161	-1.902	0.062	0.005	0.064	0.949
Important people	0.070	0.743	0.462	0.111	1.506	0.135	0.090	0.931	0.356	-0.049	-0.484	0.630
Extension Agent	-0.031	0.376	0.709	-0.013	-0.162	0.872	0.139	1.891	0.064			
	R^2=0.777; p=0.000			R^2=0.744; p=0.000			R^2=0.743; p=0.000			R^2= 0.490 p = 0.000		

The evidence shows that the intervening variables showed a high contribution in explaining variation in the adoption behavior in all the production practices studied. The power of explanation ranged from 49% in the case of adoption of improved seed practices to 77.7% for the use of lime. The results provide strong evidence in support of the contention that, the intervening variables are the likely precursors of decision making through which the influence of independent variables become manifested in behavior and supports Hypothesis 2. It can be concluded that the intervening variables offer a more practical meaning for the analysis of extension interventions, as they are factors that can be influenced to bring about behavior change compared to the independent variables. The results also show that need, perception and

knowledge related variables are more important in influencing decisions on adoption than social factors exerted by the subjective norm.

9.3 RECOMMENDATIONS

The findings of this study have implications for both research and extension work. The evidence suggests that cognitive-related variables – knowledge and need related rather than social and personal attributes contributes significantly to adoption of agronomic practices and could play a significant role for targeting extension interventions. Farmers are therefore prone to change behaviors based on their psychological rather than socio-economic dispositions. Subsequently the following recommendations are proposed:

- Socio-demographic characteristics of the farm and farmers are not to be discarded as unimportant because they do not directly influence adoption. Their potential role which should be harnessed lies in audience targeting as well as information dissemination. Farmers can easily be identified by the socio-demographic characteristics such as age, gender, farmers association, farm size etc. and they often share some common goals and therefore could potentially be the groups to which special extension messages should be targeted. Secondly, information dissemination is far easier through homogenous groups who share similar characteristics such as membership of associations, age, gender and educational levels.

- Extension programs aimed at influencing behavior change should rather focus on the cognition related variables – those that have been studied and to which this study has confirmed their relevance to extension work – prominence, need tension, awareness, and efficiency perception and need compatibility.

9.4 FURTHER RESEARCH

- The role of cognition in the farmers' behavior change is a significant finding. However, cognition covers a wide range of disciplines, psychology, philosophy and more recently information science. The possibility for the existence of more cognitive variables to

influence adoption behavior should be explored. The search for more intervening variables, especially cognitive related, with the potential to extend the epistemology of extension science should therefore continue;

- The comparison between psychological and social variables perhaps, is perhaps, pioneering and requires further repeated studies elsewhere for confirmation;
- The lack of consistency of the independent variables on in the literature and confirmed by this study opens the way for other types of research to determine whether their influence depends on the type of farm practice; and
- Collaboration between research and extension to develop appropriate tools using the socio-demographic characteristics to target extension messages.

LITERATURE CITED

ADEKOYA, A. E., 2005. Training needs of small scale poultry farmers on improved production techniques. *African Journal of Livestock Extension*, Vol 4.

ADRIAN, A.M., NORWOOD, S H., & MASK P.L., 2005. Producers' perception and attitudes toward precision agriculture technologies. *Computers and Electronics in Agriculture* 48, 256-271.

AJEWOLE, O. C., 2010. Farmer's response to adoption of commercially available organic fertilizers in Oyo State, Nigeria. *African Journal of Agricultural Research* Vol. 5(18).

AJZEN, I., 1985. From intention to action: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds): Action-control: From cognition to behavior (p 11-39) Heodelberg, Gernamy, Springer.

AJZEN, I., 1988. *Attitudes, Personality and Behavior*. Open University Press, Milton Keynes.

AJZEN, I., 2005. Attitudes, personality and behavior (2nd Edition). Milton-Keynes, England: Open University Press/McGraw-Hill

AJZEN, I., 2006. Constructing a TpB questionnaire: Conceptual and Methodological Considerations. Available at *http://people.umass.edu/aizen/pdf/tpb.measurement.pdf*.

AJZEN, I., & FISHBEIN, M., 1980. *Understanding Attitudes and Predicting Social Behavior.* Englewood Cliffs, NJ: Prentice-Hall.

ASFAW, A & ADMASSIE, A., 2004. The role of education on the adoption of chemical fertilizer under different socioeconomic environments in Ethiopia. *Agricultural Economics* 30: 215-228.

ASRAT, S., YESUF, M, CARLSSON, F., & WALE E., 2010. Farmers' preferences for crop variety traits: Lessons for on-farm conservation and technology adoption. *Ecological Economics* 69: 2394-2401.

BAGOZZI, R. P., MOORE, D. J. & LEONE, L., 2004. Self-Control and the self-regulation of dieting decisions: The role of prefactual attitudes, subjective norms, and resistance to temptation. *Basic and Applied Social Psychology* 26: (2&3), 199-213.

BANDURA, A. 1977. Social Learning Theory. Englewood Cliffs, NJ: Prentice Hall.

BATIONO, A., 2008. Integrated Soil Fertility Management Options for Agriculture Intensification in the Sudano Sahelian Zone of West Africa. Academy of Science Publishers.

BEN-HOUASSA, K. E., 2011. Adoption and levels of demand of fertilizer in cocoa farming in Cote d'Ivoire. Paper selected for presentation at the CSAE conference 2011 –Economic

Development in Africa – to be held at St Catherine's College, Oxford, on 20-22 March 2011. http://www.csae.ox.ac.uk/conferences/2011-EDiA/papers/769-Kouame.pdf

BOTHA, R.A., 1986. The influence of different perceptions on the adoption of practices related to draught resistance. *South African Journal of Agricultural Extension* 15:25-31

BURTON, R.J.F. 2004. Reconceptualising the ' approach" in agricultural studies: a socio-psychological perspective. *Journal of Rural Studies,* 20, 359-371.

BYERLEE, D., ALEX, G. & ECHEVERRIA, R. G., 2002. The Evolution of Public Research Systems in Developing Countries: Facing New Challenges. In D. Byerlee and R. G. Echeverria (Eds), *Agricultural Research Policy in an Era of Privatization*. CABI Publishing.

CHIRWA, E. W., 2005. Adoption of fertilizer and hybrid seeds by smallholder maize farmers in southern Malawi. *Development Southern Africa,* 22:1, 1 - 12.

CHOI J.N., & PRICE, R.H., 2005. The effects of person-innovation fit on individual responses to innovation. *Journal of Occupational and Organizational Psychology*, 78, 83-96.

CROPPENSTEDT, A., DEMEKE M, & MESCHI, M.M., 2003. The adoption in the presence of constraints: the case of fertilizer demand in Ethiopia, *Review of Development Economics,* 7(1) 58-70.

DE VOS, A.S., 1998. *Research at grass roots*. A primer for the caring professions. Van Schaik Publishers, 1064 Arcadia Street, Hatfield, Pretoria

DEGU, G., MWANGI, W., VERKUIJL. & WONDIMU, A., 2000. An Assessment of the Adoption of Seed and fertilizer Packages and the Role of Credit in Smallholder Maize Production in Sidama and North Omo Zones, Ethiopia. D.F.: International Maize and Wheat Improvement Center (CIMMYT) and Ethiopian Agricultural Research Organization (EARO).

DIEDEREN, P., MEIJL, V. H. WOLTERS, A., & BIJAK, K. 2003. Innovation adoption in agriculture: Innovators, Early adopters and laggards. *Cahiers d/economic et sociologie rurales* 6.

DOSS, C. R., & MORRIS, M. L., 2001. How does gender affect the adoption of agricultural innovations? The case of improved maize technology in Ghana. *Agricultural Economics* 25: 27-39

DÜVEL, G.H., 1975. The mediating function of perception in innovation decision-making. *South Africa Journal of Agricultural Extension* 4, 25-36.

DÜVEL, G.H., 1982. Need Creation and exploitation: The basis for change. *South Africa Journal of Agricultural Extension.* 11, 27-33.

DÜVEL, G. H., 1991. Towards a model for the promotion of complex innovations through programmed extension. *South African Journal of Agricultural Extension,* 15: 1-10.

DÜVEL, G.H., 1994. A model for adoption behaviour analysis in situation surveys. *Journal of Extension systems 10:1-32*

DÜVEL, G. H., 1998. Monitoring extension: A cognition oriented approach towards evaluation. *South African Journal of Agricultural Extension*, 27.

DÜVEL, G.H., 2004. *Programmed extension (Program development and implementation). S*tudy guide. Department of Agricultural Economics, Extension and Rural Development, University of Pretoria.

DÜVEL, G. H., 2007. Monitoring in extension: from principles to practical implementation. *South African Journal of Agricultural Extension*, 36.

DÜVEL, G.H. & BOTHA, A. J., 1999. Human Constraints to Sustainable Agriculture in the Arid regions of South Africa. *The Journal of Agricultural Education and Extension, 6 (1): 47-60.*

DÜVEL, G.H. & SCHOLTZ, H.P.J., 1991. The incompatibility of controlled selective grazing systems with farmers' needs. *Journal Grassland Society of South Africa*, 9 (1).

EAGLY, A.H., & CHAIKEN, S., 1993. *The Psychology of Attitudes*. Thomson Wadsworth.

Ellis, R., & McClintock A., 1994. If You Take My Meaning: Theory Into Practice in Human Communication. Bloomsbury, U.S.A

FAO, 2005. Fertilizer use by crop in South Africa. FAO, Rome.

FEDER, G., JUST, R. E., & ZILBERMAN, D., 1985. Adoption of Agricultural Innovations in Developing Countries. *Economic Development and Cultural Change* Vol 33 (2) 255-298.

FEDER, G., & UMALI, D.L., 1993. The adoption of agricultural innovations: A review. *Technological Forecasting and Social Change* 43, 215-239.

FLETT, R.F., ALPASS, S., HUMPHRIES, C., MASSEY, S., MORRIS, S, & LONG, N., 2004. The technology acceptance model and use of technology in New Zealand dairy farming. *Agricultural Systems* 80, 199-211.

FLIEDGEL, F. C. &. KIVLIN, J. E., 1966. Attributes of innovations as factors in diffusion. *American Journal of Sociology*. Vol 72 No 3 235-248.

FRANK, B.R., 1997. Adoption of innovations in the North Queensland beef industry. III: implications for extension management. *Agricultural Systems*, 55, (3), 347-358.

GASSON, R. 1973. Goals and values of farmers. *Journal of Agricultural Economics*, 24.

GILMORE, D. A. 1986. "Behavioural studies in agriculture: Goals, values and enterprise choice. *Journal of Agricultural Economics and Rural Sociology*, 11.

GONSALVES, C., LEE, D. R., & GONSALVES, D., 2007. The adoption of genetically modified papaya in Hawaii and its implications for developing countries. Journal of development Studies Vol 43 (1) 177-191.

GUEHLSTORF, N. P., 2008. Understanding the scope of farmer perceptions of risk: Considering farmer opinions on the use of genetically modified (GM) crops as a stakeholder voice in policy. *Journal of Agriculture and Environmental Ethics* 21:541-558.

HABTERMARIAM, A.G. & DÜVEL, G.H., 2003. Towards a categorization of behavior determinants with a view to a more meaningful analysis, intervention and evaluation of adoption behavior. *South African Journal of Agricultural Extension* 32, 73-84.

HABTERMARIAM A. G. & DÜVEL, G.H., 2004. Towards a more situation appropriate and responsive extension approach for Ethiopia. *South African Journal of Agricultural Extension*, 33, 52-63.

HAGGER, S.M. & CHATZISARANTIS, N. L. D., 2005. First- and higher-order models of attitudes, normative influence, and perceived behavioral control in the theory of planned behavior. *British Journal of Social Psychology, 44, 513-535.*

HENDERSON, T.H., & GOMES, P.I., 1982. Family Structure, Attitudes and Decision-making among Caribbean Peasant Farmers. *Agricultural Administration* 9, 257-265.

HIEBERT, L. D., 1974. Risk, Learning, and the Adoption of Fertilizer Responsive Seed Varieties. *American Journal of Agricultural Economics*, 56 (4), 764-768.

Howitt, D. & Cramer, D, 2005. Introduction to Statistics in Psychology 3rd Edition. Pearson Prentice Hall, London

IDRISA, Y. L., SHEHU, H. & NGAMDU, M. B, 2012. Effects of Adoption of Improved Maize Seed on Household Food Security in Gwoza Local Government Area of Borno State, Nigeria. *Global Journal of Science Frontier Research Agriculture and Biology*, Vol., 12, Issue 5.

ILLUKPITIYA, P., & GOPALAKRISHNAN, C., 2004. Decision-making in soil conservation: application of a behavioral model to potato farmers in Sri Lanka. *Land Use Policy* 21, 321-331.

ISGIN, T., BILGIC, A., FORSTER, D. L., & BATTE M. T., 2008. Using count data models to determine the factors affecting farmer's quantity decision of precision farming technology. *Computers and Electronics in Agriculture* 62: 231-242.

ISHAM, J., 2002. The effect of social capital on fertilizer adoption: evidence from rural Tanzania. *Journal of African economies*, 11(1): 39-60.

JOHL, S. S., & KAPUR, T. R., 2001. Fundamentals of Farm Business Management, Kalyani Publishers pp 253-259.

KUO, R-Z & LEE G. G., 2011. Knowledge management system adoption: exploring the effects of empowering leadership task-technology fit and compatibility. *Behavior and Information Technology* Vol 30 (1) 113-129.

LAPAR, M. L. A., & EHUI, S.K., 2004. Factors affecting adoption of dual-purpose forages in the Philippine uplands, *Agricultural Systems* 81, 95-114.

LATIMER. A. E. & GINIS, K. A. M., 2005. The importance of subjective norms for people who care what others think of them. Psychology of Health. 20, 1. 53-62.

LAWAL, B. O, SAKA, J. O., OYEGBAMI A. & AKINTAYO, I. O., 2005. Adoption and performance assessment of improved maize varieties among smallholder farmers in south western Nigeria. *Journal of Agricultural and Food Information*. Vol 6 No 1, 35-47.

LEWIN, K., 1951. The nature of field theory. In M. M. Marx. Psychological Theory; Contemporary Readings. New York: The Macmillan Company.

LI, D., LIU, M., & DENG, G., 2010. Willingness and determinants of farmer's adoption of new rice varieties. *China Economic Review* Vol 2 No 4.

LIVONEN, S., KYTO, P., MYNTTINEN, S., SARKKA-TIRKKONEN, M. & KAHILUOTO, H., 2011: Social capital and entrepreneurial behavior advancing innovativeness in interaction between small rural entrepreneurs and researchers: A phenomenographic study. *The Journal of Agricultural Education and Extension,* 17:1, 37-51.

LOUW, G and DÜVEL, G.H. 1993. The Adoption of oldman saltbush (Atriplex Nummularia) as influenced by an extension program. *South African Journal of Agricultural Extension*. 22: 29-37

MALLERY. P. & D. GEORGE. , 2003. *SPSS for windows step by step. A simple guide and reference*. Pearson Education, Inc.

MARSH S.P., PANNELL D.J. & LIDNER, R.K., 2004. Does agricultural extension pay? A case study for new crop, lupins in Western Australia. *Agricultural Economics* 30, 17-30
Steinberg S. (2005).

MILLER, R.B. & BRICKMAN, S.J., 2004. A model of future-oriented motivation and self-regulation. *Educational Psychology Review* 16, 1.

MORGAN, G. A. & V. O. GREGO, 1998. *Easy use and interpretation of SPSS for windows: Answering research questions with statistics*. School of Education, Colorado State University

MOSHER, A.T., 1976. Introduction to Agricultural Extension. New York: Council for Agricultural Development.

MSUYA, C. P. & DÜVEL, G. H., 2007. The role of independent and intervening variables in maize grower's adoption of seed spacing in the Njobe District of Tanzania. *South African Journal of Agricultural Extension, 36.*

PAUDEL, P., SHRESTHA, A. K. & MATSUOKA, A., 2009. Socio-economic factors influencing adoption of fertilizer of maize production in Nepal: A case study of Chitwan District. Paper presented at the 83rd Annual Conference of the Agricultural Economist Society. 30th March to 1st April 2009. Dublin.

O'GORMAN, M. & PANDEY M., 2010. Cross-country disparity in agricultural productivity: quantifying the role of modern seed adoption. Journal of development Studies Vol 46 (10) 1767-1785.

RANSOM, J. K., PAUDYAL, K. & ADHIKARIL, K., 2003. Adoption of improved maize varieties in the hills of Nepal. *Agricultural Economics* 29, 299-305.

REED, M., & SALVACRUZ, J., 1995. Technological Progress and International Trade: The Case of the Less Developed ASEAN Countries. In Agricultural Competitiveness: Market Forces and Policy Choice. Eds G.H. Peters and Douglas D. Hedley. Dartmouth Press: Brookfield, Vermont.

REHM, G. W. & LAMB, J. A., 2008. Corn response to fluid fertilizer placed near the seed at planting. *Soil Science Society of America Journal*. 73: 1427-1434.

REZAEI, M. & BAGHERI, A., 2011. Comparative analysis of characteristics of adopters and non-adopters of artificial insemination in Ardabil Province of Iran. *Emir Journal of Food Agriculture*. Vol 23 (5) 466-472.

RHODES, R. E., BLANCHARD, C. M. & MATHESON, D. H., (2006). A multicomponent model of the theory of planned behavior. British Journal of Health Psychology. 11, 119-137.

RIMAL, R.N. & REAL, K., 2005. How behaviors are influenced by perceived norms: A test of the theory of normative social behavior. *Communication Research* 2 (30, 389-414.

RIVERA, W. M., 2011. Public sector agricultural extension system reform and the challenges ahead. *The Journal of Agricultural Extension Education*, 17:2, 165-180.

RIVERA, W. M., 2011. Public sector agricultural extension system reform and the challenges ahead. *The Journal of Agricultural Education and Extension*, 17:2, 165-180.

ROGERS, E. M., 1983. Diffusion of Innovations (3rd Edition). The Free, New York.

RÖLING, N., 1988. Extension Science. Cambridge. Cambridge University Press.

SALL, S., NORMAN D. & A. M. FEARTHERSTONE., 2000. Quantitative assessment of improved rice variety adoption: the farmer's perspective. *Agricultural Systems* 66, 129-144.

SCHULTZ, T. W., 1981. Investing in people: the Economics of population Quality, University of California Press, and Berkeley.

SCOONES, I. & THOMPSON, J., 2011. The politics of seed in Africa's green revolution: Alternative narratives and competing pathways. IDS Bulleting Vol 42 No 4. Blackwell Publishing Ltd Oxford.

TOLMAN, E. C., 1967. A psychological Model. In: Eds. T. parsons & E. A. Shils.Towards a general theory of action. Cambridge: Harvard University Press.

TRAFIMOW, D., & FINLAY, K A., 2001. The relationship between normatively versus attitudinally controlled people and normatively versus attitudinally controlled behaviors. *The Social Science Journal* 38, 203-216.

TURA, M., AREDO, D., TSEGAYE, W., LA ROVERE, R., TSEFAHUN, G., MWANGI, W. & MWANBU, W., 2010. Adoption and continued use of improved maize seeds: Case study of Central Ethiopia. African Journal of Agricultural Research Vol. 5(17), pp 2350-2358.

UAIENE, R.N., ARNDT, C. & MASTERS, W.A., 2009. Determinants of agricultural technology adoption in Mozambique. Discussion Paper No. 67E. National Directorate of Studies and Policy Analysis. Ministry of Planning and Development. Republic of Mozambique.

VAN DEN BAN & HAWKINS, H. S., 1996. Agricultural Extension. 2nd edition, Longman, London, U. K.

VEEN V, D M., 2010. Agricultural innovation: invention and adoption or change and adaptation? *World Archaeology* Vol 42 (i) 1-12.

VIKI, G. T., CULMER, M. J, ELLER, A. & ABRAMS, D., 2006. Race and willingness to cooperate with the police: The roles of quality of contact, attitudes towards the behavior and subjective norms. *British Journal of Social Psychology*. 45, 285-302.

WILLOCK, J., DEARY, I.J., GREGOR, M.M., SUTHERLAND, A., EDWARD-JONES,G., MORGAN, O., DENT, B., GRIVE, R., GIBSON G. &. AUSTIN, E., 1999. Farmer's attitudes, objectives, behaviors, and personality traits: The Edinburgh study of decision making on farms. *Journal of Vocational Behavior*. 54: 5-36.

YU, B., NIN-PRATT, A., FUNES, J. & GEMESSA, S. A., 2011. Cereal Production and Technology Adoption in Ethiopia. IFPRI Discussion paper 31 (*http;//www.ifpri.org/publication/Ethiopia-strategy-support-program-essp*).

Appendix 1

QUESTIONNAIRE

Confidentiality
Lekunutu
We are studying farmers' adoption behavior and would appreciate your answers to the following questions. Your answers will be anonymous and will not be disclosed to anybody.

PART 1 A Demographic Information

1.0 **Respondents Name**……. ☐ V1
Lebitso la moarabi

1.1 **Location of farm**……
Sebaka seo masimo a leng ho sona
South Africa/Free State/Qwaqwa (1) ☐ V2
Lesotho/Leribe (2)

1.2 ***State farmers association you belong***…… ☐ V3
Bolela mekhatlo ea lihoai eo o leng setho ho eona.....
NAFU (1)
Tractor Owners Association (2)
Other (3)
None (4)

1.3 ***Gender*** Male (1) ☐ V4
Female (2)
Botona kapa bots'ehali Motho e motona (1)
Motho e mots'ehali (2)

1.4 ***Age***
How old are you …….. ☐ V5
U lilemo li kae? .....

1.5 Below 30 years (1) ☐ V6
30-40 (2)
40-50 (3)
50-60 (4)
Above 60 (5)
Lilemo Tse ka tlase ho 30
30-40
40-50
50-60
Tse ka holimo ho 60

1.6 ***Literacy Level***

Boemo ba ho tseba ho bala le ho ngola
Which of these languages can you ***read?***
Ke life tsa lipuo tse latelang tseo u tsebang ho li bala?

English	☐	V7
Afrikaans	☐	V8
Zulu	☐	V9
Xhosa	☐	V10
Sesotho	☐	V11
Other (State)……	☐	V12
Tse ling (Hlalosa).....	☐	

(1) Not at all; (2) With difficulty; (3) Fairly well; (4) Very well
(1) Ho hang feela; (2) Ka thata; (3) Hantle feela; (4) Hantle haholo

1.7 ***Number of years of formal education***…… ☐ V13

Bolela lilemo tseo u linkileng sekolong.....

Up to 7 years Ho fihla ho 7	(1)
8-10 years	(2)
11-12 years	(3)
More than 12 years Tse ka holimo ho tse 12	(4)
Not Stated	(5)

☐

1.8 ***How many years have you been a farmer***…… **……** V14

Bolela lilemo tseo u bileng sehoai ka tsona

1-4years	(1)
5-9	(2)
10-14	(3)
15-19	(4)
More than 20 years Ho feta lilemo tse 20	(5)

1.9 ***Do you have any other job*** ☐ V24

Na u na le mosebetsi o mong ka thoko

Yes/Ee	(1)
No/Che	(2)

1.10 ***If you have another job state time spent in farming*** V25
Haeba u na le mosebetsi o mong bolela nako e qetoang temong

Up to/ ho fihla ho	25%	(1)
	25% - 50%	(2)
	50% - 75%	(3)
	75% - 100%	(4)

1.11 Do you irrigate your **maize** farm? (**field**) V26
Na u nosetsa **masimo** a hao?

Yes/ Ee	(1)
No/ Che	(2)

1.12 Do you irrigate the entire maize farm
Na u tšella masimo ‘ohle a poone

Yes/Ee	(1)	V27
No/Che	(2)	

1.13 If the answer to 1.12 is No state percentage under irrigation V28
Haeba karabo sebakeng sa 1.12 ke che hlalosa karolo lekholong e tšeloang
……..

1.14 ***What is important to you as a farmer (Value orientation)***
Rank in order of importance
Bolela lebaka le entseng hore u khethe hoba sehoai.....
Hlahlamisa mabaka ka ho ea ka bohlokoa ba ona
(1) Making maximum income
Ho etsa moputso o holimo
(2) Making a satisfactory income
Ho etsa moputso o khotsofatsang
(3) Gaining recognition, prestige as a farmer in my community
Ho tsebahala le ho iphumanela maemo a hoba sehoai motseng oa heno
(4) Belonging to a farming community
Ho amoheleha lihoaing tse ling
(5) Feeling pride of ownership
Ho ikhatša ka seo u nang le sona
(6) Gaining self-respect for doing a worthwhile job
Ho iphumanela hlompho ka ho etsa mosebetsi o hlomphehang
(7) Enjoyment of work tasks
Ho ba u thabela mosebetsi oo
(8) Purposeful activity, value in hard work
Ho etsa mosebetsi o nang le sepheo, le ho rata ho sebetsa ka thata

V16	V17	V18	V19	V20	V21	V22	V23

PART 1 B

Problem Perception
Chebo ea mathata

1.15 What is your total arable land area (leased+own land) …….ha (**acres**) V29
Kakaretso ea sebaka sa hao sa temo ke bokae (e hiriloeng 'moho le eo e leng ea hao ka ho phethahala)..... **liekere**

1.16 What is the area under maize cultivation……ha/acres V30
Ke sebaka se sekae se lengoang poone.....liekere

Less that 20 acres (8 ha) Ka tlaase ho liekere tse 20	(1)
21-50 acres/liekere (8 – 20ha)	(2)
51-100 acres/liekere (20 – 40ha)	(3)
101-150 acres/liekere (40 – 60 ha)	(4)
151-200acres/liekere (60 – 80 ha)	(5)
201 – 250 acres	(6)
251 – 300 acres	(7)
301 – 350 acres	(8)
351 – 400 acres	(9)
Greater than 400 acres	(10)

1.17 Percentage of land under maize cultivation…… V31
Karolo lekholong e lenngoeng poone.....

Up to 20 percent	(1)
21-40%	(2)
41-60%	(3)
61-80%	(4)
Greater than 80%	(5)

1.18 What is your total yield in a normal year ….ton/ bags/ V32
Kotulo ea hao selemong se hantle ke bokae…..litone/mekotla

1.19 What is the yield /acre/ha in normal year……. V32
Kakaretso ea kotulo ea hao ke bokae?.....

0.0 – 4.9 bags	(1)
5.0 – 9.9 bags	(2)
10.0 – 14.9 bags	(3)
15.0 – 19.9 bags	(4)
20.0 – 24.5 bags	(5)
25.0 – 29.9 bags	(6)
30.0 – 34 .9 bags	(7)

35.0 – 40 bags (8)
40 bags and above (9)

2.0 Are you satisfied with your yield/acre/ha? ☐ V33
Na u khotsofetse ke **kotulo** ea hao?

Yes/ Ee (1)
No/ Che (2)

2.1 What yield level do you want to achieve per ha/acre ☐ V34
Ke kotulo e kae eo u lakatsang ho e fumana.....liekere

2.2 What prevented you to achieve your expected yield ☐ V35
Ke eng e u hlolisitseng ho fumana kotulo ee?

0.0 – 9 bags
10 – 19 bags
20 – 29 bags
30 – 39 bags
40 – 49 bags
50 – 59 bags
60 – 69 bags
70 – 79 bags
80 – 89 bags
90 – 99 bags
100 bags and above

2.3 How do you plan to achieve this yield ☐ V36
U rerile ho fihlela kotulo e joang?

PART 1C

practice of LIMING

TS'EBELISO EA LIME

Farmer's behavioral practices
Mekhoa ea ts'ebetso ea lihoai

2.4 Have you ever applied lime? V37
Na u se u kile oa tšela lime? [ ]

Yes/Ee (1)
No/Che (2)

2.5 **Soil Type (state the predominant type)**
Mofuta oa mobu (bolela mofuta o hlaheletseng)

Sandy (1)
Lehlabathe
Loam (2)
Selokoe
Clay (3)
Letsopa
Clay Loam (4)
Sandy Loam (5)
(Other) (6)

2.6 State the last time you applied lime (Year) [ ] V39
Hlalosa nako eo u qetetseng ho tšela lime ka eona (selemo)

2.7 **Type of lime applied** [ ] V40
Mofuta oa lime o sebelisitsoeng

Don't know (1)
Dolomite (2)
Calcite (3)

2.8 What type of lime was recommended [ ] V41
Ke mofuta ofe oa lime o khothaletsoang

Don't know (1)
Ha ke tsebe
Dolomite (2)
Calcite (3)

Score (Right answer 1: Wrong answer (2) **[ ]**

2.9 In your view what is the best type of lime [ ] V42
Ka ho ea ka uena ke mofuta ofe oa lime o hantle haholo

2.10 **Rate of application tons/ha (tons/acre)** ☐
Litekanyo tsa ho ts'ela tone/ ekereng V43

Don't know (1)
Above 5tons/ha (100bags) (2)
Ka holimo ho litone tse hlano heketareng
1 ton/acre/ha (20 bags) (3)
2 tons/acre/ha (40 bags) (4)
2-5 tons/acre/ha (40 – 100 bags) (5)

2.11 What is the recommended rate ☐ V44
Ke litekanyetso tse kae tse khothaletsoang
Don't Know (1)
Ha ke tsebe
Above 5tons/ha (100bags) (2)
Ka holimo ho litone tse hlano heketareng
1 ton/acre/ha (20 bags) (3)
2tons/ acre/ha (40 bags) (4)
2-5tons/acre/ha (40 -100 bags) (5)
Other (6)

Score (Right answer 1: Wrong answer (2)

2.12 In your view what is the best rate of application ☐
Ka ho ea ka uena ke litekanyetso life tse hantle haholo

2.13 **Method for application** ☐ V45
Mokhoa oa ho ts'ela
Don't know (1)
Split over several seasons (2)
Ho arotsoe ka linako tsa selemo
All in one season/once off (3)
Ho ts'etsoe kaofela ka nako e le 'ngoe ea selemo

2.14 What is the recommended method ☐ V46
Ke mokhoa ofe o khothaletsoang
Don't know (1)
Ha ke tsebe
Split over several seasons (2)
Ho arotsoe ka linako tsa selemo
All in one season/once off (3)
Ho tšetsoe kaofela ka nako e le 'ngoe ea selemo

Other (4)

Score (Right answer 1: Wrong answer (2)

2.15 In your view what is the best method ☐ V 47
Ka ho ea ka uena ke mokhoa ofe o motle haholo

Frequency of lime application ☐ V 48

2.16 **Makhetlo ao lime e ts'eloang ka oona**

Don't know (1)
Every year (2)
Selemo se seng le se seng
Every 2-3 years (3)
Lilemo tse ling le tse ling tse 2 ho isa ho tse 3
Every 4-5 years (4)
Lilemo tse ling le tse ling tse 4 ho isa ho tse 5

2.17 What is the recommended frequency ☐ V 49
Ke makhetlo a makae a khothaletsoang
Don't know (1)
Ha ke tsebe
Every year (2)
Selemo se seng le se seng
Every 2-3 years (3)
Lilemo tse ling le tse ling tse 2 ho isa ho tse 3
Every 4-5years (4)
Lilemo tse ling le tse ling tse 4 ho isa ho tse 5
Other (5)

Score (Right answer 1: Wrong answer (2)

2.18 In your view what is the best frequency? ☐ V50
Ka ho ea ka uena ke makhetlo a makae a hantle haholo?

2.19 **How do you prepare your land when applying lime** ☐ V51
U lokisa mobu oa hao joang ha u tšela lime

Applied before land preparation (1)
E tšeloa pele mobu o lokisoa
Disc before lime application (2)
U tetša pele u tšela lime
Plough before apply lime (3)
U lema pele u tšela lime
disced and ploughed before lime application (4)

U tetša le ho lema pele u tšela lime
Rip before lime application (5)

3.0 **What is the recommended way to prepare land when you want to apply lime**
Ke mokhoa ofe u khothaletsoang oa ho lokisa mobu ha u tšela lime V52

Don't know (1)
Ha ke tsebe
Apply before land preparation (2)
Tšela pele u lokisa mobu
Disc before lime application (3)
Tetša pele u tšela lime
Plough before lime application (4)
Lema pele u tšela lime
Disc and plough before lime application (5)
Tetša u leme pele u tšela lime
Rip before lime application (6)

Score (Right answer 1: Wrong answer (2)

3.1 In your view what is the best way to prepare land before applying lime
Ka ho ea ka uena ke mokhoa ofe u nepahetseng haholo oa ho lokisa mobu pele u tšela lime V53

3.2 On a scale of 1 (low) to 9 (High) state how good is your liming practice (efficiency)
Sekaleng sa ho tloha ho 1 (e le tlaase) ho ea ho 9 (e le holimo) hlalosa hore na ho tšela lime hoa hao ho nepahetse ha kae V 54

1 2 3 4 5 6 7 8 9

3.3 **General level of adoption of liming practice as assessed by enumerators out of 9 points**
Boemo bo akaretsang ba ts'ebeliso/kamohelo ea lime ka ho ea ka mobatlisisi ho lima lintlha tse 9 V55

1 2 3 4 5 6 7 8 9

Difference in score [ ]

3.4 **Needs Tension** V56

What is your goal (what are you striving to achieve) in applying lime to your soil

Maikemisetso a hao ke afe (u leka ho fihlela eng) ka ho tšela lime mobung oa hao

☐

3.5 **What would say are the advantages of liming? Rank them in order of importance**
Ebe u ka re melemo ea ho ts'ela lime ke efe? E hlahlamise ka ho ea ka bohlokoa ba eona

☐ V59

3.6 **What are the disadvantages/limitationsof liming**
Ebe mathata a bakoang ke ho ts'ela lime ke afe?

☐ V63

3.7 **Need Compatibility**
Tlamahano ea litlhoko

Your normal average yield is….tons/ha, bags/acre
Ebe kotulo ea hao ha joale ke bokae?.....litone/ ekereng

☐ V66

What do you think the average yield would be if you had used the recommendations ….tons/ha, bags/acre
Ebe u nahana hore kotulo e ne e kaba bokae haeba u ne u sebelisa litekanyetso tse khothaletsoang.....litone/ ekereng

☐ V67

What do you think your average yield would have been without applying the lime ……..tons/ha/bags/acre
Ebe u nahana hore kotulo ea hao e kabe e le bokae ha u ne u sa sebelisa lime

☐ V68

☐

3.8 **Situational compatibility**
Nyalano ea maemo

What is preventing/would prevent you from applying lime to your soil
Ke ling tse ka u thibelang ho ts'ela lime mobung oa hao

☐ V69

Part 1D

rate and type of fertilizer application – 1ST APPLICATION
LITEKANYO LE MOFUTA OA MANYOLO O TS'ELOANG – HO TS'ELOA HOA PELE

Farmers behavioral practice
Mekhoa ea ts'ebetso ea lihoai

3.8 **Do you apply fertilizer at planting**

Yes/Ee	(1)
No/Che	(2)

3.9 **Type of Fertilizer** [ ] V70
Mofuta oa manyolo

4:2:1	(1)
3:2:1 (32)	(2)
3:2:1 (25)	(3)

3.10 What is the recommended type of fertilizer [ ] V71
Ke mofuta ofe oa manyolo o khothaletsoang

Don't know	(1)
Ha ke tsebe	
4:2:1	(2)
3:2:1 (32)	(3)
3:2:1 (25)	(4)

Score (Right answer 1: Wrong answer (2) [ ] V72

3.11 In your view what is the best type of fertilizer to use
Ka ho ea ka uena ke mofuta ofe oa manyolo o motle haholo

Rate of application (Kg/ha/acre.) [ ] V73

3.12 Litekanyetso tsa ho ts'ela (Kg/ha/liekere)

Don't Know	(1)
Up tp 50kg/acre (1 bag)	(2)
Ho fihla ho 50kg/ekereng	
Up to 150kg/ha (3 bags)	(3)
Ho fihla ho 150kg/ekereng	
50 – 100kg/acre (1 to 2 bags)	(4)
150 – 300kg/ha (3 to 6 bags)	

3.13 What is the recommended rate to apply [ ] V74
Ke litekanyetso tse kae tse khothaletsoang ho tšeloa

Don't know	(1)
Ha ke tsebe	

Up to 50kg/acre (1 Bag) (2)
Ho fihla ho 50kg/ekereng
Up to 150kg/ha (3 bags) (3)
Ho fihla ho ho 150kg/ekereng
50 – 100kg/acre (1 – 2 bags) (4)
150 – 300kg/ha (3 – 6 bags)
Other (5)

Score (Right answer 1: Wrong answer (2)

3.14 In your view what is the best rate to apply ☐ V75
Ka ho ea ka uena ke litekanyetso life tse hantle haholo

3.15 **Time of application** ☐ V 76
Nako ea ho ts'ela
Don't know (1)
Before planting (2)
Pele ho lengoa
After planting (3)
Kamora ho lema
During planting (4)
Nakong ea ho lema

3.16 What is the recommended time for application ☐ V 77
Ke nako efe e khothaletsoang sebakeng sa ho tšela
Don't' Know (1)
Ha ke tsebe
Before planting (2)
Pele ho lengoa
After planting (3)
Kamora ho lema
During Planting (4)
Nakong ea ho lema

Score (Right answer 1: Wrong answer (2)

3.17 In your view what is the best time to apply V 78
Ka ho ea ka uena ke nako efe e hantle haholo ea ho tšela
Don't' Know (1)
Ha ke tsebe

3.18 **Method of application** ☐ V 79
Mokhoa oa ho ts'ela
Broadcasting (1)
Ho ts'ela ka ho hasanya hohle

	Furrow ho ts'ela meleng feela	(2)		
	Band placing ho ts'ela pela sejalo feela	(3)		
3.19	What is the recommended method of application Ke mokhoa ofe o khothaletsoang oa ho tšela		☐	V 80
	Don't know Ha ke tsebe	(1)		
	Broadcasting Ho ts'ela ka ho hasanya hohle	(2)		
	Furrow ho ts'ela meleng feela	(3)		
	Band placing ho ts'ela pela sejalo feela	(4)		
	Score (Right answer 1: Wrong answer (2)			
4.0	In your view what is the best method Ka ho ea ka uena ke mokhoa ofe oa ho tšela o motle haholo		☐	V 81
4.1	On a scale of 1 to 7 state how good is your application of fertilizer at planting Sekaleng sa ho tloha ho 1 (e le tlaase) ho ea ho 7 (e le holimo) hlalosa hore na mokhoa oa hao oa ho tšela o motle ha kae ka nako ea ho lema		☐	V 82
	1 2 3 4 5 6 7			
4.2	**General level of adoption of 1st fertilizer application practice as assessed by enumerators out of 7** **Boemo bo akaretsang ba ts'ebeliso ea ho ts'eloa hoa bobeli hoa manyolo ka ho ea ka mo**		☐	V 83
	1 2 3 4 5 6 7			
	Difference in score			

4.3 **Needs tension** V 84
Tlamahano ea litlhoko
What is your goal (what are you striving to achieve) in applying fertilizer to your soil during planting
Maikemisetso a hao ke afe (u batla ho fihlela eng) ka ho tšela manyolo mobung oa hao nakong ea ho lema

☐ V 87

4.4 **Need Compatibility**
Nyalano ea litlhoko
Your normal average yield is……..kg/ha: bags/acre
Kotulo ea hao ea ha joale ke bokae?.....kg/ekere: mekotla/ekere

4.5 What do you think it your normal aveage yield would be without 1st application of fertilizer ……kg/ha ☐ V 89
U nahana hore e kabe e le bokae ntle ho ho ts'ela manyolo lekhetlo la pele?.....kg/ekere

4.6 What do you think the yield would be if you had applied the fertilizer V90
U nahana hore kotulo ea hao e kabe e le bokae ha u ne u tšetse manyolo

4.7 **What would you say are the advantages of application of fertilizer during planting.** ☐ V 91
Ebe u ka re melemo ea ho ts'ela manyolo nakong ea ho lema ke afe?

4.8 **What would you say are the disadvantages of 1st application.** ☐ V 92
Ebe u ka re mathata a ho ts'ela manyolo lekhetlo la pele ke afe?

4.8 **Situational Compatibility** ☐ V 93
Nyalano ea maemo
What is preventing/would prevent you from applying the fertilizer at planting.
Ebe ke ling tse u thibelang ho ts'ela manyolo nakong ea ho lema.

PART 1E

Subjective Norm
Litšekamelo ho ea ka tšutšumetso

In considering the use of fertilizer at planting, there might be individuals or groups who would think you should or should not perform this behavior. Please rate the extent to which you agree with the statements with respect to your adopting fertilizer use
Ho nahaneng ho sebelisa mofuta ona oa peo ho ka na hoa eba le motho kapa batho ba nahanang hore u ka etsa kapa oa tlohela ts'ebetso ena. Ka kopo bonts'a hore na u lumallana le taba ena hakae u ipapisitse le ts'ebeliso ea manyolo ona oa peo

Normative belief
Tumelo e tloaelehileng

4.9 Most people who are important to me think I should apply fertilizer during planting

Batho ba bangata ba bohlokoa ho 'na ba nahana hore ke sebelise mokhoa ona
Likely - - -: --- ---: ---: ---: ---: ---: unlikely V94
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7
Ho ka etsahala Ho ke se etsahale
Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

5.0 Extension agents think I should apply fertilizer during planting

Mosupisi/ Mofani oa lits'ebeletso o nahana hore ke sebelise mokhoa ona V 95
Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7
Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

5.1 My close friends think I should apply fertilizer during planting

Metsoalle e pelaka e nahana hore ke sebelise mokhoa ona V 96
Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7
Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

5.2 Members of my association/cooperative think I should apply fertilizer during planting

Litho tsa mokhatlo oa ka/ koporasi li nahana hore ke sebelise mokhoa ona V 97

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

Motivation to comply
Tšutšumetso ea ho etsa se hlokahalang

5.3 In general, how much do you want to do what most people who are important to think you should do
Ka kakaretso, ke ha kae u batlang ho etsa seo batho ba bohlokoa ho uena ba reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale V98
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

5.4 In general, how much do you want to do what your extension agent think you should do

Ka kakaretso, ke ha kae u batlang ho etsa seo Mosupisi/Mofani uena ba reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale V99
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

5.5 In general, how much do you want to do what your close friends think you should do
Ka kakaretso, ke hakae u batlang ho etsa seo metsoalle e haufi le uena e reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7 V 100

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

5.6 In general how much do you want to do what your association/cooperative members think you should do?
Ka kakaretso, ke hakae u batlang ho etsa seo litho tsa mokhatlo/ koporasi ea hao li reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely ☐
Ho ka etsahala Ho ke se etsahale V 101

Extremely	quite	slightly	neither	slightly	quite	extremely
1	2	3	4	5	6	7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

PART 1F

RATE AND TYPE OF FERTILIZER APPLICATION – TOP DRESSSING
LITEKANYETSO LE MOFUTA OA MANYOLO A TŠELOANG – Manyolo a tšeloang lijalo li se li metse

Farmers behavorial practice
Mekhoa ea ts'ebetso ea lihoai

5.7 **Do you top dress** [ ] V102
Na u tšela manyolo a tšeloang lijalo li se li metse

Yes/No	(1)
No/che	(2)
Sometimes /Ka nako e 'ngoe	(3)

5.8 **Type of fertilizer** [ ] V103
Mofuta oa manyolo

3:2:1(32)	(1)
UREA (46)	(2)
LAN (28)	(3)
Other	(4)

5.9 What is the recommended fertilizer for top dressing…….. [ ] V104
Mofuta oa manyolo o khothaloetsoang bakeng sa manyolo a tšeloang lijalo li se li metse ke ofe……..

Don't know	(1)
Ha ke tsebe	
3:2:1(32)	(2)
UREA (46)	(3)
LAN (28)	(4)
Other	(5)

Score (Right answer 1: Wrong answer 2) [ ] V105

5.10 What in your view is the best fertilizer to apply V106
Ka ho ea ka uena ke mofuta ofe oa manyolo o motle haholo o ka tšeloang

5.11 **Rate of application** (Kg/ha/acre.) [ ] V107
Litekanyetso tsa ho ts'ela (Kg/ha)

100 – 150kg/acre (2 - 3 bags)	(1)

	200 -250kg/ha (4 – 5 bags) 50kg/acre (1 bag)	(2)		
	100 – 150kg/ha (2 -3 bags) Other	(3)		
5.12	What is the recommended rate Ke litekanyetso life tse khothaletsoang			V108
	Don't know Ha ke tsebe	(1)		
	100 – 150kg/acre	(2)		
	200 -250kg/ha 50kg/acre	(3)		
	100 – 150kg/ha Other	(4)		
	Score (Right answer 1: Wrong answer 2)		[ ]	V109
5.13	What in your view is the best rate to apply Ka ho ea ka uena ke litekanyetso life tse hantle tsa ho tšeloa			V110
5.14	**Time of application** **Nako ea ho ts'ela**			V111
	More than 4 weeks after germination Ho feta libeke tse 'ne kamora ho mela hoa lijalo	(1)		
	3 weeks after germination Libeke tse tharo kamora ho mela hoa lijalo	(2)		
	4 weeks after germination Libeke tse 'ne kamora ho mela hoa lijalo	(3)		
5.15	What is the recommended time to apply Ke nako efe e khothaletsoang ea ho tšela			V112
	Don't know Ha ke tsebe	(1)		
	More than 4 weeks after germination Ho feta libeke tse 'ne kamora ho mela hoa lijalo	(2)		
	3 weeks after germination Libeke tse tharo kamora ho mela hoa lijalo	(3)		
	4 weeks after germination Libeke tse 'ne kamora ho mela hoa lijalo	(4)		
	Other	(5)		
	Score (Right answer 1: Wrong answer 2)			

5.16 What in your view is the best time to apply
Ka ho ea ka uena nako e hantle ea ho tšela ke efe

V113

5.17 **Method of application**
Mokhoa oa ho ts'ela

broadcasting (1)
ho hasa
On top of the soil (2)
ho ts'ela ka holima mobu
Beneath soil level (3)
Ho ts'ela ka tlasa mobu

V114

5.17 What is the recommended method of aplication
Ke mofuta ofe o khothaletsoang

Don't know (1)
Ha ke tsebe
Broadcasting (2)
ho hasa
On top of the soil (3)
ho ts'ela ka holima mobu
Beneath soil level (4)
Ho ts'ela ka tlasa mobu
Other (5)

V115

Score (Right answer 1: Wrong answer 2)

V116

5.18 What in your view is the best method
Ka ho ea ka uena mokhoa o motle oa ho tšela ke ofe

V117

5.19 **On a 7 point scale (low to high) how good is your 2nd application of fertilizer**
Sekaleng se fellang ka 7 (ho tloha tlaase ho ea ho limo) ho tšeloa hoa manyolo lekhetlo la bobeli ho hantle ha kae

1 2 3 4 5 6 7

V118

6.0 **General level of adoption of 2nd fertilizer application practice as assessed by enumerators out of 7 point scale**
Boemo bo akaretsang ba ts'ebeliso ea ho ts'eloa hoa bobeli hoa manyolo ka ho ea ka

1 2 3 4 5 6 7

V119

6.1	**Needs tension** **Tlamahano ea lithloko** What is your goal (what are you striving to achieve) in applying fertilizer to your soil during the growth of the plant Maikemisetso a hao ke afe (u lebelletse ho fihlela eng) ka ho tšela manyolo mobung oa hao nakong ea kholo ea lijalo	☐	V120
6.2	**Need Compatibility** **Nyalano ea litlhoko** Your normal average yield is……..kg/ha; bags/acre Kotulo ea hao ea ha joale e kae?.....kg/ekere	☐	V121 V122 V123
6.3	**What do you think the normal average would have been without 2nd application of fertilizer ……kg/ha** U nahana hore e kabe e le bokae ntle ho ho ts'ela manyolo lekhetlo la bobeli?.....kg/ekere		
6.4	What do you think the normal average yield would be if you had applied the 2nd fertilizer …….kg/ha bags/acre U nahana hore e kabe e le bokae haeba u ne u tšetse manyolo lekhetlo la bobeli…….kg/ekereng mekotla/ekereng		V124
6.5	**What would you say are the advantages of 2nd application of fertilizer?** **Ebe u ka re melemo ea ho ts'ela manyolo lekhetlo la bobeli ke efe?**	☐	V125
6.6	**What would you say are the disadvantages of 2nd application?** **Ebe u ka re mathata a ho ts'ela manyolo lekhetlo la bobeli ke afe?**	☐	V126
6.7	**Situational Compatibility** **Nyalano ea maemo** What is preventing/would prevent you from carrying out 2nd application. (rank them in order of importance) Ebe ke ling tse ka u thibelang ho ts'ela manyolo lekhetlo la bobeli (lihlahlamanye ka ho ea ka bohlokoa ba tsona)	☐	V127

PART 1G

CHOICE OF MAIZE VARIETY

KHETHO EA MOFUTA OA POONE

Farmers behavioral practices
Mekhoa ea ts'ebetso ea lihoai

Do you use improved seeds

6.8

Yes/Ee (1)
No/Che (2)

Type of Seed ☐ V128
Mofuta oa peo

Composite (1)
Peo e tsoang sesiung
Genetically modified (2)
Hybrid 6363/6479/SNK/2728/2021/2778/ (3)
ZM 521/ZM421/ZM303/ CRN3505
/PAN6335
Peo e ntlafalitsoeng

6.9 What is the recommended variety ☐ V129
Ke mofuta ofe o khothaletsoang

Don't know (1)
Ha ke tsebe
Composite (2)
Peo e tsoang sesiung
Genetically modified (3)
Hybrid 6363/6479/SNK/2728/2021/2778/ (4)
ZM 521/ZM421/ZM303/ CRN3505
/PAN6335
Peo e ntlafalitsoeng
Other (5)

Score (Right answer 1: Wrong answer 2) V130

6.10 In your view what is the best variety ☐ V131
Ka ho ea ka uena ke mofuta ofe o motle haholo

6.11 **Source of Seed** ☐ V 132
Mohloli oa peo

	Other farmer Lihoai tse ling	(1)		
	Self Uena	(2)		
	Farmers association/Seed Company/ Ministry of Agric/Coerative Society Mokhatlo oa lihoai/Feme ea peo/Lekala la temo la 'muso/mokhatlo oa likoporasi	(3)		
	Other	(4)		
6.12	What is the recommended source for seeds Ke mohloli ofe oa peo o khothaletsoang			V133
	Don't know Ha ke tsebe	(1)		
	Other farmer Lihoai tse ling	(2)		
	Self Uena	(3)		
	Farmers association/Seed Company/ Ministry of Agric/Cooperative Society Mokhatlo oa lihoai/feme ea peo/lekala la temo la 'muso/mokhatlo oa likoporasi	(4)		
	Other	(5)		
	Score (Right answer 1: Wrong answer 2)			V134
6.13	In your view what is the best source of seeds Ka ho ea ka uena ke mohloli ofe o motle oa peo			V135
6.14	**On a scale of 1 (low) to 4 (high), how do you rate your use of improved seed Sekaleng sa ho tloha ka 1 (e le tlaase) ho ea ho 4 (e le holimo)** 1 2 3 4			V136
6.15	**General level of adoption of improved variety Assessed by the enumerator Boemo bo akaretsang ba ts'ebeliso ea ho ts'eloa hoa bobeli hoa manyolo ka ho ea ka mobatlisisi** 1 2 3 4			V137
	Difference in score			

6.16 **Need tension (Yes 1: No 2)** V138
Tlamahano ea litlhoko

What is your goal (what are you striving to achieve) by using improved seeds
Maikemisetso a hao ke afe (u lebelletse ho fihlela eng) ka ho sebelisa peo e ntlafalitsoeng

6.17 **Need Compatibility**
Your normal average yield is …tons/ha baga/acre V139
6.18 Kotulo ea hao ea ha joale ke bokae?.....tone/ekere

6.19 What will it be without the variety you are using ….tons/ha bags/acre V140
U nahana hore e kabe e le bokae ntle ho ts'ebeliso ea mofuta oa peo oo sebelisang?.....kg/ekere

7.0 What will the yield be if you had used the recommended variety? V141
U nahana kotulo e kabe e le bokae ha u ne u sebelisitse peo e khothaletsoang?

7.1 **What in your view are the advantages of using improved seed** V142
Ka ho ea ka uena ke makhabane afe a ho sebelisa peo e ntlafalitsoeng

7.2 **What in your view are the disadvantages of using improved seed** V143
Ka ho ea ka uena ke mathata afe a tlisoang ke ho sebelisa peo e ntlafalitsoeng

7.3 **Situational Compatibility**
What is preventing/would prevent you from using improved variety

PART 1H

Subjective Norm
Litšekamelo ho ea ka tšutšumetso

In considering the use of any farm practice there might be individuals or groups who would think you should or should not perform this behavior. Please rate the extent to which you agree with the statements with respect to your adopting the variety
Ho nahaneng ho sebelisa mofuta ona oa peo ho ka na hoa eba le motho kapa batho ba nahanang hore u ka etsa kapa oa tlohela ts'ebetso ena. Ka kopo bonts'a hore na u lumallana le taba ena hakae u ipapisitse le ts'ebeliso ea mofuta ona oa peo

Normative belief
Tumelo e tloaelehileng

7.4 Most people who are important to me think I should use improved farm practices

Batho ba bangata ba bohlokoa ho 'na ba nahana hore ke sebelise mokhoa ona
Likely - - -: --- ---: ---: ---: ---: ---: unlikely V144
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7
Ho ka etsahala Ho ke se etsahale
Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

7.5 Extension agents think I should use improved farm practices

Mosupisi/ Mofani oa lits'ebeletso o nahana hore ke sebelise mokhoa ona V145
Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7
Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

7.6 My close friends think I should use improved farm practices

Metsoalle e pelaka e nahana hore ke sebelise mokhoa ona V146
Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7
Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang
7.7 Members of my association/cooperative think I should use improved farm practices

Litho tsa mokhatlo oa ka/ koporasi li nahana hore ke sebelise mokhoa ona V147

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

Motivation to comply
Tšutšumetso ea ho etsa se hlokahalang

7.8 1 In general, how much do you want to do what most people who are important to think you should do
Ka kakaretso, ke ha kae u batlang ho etsa seo batho ba bohlokoa ho uena ba reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale V148
Extremely quite slightly neither slightly quite extremely

1 2 3 4 5 6 7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

7.9 In general, how much do you want to do what your extension agent thinks you should do?

Ka kakaretso, ke ha kae u batlang ho etsa seo Mosupisi/Mofani uena ba reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale V149
Extremely quite slightly neither slightly quite extremely
1 2 3 4 5 6 7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

7.10 In general, how much do you want to do what your close friends think you should do
Ka kakaretso, ke hakae u batlang ho etsa seo metsoalle e haufi le uena e reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale
extremely quite slightly neither slightly quite extremely

1 2 3 4 5 6 7 V150

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

7.11 In general how much do you want to do what your association/cooperative members think you should do
Ka kakaretso, ke hakae u batlang ho etsa seo litho tsa mokhatlo/ koporasi ea hao li reng u se etse?

Likely - - -: --- ---: ---: ---: ---: ---: unlikely
Ho ka etsahala Ho ke se etsahale V151

Extremely quite	slightly	neither	slightly	quite extremely
1 2	3	4	5	6 7

Khetha nomoro e nepahetseng ho tloha ho 1 ho ea ho 7 ha 1 e bontša khonahalo e kholo ea ho etsahala ho theoha joalo ho fihlela ha 7 e bontša ho se etsahale ho hang

PART 2

Self Efficacy
Boitsebelo

Can you do the following … Circle yes or no... and then indicate your degree of confidence regarding the following. Please circle one answer in each line based on a scale of 1-10 below ***(1 being low confidence and 10 highest confidence).***
Na u ka etsa tse latelang...Likaliketsa ee kapa che...ebe u bontša boitšepo ba hao ba ho atleha ho latela tse latelang. Ka kopo tšoaea karabo e le 'ngoe ka selikalikoe ho latela sekala sa ho tloha ka 1-10 ***(1 e le boitšepo botlaase ha 10 e le boitšepo bo holimo-limo).***

General Self-efficacy scale
Sekala se akaretsang sa boitsebelo

7.12 ***I will be able to achieve most of the goals I have set for myself.*** **Yes No** ☐

Ke tla tseba ho fihlela boholo ba merero eo ke ipehetseng eona. Ee Che
Degree of Confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V152

7.13 ***When facing difficult tasks, I am certain I will accomplish them.*** **Yes No** ☐

Ha ke shebane le mosebetsi o thata, ke na le bonnete ba hore ke tla u fihlela
Degree of Confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V153

7.14 ***In general I think I can obtain outcomes that are important to me.*** **Yes No** ☐
Ka kakaretso ka nahana hore nka fihlela lipheletso tse bohlokoa ho 'na. Ee Che
Degree of Confidence 1 2 3 4 5 6 7 8 9 10

Boemo ba boitšepo V154

7.15 ***I believe I can succeed at most endeavours to which I set my mind***. **Yes No** ☐

Ke lumela hore nka atleha boholong ba merero eo ke ipehelang eona. Ee Che
Degree of Confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V155

7.16 ***I will be able to successfully overcome many challenges.*** **Yes No**

Nka atleha ho hlola liphephetso tse ngata. Ee Che
Degree of Confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V156

7.17 ***I am confident that I can perform effectively on many different tasks.*** **Yes No**

Ke lumela hore ke na le bokhoni ba ho etsa mesebetsi e mengata e fapaneng. Ee Che

Degree of Confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V157

7.18 Compared ***to other people, I can do most tasks very well.*** **Yes No**

Papisong le batho ba bang, nka etsa boholo ba mesebetsi hantle haholo. Ee Che
Degree of Confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V158

7.19 ***When things are tough, I can perform quite well.*** **Yes No**

Leha maemo a le thata, nka sebetsa hantle haholo. Ee Che
Degree of Confidence 1 2 3 4 5 6 7 8 9 10
Maemo a boitšepo V159

Innovation
Boiqapelo

8.0 ***Engage in new venturing and new ideas*** **Yes No**

Ho ikamahanya le liphephetso le maikutlo a macha. Ee Che
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V160

8.1 ***Engage in new technologies/innovations*** **Yes No**

Ho ikamahanya boqaping ba lintho tse ncha Ee Che
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V161

Management
Tsamaiso

8.2 ***Reduce risk and uncertainty*** **Yes** **No**
Phokotso ea maemo a kotsi le a sa tsi tsang ☐

Ee Che
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V162

8.3 ***Develop plans to include innovations*** **Yes** **No** ☐

Ho etsa meralo e amang liphetoho Ee Che
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V163

Financial control
Taolo ea lichelete

8.4 ***Perform farm financial analysis*** **Yes** **No** ☐

Ho etsa litlhatlhobo tsa lichelete Ee Che
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V164

8.5 ***Develop financial systems and internal controls*** **yes** **No** ☐

Ho etsa meralo ea tsamaiso ea lichelete le taolo ea tšebeliso ea tsona Ee Che
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V165

Skills
Litsebo

8.6 ***Posses the skill to implement the technology/innovation*** **Yes** **No** ☐

Ho ba le tsebo le boiphihlelo ba ho phethahatsa boqapi bo bocha
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V166

8.7 ***Develop the skill to implement the technology/innovation*** **Yes** **No** ☐

Ho ntlafatsa litsebo tsa ho phethahatsa boqapi bo bocha le li-tla-morao tsa bona
Degree of confidence 1 2 3 4 5 6 7 8 9 10
Boemo ba boitšepo V167