CHAPTER 1

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Agriculture is the backbone of the Tanzanian economy accounting for about half of the national income and slightly more than half of merchandise exports. Also, about 80 percent of Tanzanians depend on agriculture as a source of food requirements (World Bank, 2001). This implies that progress in reducing poverty, malnutrition and food insecurity in Tanzania depends greatly on the performance of the agricultural sector.

The issue of improving agriculture in order to increase its productivity has been given due weight and attention in Tanzania. For example; after the independence in 1961, the government adopted a number of approaches towards agricultural development. These approaches include the Transformation Approach (1962-1966), the Improvement Approach (1963-1966), the Commodity Approach (1978-1983); while various projects were initiated such as the Sasakawa Global 2000 (1989-1998), the National Agricultural Extension Program (NALERP-1989-1996), the Southern Highlands Extension and Rural Finance Project (1994-2001), the National Agricultural Extension Project Phase II (NAEP-1996-2001), and the FAO Special Program for Food Security (1995 to – date) (Sicilima and Rwenyagira, 2001).

The main cash crops grown in the country include coffee, sisal, cashew, cotton, tobacco and pyrethrum. While the main food crops include maize, sorghum, millet, rice, wheat, pulses (mainly beans), cassava, potatoes and banana. Among these food crops, maize is the most important cereal food crop. This implies that, a shift towards self-sufficiency in food production in Tanzania depends to a greater extent on the improvement of maize production.

Njombe district is one of the districts that is famous for the production and supply of maize in the country. Most of the extension programmes like Sasakawa Global 2000 and others that had the purpose of promoting maize production practices in a package form, were initiated and introduced in areas particularly suited for maize production, like Njombe district. A package consists of the combined use of recommended maize varieties, fertilizers, seed spacing, pesticides application and weed control. Although many practices are recommended, few have been adopted by farmers, as a result low production efficiency has been a common phenomenon (Sicilima and Rwenyagira, 2001).

1.2 PROBLEM STATEMENT

Reasons for the non- or poor adoption of recommend practices have been associated with independent factors like farmers' characteristics and socio-economic, institutional and environmental factors (Rogers, 1983; Okoye, 1989; Anosike and Coughenour, 1990; Obinne, 1991; CIMMYT, 1993; Lugeye, 1994; Machumu, 1995). Due to the inconsistency of the findings as regards the relationship between independent variables and the adoption behaviour, other researchers (Düvel, 1975; Botha, 1985; Düvel and Scholtz, 1986; Koch, 1986; Koch, 1987; Düvel, 1995; Habtemariam, 2004) argue that the intervening variables namely; needs, knowledge and perception are the more direct and immediate precursors of the adoption behaviour. These opposing or even contradicting findings call for further investigations. In view of this, this study is designed with the main aim of comparing the role of independent and intervening variables in predicting the adoption behaviour among the maize growers in the Njombe district.

1.3 OBJECTIVES OF THE STUDY

The general objective of this study is to compare the independent and intervening variables with regard to their influence on the adoption behaviour of recommended maize production practices by maize growers in the Njombe district. Specifically, the study intends:

1. To establish the extent to which the recommended maize production practices are adopted by the farmers

2. To determine the current level of production efficiency which is assumed to be the consequence of the adoption of the various recommended practices.

3. To examine the influence of adoption behaviour on production efficiency attained

4. To evaluate the influence of independent variables on farmers' adoption behaviour in respect of each of the recommended practices

5. To determine the influence of intervening variables on farmers' adoption behaviour in respect of each of the recommended practices

6. To assess the comparative contribution of independent and intervening variables in prediction of the adoption behaviour.

7. To highlight the implication of the findings for future policy, research and extension interventions.

1.4 HYPOTHESES OF THE STUDY

Against the theoretical background, different models and empirical studies reviewed (see chapter 2), the following research hypotheses emerge:

1. The maize production efficiency is a function of the adoption of recommended maize production practices

2. The adoption of recommended maize production practices is influenced by the independent variables like farmer's age, sex, formal education and farm size. More specifically;

   2.1 Age of the respondents is negatively related to the adoption behaviour

2.2 The adoption of recommended maize production practices is higher among men than among women respondents' farmers

2.3 Farmers' formal education has a positive influence on adoption behaviour

2.4 The adoption level is higher among farmers with large farm sizes than those with small farms

3. The adoption of recommended maize production practices is influenced by the needs and perception related intervening variables like farmer's needs and perception, and more specifically;

3.1 the degree to which the own efficiency of adoption is overrated

3.2 the perceived compatibility of recommended maize production practices with needs (e.g. higher production efficiency or yields);

3.3 the perception of the attributes of maize production practices, namely

3.3.1 the overall prominence of the recommended practices relative to other alternatives;

3.3.2 the awareness of relative advantages of recommended maize production practices as is reflected in their number and strength;

3.3.3 the awareness of disadvantages of maize production practices, in the sense that the bigger the concern, reflected in the number and strength of disadvantages, the lower the level of adoption;

3.3.4 the imbalance of positive over negative forces, being the difference between positive and negative forces reflected both in numbers and strength.

4. The influence of intervening variables on adoption behaviour is higher than that of independent variables

1.5 SIGNIFICANCE OF THE STUDY

Although the study focuses on maize production and the adoption behaviour of maize farmers, the significance of the study goes well beyond it. In Tanzania's quest for food self-sufficiency and improved production efficiency, the behaviour insights gained from this study can prove useful not only for maize production but for extension in all fields of agriculture. Regarding maize production, the recommended production packages can be assessed in terms of their appropriateness regarding the production and economic performance as well as in terms of their acceptability by farmers (farmers adoption behaviour).

The results of this study can, therefore, provide a useful guide for policy formulation, identification of research priorities and for improving extension approaches, strategies and programs., This will enhance adoption of recommended packages and subsequently increase agricultural production efficiency, which is the primary objective of the country.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the various models of behaviour change and also the empirical studies conducted in the area of independent and intervening variables in determining adoption behaviour. The review provides a theoretical background that facilitates in formulation of research hypotheses and determines the conceptual model and research focus of this study.

2.1 MODELS OF BEHAVIOUR CHANGE

According to Berelson and Steiner (1964) human behaviour is far more variable and therefore less predictable. The range of behaviour available to any given man, as well as the range that exists across men, is far broader than anywhere else in the animal kingdom. This is due to the fact that human behaviour is more dependent upon learning and less regulated by instinct or other innate behavioural predispositions than the behaviour of lower animals. Albert Einstein is quoted by Jacobsen (1983) to have said: “It is harder to understand the behaviour of human beings than to understand that of atoms” (Düvel, 1991).

Due to the complex nature of human behaviour various theories and models have been developed in an attempt to understand and predict human behaviour. Some of these theories and models include the Traditional Approaches, the Classical 5-Stage Adoption process, the Campbell Model, the Innovation Decision-Making process, the field theory, the Tollman-Model, the Theory of Reasoned action, and Düvel’s Behaviour Analysis model. These models will be discussed briefly.

2.1.1 Traditional Approach

In a critical analysis of adoption research development, Albrecht (1964) as quoted by Düvel (1991), identified five distinguishable approaches. These are the teaching method approach, socio-cultural approach, atomistic communication approach, socio-structural communication approach and situational-functional approach.
In all approaches, except the last, generalisations are made regarding the influence of certain categories of variables, but these could not be upheld. The distinct contribution of the situational-functional approach lies in the fact that behaviour change is not regarded as the cause of a single factor like methodology of teaching, cultural ties or communication, but rather the function of an interplay of a number of dynamic inter-dependent factors making up the situation (Düvel, 1991).

2.1.2 The 5-Stage or "Classical" adoption Process

Wilkening (1953) and Bohlen (1957) as quoted by Semgalawe (1998), maintain that, consciously or unconsciously, every person goes through certain mental steps during the learning process. Based on this and other research findings the North Central Rural Committee (1961) developed a model consisting of five stages that an individual passes through before complete adoption of an innovation (Düvel, 1991). These are:

1. Awareness: The individual gets to know about the existence of the innovation but has little or no information about it.

2. Interest: The individual becomes interested in the idea and seeks more information about it.

3. Evaluation: The individual mentally applies the innovation to his present and anticipated future situation, and then decides whether or not to try it.

4. Trial: The individual uses the innovation on a small scale in order to determine its utility in his own situation. He may seek specific information about the method of using the innovation at the trial stage.

5. Adoption: At this stage the individual decides to continue the full use of the innovation.

However, the classical adoption process model has been criticized from various quarters, with the main criticism being that the process does not necessarily begin with an awareness of an innovation, that it does not provide for non-rational processes, that the evaluation can take place at different stages and that it does not necessarily end with adoption as the adoption process implies.

2.1.3 The Campbell-Model

Based on the criticisms of the 5-stage of classical adoption process, Campbell (1966) came up with a new model with significant modifications to the above. According to him the process can start by the awareness of a problem, or the awareness of an innovation, which may create a problem or dissonance. He thus made a distinction between problem-oriented decisions and innovation - oriented decisions another adaptation he made is provision for the fact that adoption decisions can be rational or non-rational. By combining the various alternatives, he came up with four types within the adoption process (Fig 2.1).

In each type, he also proposed various stages that an individual can pass as follows:

1. Rational – Problem oriented type
Stages: i) Problem ii) Awareness iii) Evaluation iv) Rejection or Trial v) Adoption or rejection

2. Rational - Innovation oriented
Stages: i) Awareness ii) Interest iii) Evaluation iv) Rejection or Trial v) Adoption or rejection

3. Non - Rational – Problem – Oriented
Stages: i) Problem ii) Awareness iii) Adoption or Rejection iv) Resolution (Including information seeking)

4. Non- Rational –Innovation- Oriented

Stages: i) Awareness ii) Adoption or Rejection iii) Resolution (Including information seeking).

However, most decisions do not fall clearly into the extremes of either of the two dichotomies. A typical process may have elements of rationality – non-rationality and problem solving and innovation orientation in it. This means the majority of decisions fall somewhere in between the four extreme points. The four points can be used as heuristic devices from which to measure actual decisions (Campbell, 1966).

Although the model explains the possible steps that an individual can pass through in the process of adopting an innovation the emphasis is still on how change occurs rather than on how it can be brought about. However, Campbell's (1966) main contribution, namely that the process is initiated by the awareness of a problem, must be honoured and was a significant step forward.

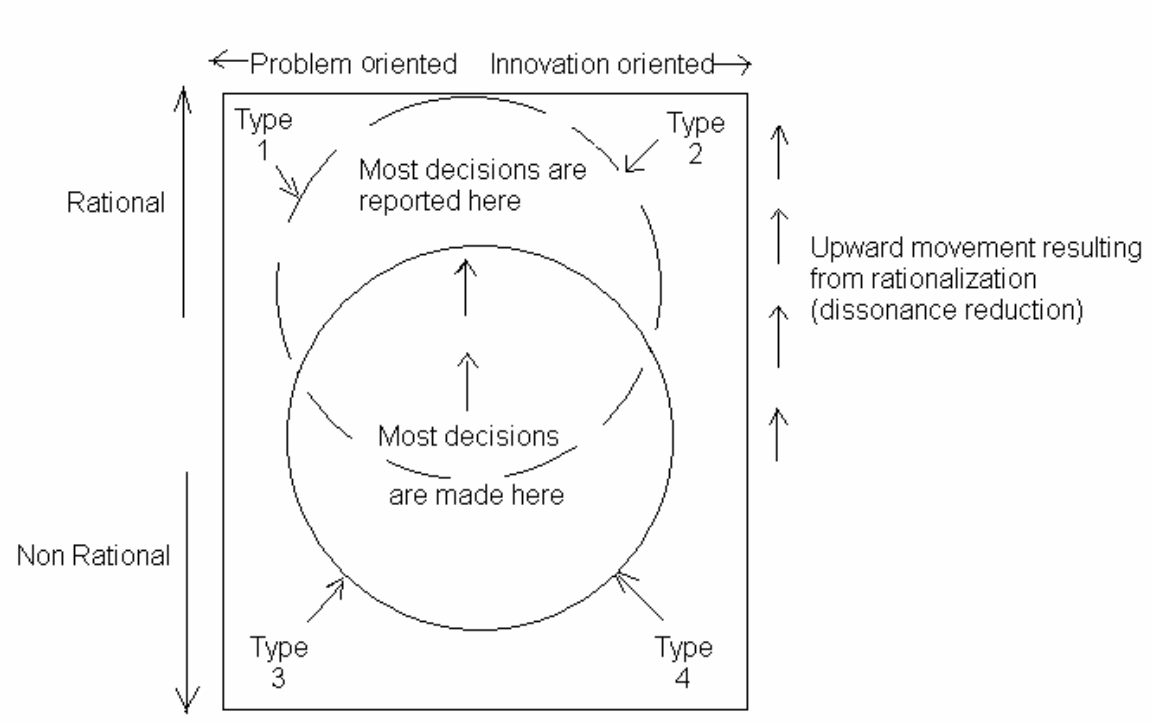

Figure 2. 1: A paradigm of Individual decision-making and adoption (Campbell, 1966)

2.1.4 The Innovation - Decision Process Model

In response to earlier models and the criticism leveled against them, Rogers (1983) developed the innovation-decision process as the process through which an individual (or other decision making unit) passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision.

He proposed five stages (Fig 2.1) that an individual or other decision-making unit passes through in the process of innovation adoption:

1) Knowledge: Occurs when an individual (or other decision-making unit) is exposed to the innovations existence and gains some understanding of how it functions.

2) Persuasion: Occurs when an individual (or other decision-making unit) forms a favorable or unfavorable attitude toward the innovation

3) Decision: Occurs when an individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation

4) Implementation: Occurs when an individual (or other decision-making unit) puts an innovation into use.

5) Confirmation: Occurs when an individual (or other decision making unit) seeks reinforcement of an innovation decision already made, but he or she may reverse this previous decision if exposed to conflicting messages about the innovation.

In his model, Rogers (1983) recognizes the importance of felt needs or problems in adoption behaviour but they fall under "prior conditions" rather than being critical or key dimension in behaviour change (Düvel, 1991). However, Rogers is not clear on whether needs or awareness of the innovation initiate the process or whether it is the knowledge of an innovation or new idea. He referred to this as a chicken or egg problem.

As far as the stages are concerned, Van den Ban and Hawkins (1988) point out that the innovation – decision process does not always follow this sequence in practice and also that there is insufficient evidence to prove these stages of innovation decision exist. Rogers (1983) solved the problem of the sequence of the phases, by reducing them to only two before decision-making. However this does not offer much help as a guide to bring about change and is a further model that only explains how change takes place (Düvel, 1991).

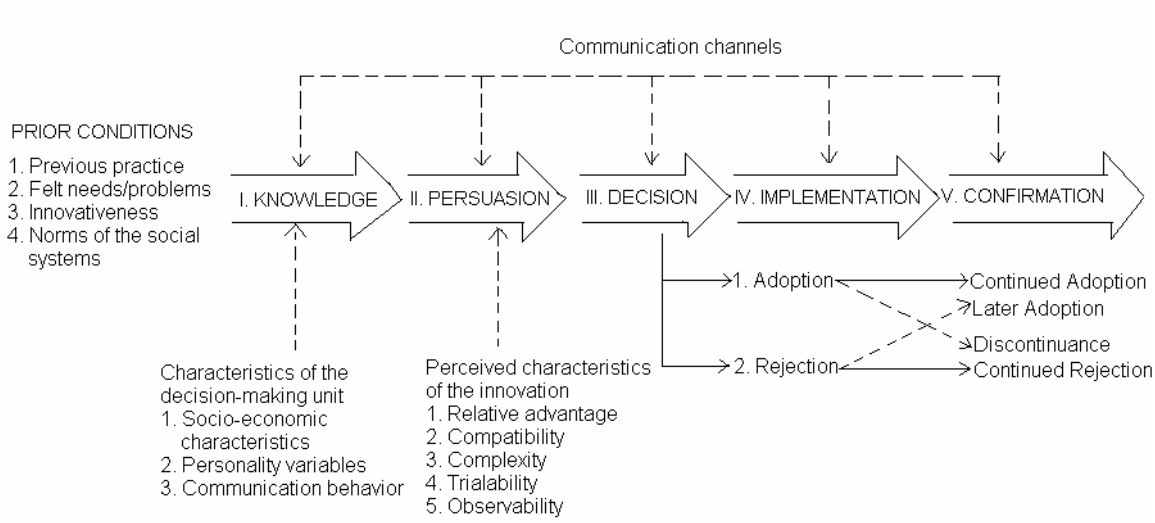

Figure 2. 2: A model of stages in the innovation-decision process (Rogers, 1983)

2.1.5 The psychological field theory of Lewin

In order to use scientific constructs in the dynamic analysis of behaviour, field theory holds that the analysis must begin with the situation as a whole. This means, instead of beginning with isolated elements of the situation and later attempting to organize them into an integrated system, field theory begins with a description of the situation as a whole. Therefore the most fundamental construct in Lewin's theory is the Life space (psychological field). The life space of an individual consists of the person and the psychological environment, as it exists for him. It is the totality of all psychological factors that influence the individual at any given moment (Shaw and Costanzo, 1970).

Hruschka (1969), quoted by Düvel (1991), identified the field theory of Lewin (1951) and made it accessible as probably the most appropriate for extension purposes. The most relevant and important features and principles of Lewin's (1951) theory making it useful as a conceptual framework for understanding and bringing about behaviour change are the following:

1. The basic motivation of every organism is to maintain equilibrium

2. A disturbed equilibrium is experienced as a need tension, that is a felt need to reduce the tension. In this state the person tends to mobilize forces or energy to reduce the tension and to re-establish a new equilibrium under the given conditions.

3. The re-establishment of equilibrium takes the form of movement (locomotion), physical or psychological, which continues until the equilibrium has been reestablished. The effects of a felt tension on perception, cognition and action are therefore such as to change the field in order to restore the tension-reduced situation.

4. Anything in the situation that is perceived by the person as a goal or as a path or barrier to a goal is understood as a force operating on the person's behaviour. This force can be positive or negative.

5. Behaviour (B) is a function of the person (P) in the perceived environment (E).

B-f (P, E)

6. There is no fixed, invariable relation between stimulus and response.

7. The factors of both the environment and the personality can become behavioural determinants. Thus the same facts and objects of the environment or personality may cause different actions

8. The co-existing forces are dynamically interdependent constituting the so called force field which is subjective, time specific and determines behaviour

9. Change or the lack thereof, is, in principle, explainable by the same concept: namely the constellation of interacting forces. Change can be brought about and directed by changing the force field, i.e. by adding or strengthening driving forces (positive forces) and/ or by eliminating or weakening restraining forces (negative forces).

Düvel (1991) points out the advantages of the field theory of behaviour for practical purposes as follows:

1. It provides a concept in terms of which the complexity of any real life situation, in respect of behaviour relevant factors can be analyzed

2. The theory is not limited to change but also explains non-change. It provides guidelines not only for situation analysis explaining behaviour but also for planning change and for evaluation

3. It is useful also for analysis of greater social units as groups of clients, organizations and also for planning change with them

4. It is easy to understand

5. It is an interdisciplinary theory, which is not confined to any one of the disciplines of the social sciences.

As compared to other behaviour models that focused mainly on explaining the process of behaviour change, the field theory of Lewin provides guidelines as to how behaviour change can be brought about. Its sound theoretical basis also represents a foundation for further models like those of Tolman (1967) and Düvel (1991). However, the field theory does not distinguish between the critical or immediate and relatively less important behaviour determinants.

2.1.6 The Tolman Model

Tolman's theory seems to be a successful combination of the majority of more modern theories and accommodates many of the principles that apply in Lewin's field theory. Tolman (1932) cited by Düvel (1994) contends that the resemblance between the theories of Tolman and Lewin is evident from the following corner stones of Tolman's model:

1. Behaviour is intentional that is behind the specific behaviour or action, there must be a reason of motive

2. Behaviour is governed by expectancies about the environment. These expectations are based on either observations of specific stimulus situations (sense perception) or on earlier experiences, which present the individual with an idea as to which methods (means) should be used in order to achieve the one or other goal (memory trace arousal)

3. The immediate precursor to action is the "behaviour space"; defined as "a particularized complex of perceptions (memories and inferences) as to objects and relations" and the "behaving self", evoked by the given environmental stimulus situation and by a controlling and activated behaviour-value matrix and implies a mental vicarious trial-and-error behaviour. The objects can have positive or negative valences.

Tolman (1951) differentiates according to his model, three sets of variables, namely the independent, the dependent and the intervening variables (Fig 2.3). He defined the independent variables as the initiating causes of the individual's action.

The dependent variables are conceived as consisting of responses which, from the point of view of a purely physiological analysis, are merely combinations of verbal, skeletal, and visceral reactions; but which from the point of the present action schema are identified and defined not in terms of their underlying physiology but in terms of their "action meanings".

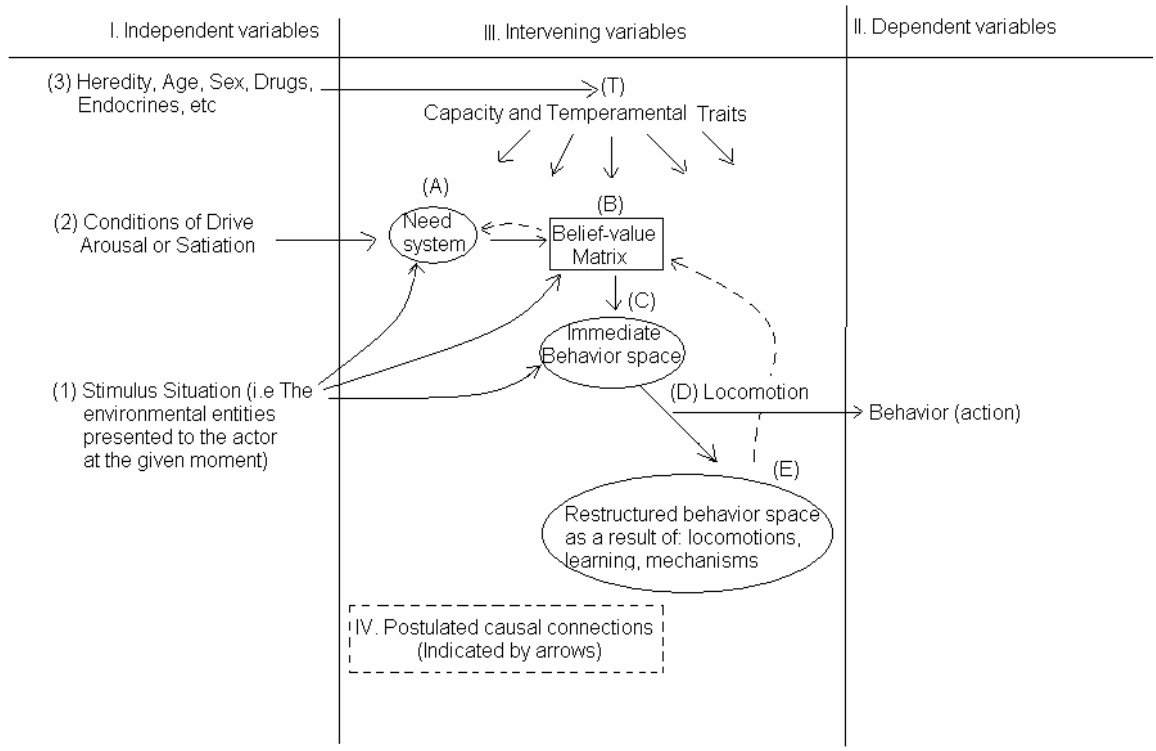

Figure 2. 3: The Tolmans Model (Source: Tolman, 1951)

The intervening variables are postulated explanatory entities conceived to be connected by one set of causal functions to the independent variables, on the one side, and by another set of functions to the dependent variable of behaviour, on the other (Tolman, 1951). Both independent and dependent variables are regarded as observable while intervening variables are not accessible to observation.

Although his model has been criticized for his intervening variables to be invisible and difficult to measure, the contribution of Tolman's model is appreciated for associating the intervening variables (field forces in case of Lewin's model) with the immediate causes of the behaviour (Düvel, 1991).

2.1.7 The Theory of Reasoned Action (Ajzen and Fishbein , 1980).

The theory is based on the assumption that human beings are usually quite rational and make systematic use of the information available to them. The theory argues that people consider the implications of their actions before they decide to engage or not to engage in a given behaviour (Ajzen and Fishbein, 1980).

Beliefs are the fundamental building blocks of the authors conceptual model (Fig 2.4). That is the totality of a persons belief serves as the informational base that ultimately determines his attitudes, intentions, and behaviours (Fishbein and Ajzen, 1975). Generally a person forms beliefs about an object by associating it with various characteristics, qualities and attributes and automatically and simultaneously acquires an attitude toward that object (Ajzen and Fishbein, 1980). This means a person who believes that performing a given behaviour will lead to mostly positive outcomes will hold a favorable attitude toward performing the behaviour, while a person who believes that performing the behaviour will lead to mostly negative outcomes will hold an unfavorable attitude toward performing the behaviour (Ajzen and Fishbein, 1980). Knowledge of a person's belief and attitude, therefore, permits prediction of one or more specific behaviours (Fishbein and Ajzen, 1975).

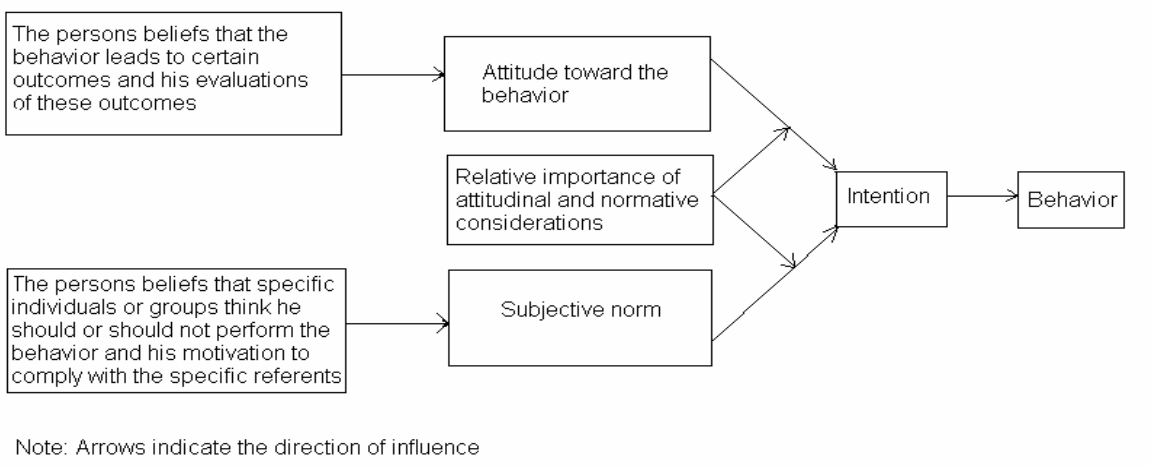

Figure 2. 4: Factors determining a person's behaviour (Fishbein and Ajzen, 1975)

The theory views a person's intention to perform (or to not perform) a behaviour as the immediate determinant of the action. On the other hand, a person's intention is a function of attitude toward the behaviour (the individual's positive or negative evaluation of performing the behaviour) and subjective norm (social influence on ones attitude).

In contrast to most other approaches of behaviour analysis, their approach has not attempted to explain behaviour by referring to external variables (Independent variables) like personality traits, attitudes toward people or institutions, or demographic variables. However they appreciate that the external variables can affect behaviour only indirectly (Fig 2.4). That is, external variables will be related to behaviour only if they are related to one or more of the variables specified by the theory (Ajzen and Fishbein, 1980).

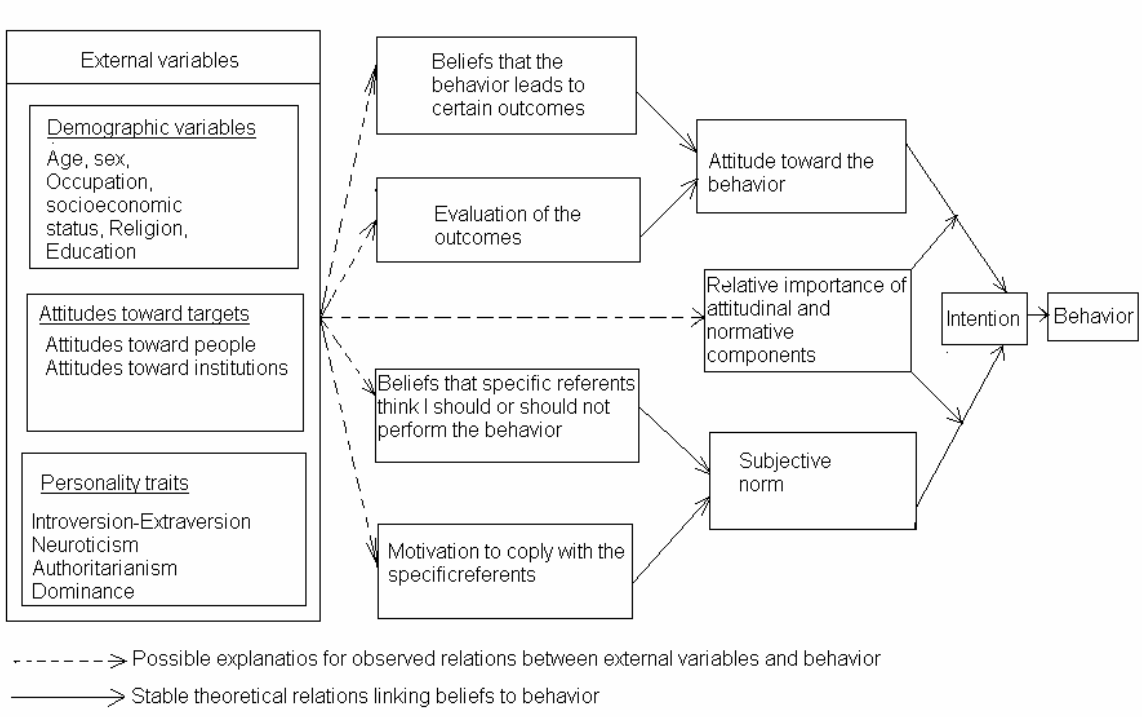

Figure 2. 5: Indirect effects of external variables on behaviour (Ajzen and Fishbein, 1980)

Of the view that independent variables have only an indirect influence is similar to that of Tolman (1951) and Düvel (1991). Also the concept of invisible nature of behaviour determinants is similar to Tolman's (1951) concept of intervening variables as being covert constructs. However, Fishbein and Ajzen did not touch on some of the salient features of Tolman's (1951) and Lewin's (1951) behaviour space, while the variety of intervening variables is limited and less appropriate for purposes of adoption behaviour.

On closer analysis of the theory, some of the concepts like beliefs and attitudes seem to overlap with concept of perception in Düvel's (1991) model. This is due to the fact that in an attempt to measure attitudes toward an object, the first step involves identification of a set of attributes relevant for that object as a result of which a favourable or unfavourable attitude is formed toward the object (Fishbein and Ajzen, 1975). On the other hand Düvel (1991) analyzed perception on the basis of attributes of an innovation like relative advantages, prominence and compatibility with the situation, which indicates a similarity between the concepts.

2.1.8 Düvel's Model for Behaviour Analysis and change.

According to Düvel (1991), any model or theory, in order to be acceptable, must make provision for the complexity and variability of human behaviour. This is the case where behaviour is regarded as a function of an extensive number of dynamically interdependent personal and environmental factors, which, depending on the situation can potentially become functional in various combinations and directions. Based on Lewin's psychological field forces and Tolman's concepts of intervening variables, Düvel (1991) formulated the model of behaviour analysis and change. His great concern was to find a basis whereby the great number of variables already found to have been correlated with behaviour, could be effectively reduced to a checklist that is surveyable and still sufficiently comprehensive to directly or indirectly make provision for all causes of behaviour.

Influenced by Tolman's concept of intervening variables, he achieved this by concentrating on those variables or determinants that are the most immanent and direct fore-runners of behaviour, namely the intervening variables (Düvel, 1991) and argues that they can be associated with the forces of change (Lewin, 1951), while the independent personal and environmental factors have an influence on these forces, but do not represent forces as such. These behaviour determinants and their influence relationship in the context of behaviour change and the results of behaviour change are illustrated in the following diagram (Fig. 2.6).

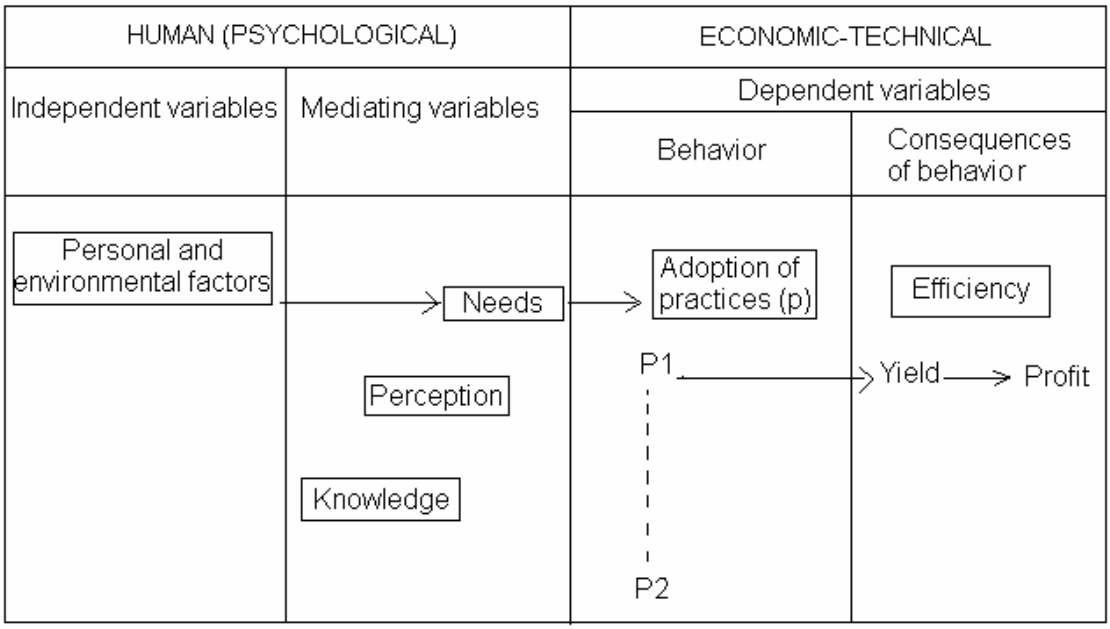

Figure 2. 6: The relationship Between Behaviour determining variables in Agricultural Development (Düvel, 1991)

According to him the intervening variables (Needs, perception and knowledge) indicated in the model are only those determinants which have been found to be important in the analysis, understanding, and prediction of behaviour based on extensive research done by various researchers like Düvel, 1975; Louw and Düvel, 1978; De Klerk and Düvel, 1982; Düvel and Scholtz, 1986; Botha, 1985; Düvel and Botha, 1990; Brockman, 1990; etc.

In general, behavioural scientists have made important contributions to the understanding of man and also have affected man's image of himself (Berelson and Steiner, 1964). This has been possible through various theories and models of behaviour change that have been developed (some explained above). Although most of the models reviewed explain how change occurs, they offer little guidelines as to how change can be brought about.

Manifestations of the latter are recognisable in Lewin's (1951) model or concept of field forces (forces of change). If, at the same time, these forces are not associated with all determinants of change, but only with those having a direct influence, namely the intervening variables, then the foundation is laid for a practical model that can be used in extension for purposes of behaviour analysis (surveys), behaviour change (extension programmes) and evaluation of change (monitoring and evaluation of extension). Against these background assumptions Düvel developed his model (See Fig. 2.7).

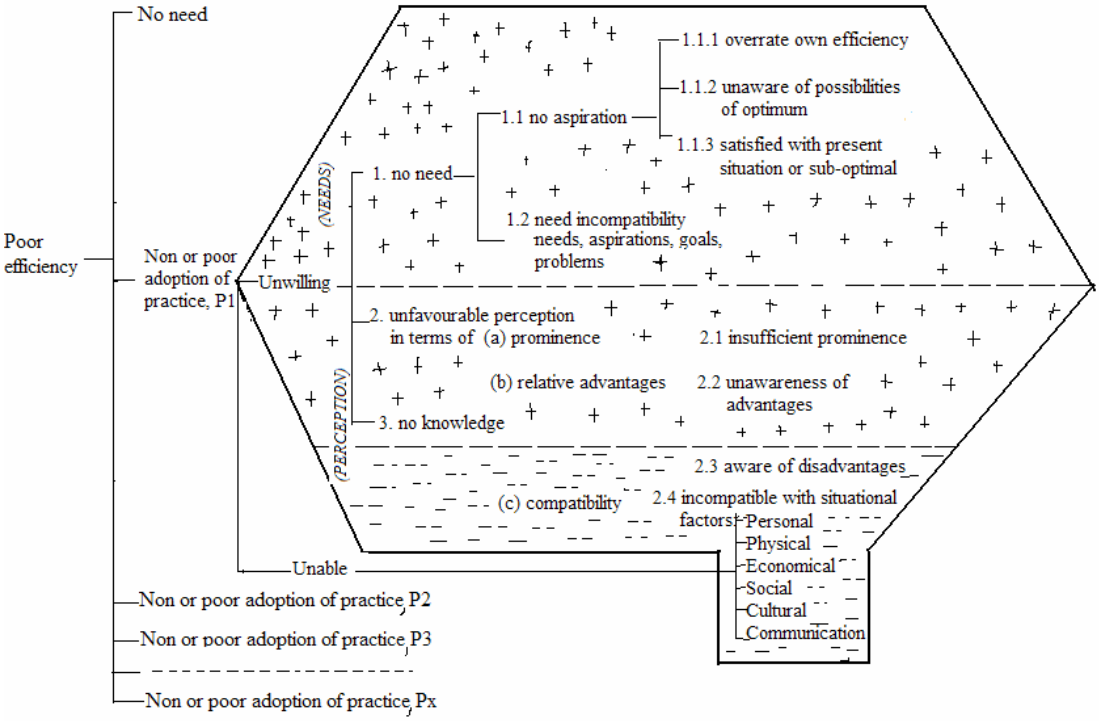

Figure 2. 7: Framework for problem conceptualization as technique in identifying the relevant causal factors in a situation analysis (Source: Düvel, 1991)

According to Düvel's model (Fig. 2.7), poor efficiency is a function of non-or poor adoption of the recommended practices. Farmers unwilling or unable to adopt cause this poor adotion. The unwillingness is influenced by several factors like need related aspects, knowledge and perception as explained below.

Need related aspects

The more direct need-related causes specified in Fig. 2.7 are the following:

(a) Lacking aspiration (1.1)

Insufficient or absent aspiration as far as any aspect of agricultural development or the adoption of a specific practice relates to or is a function of the following (Fig. 2.7):

- Overrating (or underrating) own efficiency (1.1.1)
- Being unaware of possibilities or the optimum (1.1.2)
- Being satisfied with the present situation or having a sub-optimal aspiration (1.1.3)

In a sense these aspects all have to do with problem perception where a problem is regarded as being the difference between "what is" (present situation) and "what can be" or is strived at (desired situation). Figure 2.8 is an illustration of a perceived problem, showing how the extent or magnitude of the problem (or need tension) is determined by the extent of the gap between the existing and desired situation.

If the existing situation eg. Efficiency of production or efficiency of practice adoption is over-estimated due to misperception (see 1.1.1 in Fig. 2.7), the perceived scope of the problem or potential need tension is reduced. If at the same time, there is limited knowledge concerning the optimum that is achievable (1.1.2), the potential problem and need can be further reduced to an insignificant level.

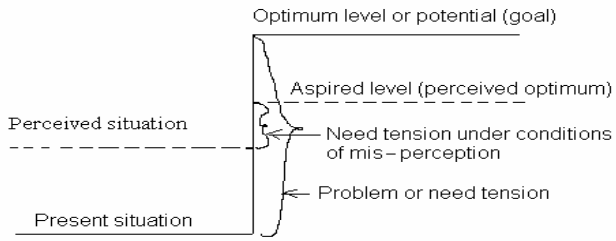

Figure 2. 8: Diagrammatic illustration of problem magnitude or need tension as influenced by perception (Düvel, 1991)

On the other hand, it is possible that the problem is correctly perceived, but that, for various reasons, the individual is satisfied with the situation (1.1.3). The opposite is also possible, namely that the individual underrates himself in terms of efficiency, and in extreme cases the goal object may consequently appear out of reach or unattainable, resulting in resignation or frustration on the part of the individual.

(b) Need incompatibility (see 1.2 Fig. 2.7)

Another need related cause of non-adoption is that the suggested solution, in terms of increased efficiency or a specific innovation or practice, is not compatible with the individual's needs, aspirations, goals or problems. Basically this means that it does not fit into the psychological field or need situation, in so far as that it is not perceived as either a need related goal, or as a means of achieving such a goal.

Perception

An unfavorable perception as cause of unwillingness to adopt can have the following causes:

(a) Insufficient prominence (2.1 Fig. 2.7)

Insufficient prominence is defined as the degree to which an innovation is perceived as being not better than the idea it supersedes (Düvel, 2004).

(b) Relative advantages

An unfavourable perception concerning the relative advantages refers to both advantages as well as disadvantages of the innovation or practice as such. The possible causes of non-adoption could thus be

- Unawareness of the advantages (2.2 Fig 2.7)
- Awareness of disadvantages (2.3 Fig. 2.7).

(c) Incompatibility (2.4 Fig 2.7)

Where advantages and disadvantages refer to an innovation or goal-object as such, compatibility relates more to situational aspects i.e the relevancy of the innovation in the individual's specific situation. Compatibility or incompatibility can refer to a wide range of aspects eg. personal, economical, social, cultural etc.

This category of behaviour determinants does not include compatibility of needs for which separate provision has been made in item 1.2 (Fig. 2.7). The reasoning behind this is that need compatibility represents the basic positive forces, where as the other compatibility aspects largely represent constraints en route to the goal. By implication this means that the compatibility aspects are potentially only negative forces.

Knowledge

Knowledge that is relevant in the case of innovation or practice adoption can be categorized as follows:

(i) Basic knowledge or knowledge of principles

(ii) Knowledge associated with the awareness of relative advantages

(iii) Knowledge in respect of the application of an innovation or practices

Generally, Düvel's behaviour analysis models (Fig. 2.6 & Fig. 2.7) are appreciated for successfully making provision for all causes of adoption behaviour. However, there are outstanding challenges where more research is essential. As far as need tension is concerned, this variable has some complications in that it is valid before behaviour change; but it disappears or decreases with need accomplishment or behaviour change. Another complicating factor is that the need tension is not independent of the perceived current efficiency, which the less efficient farmers tend to overrate their efficiencies more than the more efficient ones, thus undermining or significantly reducing the present need tension leading to the opposing tendency.

Due to this fact this study will concentrate only on assessing the influence of efficiency misperception or the degree of overrating (instead of perceived current efficiency) in determining the adoption behaviour. Furthermore, the model assumes that the possible causes of non-adoption could be the awareness of disadvantages (2.3 Fig. 2.7). It appears that the adopters and non-adopters are both aware of the disadvantages because the former have undergone through the adoption process that enabled them to be aware of them. However, this study will test this assumption.

2.2 THE STUDY CONCEPTUAL MODEL

After reviewing various models of behaviour change focusing on their contributions, strengths and weaknesses the conceptual model for this study will base on Düvel's (1991) model (Fig. 2.7). The model seems a successful combination of more modern theories like Lewin's (1951) field theory and Tollman's (1967) model.

It also appears to offer practical guidelines for a systematic and scientific approach in the analysis of adoption behaviour, evaluation of extension programs and consequential systematic change.

Selecting the Düvel Model as theoretical foundation for this study has a threefold purpose:

- To explain the adoption behaviour or lack of it with regard to maize production in the Njombe District,
- to evaluate the validity and appropriateness of the model in a different country and culture, and
- to contribute to the further development and refinement of the model

2.3 EMPIRICAL STUDIES CONDUCTED IN THE AREA OF INDEPENDENT AND INTERVENING VARIABLES

Studies on independent factors affecting the adoption of innovations are numerous and the literature is too diversified to be reviewed here. Due to this fact only those variables, which are considered in this study will be reviewed. On the other hand, relatively few studies have been done on the influence of intervening variables on the adoption behaviour. This could be attributed to the recent awareness of the importance of these variables in behaviour analysis.

2.3.1 Independent variables and adoption

The reviewed literature indicates that there is inconsistency of findings on the relationship between independent variables and the adoption behaviour. Although some of these variables appear to have a bigger influence, it is very common to find that certain studies support the influence relationship, while other show no influence and in some cases even a negative influence or relationship. (Rogers, 1983; Adesina and Baidu-Forson, 1995; Ekoja, 2004).

2.3.1.1 Age

Farmers' age has been found to influence the adoption behaviour in several ways. For example, a number of studies assert that there is a negative correlation between age and level of adoption of recommended practices, implying that the adoption is lower among the old age group than in the case of young ones (Rogers, 1983; Polson and Spencer, 1991; CIMMYT, 1993; Nanai, 1993; John, 1995; Van den Ban and Hawkins, 1996; Amir and Pannel, 1999; Foltz and Chang, 2002). On the other hand researchers like Adesina & Baidu-Forson (1995) and Senkondo *et al*., (1998) have found contradicting results and argue that the age of the respondent is positively related to the adoption behaviour.

Other studies (Kalineza, 2000; Habtemariam, 2004) report that the adoption level tends to be highest at middle age group, thereby implying a non-linear relationship. This could go a long way in explaining why researchers like Okoye (1989) and Bwana (1996) found no significant correlation coefficient.

2.3.1.2 Sex

The great role played by women in agriculture is increasingly acknowledged, but studies like that of Wambura (1992) reveal that the women's access to agricultural information is still very limited with their husbands representing the main source. This makes them to belong to a disadvantaged group when it comes to the introduction of new technology. A number of studies reveal that the level of adoption of recommended practices tends to be lower among women than men (Jefremovas, 1991; Stephens, 1992; Kalineza, 2000; Mensah and Seepersad, 1992 quoted by Habtemarium, 2004). But other studies (Temu, 1996; Bwana, 1996; Habtemariam, 2004) report that there is no relationship between sex and adoption.

2.3.1.3 Formal education

In most of the reviewed literature formal education is reported to impact positively on the adoption of recommended practices (Levinger and Drahman, 1980; Rogers, 1983; Okoye, 1989; Anosike and Coughenour, 1990; Obinne, 1991; CIMMYT, 1993;

Lugeye, 1994). This implies that the higher the level of formal education, the higher the adoption rate tends to be. However, there are studies showing no or only a very limited relationship between education and adoption (CIMMYT, 1993; Machumu, 1995). For example Senkondo *et al.,* (1998) found that adoption of rainwater harvesting technologies was not significantly explained by education but rather by other factors such as experience in farming and perceived technology characteristics.

2.3.1.4 Farm size

The size of the farm reflects the scale of agricultural production that can take place on a farm (Kipaka, 2000). With respect to the adoption of recommended practices, it has been argued that small and large farm operators differ in the speed of adoption (Polson and Spencer, 1991). Large-scale farmers can easily obtain credit, information and other inputs that facilitate their adoption behaviour. Evidence of this relationship has been provided by, amongst others, Rogers, 1983; Jamison and Laurance, 1982; Wambura, 1988; Thakre and Bansode, 1990; Hussain *et al.,* 1994; Senkondo *et al.,* 1998 and Kalineza, 2000. On the other hand, Mensah and Seepersad (1992) quoted by Habtemariam (2004) reveal that there is a negative relationship between farm size and adoption, while researchers like Temu (1996) and Habtemariam (2004) found no relationship between farm size and adoption behaviour.

2.3.2 Intervening variables

In general, a review of the literature indicates a greater degree of consistency of research results regarding the intervening variables than is the case with independent variables. Most of the studies reviewed show a positive relationship between intervening variables (perception, knowledge and need related aspects like need compatibility, efficiency misperception, need tension) and adoption behaviour.

2.3.2.1 Need compatibility

Need compatibility is a measure of whether the suggested solutions in terms of increased efficiency or introduced practices are compatible with individuals needs.

Düvel (1991) contends that non-adoption behaviour results when suggested solutions do not fit into the psychological field or need situation of an individual. The reviewed studies on need compatibility indicated a positive relationship between this variable and adoption behaviour (Louw and Düvel 1993; Düvel and Botha, 1999; Habtemariam, 2004).

2.3.2.2 Need Tension

Need tension or problem perception is another need related aspect that is important in determining the adoption behaviour. According to Düvel (1991), it is defined as the perceived difference between "what is" (present situation) and "what can be" or is strived at (desired situation) (See Fig. 2.8). In other words it is a perceived discrepancy between the present situation and the desired situation or level of aspiration.

This concept has been shown by different studies to be a key dimension in behaviour change or adoption behaviour (Koch, 1987; Düvel and Botha, 1999; Düvel and Scholtz, 1986). Distorted problem perceptions around the objective (Factual) situation could lead to irrational decision-making that may include non-adoption, under adoption or even over adoption (Düvel, 1995). Need tension is normally hypothesized to have a positive relationship with adoption behaviour. However, studies done by Koch (1987) and Habtemariam (2004) found a negative relationship. This opposing tendency is due to the fact that the poor adopters tend to overrate themselves more, resulting in many cases in lower need tension, which approaches that of adopters whose need tension may not be as high anymore, because of the higher "current level" of efficiency.

2.3.2.3 Efficiency misperception

Efficiency misperception refers to the degree to which individuals incorrectly (usually overrate) their efficiency (Düvel, 2004). Düvel (1991) notes that there is a tendency of individuals to overrating (or underrating) their own production and/or practice adoption efficiency.

This has been argued by the author to have a tremendous effect on adoption behaviour due to the fact that the more the current efficiency is overrated, the smaller the problem scope or need tension becomes and thus the smaller the incentive to adopt recommended innovations.

2.3.2.4 Awareness

It refers to an awareness of recommended solutions or the optimum that is achievable in terms of efficiency. In this case awareness refers as the knowledge of recommended maize production practices or, as far as production efficiency is concerned, to the respondents knowledge of the optimum yields attainable in the study area. This is an intervening variable that, so far, has only been found to have a positive influence relationship with adoption behaviour (Düvel, 1991; Düvel, 2004).

2.3.2.5 Perception

The underlying hypothesis regarding the role of perception is that the decision making whether or not to adopt an innovation will depend on how it is perceived by the decision maker. Against this background Düvel (1975) tried to associate forces of change with the attributes of innovations as formulated by Rogers (1983). He therefore identified three categories of attributes as relative advantages (i.e unawareness of the advantages and/or awareness of disadvantages), prominence and compatibility with situation.

Studies done by Botha (1986); Koch (1986); Düvel and Scholtz (1986); Louw and Düvel (1993); Düvel and Bother (1999) indicated a positive relationship between perception of total innovation attributes and farmers adoption behaviour. However, on the study done by Habtemariam (2004) reveals that there is no relationship between disadvantages expressed as the total numbers and the adoption behaviour.

2.3.2.6 Prominence

Prominence is defined as the degree to which an innovation is perceived as being better than the idea it supersedes.

It is contended that the more an innovation or a practice is perceived to be relatively better than the traditional practices, the higher the adoption is likely to be (Düvel, 1991; Düvel, 2004).

As said earlier, so far few empirical studies have been conducted in the area of intervening variables but it is believed that the review of various studies so far conducted will provide a sound basis for this study and also will provide the room for more contribution into the area.