TOWARDS A CATEGORISATION OF BEHAVIOUR DETERMINANTS WITH A VIEW TO A MORE MEANINGFUL ANALYSIS, INTERVENTION AND EVALUATION OF ADOPTION BEHAVIOUR

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ABSTRACT

This paper investigates the influence of some selected personal, environmental and intervening factors on the adoption behaviour and production efficiency of maize growers with the object of identifying the most important causes of behaviour and thus acquiring a better understanding of maize farmers' response to advice regarding maize production in the study area.

A total of 200 farmers were randomly drawn form the two agro-ecological zones (lowland zone and intermediate zone) in the Shashemene district. This represents a sample of ten percent. In the analysis of data multiple regressions were employed to identify the most important determinants associated with behavioural change and to calculate their variance contribution.

The results indicate that, in general, the intervening variables tend to have the highest prediction value. They were found to explain 87% of the variance of behaviour associated with the practice adoption and the resulting production efficiency, while the independent variables had R^2 value of only 0.33 and 0.27 in the case of personal and environmental factors respectively. Amongst the intervening variables needs (need tension and need compatibility) were found to have the greatest effect on both of the dependent variables ($p < 0.01$)

1. INTRODUCTION

The conviction that the promotion of individual technologies is ineffective, led to the development of the Participatory Demonstration and Training Extension System (PADETES), which was primarily designed to promote technology packages. Although numerous packages were designed and promoted in different œmmodities during the last ten years, systematic in-depth studies of their effects have not been conducted. The few studies that

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have been done (Zegeye & Tesfaye, 2001 and Howard, *et al*, 1999) were mainly focused on an analysis of the effects of some socio-economic and environmental factors, ignoring the possible influence of the intervening human causes, which Düvel (1998:31) maintained, are the immediate precursors of behaviour and through which the independent variables become manifested in decision making and behaviour.

The objective of this study, therefore, is to identify and compare different categories of variables in regard to their influence on the adoption behaviour as it pertains to maize growers in the Shashemene district located in Oromia Region some 275 km South of Addis Ababa.

2. THEORETICAL RATIONALE

Most models or approaches of behaviour change are based on a process or on behaviour determinants or a combination of both. Amongst the processes the classical 5-stage adoption process (North Central Rural Sociology Committee, 1961), the Campbell Model (1966) and the innovation-decision model of Rogers (1983) are the most well known. In a way the problem-solving approach is also a process, but emphasizes perhaps more than the others that the content is more important. The search for behaviour determinants has been going on for decades with changes in focus, which are aptly summarised by Albrecht (1969). The more recent KIS (Knowledge Information System) is another variation which appreciates the system or a bigger totality and dynamic interdependency of cognitive issues. This brings it in line with Lewin's field theory (1951), which emphasizes perhaps more than any other theory the situation-specificity and uniqueness of human behaviour.

With the increasing number of factors or variables having been related with behaviour, the challenge to distinguish between the more and the less important determinants has increased. This is of particular interest for the practitioner faced with the task of behaviour analysis intervention and evaluation.

The contribution of Tolman (1967), who distinguishes between independent and intervening variables, creates the possibility of distinguishing the more indirect from the more direct behaviour determinants, particularly if it is assumed that the indirect causes (independent variables) become manifested in decision making or adoption behaviour *via* the intervening variables.

3. HYPOTHESES

Based on the above, the following general hypothesis can be formulated:

Adoption behaviour is potentially determined by independent personal and environment variables whose influence is indirect and only becomes manifested in behaviour *via* intervening variables, which are the direct precursors of decision making and adoption behaviour.

The validity of the above hypothesis could be found in evidence indicating that: -

- both independent and intervening variables are related to adoption behaviour and the resulting production efficiency, but

- that intervening variables are the most important predictors and taken together, with account for a significantly greater proportion of the variance of adoption behaviour and the resulting efficiency.

4. RESEARCH METHODOLOGY

4.1 The identification and measurement of variables

4.1.1 Independent variables

A concise overview of the large diversity of independent variables and their association with adoption behaviour has been provided by Rogers' (1983) summary of research findings. Table 1, which provides an overview of the independent variables selected for this study, makes use of the same categorisation.

Table 1: An overview of the selected independent variables and description of their measures or scales

Variable name	Measurement and description
1. Socio economic variables	
• Agro ecology	Dummy: middle altitude = 1
• Age	Number of years of respondent
• Gender	Dummy: Male headed household = 1
• Literacy	Reading ability values 1-4
• Education	Number of years of schooling (formal schools)
• Farm size	Total holding excluding leased land
• Farming experience	Number of years spent on farming
2. Communication variables	
• Extension contact	Dummy: contact at critical periods and better = 1
• Media exposure	Dummy: exposure once a month and better = 1
3. Personality variables	
• Modernity	33 item attitudinal scale[1]

[1] *Scale developed by Smith and Inkeles (1966) in Saeed 1989*

4.1.2 Intervening variables

The concept of intervening variables, although borrowed from Tolman (1967), does not necessarily refer to only hypothetical constructs or abstract variables, but rather to variables that are the immediate precursors of behaviour and thus also the variables through which the more independent variables become manifested in behaviour. These are the variables which, with reference to Lewin's (1951) field theory, can be associated with the field forces, but not to the factors influencing these field forces. Düvel (1975 and 1991) has identified needs, perceptions and knowledge under this category of variables. They, in turn, can be further conceptualised and consist of the more specific aspects as summarised in Table 2.

Table 2: An overview of intervening variables and the more specific aspects or measures that they encompass

Intervening variable	Specific aspects
Need	• Aspirations regarding general and specific goals and normally manifested in problem perceptions i.e. in the perceived discrepancy between the current and desired or potential situation • Need compatibility, i.e. the compatibility with own needs, objectives or problems
Perception	• Perceived prominence or relative advantages • Perception or awareness of disadvantages • Perceived (in) compatibility with own situation
Knowledge	• Understanding or knowledge of underlying principles • Knowledge of solutions • Implementation skills

4.1.3 Dependent variables

Extension interventions are normally focused on the adoption behaviour regarding recommended practices for optimising sustainable production and thus the resulting outcome in terms of physical (e.g., yield) and economical (e.g., profit) success. PADETES is characterized by promoting technology packages formulated for each commodity or enterprise. The basic components of the current technical package for cereals including maize consist recommendations for fertilizers and seeds along with complimentary management practices (Kiflu, 1995:21). Based on this recommendation, a score

ranging from 0 to 9, is given on a continuous scale for each element of the package, to produce a composite score for using the whole package and thereby determine total adoption score of each respondent.

4.2 The survey

The study was conducted in the Shasemene district, which is one of the major maize producing areas of the country; located in the Northern Shoa Zone of Oromia Region, some 275 km south of the capital Addis Ababa during the period February to July 2002.

In total, the district has 36 peasant associations (PAs)[3] of which 28 are located in the low and middle altitude Agro Ecological Zones (AEZs). Random sampling technique was employed to choose 4 of the 28 PAs (2 from each AEZ), taking accessibility, deployment of extension workers for the area and resource limitation into consideration. A total of 50 farmers from each of the 4 PAs or a total of 200 farmers from 2120 farm households of the two AEZs were randomly drawn to give a total sample size of about 10%.

The formal field survey was conducted after a ten-day reconnaissance survey aimed at selection of representative sample areas, interviewers and community leaders who would be involved in the study are carried out. A one-week training of interviewers was also conducted to coincide with a testing of the structured questionnaire designed in advance.

4.3 Statistical analyses

Pearson's correlation and standard multiple regression analyses were used to assess the relationships between variables.

Preliminary analyses were made to check for normality of distribution and presence of outliers. Analysis of the distribution of scores of the independent, intervening and dependent variables showed no serious violation of the assumption of normality. Analysis of descriptive statistics, however, showed that the 5% trimmed mean is lower than the mean for three variables (need compatibility, perception of technology attributes, and efficiency) indicating the presence of potential outliers. The box plot analysis also gave similar results. These variables are, however, retained for analysis by revaluating them to lesser extreme value as suggested by Hair, *et al* (1998:66) and Pallant (2001:62).

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[3] *Lowest administrative unit.*

With multivariate analyses the existence of high pair-wise correlations (in excess of 0.8) among regressors indicates a serious degree of multi-collinearity (Gujarati, 2003:359). Tabachnick and Fidell (1996), as referred to by Pallant (2001:143) suggest the omission of one of the two variables if two variables have a bivariate correlation of more than 0.7. Farming experience and literacy were, accordingly omitted from analyses and their respective covariances age and education retained.

The assumptions of normality, homoscedasticity, linearity, and outliers can be checked from the standardized residual scatter and normal probability plots, which are generated as part of the multiple regression procedure (Pallant, 2001:137). Both the normal probability plot and the scatter plot yielded a reasonably straight diagonal line with roughly rectangularly distributed residuals respectively suggesting that there is no serious violation concerning the two assumptions of normality and linearity.

Tabachinick and Fidell (1996), quoted by Pallant (2001:14), define outliers as cases that have a standardized residual of more than 3.3 or less than –3.3. The distribution of the value of residuals of data ranged between –2 and 2 suggesting that there was no reason for concern.

Homoscedasticity refers to the assumption that dependent variables exhibit equal level of variance across the range of predictor variables (Hair, *et al,* 1998:73). Uniform diagonal distribution of sample data over the scatter plot exhibited no problem in this regard.

In addition to the above measures, the fact that the sample size was deliberately made to be large (200) from the outset and the fact that it was taken randomly, is believed to overcome problems related with violations of assumptions to bivariate and multivariate analysis and it is consequently expected that the extrapolation of sample results is high.

5. FINDINGS AND DISCUSSIONS

5.1 Relationships between independent, intervening and dependent variables

As first indication of the relationship between the independent and intervening variables on the dependent variables, correlations were calculated. These are summarised in Table 3 and 4.

Table 3: Correlations between independent variables and adoption and efficiency behaviour of maize growers of Shashemene district, 2002

Variable	Adoption	Efficiency
Dummy: Agro ecology	0.377**	0.244**
Age	-0.250**	0.300**
Education	0.321**	0.349**
Farm size	0.247**	0.023
Dummy: Change agent contact	0.119	-0.018
Dummy: Media	0.486**	0.336**
Modernity	0.168**	0.053

* *Significant: P < 0.05* ** *Highly significant: P < 0.01*

The majority of selected variables (Table 3) are highly significantly related to both the adoption of practices (measured as a total score) and the production efficiency. Exceptions are attitudinal modernity and change agent contact and to a lesser degree farm size. Age shows a negative correlation with adoption, but the relationship with efficiency is again positive and highly significant. These apparent contradictions can be partially attributed to the relatively low correlations between the adoption of some of the practices and the efficiency indicators. A more likely reason is that some dichotomous scales were used which somewhat restricts the validity of the correlations. In the case of age, the somewhat contradicting findings could be indicative of a relationship that is non-linear.

Table 4: Interrelationship between intervening variables and adoption and efficiency behaviour or maize growers of Shashemene district, 2002

Variable	Adoption	Efficiency
Need tension – practice	-0.862**	-0.663**
Need compatibility	0.678**	0.998**
Problem perception-practice	-0.318**	-0.120
Need tension-efficiency	0.111	-0.329**
Problem perception efficiency	0.113	-0.075
Perception of technology attributes	0.192**	0.029

** *Highly significant: P < 0.01*

The correlations of intervening variables (Table 4) are characterised by very low but also by extremely high correlations. This is an indication that at least some of them stand in a very close causal relationship with behaviour. This applies in particular to need compatibility. Negative correlations in the case

of several variables related with the perceived problem discrepancy (need tension) between the current and desired situation can be attributed to especially the less effective respondents over-rating their own efficiency.

5.2 The comparative influence of independent and intervening variables

The regression analysis in Table 5 confirms the rather limited contribution of independent variables on adoption and on production efficiency.

Table 5: Effect of independent variables on adoption and efficiency behaviour of maize growers, Shashemene district, 2002

Variables	Coefficient		T		Significant T	
	Adoption	Efficiency	Adoption	Efficiency	Adoption	Efficiency
Constant			3.05	4.1	0.000	0.000
Dummy: Ag. Ec.	0.352	0.304	4.695	3.8	0.000	0.000
Age	-0.052	-0.085	-0.725	-1.132	0.469	0.259
Education	0.152	0.219	1.910	2.632	0.058	0.009
Farm size	0.081	0.245	1.100	3.168	0.273	0.002
Dummy: agent	-0.070	-0.078	-1.027	-1.108	0.306	0.269
Dummy: media	0.353	0.268	4.524	3.288	0.000	0.001
Modernity	-0.064	-0.102	-0.854	-1.285	0.394	0.201

Adjusted R^2 0.331 (adoption) 0.267 (efficiency)

Only the agro-ecological region and use of media have a significant influence on adoption. The influence on efficiency is somewhat more significant with the addition of farm size and education. In accordance with these limited contributions, the total variation explained by independent variables is a mere 33 percent (R^2 = 0.331) in the case of adoption and 26.7 percent (R^2 = 0.267) in the case of production efficiency.

Table 6 summarises the findings in regard to the contribution of intervening variables on adoption and efficiency.

These contributions are significantly higher. They contribute in total 87 percent (R^2 = 0.87) and 97 percent (R^2 = 0.97) of the total variance of adoption and efficiency respectively. This significantly bigger contribution of the intervening or mediating variables provide strong evidence in support of the main hypothesis of intervening variables being the likely precursor of decision

making and through which the influence of independent variables become manifested.

Table 6: Effect of intervening variables on adoption and efficiency behaviours of maize growers, Shashemene district, 2002

Variables	Coefficient		T		Significant T	
	Adop-tion	Effi-ciency	Adop-tion	Effi-ciency	Adop-tion	Effi-ciency
Constant			7.735	-0.257	0.000	0.797
Needs/practice						
• N. tension	-0.796	-0.056	-22.723	-3.969	0.000	0.000
• N. compatibility	0.219	0.948	6.436	69.627	0.000	0.000
• Perception	-0.166	-0.013	-5.870	-1.166	0.000	0.438
Needs/efficiency						
• N. tension	0.160	-0.010	4.741	-0.778	0.000	0.438
• Perception	0.100	-0.010	3.214	-0.825	0.002	0.410
Perception of technology attributes	0.018	0.024	0.635	2.146	0.526	0.033

Adjusted R^2 0.87 (adoption); 0.97 (efficiency)

The importance of the intervening variables is also reflected in the very high contribution of individual variables. Top of the list is need compatibility, which, from a theoretical point of view and the understood role of needs, is almost a precondition for change, since it is difficult to visualise an action or behaviour that is in contradiction with his/her needs. In fact, it does appear as if the issue is not that the hypothesis regarding the intervening variables is invalid, but rather that the difficulty lies in their accurate measurement. An example is that of need tension, which represents the perceived potential need tension or difference between the current and the aspired or optimum situations. Its contribution is, according to Table 6, very significant, but should, according to theoretical considerations, have been significantly more. Its measurement as reflection of need is distorted for the following reasons:

- There is a clear tendency for the current level (of practice adoption or production efficiency) to be increasingly over-estimated the poorer the adoption or efficiency of the client. This tendency tends to cancel out or undermine the need tension. The fact that this is more likely to be the case with production efficiency than with practice adoption is the possible reason why need tension contributed less in the case of production efficiency where needs are more conscious and focused.

- Behaviour aimed at realising the need will change the need tension. Therefore unless need assessments would have all been done prior to behaviour change in the case of all respondents, it is near impossible to accurately measure or assess the important role of needs.

- The need tension reflected in the difference between the current and aspired levels is but one criteria or indicator of need scope or intensity. Equally important in reflecting the scope of the need is the current level, that is where it is relative to the maximum or optimum. For example, the need to maintain a current near maximum level of production is higher and reflects more "will of attainment" than the need to increase the level form very low to mediocre.

A noteworthy finding is that perception does not seem to be as important as needs. This may be attributable to the fact that perception as understood in this paper is very closely related to knowledge. For example the knowledge or perception of the advantages and disadvantages is hardly distinguishable. This finding could imply that knowledge in terms of its influence is a less important intervening variable and may offer an explanation as to why the mere dissemination of knowledge is seldom effective or why it is often maintained that "knowledge does not sell itself". However this calls for more research.

6. CONCLUSIONS

The findings of the study are meaningful in several aspects. The clear evidence of the key role of the mediating variables in adoption behaviour is very significant. But perhaps more meaningful is that it supports previous findings from different cultures and therefore increases the prospect of the principles being generally valid. This represents significant support for Düvel's model of behaviour analysis and intervention (1991). Although the identified intervening variables, namely needs, perceptions and knowledge already seem to explain most of the variance, the search for additional variables and especially a further refinement and more accurate measurement of these variables is necessary. Further issues that represent important challenges are eliminating the overlap between the intervening variables (namely between needs, perception and knowledge) and accounting for the variation in the intervening variables as behaviour changes. The model with its focus on intervening variables not only opens existing possibilities regarding purposeful change, but also creates a useful basis for effective monitoring of extension outputs.

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