MODELLING THE INFLUENCE OF INDIVIDUAL DIFFERENCES ON FARMING BEHAVIOUR

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DECLARATION

I declare this thesis and the research upon which it is based to be my own work and testify that it has not been accepted in any previous application for a degree, that all verbatim extracts have been distinguished by quotation marks, and that all sources of information have been specifically acknowledged.

ABSTRACT

Until fairly recently farmers have been encouraged to increase production and efficiency by government and EU funded policies. However, with the increasing occurrences of food related health scares and concern over disappearing flora and fauna, a less intensive attitude to land and livestock management is emerging. Many of the policies relating to environmental protection are voluntary. There has, therefore, been increasing concern over which farmers will implement these environmental policies.

A large body of literature exists covering many disciplines which investigates specific aspects of farming change. Cardinal variables include attitudes towards risk and innovation and secondary variables include information, knowledge, culture, goals etc. (Guerin & Guerin, 1994). The models and the variables used in the studies often fail to predict who will implement change and why. For this reason the study investigates the influence of individual differences on two types of farming behaviour.

Two categories of farming behaviours: a) production oriented, and b) environmentally focused behaviour were examined in 254 Scottish farmers. The aim of the study was two-fold: 1) to highlight what factors (such as, farming attitudes and objectives) were empirically important to farming behaviour in general, and 2) to identify the most important facets of the individual which are adjunct to the process of changing behaviour.

The study developed a set of standardised questionnaires which incorporated variables identified as important. Factors derived by factor analysis were used

in conjunction with standardised measures of individual differences such as personality traits, and intelligence. Models of behaviour were hypothesised and tested for fit using structural equation modelling techniques.

Econometric and other expectancy value models have been used to examine how farmers make specific decisions. Problems related to these models are discussed. It is suggested that a simple transactional model (antecedent, mediator and outcome) is a more suitable tool with which to investigate farming behaviour (Lazarus, 1984).

Models are hypothesised for both production and environmentally oriented farming behaviour. Other models relating to farmer stress, risk taking, and having goals etc. are also hypothesised and tested using structural equation modelling.

The study concludes that the factors derived from the questionnaires represented valid attitude, objective and behavioural measures, and these could be further developed and validated in the future. Individual differences in personality and intelligence alone predicted between 20-30% of the shared variance between attitudes, personality and behaviour. Other models, such as those of farming stress and risk taking are also hypothesised and tested. The usefulness of the hypothesised models requires validation by further study.

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LIST OF ABBREVIATIONS

CAP	Common Agricultural Policy
CISS	Coping in Stressful Situations Scale
EC	European Community
EFAS	Edinburgh Farming Attitudes Scale
EFES	Edinburgh Farming Enterprise Scale
EFIS	Edinburgh Farming Implementation Scale
EFOS	Edinburgh Farming Objectives scale
ESA	Environmentally Sensitive Area
GFM/acre	Gross Farm Margin per acre
GHQ	General Health Questionnaire
IACS	Integrated Administration Control System
KAI	Kirton Adaptor/Innovator Inventory
LFA	Least Favoured Area
NEO	NEO-FFI Personality Inventory
NEO-A	Personality trait of 'agreeableness'
NEO-C	Personality trait of 'conscientiousness'
NEO-E	Personality trait of 'extraversion'
NEO-N	Personality trait of 'neuroticism'
NEO-O	Personality trait of 'openness'
QOL	Quality of Life

SSSI	Sites of Special Scientific Interest
Enviro	Environment
Info	Information

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CHAPTER 1

COUNTRYSIDE EXPECTATIONS

"In farm and field throughout the shire
The eye beholds the heart's desire"
A.E. Housman

1:0 Introduction

This thesis will investigate in a sample of Scottish farmers, the influence of individual differences, attitudes and goals on two types of farming behaviour, namely, behaviours which are production or environmentally oriented. However, prior to defining the research area and reviewing the literature, it is thought necessary to define the farming scene by airing some of the arguments which have made such a study necessary.

Over the past three decades an increasingly strident debate has taken place regarding the effects of science and technology on the environment and the multiple rights of all land users (Robinson, 1990; Pye-Smith & Rose, 1984; Whitby, 1992; Yearley, 1991). The debate is fuelled by metaphors of crisis and change which are ascribed to the farmers who occupy the centre stage of this debate (Robinson, 1990). The farmers argue from the 18th century philosopher, Edward Burke's thesis of stewardship, that they are the custodians of the environment. They provide a care and protection service that leaves the land better than they found it (Wibberly, 1986; Newby, 1980; Blunden & Curry, 1985). Other land users, mainly from the environmentalist 'lobby', dispute this claim and argue for an input into the land use process (Pye-Smith & Rose, 1984; Yearley, 1991). Both camps see in the countryside their

'heart's desire'; unfortunately both sides have differing expectations of the countryside.

Governments from the second world war have pursued a policy of intervention and support for farming but recently have realigned more with the various 'lobbying' groups. Attitudes have become increasingly polarised over the past ten years.

Opposition to scientific farming comes from a number of separate areas. It partly arises from a clash of post-materialism philosophy with that of scientific modernism (Inglehart, 1977). This has led to a climate of change and uncertainty. Newby (1980) argues the clash arises due to fear, which is born from a lack of understanding, and this fuels further apprehension of the future.

This chapter looks at the changing attitudes to land use over the past thirty years. It is not intended to be a definitive resume, rather it is used to set the scene for the study of farming change. It is in chapter 2 and 3 however, that the main trust of the thesis will become apparent, that is, the examination of the individual characteristics necessary to promote farming change.

1:1 British agriculture and the influence of Government and European Community policy

Agriculture occupies 80% of the UK land surface and employs about 2% of the population. It meets more than 75% of the food requirements of 56 million people from 240,000 sq. kilometres of land (Soper & Carter, 1985). Very little of this land is high quality, 53% falling into the category 'Less Favoured Area

(LFA) (Soper & Carter, 1985). LFA refers to poor quality soil, generally in hilly or marshy areas which support only 'rough' grazing. Thus UK farmers feed the population very successfully on 0.4 ha. per person which is an extremely cost effective use of the land.

In Scotland about 50,000 people are employed in agriculture, contributing about £1.3 billion to the economy (The Scottish Environmental Handbook, 1990). Approximately 60% of Scottish land is classified as LFA compared with the 12% in England (The Scottish Environmental Handbook, 1990). Agriculture is an important contributor to the national wealth, health and employment (Newby, 1980). However, in today's society land has to take on many roles, from recreational use, source of water and timber, a safe haven for endangered species as well as the traditional role of food production. This increased pressure on the land has generated potential conflict between different users as each attempt to achieve their 'heart's desire'.

At the centre of the debate is the British farmer. Since the second world war government policies have emphasised the need for self sufficiency in staple foodstuffs and have promoted this increased efficiency regardless of the cost (Bury, 1985). This target of self-sufficiency has by and large been attained (Blunden & Curry, 1985). But this has not been without cost to the environment, the landscape, the consumer, rural employment and infra-structure (Yearley, 1991; Pye-Smith & Rose, 1984; WWF Consumer Module, 1990; Parry et al., 1995). Pressure from the environmental lobby and a perceived need to address the balance between agricultural efficiency and environmental sustainability has led to a change in Government and European Community (EC) policy (Gasson, 1988; Blunden & Curry, 1988; 1985; Hodge & Dunn, 1992).

The drive to efficiency and self-sufficiency was supported on a number of fronts, central to which was the Scott Report of 1942 which set out "to make every agricultural acre count" (Blunden & Curry, 1988). There was an implicit assumption that any building should be confined to towns, and the countryside left to agriculture and forestry. The aim was to restore war depleted stocks of timber and food and this view prevailed largely unchallenged until the 1970s. Even as late as 1979, a White Paper 'Farming and the Nation' was still recommending agricultural expansion. Making every acre count required the incorporation of marginal land into the production cycle. Farmers were aided in achieving this aim by guaranteed prices for their produce and capital grants schemes and a number of other supports were available. The government were aided by the National Farmers Union (NFU) and the Country Landowners Association (CLA) in the annual price reviews. Government support varied, but in general the mechanisms shown in Table 1:1 were used to support the farmers.

Table 1:1 Methods of farming support

(Adapted from WWF Global Environmental Education Programme, 1990)

Agricultural Research	Agricultural support	Taxation Relief
advice	price guarantees	On current income
research	production grants	On VAT
		On capital gains
		Capital compensation allowance
		Transfer tax on local rates

Incomes varied between different types of farming; with hill farmers having persistently low incomes in relation to arable farmers. This required a number of additional measures such as the Hill Farmers Compensatory Allowance to

redress the balance. By 1957 it was recognised that many small farmers had left the land and a drive towards larger units of production began to develop (Blunden & Curry, 1985).

Government support for agriculture brought new life through research and development and, until fairly recently such advice was offered free of charge. The research developments included new varieties of grain and livestock, technological advances in machinery, and more effective chemical fertilisers, pesticides and herbicides. The intensification of agricultural production has resulted in larger sized businesses, increased stock densities, and higher yields from both land and livestock. It also resulted in lower employment rates but increased labour productivity through mechanisation and the increased reliance on purchased inputs of concentrated feeds, fuel, and fertilisers, pesticides etc. (Bury, 1988).

In 1973, Britain joined the European Community (EC) in which the agricultural support aims although largely the same, in principle, as those in the UK, were rather different when implemented in practice. In the UK, support came from the differences between the average price received and the guaranteed price agreement, whereas, under the Common Agricultural Policy (CAP) funding was through price support set at a desirable level for the product (Bury, 1988). When prices fell below the target intervention price the EC bought the produce until the price level rose. As most of those prices were above the free market price level the products accumulated and were later sold off cheaply to Third World countries or to the then USSR. Because of the good price offered, farmers produced more of what was already in surplus and this cost billions of pounds to store (WWF, 1990).

Partly because of government policies, the structure of farming has changed in the UK. The number of holdings fell by one third during the period 1947-1980 (Blunden & Curry, 1985). In 1939, 65% of farms were tenanted but by 1980 this had dropped to 36% (Blunden & Curry, 1985). By 1980 the average farm size had increased by three times the 1940's level to 267.6 hectares (Economic Report on Scottish Agriculture, 1991). The average size of dairy herds increased, but at the same time the actual number of dairy farms decreased (Blunden & Curry, 1985). Labour also fell by one third during the same period (Soper & Carter, 1985). These changes in size allowed field sizes and mechanisation to increase. It became easier to grub out hedges and dykes than maintain them due to the lack of employees. Removal of hedges also allowed the huge harvesting machines more room to operate. Increased technology allowed marginal land to be drained and incorporated into the production cycle thus changing the physical appearance of the landscape and impacting on the flora and fauna (WWF, 1990).

Land prices increased during this period ensuring the owners assets rose faster than inflation. This was in part due to the tax incentives offered by the government as shown in Table 1.1. One of the tax incentives was capital gains taxation offered at a lower rate than current farm profits. It was therefore rational for farmers to attempt to switch income to capital gain by buying land as an investment (Bury, 1980). In general such transactions were financed by borrowing, the cost of which could then be treated as deductible expenses for income purposes. This increased level of investment took place during the phase of increased land prices when many smaller farmers sought to expand in order to compete with the intensive or more mechanised farms. Thus, for many the increased productivity of the 1970s was a trap which fed 1980's debt.

Government incentives could therefore be seen to have not only increased productivity, but also debt. At the same time new technology increased yields but decreased human labour. Price support was a spur to efficiency but it also reduced competition between farmers (Blunden & Curry, 1985). Distortions in the market also occurred as some commodities received more support than others. This fact reinforced specialisation in farming practice, e.g. grain. In order to obtain high production, high input of chemicals was necessary. By protecting and providing high prices, farmers were encouraged to use high inputs of chemicals and generally a 10% increase in chemicals produced a greater than 10% output commodity (Blunden & Curry, 1985). By the 1980's many farmers had recognised the law of diminishing returns and the application of fertilisers and pesticides declined (Blunden & Curry, 1985). High prices also contributed to intensive use of the land. Permanent grasslands were frequently drained and converted to crop land (Blunden & Curry, 1985). Protective policies promoted the cultivation of grain crops. High prices coupled with low world prices for cattle feed encouraged intensive specialisation in dairy cattle where 1kg of Soya feed could increase milk yields by 2kg (WWF, 1990). A similar specialisation occurred for pig production. However, this did not take place uniformly across the EC but different regions adopted differentially and some concentrated specialisations occurred in areas such as the Netherlands (Bury, 1980).

The benefits to the farmer of such government policies have been a stable or increasing income (at least until the 1980s). Further, the consumer generally received better quality, low cost staple foodstuffs. Farmers argue that the increase in production had been around 2-3% per annum since the 1950s, however, since the 1970s farmers income has decreased in real terms by 4-5% (and by about 45% during the period 1985-1990) (MAFF, 1991).

There have been other costs associated with agricultural change. Agriculture is not just about providing food. Land is a finite resource, and crops, soil and livestock have to be studied from a transactional view point. That is, they act and interact, the process is a reciprocal one. This conceptual framework of the environment is based on ecological processes of energy flow, nutrient cycling, competition and eco-regulation which in some cases has been disrupted by intensive agricultural practices. One such problem is highlighted by a soil research team funded by the government who reported in the 1970's and 1980's on wind and water erosion. It was estimated that 44% of arable land was affected by erosion in England and Wales (Guardian, 28th November, 1984 quoted in WWF 1990).

From 1947 to 1986 the total area of land farmed had remained stable, however, there has been a marked change in land use during this period. Cropped land increased by 11%, broad-leaved woodland had been reduced by 24% while coniferous woodland increased by 28% (Blunden & Curry, 1988). There has also been a reduction of 25% in wetland (bog, peat, moor etc.) areas of England and Wales (Countryside Commission Report, 1986; Soper & Carter, 1989).

1:2 Criticism of agricultural change

Conservationists have generally been critical of the physical changes which have taken place in the countryside. The criticism has been partly fed by increasing numbers of rural incomers and the increased recreational use of the countryside. Greater use of the private car along with more money available for leisure activities has promoted more country sports such as skiing, hill-

walking, bird-watching etc. (Munton et al., 1995; The Scottish Environmental Handbook, 1990).

The physical changes have been viewed as destroying the pastoral idyll held by certain sections of society. Concern for the landscape and natural history as a means of physical and spiritual refreshment was evident as far back as 1890-1900 (Sheail, 1995; Bunce, 1994). It is the continuation of a practice of selecting from nature its ideal or perfect form and highlighting this in an effort to romanticise the effect (James, 1989; Bunce, 1994). The rural identity is mainly the result of Victorian writers who emphasised the romantic and sentimental aspects of the landscape and village life (Bunce, 1994). It is the lingering effect of such interpretations of rural life which has lured back to the villages those who work in town but prefer that their children be raised in the healthy countryside. Indeed, such idealised images of rural life are still portrayed in many current television series such as 'Heartbeat', 'Hamish MacBeth', 'Last of the Summer Wine', 'Peak Practice', etc. However, those working on the land earn only a fraction of the salary of the commuting population and are therefore unlikely to share the values of the higher income newcomers. Roger (1989) cites Richard Pahl's classic study of village life to highlight the difference of attitude and behaviour between old and new residents and the resulting tensions. Pahl considered that a village no longer had a shared village life, rather, it was just a group of individuals sharing a village. This clash of attitudes is seen in the newcomers opposition to new developments and employment opportunities and their disapproval of farm odours, straw burning, farm buildings and the physical changes to the landscape that have occurred (Newby, 1980 quoted in Rogers, 1989).

Concern over the effects of agricultural chemicals were emotively highlighted in works such as Rachel Carson's 'Silent Spring' (1960) which expounded a doomsday scenario of the effects of DDT. A similar effect was created in 1980 with the publishing of Marion Shoard's 'Theft of the Countryside'. Pressure from these and other sources resulted in the 1978 Countryside Act (Blunden & Curry, 1988). These criticism reached their zenith in the 1984 House of Lords Select Committee for Science and Technology Report (July) (Blunden & Curry, 1988). Agricultural intensification was blamed for the physical changes in the countryside. This was followed by the passing of the Wildlife and Countryside Bill in 1986 which attempts to placate both the farmers and the conservationists. Around this time 15 sites in the UK were designated Environmentally Sensitive Areas (ESA) and many other were designated Sites of Special Scientific Interest (SSSI). It is suggested that the areas designated SSSI's would probably not have been damaged if the grants for improvements had not existed i.e. it would not have been cost effective for the farmer without a grant to drain/clear these sites. Their preservation now has been left to the education and persuasion of the individual farmer. With this new act the Nature Conservancy Council (NCC) were able to offer the landowner annual payments on a sliding scale in return for a five year management agreement plan for these sites (ESA). However, such funding is still dwarfed by support funding, nor is the site protected after the agreement expires (Morris & Potter, 1995).

1:3 Other changes in rural life

For many small farmers and those on LFA farmland, the support measures have not proved sufficient and many have been obliged to take part-time employment outside of farming. This appears to be an increasingly common

phenomenon and is growing across Europe. In the UK 25% of the farm households have another source of earned income (Blunden & Curry, 1988). This has implications for the appearance of the countryside as it is thought that these farmers will farm less intensively. However, it is equally likely that these farms are the ones which could never have been farmed intensively anyway.

More recently the consumer has come to fear intensive farming methods as a result of health scares such as Salmonella poisoning from eggs, Listeria from cheese and Bovine Spongiform Encephalopathy (BSE) and Escherichia-Coli 0157 (E-Coli 0157). Health scares related to toxic chemical sprays or pollution of the waterways, or cancer and heart disease thought to be related to red meat consumption have also affected the credibility of the 'wholesomeness' of intensively produced food.

1:4 Response to change

Farmers have become increasingly stressed by poor media coverage of farming (Sunday Times, November 1st 1992). By and large farmers have been resentful of the criticisms of the conservationist (Blunden & Curry, 1988). However, when the general public are asked what they perceive to be the worst environmental problem today, they report pollution of the rivers and lakes by industry rather than the farmer. Although they think intensive farming methods damage the countryside, perversely they think farmers are in the best position to take care of the countryside (Wilkinson & Waterton, 1991).

Over population is often proposed as the root cause of third world hunger, but very few countries have a population density comparable to that of the UK.

The USA contains only 6% of the world population but consumes 25% of the world resources (WWF Programme, 1990). Farmers argue that to farm less intensively in the UK would increase our dependency upon cheap imports from countries where environmental devastation is the norm. Thus, British farmers must compete with low cost foods while absorbing the costs of providing health foods and safe, sustainable environments for humans and animals (WWF Programme, 1990).

In their defence farmers acknowledge the fact of overproduction and note that the West grows sufficient wheat alone to feed the entire world population. However, this efficiency is often bought at the expense of the Third World (Harrison, 1989 quoted in WWF 1990). For example, food aid destroys local peasant markets (Bury, 1985). Another example is that the Netherlands alone requires an area larger than itself to provide feed for her livestock. This does not suggest efficient agriculture at all (Harrison, 1989 quoted in WWF 1990).

There is of course a further problem in that LFA land cannot be reconstructed into arable land, or climates changed for more favourable ones. There will always be the need for Government support for farmers on this land, or the need to encourage other uses for the land. However, it is recognised that subsidised surpluses force market prices down elsewhere, disrupting other economies.

The idea that free market economies and non-subsidised farming will lead to less intensive farming and greater rural employment is challenged by Saunders et al., (1991). Investigating changes in New Zealand farming after subsidies were withdrawn and the free market introduced, they found that only farmers

who were free from debt survived the change, and those that were left worked harder, used fewer inputs, labour and technology. Newcomers, on the other hand, tended to farm as intensively as possible. Thus environmental protection did not occur, stress and rural depopulation increased and the community spirit disappeared due to the long working hours. This challenges the market's ability to incorporate environmental costs. It is not sufficient to be aware of environmental problems if there are insufficient funds available to address the issue. Similarly, purely organic methods are unlikely to produce the volume of food required globally (Hodge & Dunn, 1992 p27).

The problems resulting from over production due to support and protection from governments are currently being addressed by the EC. In an attempt to correct market distortions, increased quotas are being enforced to quell over-production. Farmers are encouraged to look for alternative means of making a living by the promotion of new Government incentives to develop alternative rural employment (Ministerial Statement on farm development, 1987, quoted in Blunden & Curry, 1988).

1:5 Conclusions

In conclusion therefore, farmers, after a long period of stability and increasing incomes are being asked to accept restrictions to their production and income without further monetary reward. Their status as guardians of the land is also under attack. Further, farming methods and production outcomes that have shown a marked improvement over the years are now being questioned on a) environmental and health grounds or b) due to the distorted nature of past legislative protection. Many farmers are now being encouraged to accept the insecurity of part-time employment in conjunction with the insecurity of part-

time farming. The number of sites designated for environmental protection have risen since 1987, however, the uptake of management agreements for these sites is small (Morris & Potter, 1995).

Shifts in public attitude and concerns, along with a shift in Government and EU policy, require a corresponding change in farmers' attitudes if these concerns and policies are to be addressed by the farmer. The attitude of maximising production and efficiency has been formed over many years; now they must change to one of environmental concern and the challenges of unpredictable market demands. For a successful policy change to be implemented, farmers' attitudes have to be identified, monitored and correctly addressed by both the farmer and the policy maker (Gasson & Potter, 1988; Coleman et. al., 1992). Whether these changes are seen as a challenge to be met, or something to be resisted is of considerable importance for policy makers success. Although some studies in England have investigated attitudes to adoption of conservation techniques and the financial ability to adopt, the measurements and items used in the surveys tend to be diverse, idiosyncratic and not directly comparable across studies. In general they have shown that younger, financially stable farmers are more likely to participate in non-compulsory environmental schemes (Morris & Potter, 1995). There is a perceived need to investigate farming attitudes and those who are most likely to respond to persuasion.

This chapter has set the farming scene and the nature of the farming change which is important at this moment in time. The following Chapter will discuss the method of assessing this change. Chapter 3 will identify important areas of farming change which have been investigated in the past while Chapter 4 will identify the role of important facets of individual differences involved in change.

CHAPTER 2

COMPARISON OF ATTITUDE-BEHAVIOUR MODELS USED IN FARMING RESEARCH

"Cannot reasoning be both rational and psychological?"
Gigerenzer & Goldstein, 1996

2:0 Introduction

Chapter 1 highlighted the potential problems and conflicts which arise from varied land use, in particular the balance between increased farm production and the necessity to conserve and protect the natural environment. Before any argument, debate or conflict can be resolved each side has to accommodate the others perspective. The conflict can only be resolved when some individuals undergo a change of attitude. Where an attitude is defined as a tendency or a disposition to respond by evaluating a situation, event or person favourably or unfavourably (Ajzen, 1988; Eagly & Chaiken, 1993; Allport, 1937). This change of attitudes is seen as particularly necessary for the European farming community. Much of the Governmental and EC aid used to promote the change from increasing farm production to more sustainable farming methods is supported by voluntary measures. There is no statutory enforcement, thus persuasion could be seen as the most important factor in changing attitudes.

Because of the importance accorded to attitudes as causes of individual phenomena such as attitude-consistent behaviour, the concept of attitude has become a fundamental construct for social scientists (McGuire, 1986; Eagly & Chaiken, 1993). Such a fundamental relationship between attitudes and behaviour requires to be understood and analysed if farming behaviour is to be

predicted. An understanding of almost any system of relationships can be potentially improved by the use of models (mathematical, statistical or conceptual) therefore, modelling is at the centre of this approach to studying the attitude-behaviour relationship in farming behaviour.

This chapter will a) consider two of the theoretical attitude-behaviour models used in farming research to account for differences in behaviour and attitude/behaviour change b) propose a conceptual model of behaviour to be tested on Scottish farmers.

2:1 Models of attitude-behaviour relationship.

2:1.1 Economic utility theories

Modelling can be used either investigatively or confirmationally in order to extract theory from an hypothesised understanding of relationships and allow a clear, concise definition of these relationship in a form suitable for testing (Huges, et al., 1986; Luce, 1995; Suppes, et al., 1994). Economic decision making models are the most commonly used in agriculture. These are based on the premise that all organisms make inferences in situations where decisions have to be made under conditions of uncertainty. The economic cost-benefit models are based on probability theory. Here the likelihood of an event occurring is forecasted on the basis of how frequently it has occurred in the past. These models are based on the idea that individuals are rational, logical beings and in economic theory that the individual will wish to maximise profit. However, they often fail to predict behaviour because they do not investigate

the underlying reasons for the behaviour (Luce, 1995; Eiser & van der Pligh, 1988). Modified classical models such as subjective expected utility (SEU) have expanded the range of these models. In the SEU model the individual forecasts *the likelihood of an event occurring*. This forecast is based on *belief* about the frequency of occurrence; not the *actual frequency information* regarding occurrence used in the classical model. Expressed mathematically:

$$SEU = \sum i \; Pi \times Ui$$

where P is the subjective probability of outcome i; U is the utility of outcome i. These utilities are multiplied by their probability and summed to give the overall subjective expected utility. These normative or prescriptive theories (how decisions should be made) provide a set of rules for combining beliefs and preferences (Luce, 1995; Esier & van der Plight, 1988). The models are tested using multiple regression statistics. An example of this kind of model was used by Bingswanger (1980) in a study of risk taking attitudes in a group of Indian farmers. The participants were given hypothetical farming questions and asked to 'gamble' varying sums of money up to an amount greater than their monthly wage on the outcome. The experimental results were inconsistent with the participants attitudes to risk the findings are similar to those found in other studies (Bingswanger, 1980; Kahnmann, Slovic & Tversky, 1982).

More descriptive approaches to decision making consider individuals as human information processors and argue that it is often sufficient to 'satisfice', that is, reach a satisfactory outcome as opposed to an optimal one (Simon, 1957). A satisfactory outcome, it is argued, is a more feasible outcome because individuals have limited ability, knowledge and time, in which to optimise outcomes (Simon, 1956; Simon & Newell, 1982). Simon argues for a notion of 'bounded rationality', where individuals are considered to be pre-wired to the real world environment, the focus is on the individual and the environment

in this theory. However, the use of this approach in research is difficult and rarely used (Gigerenzer & Goldstein, 1996). When there is a lack of information leading to a random decision, the model is not a useful predictor of behaviour (Gigerenzer & Goldstein, 1996; Suppes et al, 1994).

A third approach has developed from the research into why individuals depart from logical deduction, or fail to use the rules assumed by the SEU models. The research indicates that individuals have difficulty in using probabilities, rather, they use a number of heuristics when making decisions, such as creating a 'real' world for the question within the framework of the given information (i.e. how representative is the information in a given situation) (Tversky & Kahnmann, 1974). Too much irrelevant information also makes it difficult for individuals to order relevant information. They are unaware of the importance of such things as the sample size, past occurrences, or regression to the mean, along with other biases (Tversky & Kahnmann, 1974; Esier & van der Plight, 1988). This has led Kahnmann & Tversky (1979) to provide a more general theory of decision making under uncertainty. They proposed 'Prospect' theory in which they assume that decisions are made in respect to relevant losses or gains rather than absolute costs and benefits, and it is necessary to use decision weights to reflect the importance of the possible outcomes. Prospect theory argues decisions have two stages, an editing and an evaluation stage. This means that perceived alternative outcomes from a decision may be defined as gains (or loss) from a shifting reference point P. Mathematically this is stated as:

$$\text{Value (V)} = \sum i\pi(Pi) \times (Xi)$$

Where V= value of an option and is equal to the sum of the products over its specified outcomes multiplied by each product, consisting of a utility (X) and a weight π attached to the objective probability P of obtaining X. Collins et al.

(1991) used prospect theory to examine decisions of Oregon grass seed producers between 1973-1975 and using the variance in gross farm income as a measure of risk variance were able to obtain significant results. However, the retrospective nature of the study and the estimated methods used, although supportive of prospect theory, did not predict risky behaviour. Once again, these models assume that individuals are able to calculate probabilities and assign weights. These models therefore, have only limited applicability, as was stated at the beginning, they fail to explain why individuals make decisions. Therefore, we turn to more descriptive models.

When purely descriptive methods are used individual's report factors such as job satisfaction, quality of life and the intrinsic worth of the job compete with maximising profit and production, and it is often difficult to assess which is the predominant factor (Harper & Eastmand, 1980; Gasson, 1973; 1974; Casebow, 1981; Gillmore, 1986; Ilberry, 1985; Herman & Uttitz, 1990; Coughenour & Tweeten, 1986; Coughenour & Swanson, 1988; Gasson & Potter, 1988; Fairweather & Keating, 1994; Perkin & Rehman, 1994; Heffernann, 1983; Ziggers, 1994). Can psychological models which include these more individual characteristics be better predictors of behaviour?

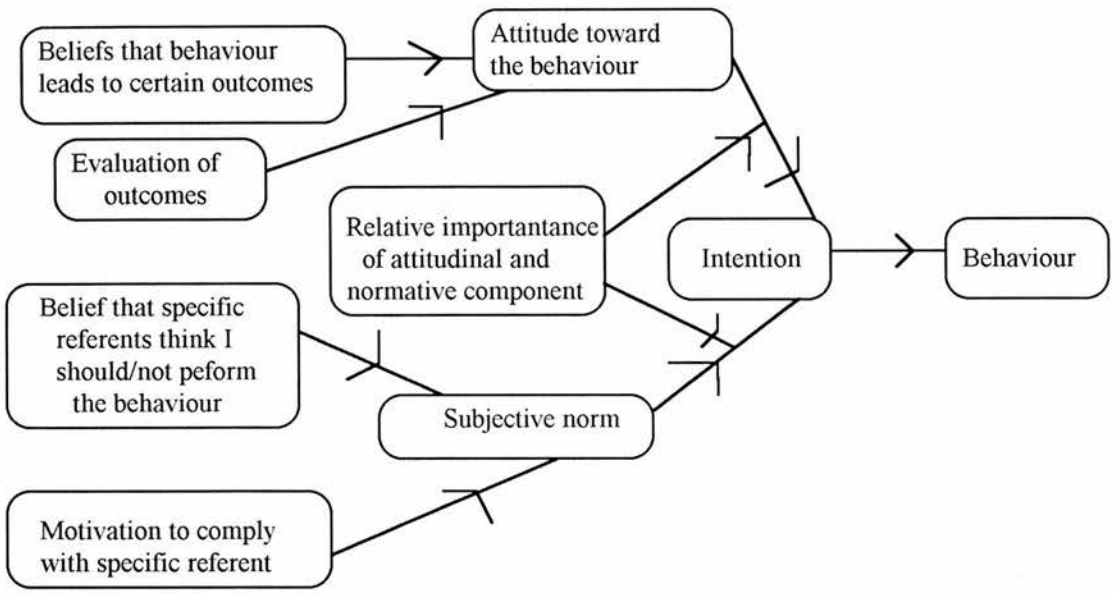
2:1.2 Fishbein-Ajzen model of reasoned action

In psychology and sociology the relationship between an individual's attitudes and behaviour is generally studied using a very similar model to that of the economist. The Fishbein & Ajzen (1975) (Theory of reasoned action) or the Ajzen and Fishbein (1980) (Theory of planned behaviour) expectancy-value models (Figure 2:1) are the most commonly used in social psychology. These probability type models suffer the same constraints as the economic models.

In farming research, Lynne & Rola (1988); Carr & Tait (1991); and Goddard (1993) have used modified versions of the model of reasoned action to successfully understand and predict conservation behaviour. By modifying the theory of reasoned action with the additional inclusion of an economic variable and acknowledging the role of information, Lynne & Rola (1988) found that money was not the main predictor of farming behaviour rather it was the individual's attitude towards conservation that accounted for the greatest amount of the shared variance.

The Fishbein model is useful but, it will be argued, it is not sufficient, and it can be improved by the addition of other variables. As this model is the one against which the proposed model will be tested it is discussed here in greater detail than the previous economic models.

Figure 2:1. Fishbein & Ajzen (1975) model of reasoned action. Adapted from Eagly & Chaiken (1993) p172



In the theory of reasoned action, cognition, affect and behaviour are treated as belief, attitude and intention by Fishbein & Ajzen (1975; 1980). This theory suggests that attitudes follow reasonably from beliefs, just as intentions and actions follow from these attitudes. The model emphasises the intention to act rather than the attitude. Intention is postulated as the proximal cause of behaviour and is best represented by the psychological construct of motivation. Intention is a product of both attitude towards the behaviour and the 'subjective norm'. The subjective norm is the importance attached to the opinion of significant others and whether they would approve or disapprove of the behaviour.

The attitude towards the behaviour is determined by how an individual evaluates the outcomes associated with the behaviour and by the strength of

those associations, by multiplying belief strength and outcome evaluation and summing the resultant products (Ajzen, 1988).

$$\text{Behaviour Intention (BI)} = w_1A + w_2SN$$

Where A = Attitude towards the behaviour, SN = Subjective Norn and w = value attached to the importance of A and SN.

$$\text{i.e. Attitude towards the behaviour} = \sum E \times V$$

Where Expectancy (E) = belief that behaviour will lead to outcome

and Value (V) = strength of association.

Similarly, intentions are also a function of the subjective norm (the belief that specific groups will approve or disapprove of the behaviour).

$$\text{Intention to carry out behaviour} = \sum SN \times V$$

Where Subjective Norm (SN) = normative belief concerning referent person (group)

and Value (VI) = motivation to comply with referent.

Behavioural intention is a linear regression function of both attitude and the subjective norm. The usual method of testing the theory is to use a hierarchical regression by entering the expectancy term first and then a value term and then test the significance of the expectancy times the value term. However, Bagozzi (1984) argues that this interactionist term is often not significant, and what is achieved is an 'additive' model that predicts from the expectancy and value terms separately and this makes the model theoretically meaningless. It is impossible to separate the terms in this way as they are meaningless when treated singularly, i.e. it is not possible to have a probability value term without an attitude predictor (Eagly & Chaiken, 1993).

Beliefs can be simple or complex. Complexity is described in terms of the number of dimensions required to describe the belief, it is the structural quality of the belief. That is, if asked to evaluate a specific car, you may have a positive attitude toward it, but define it in terms of its fuel consumption, braking qualities, road holding capabilities, quietness and comfort, all concrete qualities. The overall evaluation arises from the sum of the separate qualities. Work has shown that the more complex the belief the more moderate it is likely to be, and the less complex the more extreme the attitude held (Linville, 1982; Linville & Jones, 1980; Judd & Lusk, 1984). This suggests that the greater the information available to an individual the less extreme the view. If this is the case, information will modify attitudes and must be accounted for in a modified model.

As with personality traits the greater the aggregated measures of attitude the better the correlation with aggregated behaviour. A single behaviour can be influenced by a number of factors in addition to that of the relevant attitude. For example, an arable farmer with only a small intensive farm is unlikely to have any rough or unused ground available to be used as set-aside. Even if he is in favour of reducing production, it is possible he cannot afford to do so as he requires to say, repay a bank loan. Whereas a larger mixed farm, free of debt, may have both arable and hill ground some of which can be easily set aside without suffering a reduction in farm income. To ask, therefore, what the farmer's attitude is towards the policy of set-aside and what amount of land they have actually set aside need not give a significant correlation. The constraints have nothing to do with an attitude towards the policy. It is therefore important to aggregate attitude relevant measures of behaviour just as it is to aggregate attitude relevant areas when assessing an attitude.

Fishbein & Ajzen (1975) have shown that if this is followed, moderately high correlations can be obtained. In their study of religious behaviour they were able to obtain good correlations when the social attitudes and the reported religious behavioural items were summed (Fishbein & Ajzen 1975). A number of studies provide support for this model (for example, Ajzen & Fishbein, 1980; Fredricks & Dossett, 1983; Davidson & Morrison, 1983). In a study to predict smoking behaviour Ajzen & Fisbein (1980), showed that by using a perceived choice, i.e. to smoke or not to smoke, and allowing ranges of attitudes, intentions and subjective norm items related to the two choices, they enhanced the predictive power of the model. They did this by extracting the differences in intentions, attitudes etc. for each choice. Intention in this model is a psychological construct distinct from attitudes which represents motivation or goal directed behaviour.

Fishbein suggested that *volitional* behaviour is under the control of intentions, by definition therefore, habitual behaviour is not included in this model. Davidson & Jaccard (1979), and Davidson & Morrison (1983), investigated the intention of couples to have a child in the next two years and found correlations with intention and behaviour ranging from r = .54 to .89. However, other studies using confirmatory factor analysis rather than multiple regression analysis have shown some departure from the theory (Bentler & Speckart, 1979; 1981; Fredericks & Dossett, 1983; Oliver & Bearden, 1985; Ryan, 1982). One such study by Bentler & Speckart (1979), indicated that past behaviour was a better predictor of future behaviour than intention or attitude, other studies confirm this, (Bem, 1972; Fazio et al., 1981; Salancik & Conway, 1975). In these studies attitudes have the ability to directly predict behaviour as well as being mediated by intentions (Bentler & Speckart, 1979).

Attitudes accounted for in the theory of reasoned action are those towards the behaviour and also how 'significant others' influence the intention to act. However, the power of the 'significant others' (known as the subjective norm), is often insignificant when the behaviour is under strong attitudinal control (Shimp & Kavas, 1984; Sternthal & Craig, 1982). The ratio of the importance of attitudes to the subjective norm is about 1:5 indicating that attitudes are of greater importance than the subjective norm (Farley et al., 1981). One of the reasons suggested for this disparity is that an individual's attitude already incorporates a dimension relating to what others may think (Ryan, 1982; Oliver & Bearden, 1985).

Prediction is more accurate when the attitudes, intentions and behaviours relate closely to one another but it has been suggested that the theory merely catalogues variables that should be measured in order to predict behaviour (Eiser & van der Pligt, 1988). Like the economic theories, it is difficult to determine whether the individual is in any sense aware of the mental calculations that the theory pre-supposes underlie the decisions (Tversky & Kahmann, 1974; Eiser & van der Pligt, 1988).

There is, therefore, some doubt regarding the model on a number of fronts (Ryan, 1982; Miniard & Cohen, 1983; Bentler & Speckart, 1979, Bem, 1972; Fazio, 1990; Salancik & Conway, 1975). Other research has sought to improve the model by introducing variables such as personality, moral values and past experience (Zanna, Olson & Fazio, 1980; Scheier, Buss & Buss, 1978; Gorsuch & Ortberg, 1983; Beck & Ajzen, 1991; Bentler & Speckart, 1979; Fredricks & Dossett, 1983; Rholes & Bailey, 1983). The model does not include, or provide an explanation for many of the variables that social scientists think are important, such as, individual differences and environmental

variables, further, the constraints of using only volitional behaviour limit the model's application in predicting many common behaviours (Liska, 1984; Eagly & Chaiken, 1993).

It is argued, that the theory although useful in predicting a *temporal* snap-shot of the volitional attitude-behaviour relationship, can be improved by the inclusion of additional pathways relating past behaviour, personality traits and external variables (Eagly & Chaiken, 1993). This is something that must be kept in mind when proposing an alternative theoretical model. Personality is fairly constant across an individual's life span and many behaviours may be relatively stable and therefore, and should be taken into account in any model (McCrae & Costa, 1990, p87).

Others have argued that any complex behaviour often requires planning, co-operation from others, and access to resources etc. Such factors have to be accounted for within a behavioural model (Liska, 1984). Although an individual's behaviour is thought to be fairly consistent across time, the situation must also contribute to this behaviour, i.e., farmers have been encouraged to increase production over the past fifty years, at the same time they have been cushioned financially. However, new information on the effects of this intensive production and a reduction in available finance, impose a change in the situation. Fifty years ago few people had a negative attitude towards chemical use or to intensive farming, these attitudes are situation and time specific. What is required is a model which allows for the incorporation of time, external circumstances and individual variables.

The measurement of attitudes, intentions and behaviour has to be closely related within the constraints defined by Fishbein & Ajzen (1980), i.e. the wording for the items representing the attitudes and intention require close correspondence with each other and the behaviour under investigation. However, in many cases the target variable is not always under volitional control, or the problem situation may offer greater choice than estimated by the model (i.e. do/not do) or the necessary information may not be available to make the decision. As a result of the various criticisms Fishbein & Ajzen (1987) extended the model of 'reasoned' action to one of 'planned' behaviour. They included the notion of perceived behavioural control i.e. what obstacles are perceived which prevent the execution of the behaviour. This is akin to Bandura's (1977; 1982) concept of self-efficacy which relates to how an individual judges they can succeed in a given situation (Ajzen, 1991). However, it could be argued that people incorporate the idea of control when they plan a behaviour. Ajzen argues that perceived control is a sufficiently important addition to the model to explain past behaviour and cites three studies to support the argument (Ajzen, 1991). For example, Sejwacz et al., (1980) tested the theory in relation to losing weight and found perceived control improved the prediction of intention over and above that achieved by the theory of reasoned action.

Meta-analysis of the research related to the theory of reasoned action suggests that the model fails to satisfactorily explain behaviour under all conditions, (Shepherd et al., 1988) and it requires to be modified depending upon the situation and types of attitudes under scrutiny. Although attitude and intention specification have to be tightly matched to the behaviour under scrutiny, there is often a requirement to predict more general behaviour. Because the failure to predict behaviour lies at the individual level of analysis, greater account of

individual traits (other than attitude), that influence behaviours which are important to farming in general i.e. information gathering or the need for cognition, and ability are required in a model (Simon, 1957; Petty & Cacioppo, 1986).

In view of these shortcomings, and the recognition by most psychologists that behaviour arises from a multivariate interaction of individual characteristics, and environmental constraints, a simpler transactional model is proposed. Such an interactionist model permits the incorporation of both endogenous and exogenous variables into the theory testable part of the model. Data can be collected empirically without regard to a specific theory and may be tested in a number of theoretical models, and the best fit for the data chosen. Individual differences (traits) are more stable over time than attitudes and their contribution to the attitude-behaviour relationship should enhance the predictive power of the model.

The proposed method of analysis is structural equation analysis, which permits testing the assumptions of the theory of reasoned action in competition with models that make different assumptions. This method uses a mixture of factor analysis, path analysis and multiple regression procedures to analyse the data. Structural analysis is a correlational technique for testing the plausibility of relationships among variables using a number of alternative causal models. The likelihood that the specified paths are plausible is evaluated through a sequence of multiple regression in which the variables hypothesised in the model are assumed to be causally prior (Bentler, 1980). This type of analysis assists in the building of models which relate individual characteristics (which may be represented by a latent variable) and other related phenomena. This method will be discussed more fully in the analysis section. This thesis will:

1) Hypothesise a transactional model of the relationship between individual differences and farming behaviour also select and test a variety of variables.

2) Delineate the domains of attitudes, goals and behaviour which are important in farming, including the domains of individual differences likely to affect farming behaviours.

3) Design a series of questionnaires to cover these areas

4) Use structural equation modelling to test putative causal pathways among the data.

2:2 Proposed model

The normative cost-benefit model of economics and decision-making has moved from viewing the individual as a completely rational, maximally optimising individual to one where a rational decision may be the most satisfactory decision in the circumstances (Simon, 1957). However, even this is generally thought to fail to adequately predict behaviour because people take short-cuts, or fail to appreciate the normative strategies involved, especially, if the individual does not feel personally involved and motivated to perform the action (Kahmann & Tversky, 1979; 1984; Tversky & Kahmann, 1974). Another reason for the failure of these models to predict behaviour may be due to the mis-specification of the variables. i.e. it is often assumed that variables act independently of each other, but this is not always the case. This may be due to the multivarate interaction of the attitude-behaviour relationship or even as a result of interactions between attitudes themselves. That is, actions may reinforce behaviour and different attitudes may influence each other.

In the psychological models it is generally recognised that specific behaviour is best predicted by specific intentions and attitudes. This has led to a preponderance of models which specify one specific behaviour on the basis of highly specific intentions and attitudes. This method of seeking the cause of behaviour generally works only when the single cause is particularly powerful (Lazarus & Folkman, 1984). But like Fishbein & Ajzen (1974;75) it will be argued that no behaviour or attitude can stand alone, rather behaviour is the result of complex interaction between other behaviours, intentions and attitudes. Therefore, groups of general attitudes, intentions and behaviours are best summed prior to analysis. Any model therefore, has to reflect the complexity of these interactions.

The standard procedure of analysis in economics and psychological models is multiple regression statistics. However, when individual differences are being studied there is no definitive method of measuring such differences and it is often necessary to specify a latent variable. This is a variable which is not measured but which is postulated to account for the underlying relationship between a number of measured variables, for example, the underlying factor of intelligence as measured by a number of verbal and non-verbal reasoning test to account for the trait of intelligence. It is impossible to regress a latent variable, thus structural equation techniques are necessary.

The proposed model has it roots in reciprocal determinism, systems theory and stress research (Bandura, 1978; Cox, 1976; Lazarus & Folkman, 1984; 1990, Deary et al., 1996). The probability models used in social psychology tend to be unidirectional causal models emphasising internal determinants of behaviour. However, behaviour is not only influenced by internal determinants, many external variables also influence behaviour. The proposed transactional model

of behaviour argues that it is largely through their own actions that people generate environmental conditions which continue to affect their behaviour in a reciprocal fashion (Bandura, 1978). It is further argued that these experiences affect how the individual thinks, what they expect, and how they behave. In this model the person and the situation are considered independent causes of behaviour. It may be, that past behaviour determines present behaviour, and in this model it is possible to allow past behaviour to become an input variable in the equation. However, the assumption of reciprocity indicates there may be difficulty in determining which is a cause and which is an effect (Philip & Orton, 1983). It is however, possible to postulate a unidirectional principle because the individual traits, the environmental influences and the behaviour will not occur simultaneously, what is evident, will be a series of unidirectional links (Philip & Orton, 1983).

Lazarus (1984) argues the traditional, linear causal models are inadequate because multivariate research is often conducted at different levels of scientific analysis. In the case of farming, the external variables such as farm size, farm type, location etc. have different measurement categories from the psychological variables and they are at least partially independent of each other. Lazarus (1984) argues the link between the external and psychological variables is made through cognitive appraisal. This may be interpreted to mean that the individual's traits cannot be ignored without losing explanatory and predictive power. It is possible, for example, that the farmer may appraise his commitment to the environment through the size of his farm when implementing sustainable practices. For another, it may be through the farm's ability to generate profit. However, it is equally probable that personality factors mediate external farm variables. For example, it is unlikely that a farmer with a low level of ability will run a large efficient, highly profitable

farming unit successfully. In this study it is not possible to use the model as a process model, that is, investigating all of these factors in a dynamic, reciprocal manner over a period of time. Such a model does extend the possibilities for future farming research. This model will be used in an interactionist manner for single shot data not unlike the Fishbein model, in that, beliefs attitudes and behaviours are incorporated in the model. However, the transactional model expands the theoretical boundaries by incorporating the interaction of the individual's personality, expectations and the environmental constraints into the model.

The proposed transactional model permits antecedent variables of a personological nature to influence attitudes and to be mediated by other variables which affect behaviour. External variables may directly affect behaviour and be mediated by attitudes and values and should also be included in the model. Thus, although personality and external variables are seen as external to attitudes and intentions in the Fishbein-Ajzen model, this model is more akin to supporting the structure of personality advocated by McAdams (1995) who proposes three levels of structure. At the top lies the generalised traits, below this the motivational forces of personality and at the base, the individual's personal construct of their world, (this is not unlike Allport 1937, and Cattell's idea of cardinal and surface traits). This thesis argues that level 1 and 2 can be identified, but level 3 must rest on the behavioural actions of the individual, this is both where, and how, the interactions of level 1 and 2 are resolved. This is argued because it would be impossible to generalise the results, or even ascertain, the individual constructs held by each participant in the study. Personality is the antecedent variable in this model, it is mediated by attitudes but also directly affects behaviour. The model is sufficiently global to

accept the multivariate nature of the problems associated with farm decision making.

Although all research is time and finance limited, it is possible for such a model to be extended, modified and changed without changing the basic structure. That is, the importance of the external variables will no doubt change with time and situation but, the individual characteristics, and the need for cognitive input in the use of goals and information is unlikely to change with time. A useful model will only be achieved if the data are collected through well validated measures. Such tools are available for personological factors but no such tools exist for attitudes, goals and behaviour in farming. These tools will have to be domain delineated and constructed as part of the study.

2:2.1 Model construction

In summary, the constraints on model building are as follows. Variables in models are viewed as a) antecedent, b) mediating, or c) outcome/dependent. According to Lazarus' model, personality and cognitive ability measures are core, stable, aspects of the person and are always used as antecedent variables in the modelling exercise. Mediating variables are those which are influenced by cognitive input from the individual such as goals, intentions etc., and they mediate between the antecedent and the outcome variables. Outcome variables will be behavioural acts. The psychological variables predictive of behaviour are reviewed in the following chapter.

CHAPTER 3

THE INFLUENCE OF ATTITUDES, OBJECTIVES AND BEHAVIOUR ON FARMING CHANGE.

"In short there is much evidence that the adoption of innovations depends on the attitudes, norms, values, habits and reinforcement expectations of the farmers, and on some interactions among these variables."
N. C. Triandis in Attitudes and Attitude Change, 1971

3:0 Introduction

The previous chapter reviewed three theoretical models of attitude-behaviour relationships and hypothesised a conceptual model of farming behaviour. There exists an enormous volume of literature on farming behaviour and it cannot be comprehensively reviewed in this thesis. This chapter reviews the recent farming literature (1970-1992) in an effort to determine the most important farming variables likely to contribute to the hypothesised model. One of the aims of the thesis is to empirically establish item scales which will reliably and validly represent important farming attitudes. Therefore, no attempt will be made to critically assess the various perspectives from which these attitudes have been studied, only to identify the important variables which appear predictive of farming behaviour.

This chapter examines the approaches to studying agricultural change in both commercial and sustainable farming systems. Some of the constraints on change are highlighted, and the specific attitudes, goals and behaviour variables are examined along with external farming variables thought to constrain farming change.

3:1 Farming change

Across the world farming methods are perceived to change only slowly, farmers are cautious about adopting unproved ideas (Fearne, 1989; Guerin & Guerin, 1994). The prerequisites of change are discussed in this section. No change can occur without the means to bring it about, therefore, innovation is necessary. Innovation in farming is defined as an idea, method or technology which is perceived as new to its adopter (Rogers, 1983; 1995). But the outcome of adopting something new cannot be accurately predicted, change therefore, incurs risk. The innovation on its own is unlikely to be introduced unless the individual is willing to change, and has sufficient knowledge and information relating to the change (Gailiart, 1971; Rogers, 1983; 1995). In psychological terms this willingness to change may be defined as an open minded personality who is motivated to achieve (McClelland, 1951; 1961). To be motivated to achieve requires the setting of goals or targets. Change therefore does not take place in a vacuum, it is influenced by a number of variables.

The literature on farming change is not contained only within farming journals. Rather it is spread across a number of disciplines such as agriculture, economics, psychological, sociological, anthropological and business management and much of it is contradictory (Linder, 1987). It is hypothesised here that much of the contradiction arises from the fact that various disciplines use the same terms but define the terms slightly differently while using the same outcome variables. The literature review follows the themes of the journals but may be reduced for simplicity to two mainstream attitude variables; those of innovation and risk within which other sub-sections operate. The following sections examine the findings of the research relating to farming attitudes and

behaviours and reaches decisions on the variables to be included in the research.

3:2 Change through innovation

The adoption and rate of diffusion of new farming practices has been a major area of farming research because of its implications for economic growth. Early adoption is thought to be the result of an individual's self-motivation to achieve (Gasson, 1988; Roger, 1983). Conversely, non-adopters are seen as either risk averse or lacking in entrepreneurial spirit (Gasson, 1988; Roger, 1983). Adoption is seen as part of a decision process which is accessed over four stages, at each stage different variables are important. Initially there is a knowledge gathering phase, secondly the persuasion stage where attitudes have the greatest influence, then the acceptance (or rejection) stage and finally the on-going monitoring of the adoption process (Rogers and Shoemaker, 1971). The most important feature of innovation research is the emphasis on information and education (Rogers, 1983; 1995; Brown, 1981) Rogers (1983) argues it is the younger better educated farmer who innovates first. However, this is challenged by others (see Guerin & Guerin, 1994 for a review).

Although it is important for economists to evaluate the impact of new technology and its rate of diffusion across a community, it is argued here that it is also important to define the individual psychological variables which feed the process of change. Most studies are related either to the reason why some individuals adopt while others do not, or why some adopt earlier than others. These in fact may be classified as retrospective studies, they are usually specific to a piece of technology, methodology, or say, a hybrid corn, (cross bred species of corn) along with some of the social, psychological or farm structural variables thought to be associated by the researchers. There are very few

studies which are truly multivariate and use quantitative methodology. For example, Lin (1991) in a study of the adoption of F1 hybrid rice in China linked this specifically to education, gender and the availability of credit. Other adoption farming studies have investigated more personal attributes such as attitudes towards progress and risk, 'cosmopolitanism', level of income, and attributes of the business such as farm size, tenure, location, status etc. but not all these variables are considered together, (for example; Rogers, 1983; Feder at al., 1985; Gladwin, 1976; Franzel, 1984). There has been a tendency for researchers to use an either-or position and to omit many variables which could better explain the model (Linder, 1987). Qualitative studies on the other hand lack the ability to generalise and hence predict who will change or why.

Many innovations can be observed to be related to either commercial or environmental practices (Chamala, 1987). In commercial innovation the emphasis is on advanced technology and increased profitability whereas environmental innovation is related to sustainability and preservation. Both types of innovations are related to a number of variables such as, type of land, type of crop, chemical inputs, labour, machinery, access to markets etc., as well as attitudes towards, and knowledge about, what is being maximised (Doorman 1991).

Rogers' (1983) definition of innovation is not that of the entrepreneurial individual who produces creative ideas, rather it emphasises the early *adoption* of technology. The emphasis is on the implementation of change, rather than the underlying process of change. In dairy farming in the USA for example, the amount of farming technology employed has been shown to be one of the best indicators of the willingness to take economic risk (Driver & Onwana, 1986).

What is not examined is why these individuals purchase greater amounts of technology than their neighbours.

Innovation is a two edged sword, commercial innovations are adopted because they are thought to increase the economic viability of the farm, but perversely, technology change tends to reduce prices, or increase land prices (Brown, 1981; Rogers, 1983; Linder, 1990; Brookes et al., 1986). Therefore, only the farmer who is the *first* to adopt will find commercial practises advantageous. The rate of adoption is less relevant in most cases where individual profitability is investigated, but is necessary when considering the increased production of an area, i.e. at the macro rather than the micro-level of analysis.

As in all business, variables associated with innovativeness are intelligence and information gathering related to the innovation (Anosike & Coughenour, 1990; Bora & Ray, 1986; Lin, 1991; Boswell, 1972; Rogers, 1983; Harling & Quail, 1990; Simon, 1957; Linder, 1987). Information is considered the most important variable in innovation, it is thought to flow both to the individual from a number of sources and is returned from the individual to others (Rogers, 1983). However, there is a distinct lack of research evidence based on objective and empirical results relating to information gathering (Fearne, 1989). Thus, information and the sources of information and the frequency with which they are consulted should be accounted for in any empirical study. However, there is also a requirement for an individual to be both open-minded regarding information gathering *and* sufficiently extravert to exchange ideas with others (Hoyer & Ridgeay, 1984). Which of these variables is of greater importance in driving change needs to be addressed in the research.

As with innovation and business management studies, intelligence and achievement motivation have been suggested to be the key factors in improving economic viability (Sing & Ray, 1980; Tiwari, 1987; McClelland, 1961). Research in the West measures intelligence through the number of years spent in education but is better defined through IQ tests measuring different facets of intelligence. In Third World countries many farmers have no, or little educational opportunity. In both the UK and the USA the average age of the nations farmers is around the 50 year mark (Errington, 1991; Schertz & Wunderlich, 1982). These farmers may not have had the advantage of prolonged periods of education but may be no less intelligent than younger farmers with a greater number of years in education.

Part of the assessment of motivation in farmers in India was done using the Thematic Apperception Test (TAT) (Sing & Ray, 1980; Tiwari, 1987). This test involves participants studying depiction's of ambiguous life event scenes and telling the researcher the story they think is being enacted in these pictures. The theory is that the individual exposes their own personality and motivations in doing so. However, motivation to achieve is a difficult concept to both measure and substantiate theoretically in Western society (Locke et al., 1981). The use of TAT in an empirical investigation is problematical as there is difficulty in establishing reliability and validity (Entwisle, 1972: Pervin, 1993, p123). Therefore, the normal approach to achievement motivation is through goal directed behaviour (Latham & Locke, 1991). Closely related to achievement is the concept of autonomy, those who feel in control of their lives are more likely to succeed (Abregana, 1988). Thus farmers who are sole owners of their farms may have different behaviour orientations than those who do not (Gasson, 1988; Linder, 1987; Guerin & Guerin, 1994).

The driving force for farming change is perceived to lie within an individual's attitudes (Chamala, 1987; McGuire, 1986). Attitudes are an evaluation of a well defined object of reference and the response to this object will be negative or positive. Because of the importance of the cognitive element in the evaluative nature of attitudes, strong negative (emotional) reactions will prevent an individual from assessing new information which is not consistent with their previously held farming views, thus preventing change (Heiner, 1983). By implication, past behaviour is likely to be an indicator of future farming behaviour and should also be included in any assessment of behaviour.

Other factors such as those external to the farm production i.e. a lack of credit, farm tenure and access to information are also seen to constrain innovation (Gladwin, 1976; Linder, 1990; Gasson, 1988; Guerin & Guerin, 1994).

To summarise therefore, there is a general agreement in the literature that innovative farming is more likely among the younger, better educated, self-motivated, achievement oriented individuals who are intelligent seekers of information. There is some doubt that these are the only characteristics required for innovation, just as there is some doubt that the concept of innovation is adequately defined by emphasising these social and psychological aspects. Economic status, farm size and the type of innovation, have also been shown to play a part (Linder, 1987; Guerin & Guerin, 1994; Sirados, 1992; Gasson, 1988). On the basis of this review of innovation this study will include demographic variables of age and education but will also include measures of intelligence, information, personality traits of extroversion, open-mindedness, achievement seeking etc. Attitudes towards change will be investigated, along with items relating to the farm structure and financial details of the business.

3:3 Management of change

Brown (1981) argues aggressive management style is also an important force in the adoption of new ideas if they are to be profitable. Business management techniques are required if innovations are to be successfully adopted (Brown, 1981). There is a general consensus that, unless farmers operate using both strategic (long term) and tactical (everyday) decisions based on the good practice of fundamental management ideas they will be unable to innovate (Petit, 1976; McClymont, 1984; Brunaker, 1989; Zigger & Bot, 1989). However, Jannsen & Kirkke (1990) found little evidence of strategic planning in a sample of Dutch farmers except when applying for a bank loan. Successful farm managers are observed to use the same management strategies of other successful small businesses where there is no separation of capital, management and labour (Cassavant & Infanger, 1984; Gasson et al., 1988).

Successful farmers keep financial and production records and set targets for the business (Harling & Quail, 1990; Giles & Standfors, 1990) but there are studies which contradict this (Olsen & Tvedt, 1987). It is also shown that in general the successful innovative farmer has a larger farm and is more knowledgeable (Bora & Ray, 1986; Henderson & Gnomes, 1982). The emphasis of this approach is not in the implementation of the technology but rather on the infra-structure which makes the implementation possible.

Business managers also investigate change through entrepreneurship. Entrepreneurs are defined by their creative approach to business, of which there are two aspects; risk taking under uncertainty, and innovation (Groenwald, 1987). Entrepreneurs are risk takers in that they invest in their 'creation' even when the outcomes are uncertain or unknown. Here the

emphasis is on the creativity (innovativeness) not the risk taking aspects of the personality. From a psychological view point, it has been suggested that people are liable to a greater or lesser degree to be creative, solve problems, and make decisions in two characteristic ways. They are either adaptors who accept the problem and its attendant concepts and solve problems within the paradigm, unlike those at the opposite end of the scale, the innovators, who reconstruct the problem and move outside of the paradigm for a solution (Kirton, 1980). This definition alters the thinking about innovation. It suggests that the innovative farmer would not necessarily be adopting because of profit maximising, rather it is their creative nature which drives them to adopt. The difference in definition may be important when assessing the necessary individual requirements driving ideas of change.

As with other farming research, the business management approach also emphasises the importance of information, knowledge and education (Petit, 1976; Fearne, 1989). Sources of information can vary from media information, accountants, commercial representatives, agricultural advisors, business partners and spouse and others (Miller & Bottoms, 1989; Ford & Babb, 1989). In the USA the preference was for farm service oriented information rather than written sources of information (Ford & Babb, 1989). However, most studies fail to investigate the frequency and accessibility with which these sources are used. Identifying not only who is gathering information, but the source and frequency of such information in relationship to different types of decisions, will assist in determining if it is a key variable in farming change.

Other literature in relation to business innovation in general, suggests innovators unconsciously present themselves in a more socially desirable light than adapters, and that they are more open to new ideas (Elder & Johnson,

1989). This suggests that inherent individual characteristics play as great a role as does information in the role of change.

There is some doubt therefore, regarding what is the most important variable influencing profit maximisation; the personality aspects of innovation leading to the 'why' of the behaviour, i.e. being 'creative' or the technological aspects the 'how', i.e. adopting early, or the support of a management structure. However, there is a problem when profit is the only farming outcome measure; it is argued that the single outcome variable of measuring profit is not a sufficient measure of innovation (Gasson et al., 1988).

In summary then, psychological and social variables and variables external to the farm are seen as competing in innovative business behaviour. In both management and sociological research studies of innovation, intelligence, openness to new ideas and sociability are emphasised. It is suggested here that by measuring both aspects of innovation (risk taking and creativity) empirically it may be possible to identify which is of greater importance i.e. the 'why' or the 'how' of the behaviour. External farm variables will also be included in the survey along with items relating to how the farm business is run i.e. record keeping, setting of targets, sources, frequency and use of information. The survey will include the use of various items to compare the definitions of 'innovative' behaviour and assess the best measures of the 'how' or 'why' of farming change.

3:4 Objectives

Successful management of any business lies in the efficient use of resources and manpower. Large businesses usually operate, on a sequence of short, medium and long term goals which are implemented through the management system but which do not necessarily correspond with the private objectives of the individual managers. However, in farming, the director, the manager and the worker are often embodied in a single individual and the result may be a conflicting set of goals. These can be observed in such non-specific aims as to improve the 'quality of life' alongside more focused goals of increasing production and profits, taking on more land, or having more 'time off'. Potential conflicts of interest must be resolved by maintaining some goals at the expense of others. The importance awarded to the specific goals may depend upon factors such as age, life-style and the stage of development of the farm business (Wise & Brannen, 1983; Brazendale et al., 1993).

The literature is divided as to what extent farmers have well articulated sets of objectives. A seminal study in Britain by Gasson (1973; 1974) identified four dominant values in farming. The values were:

Economic values (Instrumental values), such as making maximum income, expanding the business, etc.

Social values, such as prestige as a farmer, continuing farming traditions, etc.

Expressive values, such as pride of ownership, meeting a challenge, etc. and

Intrinsic values, such as enjoyment of work, independence, etc.

Within these farm values two main types of objectives can be identified, those relating to economic factors and those relating to job satisfaction. The majority of farmers ranked intrinsic values as the most important reasons for farming, such as job satisfaction. However, what they thought characterised a successful farmer was economic outcomes (Casebow, 1981; Gasson, 1973; 1974; Gillmore, 1986; Ilbery, 1983). Commercial farmers (larger farms) have been observed to be more oriented toward production than others (Casebow, 1981; Gasson, 1973; 1974; Gillmore 1986; Ilbery, 1983). It is argued that this orientation towards production is the result of the lifestyle criteria having been met (Perkin & Rehman, 1994). However, it is equally likely that lifestyle is entirely dependent on financial success; it remains for the causal link to be determined.

Commercial farmers tended to be a little more concerned with economic values, while small farmers were more concerned with the independent life style that farming afforded them (Gasson, 1973; 1974; Gillmore 1986; Ilbery, 1983). However, when asked how farmers rated a 'good' farmer it was found to be the one who had the best livestock/crops and left the land better than he found it (Gasson, 1974). It would appear there is a contradiction in that for oneself the best thing about farming is what it has to offer, but if you are to be perceived as a 'good' farmer, you must produce the best crops/livestock. When a list of objectives rather than values is offered for rating Robinson (1983) found that the highest rated objective in the UK was to make a sufficient profit, followed by being good at what you do. Multiple goals relating to profit were common, such as staying in business, improved standards of living, increased time off etc., profit was important to all age groups (Wise & Brannen, 1983; Robinson, 1983; Harper & Eastman, 1980). In general the literature suggest that most farmers find farming very satisfying (Gasson, 1974; Ackerman et al., 1989;

1991; Coughenour & Tweeten, 1986; Coughenour & Swanson, 1988; Heffernan & Elder, 1987; Herrmann & Uttitz, 1990).

Other non statistical examination of farming types, not explicitly related to goal setting, has identified the same two sets of values, economic and job satisfaction (Salamon & Davis Brown, 1986). The two types of farmer identified by Salamon & Davis-Brown were the so-called 'entrepreneur' and the 'yeoman'. The labels explained the different values held by the groups, the yeoman was risk aversive, valued farming as a way of life, farm and family were important and off-farm work was normal. In the Salamon & Davis-Brown study entrepreneurs were successful farmers, risk takers who were unconcerned whether their children entered farming, and who carried large debt loads. This distinction parallels the economic and the intrinsic values of Gasson's (1974) and other studies. However, it also suggests that farmers can be identified as either one or the other. This may be an oversimplification as most farmers in the West are 'sons' of farmers, by definition, they have inherited/bought/rented their farms and are therefore equally likely to be innovators or traditionalist, they are not innovative newcomers to the business.

A broader concept of management style incorporates farmers' objectives and attitudes. This type of research has led Fairweather & Keating (1994) to propose three different types of farmers; the dedicated producer who wishes to achieve a quality product by good planning and management and who enjoys job satisfaction; the flexible strategist who looks to diversify, expand markets and generally adjust to the current situation; and the environmentalist who seeks to nurture nature, appreciates the proximity of the family and the quality of their life. The latter type is particularly reminiscent of Salmon & Davis-Brown's yeoman farmer.

There is, then, a general consensus that goals, objectives, or the values of farming, are important in understanding the decisions made by farmers. However, just as a variety of approaches have been used to conceptualise, define, enumerate and assess objectives, an assortment of methods has been used to analyse them, and this, as indicated by Perkin and Rehman (1994), can give rise to different emphasis. Paired comparison methods, (i.e. when a list of pairs of goals are offered and the farmer is asked to select the preferred goal from each pair) when used by Harper & Eastman (1980) in the USA, indicated that intrinsic values predominated in small farmers, but Perkin & Rehman (1994) were unable to describe their group by this means, as 1 in 4 of the farmers refused to rate one objective over another. This suggests that none of objectives are seen as taking priority over others; therefore, it may be inferred that factors other than objectives must play an important role in determining which objective is pursued.

In the USA, farming values and objectives have been studied through theoretical models of Quality of Life. Quality of life is encompassed in a variety of attitudes and expectations and these are related to various outcomes of the farm business such as farm size, income, tenure etc. The fact that these studies have proved inconclusive, may be partly the result of variations in what is thought to be important in the 'quality of life' and partly because of the lack of relevant outcomes (Coughenour & Tweeten, 1986). However, job satisfaction and economic return values were a consistent finding among all farmers studied (Coughenour & Swanson, 1988; Coughenour & Tweeten, 1986; Schroeder, Fliegel & van Es, 1985). Significant variables associated with the farmers perceptions of quality of life were age, education and income (Coughenour & Tweeten, 1986). The older, better educated, higher income farmer reported a better quality of life (Schroeder et al., 1985). All farmers

reported being strongly attached to their work and satisfied with farming but this was not related to income or farm size (Coughenour & Swanson, 1988).

However, identification of types of values and objectives does not confirm that farmers are actually using these objectives in the management of the farm. Qualitative studies have indicated that many farmers do not plan ahead or use objectives in a clear and structured way unless they are applying for a bank loan (Ziggers and Bots, 1989; Jansen and Kirrke, 1989). In particular, the use of innovative or entrepreneurial business practices do not appear to generalise to environmental practices suggesting that different objectives are considered in these areas (Pampel & van Es, 1977). In psychology, goal research has shown, that unless strategic planning is used an individuals goals will be non-specific (Cervonne et al., 1991).

If specific objectives are studied by qualitative methods then there appears little evidence in the literature to support the assumption that farmers are using targets and goals in farming. However, if empirical work using goal statements and quantitative scale scores covering a broad range of objectives is assessed there is evidence that farmers have recognisable groups of objectives, and the primacy of these objectives varies from individual to individual (Casebow, 1981; Fairweather & Keating, 1994; Gasson, 1973; Gillmore, 1986; Ilberry, 1983; Perkin & Rehman, 1994). If this information is to be useful in predicting the uptake of policy, then more systematic and comprehensive research is needed to identify farmers' goals, individual differences, and aspects of the farm. It is therefore proposed that multiple goals should be assessed and analysed in conjunction with individual differences and farm structural variables.

In summary, there is general agreement that objectives, values and goals (three terms usually treated as synonymous) are important in farming, but little agreement as to which of these are of greatest importance, or if they are indeed all equally important. The literature suggests that economic goals, satisfaction with farming, life style and status derived from farming are important and these may be related to age, farm size and tenure. As Perkin & Rehman (1994) have indicated research findings differ depending upon the methodologies used to assess the goals. This thesis will therefore include measures of all of the above objectives and test them in attitude-behavioural models.

3:5 Risk taking attitude

Change involves risk; economists concentrate research studies on the farmer's attitude to risk taking and change. The agricultural production process is risky in many of its stages. For the arable farmer the availability of sunlight and/or water, affects crop growth and harvesting stages. The effects of pest, disease and machinery breakdown on the overall crop yield also puts production at risk. Nor does the farmer know what the market demand and price for the product will be twelve months later, when he is ready to harvest. Legislative changes also induce uncertainty such as, new regulations on chemicals, subsidies, quotas etc. Some may be specifically designed to reduce risk, others reduce it in some areas while increasing it in others. An example might be that of the government encouraging farmers to increase their farm size and increase the use of large technology, and the result of this was to increase land prices while reducing produce prices due to the increase in production (Brookes et al., 1986). Farmers accept risks that no salaried employees would tolerate (Brookes et al., 1986). Such risk (induces stress which in turn will) affects

behaviour. Risk attitude is therefore of major importance in the study of farm decision making (Thomas, 1987).

It is argued that success-oriented individuals will prefer *moderate risk* to any other form (McClelland, 1954; Sachs, 1973; Sorrentino et al., 1992). Risk attitudes have been studied from the view that risk taking is a gamble. Gambling (game) theory is used to explain how to maximise a bet (Lopes, 1983). However, this formal statistical decision making theory claimed to predict everything from placing a lottery bet to who would adopt new technology (Lopes, 1983; Bingswanger, 1980). All that appears to have been proved is that people are not 'rational' in the mathematical sense (Lopes, 1983; Lee et al., 1988; Brehmer, 1987; Kahman & Tversky, 1979; Groenwald, 1987). Modified utility theories such as Portfolio and Prospect theory (Coombs, 1975; Tversky & Kahmen, 1974) explain risk taking as a trade off between potential expected returns and perceived risk. These are theories where a number of objectives are pursued by the individual who is assumed to 'compute' and weight the probabilities associated with each objective before deciding on a course of action. However, the differences between individuals decisions in these mathematical models leads to many different ways of explaining the outcomes; and correlations between objective risk and innovative behaviour were low (Brehmer, 1987).

Financial risk taking includes a willingness to take on debt, and the lack of willingness to take risk is seen to limit adoption and innovation (Driver & Onwana, 1986; Pile, 1991). Risk aversion is exhibited in diversification of the business, taking out insurance to protect against risk, contract selling, that s being contracted by a supermarket to produce specific crops, hedging that is using the stock market to hedge against price fluctuations etc. (Lee et al., 1988;

Driver & Onwana, 1986). Other descriptive studies of farming risk attitudes have identified sustainability, this vague term appears to relate to the maintenance of the land with the minimum of input and the maximum outputs that can be sustained over a long period of time, succession (inheritance of the farm business by a family member) and off-farm work as factors related to risk averse production behaviour (Salamon & Davis-Brown, 1986; Fairweather & Keating, 1994; Murdock et al., 1986; Brookes et al., 1986).

Due to the lack of separation in research and practice between innovation and risk taking variables, individual characteristics of intelligence, motivation and education have also been found to relate to risk taking behaviour and production (Sagar & Ray, 1985; Tiwari, 1987; Vijayakumar, 1985; Anosike & Coughenour, 1990). Other demographic and farm structural variables such as being older, having a larger than average farm and increased productivity along with the farm type and structure are also correlated with risk taking behaviour (Sagar & Ray, 1985; Thomas, 1987; Newman et al., 1990; Anosike & Coughenour, 1990). Unlike innovation, risk taking is associated with being older, rather than younger. This suggests it is not a measure, or an association with a personality trait of venturesomness, usually associated with youth but a separate variable which may be related to having less financial restrictions (debt) which possibly comes with being older and better established in the business.

The econometric theoretical stance places the emphasis on the financial risk taking nature of the individual's personality and is defined by financial risk taking behaviour but, it can also be defined as striving for achievement (Sachs, 1973). Psychologists, on the other hand, explain risk taking behaviour in terms of stable traits i.e. adventure, (Lopes, 1983; 1987). The literature is unclear whether farm business risk taking is a result of achievement motivation or a personality that is oriented towards taking risk (as in gambling), or something

else, thus any empirical study has to include items which define both traits and achieving attitudes.

3:5.1 Diversification

Diversification is one of the most frequently studied aspect of risk aversive behaviour among farmers. Diversification can be classified under three headings.

1. Farming diversification using new crops such as flax, new livestock lines such as ostriches or lamas, or just changing the nature of the crop or breed, e.g. introducing intensive pig farming alongside the usual farming produce.

2. On-farm diversification, not directly related to farm production, such as pony trekking, bed & breakfast, holiday cottages, craft or farm shops.

3. Off-farm diversification, or pluri-active farming, where full or part-time employment, which may not be, related to farming or forestry is taken by the farmer or other household members.

In Britain, 1 in 4 farmers are likely to have off-farm work. This figure is considerably lower than for the rest of Europe (Gasson, 1988). However, this may be increasing as income from farming decreases (Marsden, 1989). In both the USA and Britain it has been observed that diversification through off-farm work is not uniform across the country (Gasson, 1988; Anosike & Coughenour, 1990). This may be due in part to the opportunities available for off-farm work in the various regions and such a lack of opportunity may be a particular problem in the Highland and Border regions of Scotland.

However, although many argue diversification is a risk reducing strategy (Lee et al., 1988; Driver & Onwana, 1987; Salamon & Davis-Brown, 1986) there are others who do not regard pluri-activity options simply as a risk reducing strategy (Newman et al., 1990; Gasson, 1988; Herrmann & Uttitz, 1990). For example, New Zealand farmers have argued that diversification is not a risk reducing strategy, it actually increases risk because the producer is less knowledgeable in the new field and it limits opportunities for increased production (Saunders et al., 1991). These producers thought with hindsight, they should have specialised rather than diversified. This intriguing claim does not appear to have been investigated elsewhere, nor is it clear from the literature how many farmers abandon diversification or are saved from financial failure by it. Information of this nature would help to define if diversification is indeed a cost effective strategy.

Income alone is unlikely to be the driving force for diversification, as larger farms are more likely to diversify than others (Gasson, 1988). Larger farms are also more likely to adopt environmental practices and this may be related to the lack of need for income (Anosike & Coughenour, 1990; Gasson, as quoted in The Commission of the EC Report, 1986). However, this is contradicted by Taylor & Miller (1978) where lower socio-economic status was identified with environmental practice. There is a suggestion here that diversification and innovation are more closely related to increasing profit rather than a specific means of reducing farming risk.

Similar external constraints operate on diversification as they do on adoption of innovations. The ability to borrow to finance the project, and having the necessary number of hectares required to diversify are important. Legislation and policy decisions by external authorities to aid or encourage diversification also affect the behaviour (Gasson, 1987).

Off-farm work, believed to be another form of diversification or risk reduction, has been hypothesised to be a consequence of a farmer's attitudes and values rather than the result of economic necessity, (Hermann & Utitz, 1990). There is some controversy over how satisfactory farmers' find off-farm work (Hermann & Utitz, 1990; Schulman & Green, 1986). There are signs of confusion in the literature as to what extent preference for off-farm work, and the needs of a farm successor influence the choice of strategies, and why a particular strategy such as off-farm work is used. Examination of why off-farm work may be important to a farmer will have to be investigated in this research.

Farmers who operate the farm but who also work full time off-farm appear to do so for a number of reasons. It may be the combination of work, home and leisure, economic necessity or the intrinsic worth of the off-farm work is greater than that achieved through farming (Foster & Rausser, 1991; Schroeder et al., 1985; Heffernan & Elder, 1987; Coughenour and Swanson, 1983; Brooks et al., 1986). However, it has also been argued that such pluriactivity ultimately results in withdrawal from farming (Schulman & Garret, 1990). Off-farm employment the reasons for it, and the status associated with the off-farm employment are necessary ingredients in a model of farming behaviour if they are to predict if the farmer continues in farming and the reason why.

It would appear that off-farm work is increasing in the past two decades, but whether this is a prelude to leaving farming, a good strategy for surviving a crisis, or a model for all family farms in the future will have to be determined by further longitudinal study (Gasson et al., 1988). The increase in pluriactivity (Gasson et al., 1988; Commission for the EC, 1986) may partly arise from the

manner in which pluriactivity is defined. Pluriactivity is defined as the involvement of the family or any family member, in off-farm employment rather than just the principle operators (Gasson et al., 1988). Increasingly more women take employment outside of the home in all levels of society, thus farmers wives would also be expected to do this regardless of the financial need of the farm (Commission for the EC Report, 1986). A more appropriate measure of the importance of pluriactivity is required. Another measure of economic expediency is the amount of *on*-farm work the spouse and children contribute to the running of the farm (Commission for the EC, 1986).

From the literature the importance of pluri-activity within farming appears to have its roots in a number of attitudes, those towards retaining ownership of the farm in a time of crisis, a means of increasing the viability of the business, retaining the satisfaction of farm work without the need to depend upon farming finance, or conversely achieving greater satisfaction in off-farm work. All of these attitudes require consideration when modelling farming behaviour.

3:5.2 Succession

Succession, or the inheritance of the farm business by a family member, is also thought to be an important reason for diversifying rather than selling up and moving out of farming. Those who leave farming may do so because they do not have a successor willing to take over the farm (Errington & Tranter, 1991). Others argue because farming is seen as a good way of life, farmers will take off-farm employment to retain the farm for themselves and future generations (Salamon & Rogers, 1983). In the present climate of recession, decisions related to staying in business and passing on the farm to the children are important objects of study. Current succession levels across Europe are

approximately 23% and this has implications for production, land prices, policies and the pace of change (Fennell, 1981). However 80% of all family farmers in Britain are run by farmers whose fathers farmed before them (Gasson & Winter, 1991). Changes in this percentage could affect a great number of farming policy decisions if these farms withdraw from production, or less experienced farmers operate them i.e. without this wealth of farming experience production levels are likely to fall and more bankrupt and failing farms will emerge. Attitudes towards succession and the expectation of it taking place are therefore, important for long term policy implications.

3:6 Environmental Attitudes

It has been argued that economic theory is of little help in identifying the attitudinal variables which influence the farmer's behaviour processes and this is particularly true in the case of conservation behaviour (Lynne et al., 1988; Taylor & Miller, 1978). Although, innovation and adoption are equally applicable to environmental methods that is, an innovation can be environmentally sound *and* lead to increased production (at least in the short term) (Chamala, 1989). However, it could be argued that environmental innovation may, in many cases, be closer to a withdrawal from technology rather than an advance i.e. where organic farming techniques are used there is likely to be a *reduction* in output per acre. This makes it difficult to assess whether the manner in which adoption is usually investigated is appropriate for both production and environmentally oriented practices, especially, where the best predictors of environmental practices have been associated with lower socio-economic status (Taylor and Miller, 1978). Where the emphasis is on sustainability (a constant, viable sustainable level of production and income rather than constantly increasing production), it will not necessarily be the rate

of adoption which is crucial to success, it is equally likely that intelligence, and a tenacious personality will contribute more to the sustained effort required to achieve environmentally sustainable objectives. Longitudinal investigation would be more appropriate than cross-sectional study to examination of the variables involved in the implementation of environmental practices. However, the ways in which this is achieved, and the individual characteristics of those willing to pursue a more arduous course of farming, involving greater financial risk, may be of greater importance. It is conceptually possible it may be those who have *never been* innovative who will now be seen at the forefront of environmental behaviour, as are those with lower socio-economic status which of course may compose the same group (Taylor & Miller, 1978). These individuals are likely to have been referred to as the 'traditional' or less intensive, farmer. It may be that middle sized, middle income farmers would be a more appropriate target for investigation as their contribution to environmental farming will have a much greater impact overall than the smaller less viable sections of farming.

Adoption of environmental policies does not seem to be affected by the same variables as production/financial decisions (Lynne & Rola, 1988; Napier & Foster, 1982; Pample & van Es, 1977). An attitude for profit maximisation or sustainability will determine which type of innovations will be adopted (Pample and van Es, 1977; Taylor & Miller, 1978). Although, Lynne & Rola (1988) argue that income alone is not a significant predictor of conservation behaviour. Profit motives are stronger than environmental motives, even while there is an awareness of the environmental problems (Newman et al., 1990; Lynne & Rola, 1988; Pample and van Es, 1977; Carr & Tait, 1990). In some cases the perceptions of the farmer and the soil expert on the need for conservation are not in agreement (Saunders et al., 1991; Smith, 1994). When

a farmer plants trees or replaces hedges the reason is more likely to be for one of agricultural necessity rather than environmental protection (Carr & Tait, 1991). This reluctance to accept change may be due to the fact that most environmental policies are necessitated by legislation, and may not have the same effect on attitudes as those behaviours which are freely chosen by the farmer. Many farmers perceive conservation measures to be uneconomic as they may increase the financial risk for high debt farms, it is only when the need for environmental measures is perceived by the farmer that the behaviour is likely to occur (Taylor & Miller, 1978; Turvey, 1991).

Environmental attitudes are thought to be shaped by having a successor, fear of the future and farm debt, but adoption of environmental measures generally goes hand in hand with monetary inducement and education (Gasson & Potter, 1988; Potter, 1986; Novak, 1982; Barkley; 1982; Lovejoy, 1990). Assessing attitudes towards grants and how the information is presented may be important if it is to appeal to conservation attitudes (Novak, 1982).

External variables likely to affect the adoption of conservation measures include farm structural factors such as farm size, tenure and type but there is some controversy over which of these factors is important (Morris & Potter, 1995; Schertz & Wunderlich, 1982; Nowak, 1987).

It is often argued by the farming community that farmers are seen as stewards on the land, who hold the land in trust for the rest of the nation (Small Farmers Conference Reading, 1993; Napier & Forster, 1982). But it is more likely that farmers hold the land for themselves, or their landlords, and their successors (Gasson et al., 1988). When farmers are asked what is required in the field of

conservation, they are able to define what the problems are, but would prefer the government to take action and provide the finance to support conservation programmes (Novak, 1987). If change is to take place without extensive financial aid then it is important to access these attitudes and obligations that would encourage responsible change.

The literature is ambivalent regarding the attitudes which encourage environmental concerns. There is an emphasis on information and a general agreement that environmental changes are unrelated to financial gain, although those which are adopted may lead to short term financial gain. There appears a problem in defining what is important in practising environmentally concerned farming, and there is a need to develop better measurement of criteria. It is unrealistic to expect a wholesale adoption of environmental measures if it means that profits fall below a viable level. It is suggested that inclusion of both profit and environmental behaviour measures are necessary in any study of conservation attitude and behaviour, along with the many attitudes and goals that contribute to these behaviours. Studies must be multivariate and longitudinal. New environmental practices can hardly be considered innovative if they are only instituted by those who are economically unviable and whose contribution to reducing/sustaining production would be unchanged.

3:7 Farming stress

The impact of financial and psychological stress on farming behaviour is widely reported in the recent literature. In the USA the National Institute of Occupational Safety and Health ranks farming in the top ten of 130 stressful occupations (Heffernan, in Belyea & Laboa, 1990). In the USA during the 1980s farming recession 100,000 farmers a year were made bankrupt (Jurich &

Russell, 1987). In Britain during the period 1990-91 alone, 14,000 farmers left the land and all across Europe, rural change is taking place. Until fairly recently when farming crises occurred little attention was paid to the psychological consequences (Heffernan & Heffernan 1986; Molnar, 1985). The post war increases in farm size and the decrease in labour along with the intensive capital investment required for modern farming has left farmers vulnerable to farming stress because of isolation and financial pressure (Albretcht et al., 1987; Tweeten, 1984, as quoted in Belyea & Laboa 1990).

Economic vulnerability is generally defined as the inability to make payments on debts, having variable income levels and high levels of debt and this is usually measured by the debt to assets ratio. Farmers are caught in a difficult situation when borrowing, in essence they set borrowing targets once a year and should the weather adversely affect the crop or the market prices fall during this period, then they may not be in a strong position to pay back what they have borrowed. Indeed it may result in further borrowing in an attempt to recoup the loss, this is often the root cause of farming crises (Brooks et al., 1986). Farmers who own their farm can borrow greater amounts because of the collateral than can tenant farmers.

Economic vulnerability is thought to relate to farm size and having grain crops (Belyea & Laoboa, 1991). Those with high debt levels tend to make more changes to their farming methods and are more likely to suffer from depression than those with less debt (Ekstrom & Leistritz, 1986; Belyea & Laboa, 1990; Armstrong & Schulman, 1990; Rosenblatt & Keller, 1983; Walker & Walker, 1987). Interestingly, Schulman & Armstrong (1989) found a curvilinear relationship with economic difficulties, that is, higher and lower income operators were more distressed by debt than middle income farmers. On the

other hand, Runge (1987) argues it is the younger better educated, more technologically advanced farmer who quits farming in times of trouble, leaving behind the smaller less efficient units. Lower incomes were observed to be less stressful for the better educated (Ross & Hunter, 1985).

Prolonged periods of stress can lead to depression, which in turn can contribute to a number of other factors such as increased alcohol intake. Hsieh et al. (1988; 1989) noted in the early 1980s farmers had increased referral rates (21% increase compared with 4% in the non-farming population) to state alcohol clinics and that the greatest increase was in the 21-39 age group. However, it is not only economic vulnerability that contributes to farming stress. Unpredictable weather, time pressure, government policies, farm hazards and geographic isolation also account for stress and illness (Walker et al., 1986; Eberhart & Pooyan, 1990; McGregor et al., 1995; Deary et al., 1997).

Stress was indicated by problems such as, problems with balancing work and family responsibilities, insomnia, back-ache and poor concentration (Walker & Walker, 1987). Stress also arises within the extended farm family but the literature is ambivalent over who is more stressed; the younger or older family members (Weigel et al, 1987; Schulman & Armstrong, 1986). A more extreme consequence of depression is farming suicide which has a higher incidence than would be expected for this group. One of the reasons proposed is high exposure to organo-phosphates and other chemicals such as pesticides and carbonates containing antichlorinesterase (Stallones, 1990). Exposure to these chemicals can result in long term memory loss, depression and anxiety (Stallones, 1990; Stephens et al., 1995).

The amount of personal control an individual perceives themselves to have also affects health and stress levels, those with greater perceived control are less likely to feel stressed (Keating, 1987; Kobasa, 1979; Sweeney, 1986; Seeman & Seeman, 1983; Krauser & Stryker, 1984; Hull & Mandolia, 1991). Those with better coping strategies are also less likely to be stressed (Lazarus, 1990).

Stress is acknowledged to affect the decision making process, both in terms of what is done on the farm, for example, increase production when market prices fall, taking off-farm employment, or leaving farming etc. Many stress factors have been highlighted from weather to finance but it may not be possible to identify these in a study such as this. The idea here is not so much to identify the stressors as to check the mental health of the farmers participating in the study. This will help to establish if this variable is important in the hypothesised model.

3:8 Attitudes towards legislation

New policies and legislation are generally perceived to increase farmers' workload and reduce their income (Sunday Times Nov., 1992; Jurich & Russell, 1987; Schulman & Armstrong, 1989). The increase in environmental legislation relating to farming has been reported as one of the factors responsible for the increasing suicide and depression rates among farmers (Jones, 1994) suggesting farmers are becoming pessimistic about the future of farming.

Many farmers and non-farmers complain that the UK Government and European Parliament interfere too much in farming, but in general it has been found that when goals are assigned by legitimate authority they typically

influence people's personal goals and attitudes and make them motivated to comply (Locke et al., 1984; Dember, 1975). Whether this is true of environmentally oriented farming remains to be investigated.

Legislation has increased in all western countries in the past two decades. Many farmers complain that there is too much government interference in farming. McGregor et al. (1995) reported that farmers' find new legislation as stressful as the weather. Farmers complain they are not equipped to deal with the administrative aspects of new legislation on the farm. The fact that they might be penalised for providing incorrect information (for example, an incorrectly counted and recorded head of hill cattle) increases their anxiety levels as does the lack of forward planning by the policy makers themselves (for example, when this study started no one knew if set-aside was to a)continue b) continue either in its present form or c) in a different form). This stress does not wholly arise from legislation, more recent regulation of pollution has increased the financial strain on many farmers. It has been suggested that the distrust of new legislation arises from the fact that farmers are not involved in forming the new policies (Endruweit, 1990). Attitude items relating to legislation and policy making will be included in a multivariate study.

3:9 Discussion

The most important variables identified in the adoption of innovation on farms by farmers were farming were age, self-motivation, information, education, the availability of credit, farm size, and tenure. Psychological variables identified were those of extroversion and open-mindedness. The same variables appear to be equally important in risk taking although the emphasis in this case on financial matters rather than creative ones. Risk taking attitudes are thought to

be revealed in farm diversification, which may or may not be an innovative behaviour. Risk taking is thought to be influenced by additional factors such as succession, stress and legislation.

The literature also indicates that management structure and type are important indicators of successful farming behaviour. Many farming goals are implicated in behaviour, these range from financial, satisfaction with work, quality of life and the status derived from farming.

The review indicates that environmentally oriented behaviour is not influenced by the same variables as those relating to profit maximisation. However, there is a body of literature which suggests that many of the conservation measures adopted are related to short-term financial gain or by farmers who already operate less intensive farms. External variables such as farm size, tenure and government policy and legislation are also involved.

In summary, these variables might be classified as follows.

Demographic: Age, education. These have been related to risk taking, innovation, intelligence and information seeking.

Financial: Debt levels, insurance, contract selling, hedging, diversification, off-farm employment, income level. These have been related to stress, risk taking and innovation

Managerial: Keeping records, setting targets. These have been related to innovation and having clear goals for the future of the farm.

Structural: Farm size, farm type, tenure, technology and labour. These have been related to innovation, risk taking, stress, and autonomy.

Personological: Achievement motivation, creativity, sociability, openness to new ideas, intelligence, satisfaction, optimism, stress levels and coping with stress. These have been related to risk taking, innovation and management of the business.

Others: succession, sustainability, and information gathering. These have been related to risk taking, innovation. Information has been linked to all aspects of behavioural change.

Important goals likely to affect behaviour are identified as

a) *specific goals* relating to profit or production, and
b) *values* important in determining quality of life and status of the individual.

These variables are associated with a range of *farming behaviours*, the main behaviour reported in the literature being

- *production oriented*
- *environmental oriented behaviour*.

These behaviours also have a subset of behaviours such as

* *off-farm employment*,
* *innovation*
* *diversification*

This brief review of the farm risk, farming attitudes, goals and behaviour research literature indicates that behaviours are influenced by variables such as attitudes, personality, education, knowledge, intelligence, as well as a variety of social and farm structural and contextual constraints but there is nothing in the literature to suggest which are likely to have the greatest influence on farming behaviour. Few if any studies put them all together and investigate them in a holistic manner (Doorman, 1991; Siardos, 1992).

In the past researchers have investigated either single farming behaviours or farming behaviour from a specific theoretical stance. It is argued here that many of the variables investigated overlap and there is difficulty in fitting them to only one aspect of farm behaviour. Some are inadequately defined, for example, creativity, risk and achievement motivation. The implication from the literature is that attitudes are not held singly, many attitudes are focused on the final decision and they should therefore be investigated together. In this chapter's review of innovation the following questions arise. Is the farmer who innovates seeking information on innovations, or is he responding to targeting by commercial representatives, governments etc.? Is innovation related to personality traits, creativity, attitudes, or is it risk taking behaviour?

No standardised questionnaires exist to evaluate the range of attitudes and goals found to influence farming behaviour. Individual differences are known to contribute to the adoption of new farming methods and diversification but few are measured by standardised questionnaires or items.

Farmer behaviour will result from the juxtaposition of that behaviour with other important behaviours i.e. production and innovative behaviour or off-farm employment and all of them should be accounted for in the final analysis. The perception of what is most important at that time is likely to be the 'cause' of the resulting behaviour. It follows, therefore, that behaviours should be viewed in relation to other behaviours. It is important to profile the farm behaviours that are important to all farmers and relate those to individual differences arising from the farmer and the farm if the farm decision making process is to be understood more fully.

As a step along this road to a better understanding it is proposed that the development of standardised scales to measure these farming attitudes, goals and behaviours would be a useful research tool. When used with standardised scales of individual differences and structural equation modelling techniques the importance of these variables may be more illuminating than the pursuit and development of specific theories. As suggested by the conceptual model in chapter two, scales relating to attitudes, goals and behaviour will be developed for this study. No one specific farming behaviour will be targeted; the model and the scales will be general to all farming behaviours. It is hoped that the study will identify general attitudes and goals along with individual traits which are important in a range of farming behaviours. Any models developed may be further expanded by adding and investigating specific behaviours and goals. This should ensure that models will account for more of the variance and lead to greater ability to predict behaviour.

The following chapter investigates the psychological constructs necessary for inclusion in a study of farming behaviour.

Chapter 4

IDENTIFYING THE INDIVIDUAL DIFFERENCES IMPORTANT IN INFLUENCING FARMING BEHAVIOUR

"As psychologists we seek structure in aspects of human behaviour .....the existence of psychological structure cannot be in doubt but what the structure is, is another matter".
Luce 1995 pp2.

4: 0 Introduction

The previous chapter reviewed the literature relating to farming change from the 1970s and identified important variables influencing that change. However, it has been argued in Chapter 3 that the models most commonly used in farming research fail to account for the multivariate nature of farming behaviour. In particular the effects of individual differences on behaviour are generally neglected. This chapter reviews, and advances some arguments for the inclusion of a number of, a number of psychological variables when investigating farming behaviour. The farming literature reviewed has highlighted the importance of variables such as goals and attitudes, and the traits of extraversion and open-mindedness have been identified as important. These are discussed in greater detail in this chapter along with other variables thought to be important. Suggestions are made regarding the measurement of the variables identified.

4:1 Individual differences

Farming attitudes and behaviour have been examined from a number of aspects but usually only a single attitude-behaviour relation is considered, i.e. profit

maximisation, risk taking, innovation or a conservation behaviour (Carr & Tait, 1991; Bingswanger, 1986; Rogers, 1983). These behaviours have been studied from a number of theoretical positions (econometrics, sociological, anthropological or business management) but the psychological domain of how individual differences affect farming behaviour has been relatively neglected, especially in the study of farming behaviour in the West.

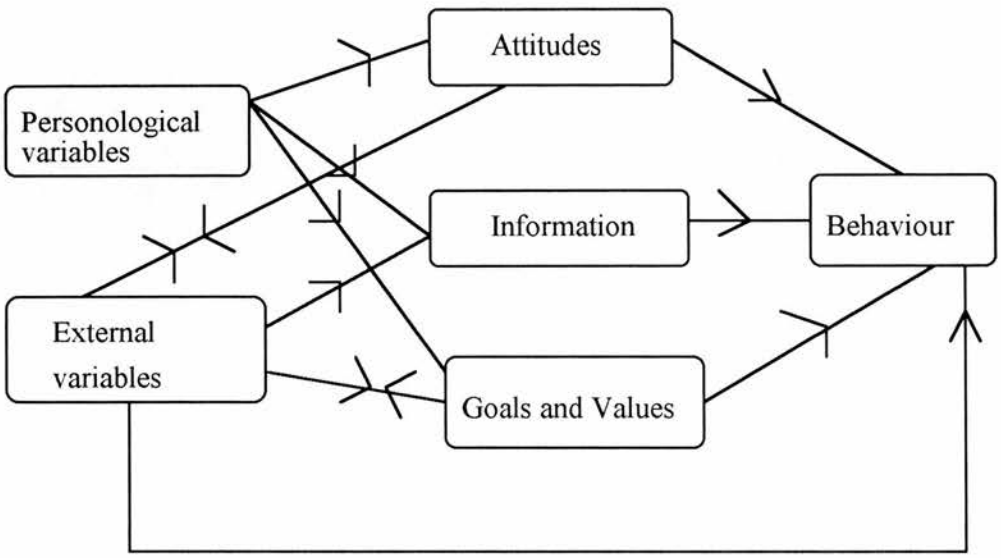
Economists, sociologists and many psychologists view behaviour as relatively malleable, shaped almost entirely by situational factors. This means that many attitude-behaviour relationships are time and situation dependent and they are likely to change as new information unfolds (Ajzen, 1988 p7). However, it is widely recognised that behaviour is not influenced solely by attitudes; other traits such as personality, goals and intelligence also play a part in influencing behaviour (Ajzen, 1988).

Traits are seen as an individual's predisposition to act in a specific way. Unlike attitudes, they are not directed at any specific issue, person or object, rather, they describe tendencies to act within a given domain i.e. they are not situation-specific (Ajzen, 1988; Allport, 1937). Because psychological traits are significantly affected by genetic influences they are less influenced by argument and information and more resistant to change (Bergman et al., 1988; Bergman et al., 1993; Plomin & Rende 1991; Hershberger, et al., 1995; Tesser, 1993). By neglecting these traits when modelling farming behaviour we ignore the impact attributed to the variance of heritability across such behaviours which in turn must affect the effectiveness of any situational variance tested (Tesser, 1993). Thus psychological traits can be seen to directly affect behaviour.

Traits, although they deal with the total individual, do not explain all of the complexity of an individual (Emmons, 1995; McAdams, 1995). It has been suggested that a model of the domain of personality would contain a minimum of three levels of constructs (McAdams, 1995; Emmons, 1995). At level 1, traits would operate; these are habits and stylistic tendencies of the individual. At level 2, motivation and goals would be the driving force. Level 3 would be the construct of reality within which the individual operates to explain purpose and coherence over a life-span (McAdams, 1995, Emmons, 1995). The literature review in Chapter 3 highlighted the importance of level 2 constructs in farming research. The literature reviewed here relates to individual differences at both the level 1 and level 2 constructs of this view of personality structure.

This thesis proposes that some individual differences will predict across more than one situation or behaviour and that when these and specific attitudes are included a greater amount of shared variance will be explained in the outcome behaviour(s). That is, by predicting the traits which have the most general effect on general behaviours along with the specific attitudes towards behaviours which might be required in new situations, we will be better able to predict who will be more likely to change their behaviour in the future. A simple conceptual model of the traits likely to affect farming behaviour is shown in Fig. 4:1. This is based on the information gained from the literature search (Ch 3) and the proposal made in this chapter (Chapter 4). Traits are assigned independent antecedent variable status, they are assumed to be mediated by attitudes, goals and information (cognition) and behaviour is the dependent outcome variable.

Figure 4:1. Proposed conceptual model of individual traits most likely to influence farming behaviour.



The proposed model will be discussed and an assessment of the availability of measures for those factors ascertained in the following sections of this chapter.

4.2 Personality

In this model personality is assumed to be one of the independent, antecedent variables having both a direct and a mediated effect on behaviour. Personality can be broadly defined as

> *"those characteristics of the person that account for consistent behaviour patterns".*
>
> *(Pervin 1993 p3).*

The key assumptions of the personality concept are that individuals are both unique and consistent and that character and intelligence develop early and remain largely unchanged throughout the adult life span (Finn, 1986).

Distinctive broad personality traits are derived by statistical analysis of a large set of language descriptors, and five personality factors are thought to be basic to a model of personality (McCrae & John, 1992; Brody, 1988; Zuckerman et al., 1993). These (factorised) traits do not offer a unique personality description, rather it is the score on each factor which defines the individual. For example, consider how accounts of other human beings behaviour are developed to enable us to predict or make sense of their current behaviour. This is done by developing concepts about their personality based on their behaviour. That is, if someone is very quiet, doesn't mix much with others, likes to take holidays alone, prefers to read books than go to parties etc., if that individual commonly acts in this manner then they are labelled 'introverted'. Thus 'introversion' is an inferred 'trait'. It represents a disposition to act in a specific way which reflects the individual's thoughts and character.

Although there are many theories of personality the preference of many scientists is for the psychometric view of personality and its empirical methods of measurement (Costa & McCrae, 1992; Zuckerman et al., 1993; Deary & Matthews, 1993).

Five factors are claimed by various researchers to underlie much of the variance in many of the personality tests available, even those not designed to measure them (Digman, 1990; John 1990; Norman, 1963, Pervin, 1993). These factors have been found in self-report ratings, natural language, theoretically based

questionnaires in English, Dutch and Japanese samples and in leading personality tests such as Eysenck's, Meyer's Briggs type indicator and Guildford scales (Costa & McCrae, 1992; 1988; Pervin, 1993). The five basic personality factors are derived empirically from factor analysis and are labelled as follows:

- Factor 1 extraversion-introversion (talkative, adventurous, sociable etc. and their opposites).
- Factor 2 agreeableness (good natured, co-operative, gentle etc. and their opposites).
- Factor 3 conscientiousness (tidy, responsible, persevering etc. and their opposites).
- Factor 4 emotional stability vs. neuroticism (anxious, excitable, nervous etc. and their opposites).
- Factor 5 culture (artistically sensitive, imaginative, intellectual etc. and their opposites).

Support for those five factors comes from a number of areas, such as, factor analysis in terms of the language used to describe personality, the relationship of self-report trait questionnaires and ratings by others, and the analysis of the genetic contribution to personality. These five factors are well measured in Costa and McCrae's Five factor personality inventory (NEO-FFI) which has shown good agreement between ratings of observers and friends, and is reproducible over time (Costa & McCrae, 1992).

Personality traits are the foundation of occupational testing where individuals are assessed and assigned to jobs according to their score on a number of traits. For example, it is known that the trait of conscientiousness is a significant predictor of job success and job satisfaction ($p<.02$) (Barrick et al., 1993; Barrick & Mount, 1989). The idea is that conscientiousness is an important

characteristic of goal setters. Others have found successful managers to score less on the trait of agreeableness than others (Tett et al., 1991). If these five traits are considered to contribute to job success in industry and other occupations then it is possible they will also contribute to explaining successful farming behaviour, something that has not been investigated before.

Personality has also been used to account for behaviours other than those found within the factor structure (traits) which are important in analysing individual differences for example, entrepreneurial or innovative behaviour, and coping in stressful situations (Kirton, 1976; Endler & Parker, 1990). It is generally acknowledged that traits alone are insufficient in describing the individual. Therefore, in the proposed model, variables such as, mental health (stress), the ability to cope in stressful situations are proposed to mediate between traits and behaviours alongwith attitudes identified as important in the farming literature, and the creative aspect of personality which prompts change will be used.

4:3 Intelligence

The next independent, antecedent variable to be considered in the model is that of intelligence, sometimes considered the sixth personality trait (Brand, 1994). Economic and behavioural models recognise the importance of cognitive ability in the decision-making process (Simon, 1957, Rogers, 1995). In the proposed model, intelligence will directly affect behaviour but its effect will also be mediated by attitudes and knowledge gained from information gathering which in turn will affect behaviour (Weinberg, 1989). It is postulated that intelligence will be mediated through attitudes because attitudes are under greater cognitive control than personality. Intelligence is often seen as one of the broadest and

most important traits, in that it affects every aspect of life (Weinberg, 1989; Brody, 1992; Herrnstein & Murray, 1995).

Intelligence is often defined by the ability to think abstractly, solve problems, deal effectively with the environment, reason effectively, etc. (Kline, 1993; Vernon, 1950; Freeman, 1963; Neisser et al., 1996). This implies intelligence, like personality is not a single entity. Rather it is hierarchical in nature, intelligence is the 'trait' described by the skill in a series of other specific abilities (Neisser et al., 1996; Brody, 1992). These skills are usually measured through psychometric tests and factor analysis (Spearman, 1904; Vernon, 1953; Cattell, 1978).

Because intelligence has always been regarded as important it has been measured and investigated extensively (Herrnstein & Murray, 1995). Factor analysis of intelligence tests has resulted in a wide spread agreement on a single large factor ('g') which flows through all intellectual activity and which accounts for half of the observed differences in test scores (Carroll, 1991; 1993; Vernon, 1971; Weinberg, 1989). Two sub-factors, fluid and crystallised intelligence, account for most of the variance in test scores (Seligman, 1992).

Fluid intelligence is measured by ability to tackle unfamiliar tasks or tasks which require no previous knowledge, it can be assessed using non-verbal items. Usually this entails showing the participants pictures and asking them which shape this represents after rotation or mirror imaging, or when folded in a certain way what their final construction would look like, or they are asked to complete the pattern from multiple choice items (Kline, 1993). Crystallised intelligence is measured by those skills that could reasonably be considered to

be available to all of a relevant age and culture. Crystallised intelligence has been shown to be best measured by a vocabulary test where the subject is asked the meaning of, or an analogy of, or pick the missing word, in a verbal reasoning test (Klein, 1991).

Although it has been suggested that intelligence is what intelligence tests measure (Boring, 1923), it is well documented that intelligence tests do correlate with things like academic success [r = 0.5] and job performance [r = 0.54] and explain respectively 25% and 29% of the variance in performance (Jensen, 1980; Hunter, 1983; Neisser et al., 1996). If intelligence is a good predictor of job success in other occupations then it should also be useful in predicting successful farmers. There is general agreement about the concept of intelligence as a trait and its ability to predict job success (Neisser et al., 1996). Therefore, will be included as an important direct and mediating variable in the model.

Most tests of intelligence involve lengthy sets of items covering such as abilities as reasoning, and verbal, numerical, spatial, and motor skills. However, there are a number of well developed and reliable instruments which measure fluid and crystallised intelligence which can be administered quickly. It is proposed that the Raven's Standard Progressive Matrices test of fluid intelligence be used, along with the National Adult Reading Test (NART) which is a measure of verbal ability (Raven, Court, & Raven, 1992; Nelson, & Wilson, 1991).

4:4 Stress and autonomy

Stress is included in the model, as a number of studies have established that personality is a predictor of perceived stress (e.g. Deary et al, 1996). Prior to this study reported levels of farming stress were extremely high, and stress is known to influence farming behaviour (Eberhardt & Pooyan, 1990; Schulman & Armstrong, 1989; Van Hook, 1987). Farmers have the highest reported incidence of suicide of any occupational group. (Sunday Times, 1992; Jones, 1994; Stallones, 1991; Ragland & Berman, 1991). At the time of writing the world wide ban on British beef due to the Bovine Spongiform-Encephalopathy (BSE) scare is again causing stress to many livestock farmers.

There is a long established relationship between health and personality. Hippocrates postulated four personality types and related those to specific diseases. More recent evidence of this relationship is reviewed in Adler & Matthew (1994). One of the strongest personality factors identified with illness is that of anxiety-neuroticism and this concept of anxiety has spawned the largest body of clinical research related to stress (Adler & Matthew, 1994). Anxiety is defined as *"feelings of uncertainty and helplessness in the face of change"* (Pervin, 1993) and one of the leading sources of this condition is stress. Stress is initially thought to stimulate activity but, over time it leads to fatigue, anxiety and depression, with somatic symptoms occurring that are generally attributed to a lack of perceived control (Seligman, 1975; Beck, 1991; Rotter, 1966; 1982; Janis & Mann, 1965). At a time when UK farmers fear the changes imposed by the European Union and those of their own Government, perceived freedom to control decisions taken on the farm is likely to be an important influence on behaviour. It is therefore important to include both stress and autonomy in any study of farming behaviour.

However, as some individuals are less affected by stress when in exactly the same situation as others it is necessary to include another variable, that of coping with stress, into the model. Coping styles are also strongly related to personality traits (Costa & McCrae, 1988; Gomez, 1997)

4:5 Coping with stress

How farmers cope in stressful situations will significantly influence their behaviour and the amount of stress experienced. Although related to personality, coping strategies are under cognitive influence and will be mediators of traits in this model as they are defined in terms of stress coping. A number of coping styles have been identified. These are, task oriented coping, avoidance coping, emotion-focused coping and distraction coping (Folkman et al., 1986; Endler & Parker, 1990; Holahan & Moos, 1990). Avoidance coping entails ignoring the fact that there is a problem, whereas distraction coping would involve doing something to displace the stress e.g. throw a party. The most useful style of coping is to be task oriented and tackle the problem head on, or learn to use stress reducing measures if the problem is unlikely to be resolved (Folkman et al., 1986). The least useful method of coping with stress is to use emotion focused coping such as crying, anger, tears etc. As in the stressful situation the greater the perception of mastery the better the physical and psychological health (Parkes, 1984). The personality trait of extraversion has also been implicated in coping, extraverts tend to seek greater social support and be more optimistic and this is related to self-esteem (Amirkhan et al., 1995).

4:6 Goals

Goals are especially important in farming where many decisions have to be made up to a year in advance. In farming, as in no other business, the cycle of production in cereal farms takes a year from conception to fruition and once committed to the cycle there is only partial control by the manager (in livestock rearing this may be longer). The emphasis on behaviour so far has been on either an unchangeable disposition to act, or the ability to cope in stressful situations where there may be a perceived lack of control (i.e. a 'risky' situation). However, much of human behaviour is felt to be purposeful, and actions volitional. People have the ability to think about the future and be self-motivated and goal oriented (Binswanger, 1991; Locke & Bryan, 1969). Thus, goals are proposed to be mediating variables between the antecedent variables of personality and attitudes and the farming outcome behaviour in the model. Or they may be considered as the level 2 constructs of personality structure proposed by McAdam (1995).

It is thought that goals guide us in establishing priorities and in selecting among situations thus reducing information overload (Latham & Locke, 1991; Cervone et al., 1991). If this is so, it is possible goals mediate intelligence and personal preferences. A person's goals are organised in a system, so that some are more central or important than others (Latham & Locke, 1991). However, this is generally not a rigid or fixed system, especially in farming, because of financial and environmental constraints. Rather a person may select among goals depending on what seems the most important or achievable to them at the time, what the opportunities appear to be, and their judgements of what is achievable relative to the demands of their environment. For example, a farmer's goal may be to increase profit by increasing productivity but he may be unable to purchase the new machinery or breeding stock required to meet

this goal because of financial constraints imposed by the bank at this moment in time. Thus goal directed cognitive input is an important influence on behaviour.

People may acquire internal standards to evaluate their own behaviour and that of others. These standards represent goals to achieve and bases for expecting reinforcement from others or ourselves and are possibly related to personality variables. The process of self reinforcement is particularly important over time in maintaining behaviour (Latham & Locke, 1991). In cognitive theory, behaviour is maintained by expectations or anticipated consequences, rather than what happens immediately decisions are made. But is it sufficient to set goals and harbour expectations of their achievement?

Goal themselves are thought to have two attributes, content and intensity (Locke et al., 1981). Goal content can range from vague to specific goals, can be easy or difficult to achieve and this applies to the relationship between the person and their goal. Thus for some the same goal may be easy, for others it may be difficult to achieve. Achievement is linearly related to goal difficulty and effort (Latham & Locke, 1991). To predict farming achievement on task difficulty alone, you would have to know what their goal is for the farm to enable you to predict how hard they will work on the task (Latham & Locke, 1991). This thesis argues that how hard you work at something is determined by motivation or a personality trait related to conscientiousness, which suggests goals might be strongly influenced by personality (Barrick et al., 1993). There is some indirect evidence for this, in that, those with non specific goals are generally much happier with their performance than those with hard specific goals (Latham & Locke, 1991; Mento et al., 1987). This suggests that the

latter individuals are more conscientious, motivated (or perhaps more neurotic) than others.

The other goal attribute of intensity is a broad term referring to the scope, clarity, mental effort etc. involved in the mental process. Those who think hard and comprehensively about how to solve a problem as well as having a personal goal were most likely to become committed to solving it and more importantly were most likely to take the necessary action to solve it (Latham & Locke, 1991). Commitment refers to the degree of attachment to the goal, how important it is, how determined they are to reach it, and to keep going when setbacks occur. The ultimate proof of commitment is action, which in turn reflects the amount of thinking that preceded the choice (Binswanger, 1991; Wood & Bandura, 1989). Therefore, it appears information and intelligence influence goal performance and these variables would be mediated by goal performance. This is partly confirmed in Hollenbeck & Brief's (1987) review of individual differences and goal setting research. Ability, goal setting and the personal characteristics of the individual appear to determine the level of goal set, and whether the individual will pursue those goals.

Goal commitment can act both as a causal factor and a moderator of performance. Less committed people give up their hard goals in favour of easier ones (Erez & Zidon, 1984). Whether this is due to lack of information or conscientiousness is unclear. There appears to be indirect evidence in the literature for the role of conscientiousness in goal setting and it may be possible to model the general involvement of conscientiousness in goal setting in this study.

It has been suggested that it is not motivation that enhances performance, rather it is task strategies which are developed that improved performance (Latham & Locke, 1991) This would relate to the idea that once people become convinced the goal is possible and important then the important factors in achieving it are ability, experience, training, information about the appropriate task strategies, past success, and internal attributes such as conscientiousness (Hollenbeck & Brief, 1987). Task strategies imply a role for task oriented coping strategy, reinforcing the usefulness of this variable in the model. However, in farming many goals are imposed by outside agencies.

4:6.1 Imposed goals

Many farmers and non-farmers complain that the Government and European Parliament interfere too much in farming, imposing ideas and goals that are at odds with current farming concepts. However, it has been found that when goals are assigned by legitimate authority they typically influence people's personal goals (Locke et al., 1984). Dember (1975) concluded that being asked to do something is tantamount to being motivated to do it, whereas assigned goals lead to goal commitment because listening to the assignment without objection is in itself a form of consent (Salancik, 1977). Moreover assigning the goal implies it is capable of attainment which in turn increases the person's self-efficacy regarding the task. It is therefore possible that imposing or encouraging goals for set-a-side of farming land, alternative crops etc., may in fact mediate production oriented attitudes and goals in some farmers. However, there appears little evidence that EU and Government encouragement of environmental goals is as efficient as setting legally binding targets (Novak, 1987; Gasson & Potter, 1988). At the time of writing the thrust of Governmental policy is to encourage environmental change through non-statutory measures, thus goal oriented behaviour will be only minimally

influenced by these measures unless it is related to an achievement orientation. Other persuasive variables may be more important.

4:7 Values

Values are also seen as mediating variables in this model. Values are often associated with both attitudes and personality and there is some confusion over their definition. Jones & Gerard (1967) define values as

> *"Any singular state or object for which the individual strives, or approaches, extols, embraces, voluntarily consumes, incurs expense to acquire is a positive value.... Values animate the person, they move him around his environment because they define its attractive and repelling sections"*

For them, a value expresses a relationship between a person's emotional feeling and particular cognitive categories. They are evaluations similar to attitudes in this definition.

Allport (1961) defined values as a belief upon which man acts by preference.

> *"We know a person best if we know what kind of future he is bringing about - and his moulding of the future rests primarily on his personal values".*

and Rokeach (1973) defined value as

> *"A value is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct."*

This suggests that values are a product of personality and society. Although these definitions are similar to attitudinal definitions, attitudes are directed at an object but values are in the individual not the object, this would suggest that they are more personality related. There is a motivational and emotional

component as well as a cognitive aspect to the preferred mode of conduct. Values appear as both instrumental and an end-state. Instrumental can refer to morality or competence so values have two important functions, as in goal directed theory, they motivate and they also set standards (Rokeach, 1973). Therefore, they may be influenced by intelligence, attitudes and personality. They may be assumed to be a level 2 construct of personality.

Values are seen as occupying a more central role than attitudes, for example, a value of world peace would have a large number of attitudes that cluster around this. However, because values are less specific than attitudes they are less easy to detect in behaviour patterns. Personality related goal theories emphasise that action depends upon which goal is the most important at that time, or in that context (Vallacher & Wegner, 1985; 1987). It is possible that values and goals may occupy an attitude hierarchy in much the same way as personality traits. By testing the conceptual model suggested, the point at which values exert the maximum influence on behaviour may be deduced.

Another theory that attempts to encompass the need to understand the 'why' of attitude is the theory of Goal Pursuit (Warsaw, Sheppard & Hartwick, 1982; Bagozzi & Warshaw, 1990). They modified the theory of reasoned action by proposing that goal attainment is determined by the process of trying. Behaviour is goal directed in this model. Goals are seen to be interchangeable with values. Values serve as standards, one can view them as ideals to which we strive. e.g. I put a high value on 'honesty', at the same time my actual attitude and behaviour can be evaluated and measured against the standard set by my value of honesty (Reich & Adcock, 1976). Values may be nothing more than an attitude or goal in this theory but by testing the hypothesised model these dilemmas may be resolved.

Values are thought to be consistent personal assumptions that underpin attitudes. They are concerned with general principles like moral rights and wrongs or social desirability and in the case of farming, to do with the intrinsic worth of the job as well as the moral responsibilities that accompany it. Because personal values and principles are the standard by which we judge ourselves and others they are closely linked to our attitudes. In many cases attitudes are thought to be directly derived from our underlying values (Eagly & Chaiken, 1993).

Values, like attitudes, cannot be measured directly. It is assumed in all of those theories that values are arranged hierarchically and can be met one at a time. However, Tetlock (1984) suggested (in respect to political reasoning) that values could be in conflict. Where this occurs complexity is shown to be greater when participants assign high or near-equal importance to two or more conflicting values relevant to the issues studied; for example a farmer manager who holds the value of 'respect for animals' but is of necessity forced to run an intensive farm production system. This explanation has a familiar ring of both 'balance' theory and dissonance theory to it. It is widely reported that farmers hold conflicting attitudes towards farming, i.e. the need to make a profit, while enjoying farming for its intrinsic benefits. This may be worth investigating. It maybe that more than one choice is available but by implication only one choice can be made, therefore one is obliged to make the 'best' choice which for the economist would be the increase of profit or production.

The literature suggests that personality traits, intelligence, attitudes, goals and values influence behaviour and that many of the those influences overlap, i.e. values overlap with attitudes, goals and personality and intelligence and

information gathering is important in the cognitive aspects of attitudes and goals. However, theoretical treatments of their influence on behaviour differ.

4:8 Attitudes

Attitudes are considered to mediate all of the independent variables in this model because of their cognitive nature. At the same time they will both directly influence behaviour and intentions. Attitudes differ from personality traits on a number of dimensions as discussed in chapter 2. . An attitude is defined as:

> *'the psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour'.*
> *Eagly & Chaiken 1993 p 1*

Psychological tendency refers to a disposition to act, while evaluating refers to all classes of responding whether it is cognitive, emotional or behavioural. Thus, by reason of the cognitive input into attitudes they are assumed to mediate rather than antecede behaviour. Attitudes are reinforced by beliefs, they are often associated with strong feelings and lead to specific types of behaviour. The emphasis here is on emotional and cognitive aspects of the response. To evaluate something implies some degree of goodness or badness is being ascribed to the object. Therefore evaluative responses tend to be of the nature like-dislike, approach-avoidance, attraction-aversion, approval-disapproval, etc. Evaluative responses and the tendencies that are presumed to underlie them are regarded as differing from the positive to the negative end of a continuum, just as in personality an extravert differs from their opposite end introvert.

Attitudes are thought to motivate behaviour and exert a selective influence at various stages of information processing, that is, through attention, perception, or retrieval (Allport, 1937; Asch, 1952). The assumption is that individuals selectively attend to relevant attitudinal material. The importance of attitudes as a concept is shown in the range of research conducted and the wide variety of theoretical approaches which have characterised the research over this century. For example, much of the earlier work on attitudes centered on attitudes as learned outcomes, or the cognitive process of categorising, or the role of memory in attitudinal-objective evaluation (Zanna & Remple, 1988: Fazzio 1986; 1987).

Attitudes are not usually consciously held, they have to be activated by something, this implies that attitudes are a cognitive construct and not just a product of the situation. Attitude related behaviour is influenced by information and past experience, attitudes are under greater cognitive control than personality related behaviour and, as such, are open to change (Fazzio et al., 1984; McGuire, 1985). This ability to change makes them a very important construct in this study. The manner in which attitudes are thought to operate is important. Smith, Bruner and White (1956) argued object appraisal is the way attitudes guide our reactions towards objects and features of the environment so we don't need to work out how we react to them. This could be interpreted as reducing the amount of information to be processed and, for example, could account for the importance of information in changing the way the environment or land sustainability is considered for example it may be ignored as irrelevant to the intensive practising farmer.

Attitudes can be broad such as 'conservationist', 'honest' etc. or they can be narrowly focused, in that we are conservationists in only some situations, and

not others, i.e. recycle paper and glass but still use the car to go to work, and similarly for honesty. However, aggregation and generalising attitudes allows us to predict such that, on average, an individual exhibiting a specific trait will in general, behave in a particular manner (Fishbein & Ajzen, 1975).

The range and extremity of attitudes and the strengths with which they are held are recognised by society in general. Consider the French farmers when confronting their government on agricultural support cuts or, the attitude of animal rights protesters in the exporting of veal calves from Britain. Attaching personal importance to an attitude gives it a weight which may then be attached to other relevant objects. Some attitudes appear more important than others, and these attitudes are thought to be more resistant to change, more stable over time, and to have greater impact on cognition and behaviour (Boninger et al., 1995).

4:9 Information

Information is proposed as a mediating factor in the model. It is postulated it will mediate the independent variables of intelligence and personality on the following basis. The information processing theory of goal setting as described by Neuberg & Newsom (1993) argues that with the vast amounts of information impinging on the senses and the well documented limits of attentional capacity, the task of rendering information useful is formidable. Thus, people look for ways to reduce their information load. There are two main methods available to reduce overload, first through avoiding the amount of information they are exposed to. However, by using this strategy they may actively ignore potentially useful information. An alternative strategy is attempting to structure the world into a simplified, manageable form. Neuberg

& Newsom found that those using the latter method had a positive correlation with the personality trait of openness to new ideas. Those using the former method positively correlated with the personality trait of neuroticism (N) and negatively with extraversion (E). Therefore neurotic introverts restricted their world but those open to new ideas structured and simplified it. Thus information so important in both innovative and risk farming studies may be closely related to personality traits.

McCrae (1996) and others have observed the correlation of openness with intelligence related variables. Simon (1952; Simon & Newall, 1980) has also indicated the role of information and ability in decision making. Thus, there is evidence that the five personality traits will be important in any model of behaviour.

4:10 Behaviour

Ajzen & Fishbein (1977) have suggested that behaviour like attitudes have a more complex nature than is often assumed. They suggest that behaviour has four elements, that of action, target, context and time. They argue that if you are generalising from the specific to the general attitude it is necessary to evaluate behaviour in relationship to all of those elements. That is, if you measure only one environmental behaviour of say replacing hedges, it would be necessary to account for the time, context and target of that behaviour. However, as we are planning to aggregate a number of general attitudes and behaviours, a more general case could be argued which would be aggregated over a range of actions, targets, contexts and times (in this case, behaviours that are presently occurring and those which have occurred during the past five years). Of course attitudes may also be referenced without any of those

elements if only one target is investigated and these are implicitly included (Eagley & Chaiken, 1993). This implies any attitudes evaluated are context and time dependent, they will only be 'true' for that particular situation, and the time of measurement. In farming certain attitudes could be seen to be true to the time period immediately pre and post legislation or policy implementation or as now, when environmental concern, rather than production is the main focus of attention. It also emphasises the situation's importance in the evaluation of attitude. Thus behaviour related to soil conservation will only be observed in areas where soil erosion is a problem, just as preservation of fen land will only apply where the fen land exists. For this study general conservation behaviour will be assessed using the individual's behaviour aggregated over a number of behavioural items but it is acknowledged that many behaviours are situation, context and time dependent. However, by including traits as well as attitudes in the model an individual who is likely to change behaviours will be better identified than through the attitude-goal relationship alone.

4:10.1 External influences on behaviour

The last independent group of variables to be considered in the model is that of external variables. External variables are also proposed to both directly affect and mediate behaviour. External variables such as legislation may impose specific goals and behaviours on the farmer, such as, taking care to monitor or stem pollution, or a system of payments for environmental actions may affect attitudes, or the effect of fluctuating market prices on what to plant/sow/buy may directly affect behaviour. However, the two-way arrows (Fig. 4:1) suggest that these factors may equally not be implemented if the attitudes and objectives are in the individual against implementation are stronger than the incentive to comply. External variables such as legislation may mediate

attitudes by making some redundant or enhancing others by special payments or subsidies.

Some variables are external to the farming business and more or less outwith the farmer's control to change such as the farm size, location, the type of farm, local and national legislation, market prices etc. These can be quantified under three headings, 1) situational; this refers to the farm size, distance from markets, land type, climatic conditions, indigenous pests/disease, proximity to urban conurbation, or availability of land for expansion. 2) Economic; this refers to market prices, availability of loans, indebtedness etc., and 3) External influences; such as local, national and European policies and regulations, or controls imposed by landlords, national parks, National Trust etc.

In summary therefore, many individual differences can be cited as important variables in any decision making model. Personality variables and intelligence are well established antecedent variables of behaviour. Variables affecting behaviour but dependent upon cognitive input such as attitudes, goals, values and information gathering can be seen as mediators of these antecedent variables. In some cases stress, and coping with stress may be included in a conceptual model of farming behaviour.

Well validated and standardised tests of intelligence, personality, stress and coping are widely available, however no such standardised tests exist for farming attitudes, goals and values, or for farming behaviour, and these will have to be developed for the study. The domains of such variables will be explored in the farming literature in the following chapter.

4:11 Conclusions

McGuire (1986) has argued that for the 1990s, research on attitude structure should use a systems approach and it should be multi-dimensional, naturalistic and recognise that causality can flow in any direction. This sounds very much in accord with Cattell's (1945) naturalistic multivariate approach to personality. McGuire argues there is a need to move from *a priori* hypothesis testing to exploring, discovering and generating hypothesis on the basis of data, then going for conformation in later studies. He argues for casting a wide net of theory relevant variables and the use of repeat testing to discover causality. Statistics should be used to discover rather than confirm hypothesis. Multivariate analysis should be used to estimate the robustness of the information, and structural equation modelling serve to evolve a number of causal pathways among the data. In all of this descriptive statistics must not be forgotten. This thesis attempts to follow this advice.

As trait theory, especially attitude traits, is not sufficiently well developed to address all of the questions that need to be answered, McGuire's summary appears the most appropriate way forward. It will be necessary to adopt a psychometric approach and treat both attitudinal and personality traits on an empirical basis. Personality and intellectual ability traits can be measured by well developed, reliable instruments. However, attitude traits have not been similarly developed due to the different theoretical approach.

In the psychometric approach to modelling individual differences in farm-decision-making, attitudes, goals, personality and ability traits should be incorporated in the model as well as the external variables likely to influence the outcomes. All of the farming attitudes, goals and behaviours to be studied

should be explored by factor analysis, descriptive and correlation statistics. Confirmatory factor analysis should then address the problem of assessing the best fitting model and the direction of causality of farming attitudes.

This short review indicates that traits of personality, intelligence and attitude can be observed in an individual's behaviour. They are best shown when the trait under study is aggregated over a number of related variables to enable them to have predictive power. Many of the traits have been shown to have a genetic component making them more powerful predictors of behaviour (Neisser et al., 1996; Buss, 1989). Behaviour itself must be aggregated to enhance prediction and causality. Factor analysis and rotation is the best method for deriving the traits, but the items must be valid and reliable as well as having a normal distribution in the sample population. Because attitudes in particular are considered evaluative i.e. a negative or positive response to an object, and are assumed to be linear. However, there is no current method of measuring more than one attitude at a time i.e. it is highly unlikely that a single attitude affects behaviour it is more likely to be held as an imbalance between other attitudes. i.e. an attitude towards conservation is likely to be held in congruence with an attitude towards perhaps, intensive farming and profit.

Ajzen's (1991) logical theory of planned behaviour goes some way to explaining the attitude-behavioural relationship but it does not offer a complete theoretical explanation (Eagly & Chaiken 1993). Personality and intelligence traits on the other hand are better explained at the empirical level than at the theoretical level (Pervin, 1993). The conclusion must be that by treating attitudes and values in the same way as personality and intelligence traits i.e. at the empirical level, we may be able to highlight the groups of behaviours that influence farm decision-making behaviour. In the past, traits in general, and

attitudes in particular, have been studied from a specific angle, rather than banks of traits being assessed and the correlations between the traits noted and modelled for their causal pathway. It may even be that all of the traits are involved in problem solving i.e. intelligence, personality and goals and attitudes. They may even form a hierarchy in some cases. Having identified the variables necessary for inclusion in the study the next chapter delineates the methodology used in the study.

CHAPTER 5

METHODOLOGY

All things began in order, so shall they end,
and so shall they begin again...
Sir Thomas Browne: Christian Morals, pt. I

5:0 Introduction

This chapter discusses the development of:

- some of the survey questionnaires.
- a pilot study of the proposed questionnaires.
- the recruitment of farmers for the main study.
- and the proposed analyses of the data.

The survey was designed to encompass the variables described by the model (Fig.4.1) in chapter four, those reviewed in the farming literature in chapter three, and the individual differences identified as important in Chapter 4. To encompass such a range of variables it was first necessary to develop new reliable measures of farming attitudes, goals and behaviours in these areas. In the past, research has tended to concentrate on single variables i.e. environmental attitudes and behaviour, such as attitude and behaviour to chemical spraying, or attitude and behaviour to information in relation to profit. What is proposed in this study is that some farming attitudes and goals may be defined as fundamental to all decision making areas, however, they can only be arrived at by empirical means. A range of reliable, well validated standard psychological questionnaires are available but no such standard questionnaires exist for any of the farming attitudes, objectives or behaviour. This study seeks to supply the basis for a range of questionnaires which could be further

developed, validated and reliably tested in the major domains of farming behaviour. Concepts from which attitudes and goals develop will be measured on a continuum from low to high scores.

5:1 General design of attitudes, objectives and behaviour scales.

The survey was designed to measure the influence of individual differences (in cognition, personality, and so forth), farmers' attitudes, goals and external constraints on farming behaviour. This chapter discusses the general issues associated with the survey. More detailed information on each of the specially designed questionnaires will be given in the chapter relevant to the analysis of that scale.

Four scales were specifically developed for the study (Appendix A & B). These were; 1) Edinburgh Farming Enterprise Scale (EFES); 2) The Edinburgh Farming Attitudes Scale (EFAS); 3) The Edinburgh Farming Objectives Scale (EFOS); and, 4) Edinburgh Farming Implementation Scale (EFIS). The EFES was designed to gather information on the farm structure (farm size, type, tenure etc.), financial structure (debts, assets, revenue etc.) and demographic information relating to the farmer and the farm household. This information represents some of the external variables hypothesized in the model (Chapter 2, Fig.2:1), these variables would be independent and act both directly on behaviour as well as possibly being mediated by some farming goals. A possible example may occur when land is considered for set-aside payments. In the case of the larger farmer who may operate a mixed enterprise of cattle and cereal, the availability of land for set-aside may be greater and the drop in income negligible compared with the small intensive arable farm setting aside a similar proportion of land. That is, in the first case the payment will influence

the goal of environmental oriented farming, whereas in the case of the smaller farmer it will have no affect on his behaviour or goals as he cannot afford to take a reduction in income. The EFES also contained a separate section on what kind of information was sought for strategic decisions by the individual and the sources of that information. Unlike the other three scales (attitudes, goals and behaviour) which were designed only with reduction by factor analysis in mind because of the large number of items involved, the EFES scale (with the exception of the information section) was not intended for reduction as it was thought that many of the items were of interest in themselves.

The items developed for the scales were derived from a variety of sources such as a) the farming literature; b) talking to farm advisors: c) reading the farming press d) a pilot study of 10 local farmers.

The item format in the questionnaires designed for the survey consisted of a statement about an aspect of farming which was then scored on a 5 point Likert scale i.e. an attitude item such as "Off-farm work is necessary to stay in farming" 1=Very Important to me -through to- 5=Not very important to me. A Likert scale allows for a useful discrimination between farmer's scores on individual items and factors. It does however, assume the scale as having clearly distinguishable points which are linearly related, a criterion necessary for later analysis.

Aggregation of items is important when measuring traits, as a score on a number of items increases the researchers' ability to argue that the results are generalizable over situations and time (Epstein, 1979). When using only single items for correlations, any results are likely to be specific to the time and place

in which they were measured and are likely to explain much less of the variance than the summed general score. A number of attitude items surrounding each concept were developed, for example, the concept labelled a 'traditional way of farming' included items such as, *"Farming is a way of life", "Farming is a business to be run efficiently", "Religion and worship are important in farming", "New machinery has not improved upon traditional methods"* etc. These items although all quite different were thought by the researcher to relate to the broad concept of 'Traditionalism'.

If these attitudes have an important influence on a farmer's motivation then it is also necessary to design and measure how important they are to the individual. A similar set of objective type items was designed, such as, *"It is important to stay in farming whatever happens"; "It is important to pass on the farm to a family member"; "It is important to leave the land as good as you found it"* etc. was addressed in the EFOS scale. Thus attitude items were evaluative statements, while objectives were measured by how important the particular concept was to the farmer but they were also measured on a Likert 1-5 scale ranging from 'very important' to 'not important'.

Actual reported behaviour was investigated using a similar set of items to those used in the attitude and objective scales and covering the same domains such as, "Have you taken any active conservation measures in the past 5 years?", "Have you replaced your machinery in the past 5 years?", "How often do you attend church?" etc. Once again a Likert 5 point scale was used with the extremities of the scale labelled in a suitable fashion, i.e. 'a little' or 'a lot', 'many' or 'none' etc.

If these were the behaviours practised by the farmers then a strong correlation would be expected between related item domains on the attitudes, objectives and behaviour scales. For each domain investigated a set of items were constructed (where possible) to cover both the attitude, objectives and behaviour scales. If, as expected that many of the items in each questionnaire overlap, then there will be an underlying structure in each of the questionnaires which principal component analysis should confirm. It is assumed that some common relationship would exist between the similar factors on all three scales. As the items were derived from the same underlying construct or farming domain it is assumed that if they were meaningful to the individual then all three scales would be correlated for that individual. In other words there would be little dissonance between attitudes, objectives and behaviours. It should therefore, be possible to relate both individual items and specific 'factors' across the scales allowing evaluation at both a general and specific level.

Farmers operate very diverse businesses and what is specifically important and relevant to one farmer may not apply at all to another. For example some farmers may be grain farmers while another may be livestock and yet another operate a mix of both. Therefore, items in the questionnaires had to be presented in such a manner that they were applicable to, and could be completed by, every farmer taking part in the study. That is, the items had to be presented in a general format such as, *"How many grants are you eligible for?" and "How many have you claimed?"* rather than listing *each* grant and scheme available and asking farmers' to mark which they were eligible for and what they had taken up. Similarly for items such as *"How important are new varieties/livestock to you?"*, rather than individual questions relating to livestock and varieties. Items such as *"To what extent have you diversified the*

farm business?", and *"How much on-farm diversification do you have?"* and *"How much off-farm diversification do you have?"*, rather than listings of the specific types of diversification.

5:1.1 Identification of farmer numbers and farming types

As the information necessary to assess farming behaviour covered such a wide range of variables it was clear that a large number of participants would be required both to ensure the validity of the analysis and the representativeness of the Scottish farming population. In general, the criterion for a powerful sample size for analysis is approximately five participants to each variable and preferably 10 (Hair et al., 1995). Structural equation modelling of the data will require 150-200 participants, less than 100 and greater than 300 posses particular problems for this type of analysis (Hair et al., 1995). It was assumed that when the scales were factor analysed the number of relevant factors and items would be reduced, therefore, no more than 300 participants would be required.

Because of the size of the survey it was considered that a two-part data collection would be the most sensible way to achieve the co-operation of the farmer as the overall time required to complete the survey questionnaires was four hours (670 items). Good practice and length and nature of the survey dictated that a pilot study was necessary to assess the feasibility of the study.

5:1:2 Farming types

Farmers in general operate very diverse businesses in very different farming conditions. Farms can range from a few hectares to very large hill farms of thousands of hectares in Less Favoured Areas (LFA) (LFA refers to areas where the ground rises steeply and/or the soil thin and poor and unable to sustain crops or many livestock per acre). Farmers may operate mixed farms of stock, arable and dairy, to intensive single unit farms of arable, horticultural, dairy or livestock production. As conditions on the different units are so diverse it was decided to limit the survey to two recognisable sub-groups of farmers, livestock farmers in LFA's and those who operate intensive arable farms in the fertile areas of the east coast of Scotland.

For practical reasons and on the advice of the Scottish Office Economic Advisor it was decided to limit the survey to small family or farmer operated farms with a return of not less than 800 British Standard Units (BSU) that is, an income of not less than £16,000 in 1992. This was thought to be a viable income level at this time.

Confidentiality of the study was assured by using only numbers in the analysis of the survey material. Verbal statements made to the farmers at meetings and statements attesting confidentiality were prominent on the front page of every scale.

5:2 Pilot study

5:2.1 Introduction

The questionnaires developed for the study, along with the psychological questionnaires, were examined by two agricultural advisors who agreed the content would be seen as relevant to farmers. However, they were concerned by the length of the survey.

5:2.2 Design

The pilot study was designed to check:

a) how co-operative farmers would be with a survey of this length and the items contained within it.

b) how relevant the items were to the farmer's situation.

c) how well the items addressed the issue of farmer behaviour.

It was *not* designed to codify or analyse the data, as the subject to item ratio would not have sufficient power for analysis.

5:2.3 Participants

Ten farmers, all male, of large, intensive cereal, and mixed livestock and cereal farms, who either owned their farm or were life tenants of the farm were enrolled in a pilot study, one subsequently dropped out due to illness. All farmed in the East Lothian area (non-LFA area).

5:2.4 Tests presented

The tests presented were:

The four novel questionnaires relating to farmers' objectives, attitudes, farming behaviours and business which were developed as a major part of this research programme.

The Edinburgh Farming Objectives Scale (EFOS). This was composed of items relating to what was thought to be a range of goals pursued by farmers in the running of their farms as identified by the literature review and discussion with farm advisors. These ranged from goals such as maximising profit or production to improving the quality of the farm and the family life and will be dealt with in greater detail when the scale is analysed in chapter eight.

Edinburgh Farming Implementation Scale (EFIS). This inquires about the reported behaviour of the farmers in different areas of the farm enterprise. The aim of this questionnaire was to build up a picture of what the farmers had actually done on their farms over the last five years. The development of this scale will be discussed in greater detail in the chapter nine.

Edinburgh Farming Attitudes Scale (EFAS). This questionnaire asked about the farmers' attitudes to conservation, business management, farming systems, optimism regarding the future of farming, and so forth, and the items were expected to correlate with those on the behaviour and objectives scale at both a general and specific level. The development of this scale will also be discussed in greater detail in the chapter seven.

Edinburgh Farming Enterprise scale (EFES). Unlike the EFOS, EFIS and EFAS, this questionnaire was not intended to be subjected to development via a data reduction analysis. The EFES examined farm structure, the financial structure of the enterprise and who was consulted about strategic business decisions. In addition, it gathered demographic information about the farm household including family size, age of household members, farming experience, levels of education, and so forth. With the exception of the information-gathering section questions from this instrument were of interest in themselves and were not seen as indicators of a latent dimension, that is, they would not be reduced by factor analysis,.

Five factor Personality Inventory (NEO-NFFI 60 items). (Costa & McCrae, (1992). NEO-NFI Test Manual).

This is a shortened version of the revised NEO-PI-R 240 items which measures the five major dimensions of personality. The NEO-PI-R is based upon a conceptual model of personality which is empirically measured through a number of scales which contribute to the trait domain. These scales are derived from factor analysis and are well validated. The NEO-NFFI 60 item is composed of the highest loading items from each of the five domains:

THE FIVE DOMAINS OF PERSONALITY ARE:

Neuroticism (N)

This trait is best described by a tendency to experience negative emotions such as fear, sadness, anger, etc. and an inability to cope well with stress; at the other end of the continuum is a calm relaxed individual.

Extraversion (E)

Extraverts are lively, active, talkative, optimistic individuals; at the other end of the continuum is the introvert who is characterised by reserve, independence, shyness but not necessarily a pessimistic, or socially anxious individual.

Openness (O)

An open individual is characterised by imagination, intellectual curiosity, and preference for variety but although this can be related to intelligence, it is not equivalent to a measure of intelligence. Those at the opposite end of the continuum are more conventional and set in their ways with a narrower range of interests.

Agreeableness (A)

Altruistic, acquiescent, sympathetic and helpful comprises this agreeable domain rather than the independent, sceptical, competitive and critical individual at the other end of the continuum.

Conscientiousness (C)

The ability to plan, organise and self achieve are the domains of conscientiousness; at the other end of the continuum lies the more easy going carefree individual.

Interpretation

The scale measures traits that approximate to normal bell-shaped distributions. Most individuals are near average for the scale. Scales are best explained by describing the characteristics of the high and low scores, i.e. extravert or introvert however, the scale is continuous and most individuals would show a combination of both extraversion and introversion. Standard norms are given

in the table 6:1.3 in this case where the majority of the sample were male only the norms score for men is given.

Kirton Adaptor-Innovatory Inventory.

The Adaption-Innovation theory regards problem solving to be linked to cognitive style (Kirton, 1987). It is thought that by locating the theory as one of style as in, *"in what manner is the problem solved"* it is then separated from the orthogonally related concept of cognitive capacity (how much), which is a measure of IQ. As a style it can be seen to be different from learned techniques (how can).

The Kirton Adoption-Innovator Inventory (KAI) is a measure used to test this theory and the scores lie on a continuum from adaptor to innovator, either of which can be advantageous depending upon the situation, the problem and the perception of the individual. An individual whose problem solving style challenges the current mores or attitudes the solution to any problem is likely to be innovative, at the other end of the continuum accepting the current attitudes and norms leads to an adaptive problem solving style. Adopters can be classified as doing things 'better' where as innovators do things 'differently'.

The General Health Questionnaire (GHQ) 28 items

The General Health Questionnaire (Goldberg & Williams, 1991) is designed to be a self administered screening test aimed at detecting non-psychotic psychiatric disorder in community settings and in non-psychiatric clinical settings. It focuses on breaks in normal functioning over the past two weeks in four categories, somatic, anxiety, depression and social dysfunction.

It can be scored using either a Likert Scale 0 1 2 3 which produces a less skewed distribution than the usually scored GHQ 'caseness' score of 0 0 1 1 those with a 'caseness' score of 6 and above exhibit clinical symptoms of psychological distress (on the Likert scale this will be a score of 20). This scale is well validated and reliable (Goldberg & Williams, 1991).

The 28 item GHQ scale is a sub-scale of the GHQ 60 and the four factors are not independent of each other. There is no assumption made that the four factors on which the scale was developed will exist in any other sample tested. Therefore, it is necessary to factor analyse and compare the amount of variance explained by the four factors with other studies. In the UK studies have found 22% of the population score above 6 on this scale. Most high scores will be transient, with approximately 12% having persistently high scores (Goldberg & Williams, 1991).

Ravens Standard Progressive Matrices

This scale is an estimate of an individual's capacity to think clearly in a non verbal way (Raven, Court & Raven, 1992). This is closely related to the 'g' component of Spearman's theory of cognitive ability where 'g' is the fluid general intelligence that generates new non verbal concepts and identifies relationships. The scale is composed of 12 x 5 sets of diagrams of progressively increasing complexity each with a piece of the diagram missing. The subject is asked to choose the correct missing piece from the options available at the bottom of the page. The completion time can be unlimited. In this study, participants were instructed to complete as many of the puzzles as they could in a 15 minute period. The correct number scored in this period was

used as a measure of cognitive ability. The test is well validated and reliable (Raven et al., 1992).

National Adult Reading Test. (NART) (Nelson & Willison, (1991). National adult reading test (NART): Test Manual).

This is a test of verbal ability and consists of 50 words of increasing difficulty both in meaning and occurrence which the subject is asked to pronounce. The words do not follow the normal rules of pronunciation and therefore can only be pronounced correctly if they are known. This is a measure of crystallised or 'learned' ability.

Test scores can be used raw, or corrected for verbal IQ according the handbook.

Coping in Stressful Situations Inventory (CISS).

Coping is observed to be important in an individual's adaption to stressful events. If coping skills are poor the individual experiences much greater stress resulting in both physical and mental health problems. This self-reporting measure investigates an individual's preferred style of coping in a stressful situation (Endler & Parker, 1990). It measures three main coping styles, broadly defined as follows. Task oriented coping is achieved by tackling the problem head on; emotion focused coping is a reacting to stress through crying, blaming ones-self or others, getting angry etc.; avoidance coping (this has two subscales, distraction and social diversion) means ignoring the problem and delaying tackling it. These three styles of coping may be used in different situations by the same individual. What the scale measures is the preferred style of coping.

5:2.5 Methodology

Farmers were initially contacted by letter and telephone (Appendix C). A suitable time was arranged to visit each individual farmer where the material was explained in detail, along with the expected outcome measures. The farmers were then asked to complete the farming scales and note the following:-

1. their reaction to the material, that is, was the survey too long, or boring, did it make sense to them?
2. were any of the items ambiguous?
3 what areas of interest to farmers were missing or insufficiently covered by the survey?
4 was any of the material irrelevant or obscure?
5. how they felt about completing the various psychological tests, such as the Raven's Matrices and the GHQ etc.

Initially a group meeting was to be arranged but this was not possible and a return visit was arranged and each farming scale item assessed individually by detailed discussion with each farmer and their comments on the other scales were recorded.

5:2.6 Results

As a result of the pilot study one or two questions were clarified and an increased number of questions relating to legislation and policy were incorporated into the attitude and objectives scales. These were items such as, *"It is important to get all you are due from legislation", "Legislation in farming involves to much paper work", "Some current legislation is unrealistic*

in its demands", etc. The revised scales are attached as appendices A and B. The nine farmers unanimously approved the survey and considered it to be relevant to the study of farmer decision making behaviour. One livestock/cereal farmer noted the survey was thought-provoking in that he had not considered how many others may be involved in the decision making process. Had he been asked who he involved he would have replied *"only himself"*. Some of the items made him aware how much he was influenced by his wife who was an ecologist. Another was adamant that although he spoke to others before taking a decision he and *only he* made the final decision. He was therefore reluctant to admit any other person was involved. This was the consensus of the majority of farmers in this sample.

Another farmer who grew under contract was concerned with his lack of freedom in many decision areas. He felt decisions were held by the contracting company and he had to fertilise, spray, harvest etc. on their commands. Another was constrained by a controlling father for whom he farmed. A tenant farmer remarked on some interference by the owner in certain areas of decision making, such as, in the woodland tree planting scheme. This promoted the inclusion of a few items on autonomy.

This survey was conducted shortly after Britain had withdrawn from the European Exchange Rate Mechanism, which had resulted in an improved 'Green' pound and a corresponding improvement in the livelihood of many farmers. However, the form filling requirements of the new Integrated Administration and Control System (IACS) form was still a burning issue. This scheme covered the arable area payments, beef special premium scheme, suckler cow scheme and hill livestock compensatory allowances, and involved extensive form filling. There was a further unresolved problem regarding the

current set-aside scheme and if it was to continue in its present form. This meant that every farmer visited had a long list of complaints about legislation and policy issues and especially about the paper work generated from the introduction of the scheme. As a result the legislation/policy questions were increased to twenty.

The psychological scales all met with approval, none were thought intrusive. In fact many of the farmers requested an individual personality and intelligence profile analysis.

No attempt was made to code or statistically analyse the results of the pilot study as there was an insufficient number of participants in relation to the number of variables in the study.

This work was funded by the Scottish Office Agriculture, Environment and Fisheries Department, and work could only begin after the Government's Survey Control Unit in London had approved the farming questionnaires developed for the study. The modified, extended scales were sent to the Survey Control Unit and approval for the survey was received on 30th December 1993. The questionnaires designed for the study were then collapsed into two parts and renamed. 1. The Edinburgh Farming Business Questionnaire, this comprised the Edinburgh Farming Enterprise Scale (EFES), (which also incorporated the information seeking section), the Edinburgh Farming Implementation Scale (EFIS)and half of the Edinburgh Objectives Farming Scale (EFOS). The latter was split to ensure that participants did not feel obliged to 'match' their results on the attitudes and objectives sections of the scales. The second section which was administered at a later date was

composed of The Edinburgh Farming Attitude Scale (EFAS), and the remainder of the EFOS.

5:3 Main study

5:3.1 Participants

All participants were farming on the east coast of Scotland between Montrose in the north and Newcastleton in the south. Although 60% of Scotland is classified as LFA, the East coast of Scotland has a large fertile belt running parallel with the coast where grain is produced and cattle fattened for market. Thus, two main types of farming were selected, hill sheep-cattle farms in two LFA areas and arable/cropping farms on non-LFA land.

Names of possible farmers were supplied by the Scottish Office Agriculture & Fisheries Department (SOAFD). The list was sourced from the annual June Census which provided the name and address of the farmer and the farm's classification in terms of its farming type (arable or hill sheep and cattle). The random sample of 1000 farmers was evenly split by farm type. 500 arable or cropping farmers and 500 LFA hill sheep-cattle farmers were randomly selected from a possible 3940 East Coast of Scotland farmers. This represented approximately 25% of the possible sample of such farmers in this area and one sixth of the total Scottish farming population of 31,577. (SOAFD. Annual Report, 1992). These names were released by the Scottish Office Agriculture Environment and Fisheries Department in January 1994. The sample was reduced to 718 farmers when duplicated farms, properties managed by executors or solicitors, absentee owners, and incorrectly designated properties (i.e. purely horticultural properties) were removed. The target number of

participants for the survey was 300. The list of 718 farmers was split between the two farming types and a random number generator was used to extract the first selection of names from each group.

The participants were mainly male and volunteered to assist in the study after it had been explained to them.

5:3.3 Method

Contact with the potential population of respondents was by three methods and took place over the last three weeks of January 1994. The first contact involved sending a letter explaining the study and informing the farmer that the researcher would contact them by telephone the following week (Appendix D). This was followed by a telephone call for those farmers whose telephone numbers could be obtained. The telephone conversation elaborated on the details of the study and the farmer's assistance was sought. Contact by telephone proved to be much more difficult than expected, both in finding the relevant number in telephone directories, (as trading was sometimes done under another name) and, often 5-7 calls were necessary to contact the farmer, many of them in the evening. January-February also covered the 'holiday' period for many farmers, making them elusive. The remainder, for whom only addresses were available, were sent a letter and asked to take part in the study by returning a pre-stamped rely slip, or, in the final wave, both the letter *and* the first part of the study questionnaire (The Edinburgh Farming Business Questionnaire) were posted.

After affirming their intention to participate in the study the Business questionnaire and invitation to attend an evening meeting were dispatched. The meetings were scheduled in a local hotel for a date approximately two - three weeks ahead. Reminders of the evening meeting were sent on the Monday of the week proceeding the arranged meeting.

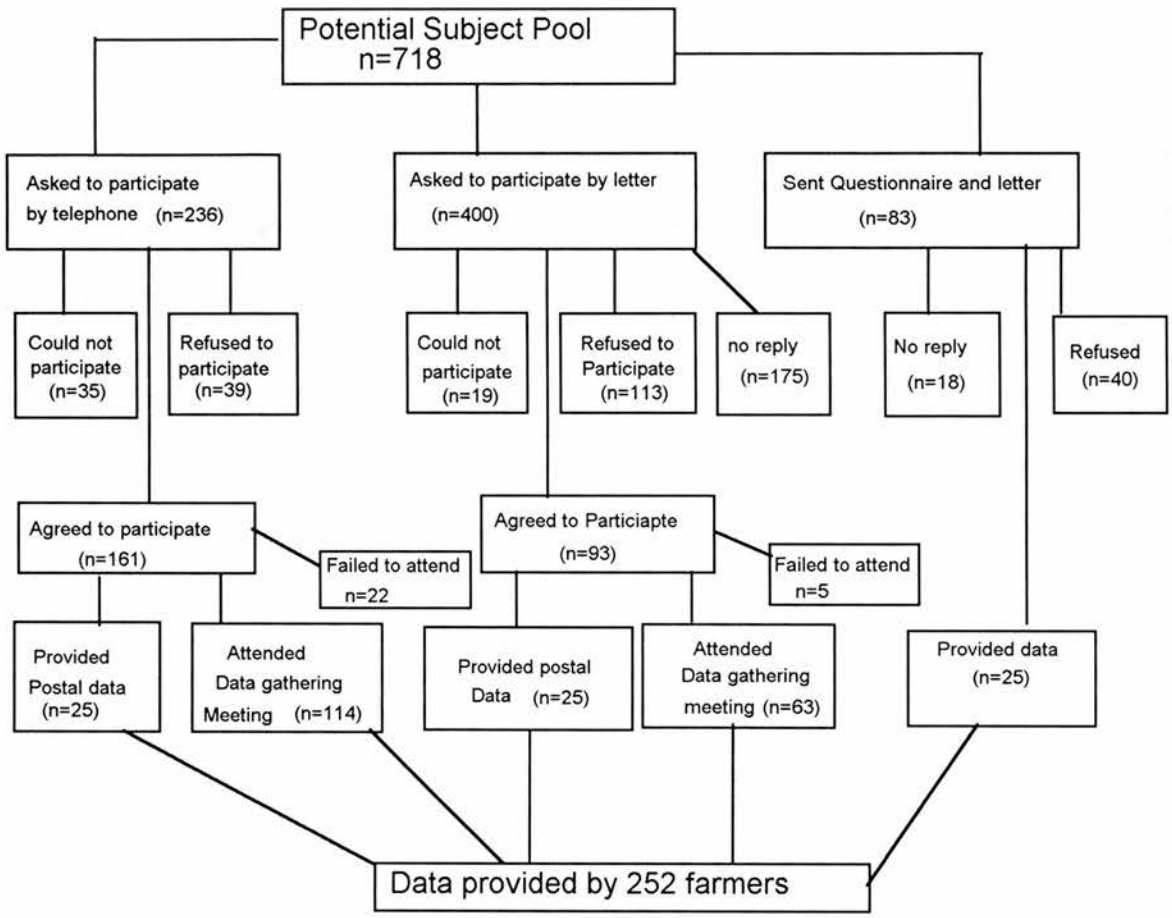
Many of the hill farmers in this study lived some distance from their neighbours and they appreciate a chance to meet with other farmers, but the distances also proved a problem in selecting a venue for evening meetings. Winter conditions necessitated limiting the travelling distance of each farmer to no more than 30 miles. Accordingly, a series of country hotels normally used by farmer groups such as the National Farmers Union were booked for conference facilities and an evening meal (after checking that no other farming group meetings were to be held there that evening, or indeed during that week). This was done on a provisional basis prior to contacting the farmers. When the acceptances to the meeting started to arrive the hotel bookings were confirmed.

First, the farming business questionnaire was mailed to farmers who were asked to complete it prior to attending an evening meeting. At the evening meeting the questionnaires was checked for missing data and the financial details relating to the farm business noted (if the participants agreed). After an initial speech of thanks for their help and a resume of the evenings events, the Raven's Standard Progressive Matrices were administered to a group of farmers over a 15 minute period (Appendix E). The test was explained using enhanced pictures of the test material and the researcher circulated around the room to deal with any problems. The personality, coping and attitude questionnaires were issued, and the participants worked on these at their own pace, this meant there was a conveniently staggered finish which allowed for the administering

of the National Adult reading Test (NART) individually at the end of the session. An evening meal followed and during the meal extensive notes were made regarding what farmers thought were important to farming at this period in time. Where farmers were unavailable to attend evening meetings, personal visits to the farms were made to complete the second phase of the data collection.

Details of the numbers participating or refusing to participate as a result of the various methods of approach are shown in Figure 5:1. This is of interest as the different approaches provided slightly different results. It is also useful when considering the importance of any selection bias in the sample.

Figure 5:1 Subject Recruitment Chart



For those farmers, where the initial letter was followed by a telephone contact, 35 could not participate because they had retired, moved away or were deceased, and 161 agreed to participate (80.5% acceptance). Thirty-nine (19.5%) refused to take part, and 5 participants did not wish to attend a meeting but asked for the questionnaires to be sent to them, followed by a personal visit. Of the 161 acceptances, 114 (45%) eventually attended an evening data collection meeting. Twenty of the 47 (18%) who failed to attend

the evening meetings completed all phases of the survey by postal questionnaires and personal visits. The overall acceptance when the contact was initially made by telephone was 59% of this population.

Those farmers where telephone numbers were unavailable - 400 in total - were sent letters explaining the study and requesting their participation. A response slip was enclosed in the letter along with a pre-paid reply envelope. A total of 92 (23%) agreed to participate in the two stage survey with 15 subsequently failing to attend an evening meeting. Of this group 25 (6.25%) either agreed at the outset to individual farm visits or did so after failing to attend an evening meeting. No reply was obtained from 175 (43.75%); it is not known if they had moved, retired, were deceased or just did not wish to participate in the study. A further 113 (28%) indicated that they did not wish to participate and 19 (5%) had left farming, were deceased or had rented out the farm, they were removed from the subject pool. The overall acceptance rate for those contacted by post was 22%.

By the end of March 1994 a total of 227 farmers had fully completed the requirements of the survey. By this time, the majority of farmers were heavily involved in lambing or cultivation and were therefore not prepared to attend evening meetings. The remaining 83 participants on the list were sent a covering letter and all the questionnaires and asked to complete and return them at their leisure. In all, 25 (30%) of this group provided data and no replies were obtained from 18 (22%); a further 40 (38%) refused to participate. The overall response rate for the initial population of 718 farmers was 35%.

The data collection was finally completed in June 1994. The results show that personal contact by telephone is much more likely to result in co-operation.

5:4 Data entry

All of the data were scored and coded prior to entry by the researcher. Data was then entered into an Excel spreadsheet package by both the researcher and another experienced data handler. All data were double entered into a spreadsheet and one dataset overlaid on the other to identify any inconsistencies in the data entry phase. Data was also 'eyeballed' to check for any gross errors and omissions. Data entry was completed by December 1994.

5:5 Statistical analysis

Subsequent statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) on a 486 PC by the researcher.

Initially descriptive statistics such as mean and standard deviation and skewedness were carried out on each item as a check as a result no items were discarded because of extreme skewdness.

Items where the order of scoring within a domain set had been reversed i.e. were 'most important' had been scored as 1 rather than the more usual 5 were inverted by subtracting the score from 6 for each reversed item in the individual questionnaires. This ensured that items scored in the same direction throughout the domain. It should be noted that the implementation scale was scored on an increasing scale whereas the objectives and attitudes were scored on a decreasing scale, this results in negative correlation among the behaviour, objectives and attitude factors.

The three scales EFAS, EFIS and EFOS were individually analysed by Principal Component Analysis (PCA) and then by factor analysis. The results will be discussed in the following chapters.

CHAPTER 6

DESCRIPTIVE STATISTICS AND GENERAL RESULTS DERIVED FROM THE SURVEY DATA

6:0 Introduction

The questionnaire items were designed to cover the variables described in the conceptual model (Fig. 4.1) and the literature review (Chapters 2 and 3).

This chapter examines the descriptive data from the EFES scale relating to:-

a) the demographics of the farming sample.

b) structural and financial analysis of the sample.

c) information gathering, who is consulted, and with what frequency, regarding different areas of strategic decision making.

d) how far the participants conform to a normal population sample both with regard to the psychological testing scales used and other UK farming populations.

6:1 Demographic variables

Demographic data are of interest in their own right and are shown in Table 6:1. The average age of this sample of 254 Scottish farmers was 48.5 years and is similar to the mean age of the general farming population in the Britain (Potter & Lobley, 1995). Only ten of this sample were women.

In this survey 91% of the sample were married, 57% had inherited the farm but 86% had been raised on a farm, as had 56% of their spouses. These findings are similar to Errington & Tranter (1991 p 23) findings from previous English farming surveys. Of this Scottish sample, 48% owned their own farm and 20% had a mixture of owned and tenanted farms, a finding which is also similar to Errington & Tranter's (1991) and Potter & Lobley's (1995) findings. It is possible that in the future numbers of inherited farms will fall as only 67% thought their farm would be passed on to a family member, this is a similar finding to Gasson et al., (1993).

One possible inference that farming is a satisfying way of life for the majority of the farmers in the study, was that only 45% of this group thought they would retire at the 'normal' age, 30% only contemplated partial retirement and 8% had no intention of ever retiring, the remaining participants reported a preference for early retirement (another possible inference is that they need the income from the farm). Potter & Lobley (1995) found that 22.3% thought they would never retire and 26% would partially retire therefore, this sample is reporting slightly lower figures for earlier retirement. However, satisfaction with farming in this sample may be inferred, as 40% reported their main hobby to be related to farming.

Table 6:1 Demographic and structural details of the sample.
Number of participants: N= 254 of which 245 male and 10 female.

Variable	Mean	Std dev	Range (yrs)
Farmer's age	48.4	11.3	25-83
Farmer's education	12.2	2.4	8-19
Farmer's experience	31.5	12.9	1-60
Spouse's age	46.1 yrs	10.7	
Spouse's education	12.9	2.3	

6:2 Farm structural variables

Farm structural variables (below) are known to be correlated with a number of important behaviours, such as, conservation oriented behaviour, diversification and off-farm employment (Gasson, 1988). Some correlations of farm structural variables are shown in later chapters following the analysis of the farming attitude, goals and behaviour questionnaires used in the study.

Farm structure details:

Land type:
122 participants had LFA farms (49.8%)
124 had arable farms (50%)

Farm type:
42 farms were arable (14%)
95 farms were livestock (39%)
109 farms were mixed farms (44%)

Area (Ha) farmed:
ranged from 12.2 to 3915 Ha with a median of 218.3 Ha

Business partners:

None	= 38
1-2 partners	= 120
3 or more partners	= 87

Farm ownership:

owned	48%
tenanted	37%
mix tenancy	20%

Farm size over the preceding five years was reported static by 61% of this sample, with 20% decreasing the size, and 19% increasing. On the whole the picture is of a stable pattern of farming size. However, there had been a significant reduction in both full and part-time employees in the past five years

($p<0.001$, Table 6:3) and possibly as a result, 35% of the sample reported difficulty in finding time for family and friends (Q54 of EFIS).

The farms in this sample were on average 5.5 miles from the nearest town with distances ranging from 0.5 to 25 miles. Isolation was not perceived by the farmers as a problem.

Environmentally oriented farming behaviour was not particularly prevalent among this sample if pesticide/herbicide/etc. sprays are taken as an indicator, only 3% of farmers *never* used chemicals, 14% used them sparingly and 6% used them heavily. Only one percent of this sample had tried organic farming but 11% had replaced a large number of dykes and hedges in the past five years.

6:3 Farm economic variables

Reported income had increased for 40% of the participants in the past five years, remained static for 37% and decreased for the remaining 23%. This is very similar to the finding of net change in farming income 1988-1993 for England and Wales reported by Potter and Lobley (1995, p26)

In both business and economics it is assumed that profits will be maximised. 66% of the Scottish farmers surveyed reported that they managed the farm business to maximise production and 57% to maximise profit. From conversations with the farmers few distinguished between the two behaviours which should perhaps be a significant pointer for policy makers and farm advisors.

Formal business management practices were evident in about one third of the sample, i.e. reportedly 32% used targets in managing the farm business, 33% kept production records and 30% monitored the business performance. However, 76% kept financial records. New farming methods/ideas were reportedly used by 12% with 21% nearly always using them.

At the commencement of this survey there was a great deal of media concern about the stress generated by low or falling incomes in farming and increasing debt due to the high interest rates of the period (Sunday Times, 1992). For this sample, farm business debt had increased for 19%, decreased for 23% and remained stable for the remaining 37%. In this sample, 15% thought they would lose the farm if they attempted to clear their debt. 18% found it difficult to meet their farm and personal commitments. Interestingly, 47% had made 'largish' investments in the farm business in the past five years. The majority of this Scottish sample did not therefore conform to the literature's interpretation of farm problems.

It has been argued that farmers experiencing the greatest stress are those younger farmers with families. They are likely to be at the expansion/renewal stage of their careers and as a result are likely to have the highest debt (Belyea & Laoboa, 1990; Ekstrom & Leistritz, 1986; Armstrong & Schulman, 1990). However, no such correlation with age was found for this sample.

There is an economic hypothesis which argues that in a falling market producers aim to produce more, failing to see they are further reducing the market prices. Those who do not change, treat the market as stable, (as the majority of this sample reportedly did), while those who reduce production are

more market oriented. In this survey 18% reported that they increased production when market prices fell and 7% decreased, the remainder made no change. This is a finding similar to that of Potter & Lobley (1995) who reported that those who were more production oriented increased production in all situations when prices fell.

Farm income cannot be directly compared across an LFA and arable farm because of the differences in subsidies, grants and size of farm required to sustain a viable income. The most efficient manner of comparing such farms is through the gross farm margin per hectare this is a measure of the income per hectare from the farm (gfm/Ha).

The size and cost of new technology has soared over the past 10 years and this is reflected in this sample in that 4% leased out machinery while 13% leased in.

As noted in chapter 3 one risk reducing method suggested by the literature is diversification of the farm business. In this sample only 13% reported diversification over the past five years.

Off-farm work is another risk reducing measure according to the literature (Errington & Tranter, 1991; Herrmann & Uttitz, 1990). 12% reported being dependent on their own off-farm work, 7% reported dependency on other family members off-farm work and interestingly, 32% were dependent on other family members *on-farm work* for their viability. This is a similar percentage to that found by Marsden (1991). Table 6:2 indicates the distribution of on and off-farm work of the family.

Table 6:2 Off-farm work by the farmer and the family.

	Number of participants	% of total sample
Farmers working full-time off-farm	8	3
Farmers working part-time off-farm	24	9.4
Spouses working full-time off-farm	33	13.4
Spouses working part-time off-farm	53	21.5
Spouses working part-time on-farm	42	17
Spouses working full-time on-farm	1	
Children working full-time on-farm	1	
Children working part-time on-farm	63	25
Children working full-time off-farm	39	15.4
Children working part-time off-farm	78	31
Pension cover		87%

Table 6:2a Financial structure of farm

	mean	Std dev
80 farmers had no debt	31.3%	
mean debt level of total sample(1 = high, 5=low)	4.4	1.4
Number of people financially dependent on the farm	5.2	2.4
revenue (n=107)	£158066	£146318
Assets (n=107)	£380346	£444385
gross farm margin/hectare (gfm/Ha)	£50.6	£67.2

When Britain withdrew from the European Monetary Exchange in 1992 the value of EEC subsidies increased because of an increase in the 'green' pound. Nearly half of the sample (48%) reported deriving 20-30% of their income from subsidies, 1% as much as 70%, and 3% none. Level of subsidies on average were, for LFA farms 40% and arable farms 20% of their income. Most of the sample were eligible for approximately four grants and reported claiming for them all.

Of this sample 13% (30) had no retirement provision and this was significantly related to age ($p<.02$), (i.e. the older the farmer the less likely they were to

have made specific provision for retirement), and having greater amounts of debt and fewer hectares.

LFA farms and arable farms in the sample differ significantly from each other in a number of respects. Using Student t-test statistics significant differences were found for the areas reported in Table 6:3.

Table 6:3 Comparison of significant LFA and arable farm differences.

	Arable		LFA		t-test sig.
	mean	**std dev**	**mean**	**std. dev**	**significance level p<**
Hectares	203.7	141.4	690	784	.000
Revenue	211788.5	170370	1091241	97999	.000
variable costs	114732.5	12679	70375	86533	.011
GFM/Ha	84.2	65.6	23	54.7	.000
subsidy % of total income	20	10	40	11	.000
full-time employees	1.3	1.85	0.7	1.1	.001
Inherited*	82		59		.01 (Chi-square)
Computers*	45		21		.001 (Chi-square)

** Chi-square analysis used as both variables are dichotomous.*

6:4 Information gathering on strategic and tactical farming decisions

The planning of any action is dependent upon information, decisions are generally improved by greater knowledge (Simon, 1956; Driver & Onwona, 1986) and this is especially true of strategic decisions. The revolution in farming technology and biochemistry over the past thirty years has been responsible for many changes in agriculture, increasing the demand for farmers to extend their sources, usage and volume of information in order to keep up-to-date and remain in business.

Information may come from a variety of sources, such as, the farmers own experience, advisors, government, family, friends, neighbours, commercial representatives, media sources (Ford & Babb, 1989). By identifying sources of information in any strategic decision making area, an idea of the quality of the information given can be assessed (Fann & Smeltzer, 1989). Domains of farming practice poorly sourced may possibly be targeted more effectively with information. This is targeting of information is of importance to the farmer, advisor and government. One of the queries raised by the literature review (Chapter 3) was the question of whether farmers gathered information from choice or because it was targeted at them by government advisors, commercial representatives etc.

Information was sought by farmers on a range of strategic decisions from book-keeping through investment to marketing decisions (Table 6:5), farmers were asked who they 'always' consulted regarding each type of relevant decision. Overall the business partner was the most frequently consulted regarding decisions, although this varied with the type of decision, as shown by the fact only 14% consulted partners regarding off-farm work and 28% about diversifying. Spouses are the next most frequently consulted group in all areas but particularly on decisions about investment (46%) and planning (47%).

Nor surprisingly this supports the hypothesis that there is a close link between the business and the family for many farmers. Unsurprisingly accountants and bank managers were consulted for a range of financial decisions. Children and employees were consulted across a small range of topics, but interestingly agricultural advisors were not consulted frequently regarding any decision. Only commercial representatives and lawyers were less frequently discussants with farmers regarding business decisions. If this pattern were repeated across

the UK then the low consultation rate with advisors would have interesting implications for the delivery of advice and promotion of policy.

Table 6:5 indicates the frequency (%) with which significant others were 'always' consulted in the specific decision making areas. Other individuals consulted by the individual farmers but not specifically named in the questionnaire were, the auctioneer at the market, business friends, and other close relatives.

Table 6:5 Type of farm decision by number of 'always' consulted source of information.

Type of decision	Business Partner	Spouse	Accountant	Children	Employee	Bank Manager	Other	Agricultural Advisor	Commercial Representative	Lawyer
Investment Decisions	72	47	25	12	3	20	3	4	8	2
Financial Decisions	68	42	25	10	2	17	5	4	5	1
Planning the future	65	46	17	20	8	15	8	10	0	4
Size of the business	59	33	7	15	8	9	5	6	0	3
Marketing Decisions	52	23	4	13	8	1	8	3	0	0
Day to day decisions	43	26	-	16	32	-	0	-	-	-
Contracting In	37	13	3	9	8	1	8	1	0	0
Book keeping	36	39	59	5	1	3	8	2	0	0
Contracting out	33	11	2	6	6	1	0	1	0	0
Diversifying	28	39	5	10	5	5	3	7	0	0
Off-farm work	14	35	-	10	-	-	-	-	-	-
Rank order by Mean consultation % of 'always' consulted sources.	**46.1**	**32.2**	**16.3**[1]	**11.5**	**8.1**[2]	**8**[1]	**5.3**[1]	**4.2**[1]	**1.4**[1]	**1**[1]

[1] mean score for 9 decisions. [2] mean score for 10 decisions all others for 11 decisions

Table 6:6. 'Occasionally' consulted sources by type of farm decision

Type of decision	Other	Spouse	Account ant	Business Partner	Agricultural Advisor	Children	Employee	Bank Manager	Commercial Representativ e	Lawyer
Book keeping	33	26	36	37	15	24	8	13	1	9
Contracting out	23	29	14	27	9	21	30	5	9	3
Contracting In	36	40	11	33	15	17	32	2	17	1
Financial Decisions	49	39	55	20	35	27	11	49	15	36
Investment Decisions	59	33	52	18	33	25	20	49	14	37
Marketing Decisions	64	40	19	31	35	21	24	15	36	4
Planning the future	64	39	45	25	45	32	36	39	28	36
Size of the business	44	37	27	21	27	22	24	24	15	11
Off-farm work	-	33	-	25	-	29	-	-	-	-
Diversifying	45	24	18	31	28	23	14	13	12	10
Day to day decisions	47	56	-	35	-	31	41	-	-	-
Rank order by Mean consultation % of 'occasionally' consulted sources.	**55.6**[1]	**36**	**30.8**[1]	**27.5**	**26.9**[1]	**24.7**	**24**[2]	**23.2**[1]	**16.3**[1]	**16.3**[1]

[1] mean score for 9 decisions. [2] mean score for 10 decisions all others for 11 decisions

Those from whom participants occasionally asked for advice, is shown in table 6:6. Interestingly it is those identified as the auctioneer, the business friends etc. who are consulted.

When considered as a whole, the decisions about which farmers most frequently seek advice are strategic in nature such as, planning for the future, and investment decisions (Table 6:7). The more tactical the decision, the less consultation takes place. The total number of sources consulted in each area are shown in Table 6:7.

Table 6:7 Decisions by the mean number of sources consulted.

Variable	Mean number of consultations	Std Dev	Minimum consultations	Maximum number consulted
Planning the farm future	5.9	2.9	0	19
Investment decisions	5.	2.5	0	16
Financial decisions	5.3	2.4	0	14
Book-keeping	3.9	1.9	0	12
Changing farm size	3.9	2.7	0	14
Marketing decisions	3.6	2.2	0	10
Contracting out	2.4	1.8	0	9
Day to day decisions	2.0	1.3	0	6
Contracting In	2.0	1.9	0	8
Diversification	1.7	1.5	0	6
Off-farm work	1.5	1.4	0	6
Mean total number of sources consulted for the 10 decision areas	**37.7**	**22.5**	**0**	**120**

Large differences between individuals emerge as observed by the maximum and minimum numbers consulted for each decision area. Because of the importance attached to information-seeking in the literature on farming behaviour change, the sample was grouped into three;- high, medium, and low information users and a further analysis done to investigate any of this with other farm/farmer

variables. This was done by awarding each subject a 'total information gathering' score by summing the scores for all areas of decisions making. By dividing the information gathering totals into three groups, that is, the bottom 30% were classified as 1, the top 30% as 2 and the intermediate 40% as zero. A crosstabulation of information levels with categorical and nominal variables such as farm type, land type, ownership etc., was assessed using chi-square statistics. The only significantly correlated variables with high levels of information gathering were; having a computer ($p<.04$), number of (diversified) enterprises ($p<.001$) and the number of business partners ($p<.001$). The correlation between high information users and the number of business partners, is relatively unsurprising given the nature of the analysis that is, the more partners the business the larger it is likely to be and the greater the income. However, it was not clear why information gathering decreased when there was only one partner, it was speculated that this might be related to age, i.e. younger, less knowledgeable farmers. This prompted a further investigation of age and partnership.

Table 6:8 Crosstabulation of information range with number of partners

	Information seeking		
Number of partners	**low**	**medium**	**high**
0	18	16	4
1	7	7	9
2	23	49	22
3 or more	13	30	41

Differences in information seeking between high and low groups was significant a $p=0.00004$ level.

For a convenient comparison of age with information seeking, age was similarly divided into three ranges as in Table 6:9.

Proportionally fewer younger farmers farm on their own, they are more likely to be in partnership with a larger number of partners than older farmers. It is

possible that age and information gathering are inter-related. An inspection of age range and information gathering is shown in Table 6:9.

Table 6:9 Information seeking by age.

	Information seeking		
Age	**low**	**medium**	**high**
25-35	7	17	7
36-45	20	33	14
46 and older	35	50	55

The differences in age and information seeking between the high and low groups was significant at p=0.04 level.

In this sample the younger age (25-35 yrs) range seek much less information than farmers in both the remaining age ranges.

As has previously been discussed diversification of the farm enterprise is thought to require greater amounts of information or the diversification fails. In this sample those who were high scoring seekers of information were likely to have diversified more than once (significant at $p < 0.001$ level).

6:4.1 Other sources of information

Independent of the information gathering questionnaire, farmers in the sample were asked their sources of farming and policy information on a 5 point Likert scale with 1='never' to 5='always'. 65% of this sample *always* read the agricultural press and 95% nearly always, 38% frequently talked to their advisors and 40% talked to their neighbours and 60% with the family regarding new policies and farming matters. This is in broad agreement with the previous findings where most of the sample always consulted the family, or farming

neighbours there is a greater reporting of consultation with agricultural advisors than in the previous section but this could be related to the generality of the items in this section compared with the specific decisions consulted for in the previous section.

Training courses are also a means of gathering information and the average number of courses attended was 1.42 (std. dev. 2.69) over the past five years. However, the number ranged from zero to 20 courses. There was a significant relationship between the number of courses attended and information gathering. (Spearman's correlation coefficient = 0.15; $p<.05$)

Other variables of interest lie in the areas of innovative farming and openness to new ideas in farming, for example relating to new technology, new machinery, ideas etc., as they rely on information. Of the sample, 8.7% reported always replacing machinery as soon as they could. The influence of computer technology extends to farms, 27% of the sample (66) owned a computer of which 62% used it for farm accounts, 48% used a financial management package and 35% had specialist farming programmes. Arable farmers where significantly more likely to own a computer than an LFA farmer ($p<.001$, crosstabs). Farmers who used computers had significantly larger farms, earning a greater gfm/Ha and they also scored higher on information gathering than did their counterparts ($p<.04$, crosstabs).

Of this sample 58% had worked abroad for a period. 21% reported they were the first to use new methods in their area and 6% reported that other farmers got a lot of information from them. Significantly more arable farmers reported

having others use their new ideas than LFA farmers ($p<.02$). As can be seen from Table 6:6 these items were significantly correlated.

Table 6:10. Correlation between computer ownership and information seeking.

	Information seeking		
	low	**medium**	**high**
computer	9	33	23
no computer	52	69	54

The difference between computer ownership was significant at the p=.04 level

6:4.2 Relationship of information gathering to other variables

Information gathering has been considered crucial in a number of areas, such as diversification, innovation etc., it is therefore to be expected that information gathering would be significantly correlated with a number of important variables in the study. In this study significant correlations with total information gathered are shown in Table 6:11.

Table 6:11. Correlation of information gathering with other survey variables.

Variable	Total information
gfm/Ha	**.30****
Number of diversified enterprises	**.19****
Off-farm goals	**.18****
Farm size (Ha)	**-.13***

*p<.05; **p<.01

It was suggested in Chapter 4 that farmers may independently gather information or it may be targeted at them by government advisors and commercial representatives. Empirically it appears that many farmers are independently seeking information from sources close to them (partners and spouses).

6:5 Psychological profiles

The psychological tests used in the survey have been described in the methodological section of Chapter 5.

As shown below in Table 6:12, farmers in this survey did not differ from the general population on any psychological variables other than intelligence. This sample population had a higher intelligence as estimated by the NART test than the general adult populations tested (Table 6.12) (Nelson & Williston 1991).

Table 6:12 Comparison of farming sample with a general population psychological profiles.

Variable	Mean	Std Dev	Normed pop. mean	Normed pop. St dev
Personality N=246				
Neuroticism	17.4	6.8	17.6	7.5
Extraversion	26.6	5.3	27.2	5.9
Openness	22.5	5.4	27.1	5.8
Agreeableness	28.5	5.1	31.9	5.0
Conscientiousness	33.0	5.4	34.1	5.9
Coping with stressful situations N= 246				
Task coping	60.5	7.7	58.6	9.9
Emotion focused coping	39.1	9.4	39.2	11.5
Avoidance coping	37.3	10.5	38.1	9.6
Distraction coping	16.2	5.5	17.5	5.5
Social diversion coping	14.1	4.1	13.3	4.1
Adapter/Innovator N=242				
Kirton Adaptor/Innovator Inventory (KAI)	94.80	11.98	95	17.9
Intelligence N=216				
(NART) Verbal Intelligence	33.9 (average of 16 errors)	9.9	22 errors	
(Raven Std Matrices) Non-verbal Intelligence	34.7	8.5		

Although it was widely reported in 1992 that farmers were top of the suicide league tables (Sunday Times, 1992, Jones, 1994) in this group only 10% (26) of the sample were clinically psychologically distressed according to the General Health Questionnaire evaluation. In the general population 20% of the participants are likely to be clinically depressed when rated by this scale (GHQ Test Manual; Goldberg and Williams, 1991). As this study relied on volunteers and was particularly demanding of the farmers' time, it is unlikely that any distressed farmer would volunteer to participate. It was noted that some

farmers contacted by telephone did both report and sound 'stressed' when refusing to take part; a few others reported this by letter when declining participation.

The 28 item GHQ scale is a sub-scale of the GHQ 60. This questionnaire comprises four minor scales relating to physical symptoms of stress, anxiety and insomnia, depression and social dysfunction. The four factors arising from analysis of the 28 items are not independent of each other. There is no assumption made that the four factors on which the scale was developed will exist in any other sample tested. Therefore, it was necessary to factor analyse and compare the amount of variance explained by the four factors with other studies. Our sample did result in four factors and these explained 50 % of the variance compared with 53% of the Goldberg & Blackwell (1970) and 58% in the Marks et al (1979) studies (cited in Goldberg & Williams, 1991).

In the UK, studies have found 22% of the population have a 'caseness' score above 6, (or a total score above 21 depending upon whether the questionnaire is scored sing caseness or the Likert scale) (see chapter 5), but most of those high scores will be transient with only approximately 12% having persistently high scores. Therefore, the survey sample scores are relatively low, we have a less stressed group than would normally be expected in the general population. The scales and scores are shown in Table 6:13 below.

Table 6:13 General Health Questionnaire (GHQ) scores by factor (N=248)

Variable	Mean	Std Dev	Min	Max
GHQD somatic symptoms	0.98	1.8	0	11
GHQB anxiety and insomnia	4.0	3.3	0	17
GHQA social dysfunction	4.1	2.8	0	14
GHQC depression	7.0	1.8	1	14
GHQ Total score	16.1	7.6	4	50

The correlations of farm structural, economic, demographic and psychological variables are shown in Table 6:14 & Table 16.15.

Table 16.14. Correlation of farm structural variables

	debt	diversify	farm type	ownership	gfm/Ha	land type	no. children	off-farm work
debt	1							
diversify	-.08	1						
farm type	.06	**.35****	1					
ownership	.07	**.14***	.04	1				
gfm/Ha	-.03	.07	-.03	.13	1			
landtype	-.05	-.05	-.03	.10	**.46****	1		
no.children	-.11	-.07	-.12	-.02	-.04	.01	1	
offfarmwk	**-.18****	.11	-.04	-.04	-.01	-.02	**.26****	1
onfarmwk	**-.13***	.02	.03	**-.14***	-.11	**-.15***	.07	**.22****

*p<.05; **p<.01

Table 6:15. Correlations between economic, demographic and psychological variables.
*p<.05; **p<.01

	gfm/Ha	NEO-C	NEO-E	NEO-N	NEO-O	Aoid cp	Emotion cp	Task cp	Totalinfo	Raven	NART	Diversify	GHQ	age	debt
gfm/Ha	1														
NEO-C	-.04	1													
NEO-E	**.16***	**.28****	1												
NEO-N	-.02	**-.41****	**-.38****	1											
NEO-O	**.16***	**-.19****	0.12	.12	1										
Avoid cp	.11	-.05	**.14***	**.19****	**.23****	1									
Emotion cp	.02	**-.31****	**-.24****	**.68****	.06	**.37****	1								
Task cp	.06	**.36****	**.22****	**-.18****	.09	.08	-.00	1							
Tot info	**.26****	.00	**.16***	.00	**.15***	**.23****	.09	**.13***	1						
Raven	.08	-.01	.03	-.12	**.28****	-.11	-.01	.07	-.01	1					
NART	.06	-.10	.06	-.10	**.29****	**-.18****	**-.15***	-.00	-.01	**.41****	1				
Diversify	.07	-.09	.09	.07	**.20****	-.01	-.013	-.04	**.19****	.10	.07	1			
GHQ	-.02	**-.16***	**-.28****	**.56****	-.02	.01	**.44****	-.08	-.02	-.06	-.07	-.05	1		
Age	.02	-.04	-.07	.09	-.09	.01	.08	-.07	.09	**-.32****	-.04	-.01	-.01	1	
Debt	-.03	.09	-.08	-.12	-.11	-.10	-.11	-0.01	-.06	-.00	.06	-.08	.00	.01	1
KAI	**.16***	-.07	**.24****	**-.16***	**.30****	-.03	-.10	**.21****	.05	**.16***	**.14***	.06	-.08	**-.24****	-.04

Diversification is significantly related to a personality that is open to new ideas as well as gathering information. Information gathering in this survey is significantly correlated with psychological characteristics of extraversion and being open to new ideas. Extraverts are more likely to talk to others and hence gather more information, and being open to more ideas is significantly related to intelligence and information gathering in this sample Table 16:15a. This confirms Simon's (1957) thesis that the intelligent use of information is of importance in predicting who will be successful in business. It also confirms the assumption that extraverts are more likely to gather information from other individuals than introverts (Hoyer & Ridgeway, 1984).

In conclusion, the sample has been assessed similar to other surveys for characteristics of age and farm size. Psychological data follows the profiles that of the general population with the exception of the psychological traits of 'openness' to new ideas, which had a lower mean score, whereas the trait of conscientiousness has a higher than general mean score.

6:6 Discussion

The farmers in this sample had a mean age comparable to that found in other British (and Western) samples. A high proportion of the farmers where married but more than two thirds of this sample thought it doubtful that their children would take over the running of their farm. However, most were satisfied with farming as a way of life.

There was evidence that farm size had remained fairly static over the past five years with an equal percentage of farmers moving in and out of the market.

However, there had been a marked reduction in full and part-time farm workers and one third of the sample were dependent upon family labour to operate the farm. Larger farms were more likely to have diversified and were also more likely to have practised some environmental behaviours, confirming Gasson's findings of 1988, i.e. that larger farms were more likely to diversify and that this was not necessarily done because of a need to augment income.

Economically farming circumstances have changed little over the past five years for these farmers although one in five thought their debt level had increased over the past five years. Two thirds reported they ran the business to maximise profit and production, however, only one third of the sample exhibited management practices such as setting targets, keeping production records and monitoring the business performance. Off-farm work was essential to only 12% of this sample which is much less than the average of 1 in 5 farmers in off-farm employment (Gasson, 1980).

Arable farmers were less dependent (than LFA) upon subsidies and had a greater gfm/hectare. They also made greater use of computers and had more full-time employees. This would suggest that arable farmers are therefore, more innovative than LFA farmers if computers are a measure of this factor. Arable farmers were also more likely to use computers than LFA farmers but this may be a reflection of the number of useful programmes available to assist the arable decision making process.

This sample of farmers had an average age of around 48 and at least 30 years farming experience, this infers a sound knowledge base from which to make decisions. Since only 8 participants had less than 10 years experience it was impossible to compare the importance of experience and knowledge gathering.

However, it was noted that farmers with only one or two business partners, whether they were high or low users of information, showed a reluctance to use other sources of information. This may be due to a number of factors, such farmers may be constrained by external variables and have little need for information, or it may be that they become complacent and do not seek information.

Age has also been implicated in lack of information gathering, but it is possible that the younger farmers do not have sufficient autonomy regarding the implementation of farming decisions; that is, the father, or other partners, may be responsible for information collection (skewing the results).

Farmers in this sample used mainly the farming press, their partners and spouses as sources of knowledge for the majority of decisions that they made, that is, the sources of advice are generally personal and easily accessible. Little use was made of private experts such as the agriculture advisor, although 38% did say they frequently consulted their advisor, which may mean that this advice is circulated among farmers but not necessarily included at the immediate decision making level. It is worth noting that agricultural advisors contributions increase when the decision involves future planning of the farm, a significant decision that is likely to requires a considerable amount of information. The commercial representative's contribution to decision making is greater at the marketing level.

As expected the more complex decisions relating to planning, finance and investment require more sources of information. What is surprising in this sample is the lack of interest in diversifying given the emphasis in ministerial advice and the farming press. Few farmers in this sample had diversified their

enterprise. Those who had more than one diversified enterprise were greater seekers of information than those with only one or no enterprise diversification. Diversification may therefore be due as much to lack of information as lack of interest, something which might be pursued in further studies.

The correlation of information gathering with other variables is of interest given the literature on the subject. As has been noted in the result section, information gathering and gross farm margin are correlated emphasising the importance of knowledge in production and profit oriented behaviour. There is further corroboration of this in the correlations with production, environmental and diversified behaviour as well as having goals which focus on improving the quality of life and increasing the satisfaction derived from farming. Personal characteristics such as being open to new ideas, having a positive attitude to trying out new ideas and methods is also important, and, as one would expect, being outgoing, talkative and enjoying the company of others assists the information gathering process.

In conclusion, knowledge gathering is important in the decision making process. Farmers may need to be reminded about using as many and varied sources as possible, not just the immediate associates and family. Advisors need to be aware of the areas where their unbiased knowledge may be more usefully deployed. Farmers' sources of information could be improved by directing information through agricultural advisors and specially prepared articles targeted at the most widely read sectors of the farming press. Another media possibility is to target specific decision topics using video presentation which might be more suited to the less extrovert farmer who would rather read or hear about hem without spending the time in the company of others.

The results obtained from this study can be interpreted to be representative of the farming community from which they were drawn and generally conforming psychologically to the population in general. It was noted that they did have mean scores which were slightly less then normal for the traits of 'openness' and 'agreeableness', conversely they scored higher on 'task coping'. The results give rise to the assumption that the data are in general dependable and may be compared to similar farming populations.

CHAPTER 7

METHOD OF COMPILING ITEMS AND THE ANALYSIS OF THE EDINBURGH FARMING ATTITUDES (EFAS) QUESTIONNAIRE.

"So many men, so many opinions; his own a law to each"
("Quot homines tot sententiae; suus cuique mos".).
Terence: Andria 454

7:0 Introduction

This chapter analyses the Edinburgh Farming Attitude Scale (EFAS) developed for this study. The blocks of attitudes developed for the study are discussed in detail and the factors resulting from the data reduction method of factor analysis are identified and compared with the original sample of items. This chapter also deals with the Principal Component and subsequent factor analysis of the 130 item attitude scale (Appendix B) and the resulting factor correlations with financial, structural and psychological variables.

An attitude can be defined as an individual's positive or negative evaluation of the attitude-object. Such an evaluation is thought to explain and motivate behaviour. Attitudes are thought to be under cognitive control and hence exert a selective influence at various stages of information processing through attention, perception, or retrieval (Allport 1937, Asch 1952). There is an assumption that individuals selectively attend to relevant attitudinal material therefore, if attention is caught if it is possible to introduce new information and it may be possible to change attitudes (Petty, Cacioppo & Schumann, 1983). Because of these assumptions attitudes are a focus of research in many

branches of social sciences. Much of the research has shown that if the a multi-attitude model is used behaviour can be predicted (Eagly, 1992).

At present, no definitive measurement tools exist for the assessment of farmer's attitudes. Prior to constructing a set of tools the relevant literature on attitudes, was reviewed in order to enumerate those domains identified as important. Farming attitudes were reviewed in Chapter 3 but a brief summary is presented below.

7:1 Compiling attitude items

As the range of attitudes to be studied was extensive, it was decided to group the items pertaining to a specific domain identified in the literature. The items were selected on the basis of the literature review, discussion with farm advisors and with the farmers' themselves during the pilot study. The original draft questions completed by the farmers contained 130 items covering the domains of attitudes towards risk, innovation, management, satisfaction with farming, tradition, conservation, off-farm work, succession, legislation, optimism, and information. The questions were phrased in such a manner that all of the farmers in the study could respond to every item. There were no questions which were specific to one type of farmer, i.e. no questions directly relating to livestock or arable farming. Although the items were originally defined by domain they did not appear in domain blocks in the final questionnaire. Items were randomly scattered throughout the questionnaire in as a means of checking any tendency by the farmers to impose cognitive consistency on their response. It was explained that these statements had been made by other farmers and they were asked to score their reply on the basis of how true they thought these statements were for farmers in *general* and not

with respect to their own situation. This is a recognised method of allowing the participant to feel free to respond without thinking about how they might respond to please the researcher. The items were scored on a 5 point Likert scale with anchor points 1 = strongly disagree and 5 = strongly agree. This questionnaire was presented and completed at the evening meeting at least two weeks following the completion of the questionnaires relating to the farm business, some farming objectives and farming behaviour.

As the literature is ambiguous in its definition of what is the most important aspect of profit maximising behaviour many of the items could belong to more than one group, for example, many of the 'traditionalist' items could be viewed as the negative end of the response continuum for the business management items. This was not considered a problem as factor analysis of the empirical results would reduce the questionnaire to its most efficient form.

7:2 Groups and items

Groups of 5-10 items relating to traditional farming attitudes, conservation, production, financial, business management, risk taking, stress, coping with stress, legislation and policy attitudes, satisfaction with farming and optimism regarding the future of farming were explored. These grouping appeared to cover the variables identified in the literature as important. These groups of items are presented below. The question number at the end of the item was its position in the attitude scale presented to the farmers, the *F number occurs when the item is retained by the factor analysis and the number following the F refers to the factor number.

As a result of the pilot study a further 10 items were added to the legislation scale, plus an item relating to attitude of the banks towards farmers. This was necessary because the farmer in the pilot felt were not adequately addressed in the original draft. The complete set of items in each domain presented to the participants in the survey is shown below.

7:2.1 Attitude towards production and profit

- Debt management assistance is necessary Q91
- Borrowing money is bad for the farm Q78 ***F5**
- It is important to maximise profits Q97
- Cheap Government loans would be preferable to grants Q79 ***F5**
- Short term loans are a good thing for farming Q117 ***F5**
- It is important to pay attention to market prices Q80 ***F1**
- It is important to pay attention to your cash flow position Q81
- It is not important to monitor production levels Q82 ***F4**
- It is important to keep an eye on the futures market Q83
- Borrowing money over a long period to ensure the future of the farm is important Q84
- Money is not the most important thing in farming Q86

7:2.2 Risk taking attitude

- Physical risk is part of farming Q36
- Farmers should make sure they have insurance to cover most loss Q57 ***F1**
- Successful farmers take financial risks Q64 ***F5**
- If there is a possibility of benefit then farmers will take risks Q88
- In starting a new venture one should be willing to take out a loan for most of the capital required. Q38 ***F5**
- Farming is too financially risky Q43
- It is appropriate to take financial risk in farming Q23 ***F5**
- To farm successfully one must be in debt Q70 ***F5**

7:2.3 Attitude towards Information gathering

- It is important to read about farming practices Q49 ***F1 & *F4**
- The media is a useful source of information Q58
- It is sometimes necessary to consult with professional farm advisors before taking a decision Q28 ***F4**
- Farming neighbours should be used as a source of farming information Q45
- Useful information can be obtained from commercial representatives Q29
- Important information on new ideas can be obtained at agricultural shows Q66 ***F1**
- It is important to visit other farms and look at their methods Q2 ***F4**
- It is more important to use your own experience and knowledge than ask others for information Q71

7:2.4. Decisions and who should be involved

- Farming decisions should be made by the family Q46
- Day to day decisions should be taken by farmers only Q39
- Production decisions should be taken by farmers only Q112 ***F4**
- Successful farmers take decisions on their own Q48
- Families should be consulted about financial decisions Q20
- It is necessary to consult with professional advisors before taking decisions Q73
- Farming neighbours should be consulted before taking major decisions Q61
-

7:2.5 Environment

- Organic farming is a fad Q65 ***F6**
- Green groups are useful Q13 ***F6**
- Farm land should be fully productive Q67 ***F1**
- Green groups should not dictate to the farmer Q55
- If prices fall the best thing to do is decrease production Q37
- Current conservation grant schemes are good Q76
- It is important to have a tidy farm Q54 ***F1**
- Environmental grants are not helpful to the farmer Q27
- Pest control should be dictated by the farmer, not environmental groups Q44 ***F1**

- EC and Government policies are geared toward the conservationist Q102
- It is important to reduce pest control chemicals by using effective rotation Q123 ***F6**
- Conservation measures should be paid for by increased prices to the farmer Q128
- When prices fall farmers have to produce more Q129
- It is important to reduce nitrogen application by using non-chemical methods Q122 ***F6**

7:2.6 Optimism

- The long term outlook for farming is good Q92
- Current level of subsidies can't last Q75
- Young people should not be encouraged to farm Q100 ***F3**
- Farming is likely to provide a secure retirement Q87 ***F2**
- Many farmers will look for another job in the near future Q25
- Prices of crops and stock are bound to fall in the future Q69 ***F3**
- A good living can be made from farming Q56
- If there was a compensation scheme that allowed farmers to clear debt and leave farming, it should be taken. Q94
- Farmers are pessimistic about the future of farming Q50 ***F3**

7:2.7 Tradition

- Farming is a way of life Q103
- A farm is a business to be run efficiently Q10 ***F1**
- Religion and worship are important Q14
- It is important to serve in the community Q51
- Modern record keeping systems are unimportant in farming Q17 ***F4**
- It is important to use tried and tested ideas Q34
- Farmers should be cautious about adopting/applying new farming techniques Q111
- New machinery has not improved on tried and tested techniques Q30 ***F4**
- It is important to pass on the farm to a member of the family Q2

7:2.8 Pride in the farm (Status)

- It is important to have the best livestock/pasture in the area Q114 ***F1**
- It is important to win prizes at farming shows Q3
- Farm production is the thing to take most pride in Q106 ***F1**
- Farming is a job like any other Q6
- It doesn't matter what the farm looks like as long as its productive Q107
- Farmers are important in the community Q21 ***F1**
- It is important that farmers are respected in the local community Q24 ***F1**
- It is important to have the occasional member of public visit the farm Q130 ***F4**
- It is important to have the respect of other farmers in the community Q4
- Being a farmer is a source of pride Q32

7:2.9 Satisfaction

- Farming is satisfying Q18 ***F3**
- It would be nice to give up farming Q116 ***F3**
- Farming is depressing Q40 ***F3**
- Farmers generally enjoy doing their job Q26 ***F3**
- Other employment would be better than farming Q63 ***F3**
- Farmers in Britain are demoralised Q9
- The quality of life could be better Q33
- Farming is a job with a lot of scope to do things your own way Q19 ***F3**
- Farmers get a bad press Q31
- The media is very supportive of farmers Q59
- Farming is so rewarding I never intend to retire Q89

7:2.10 Stress

- Uncertain financial positions cause stress Q1
- The work load of modern farming cause stress Q115
- The nature of farming is stressful Q16
- The past year has been very stressful for most farmers Q108
- The weather causes most stress in farming Q12
- Farming is a relaxing job Q104

- Farming is a lonely job Q7
- Farming folk are very supportive of each other Q22
- Bankers don't help farmers like they used to do Q119
- Filling in grant forms is anxiety provoking because error can be penalised Q118 ***F2**
- Most farmers find it hard to relax Q4

7:2.11 Coping with stress

- It is easy to discuss financial problems with other farmers Q62
- Nobody understands farming problems Q47
- Farmers should keep themselves to themselves Q53 ***F3**
- Farmer need to pray for help Q60
- Farmers problems should be tackled head on Q41 ***F1**
- When faced with a problem it is best to ignore it until it goes away Q52
- Farmers get lots of support from friends and family Q42 ***F3**

7:2.12 Autonomy

- It is the farmers fault when things go wrong Q121
- When things go wrong it is often due to government policies Q8
- The weather is generally to blame when things go wrong Q72
- The government controls farming too much Q68 ***F2**
- Successful farming is the result of hard work Q74
- Successful farming is the result of cautious planning Q109 ***F1**
- Successful farming is often due to luck Q99
- Farmers are generally in control of their farm business Q77 ***F1**
- Successful farmers take decisions on their own Q48 ***F1**

7:2.13 Policy and Legislation

- It is important to keep up with new policies Q92 ***F1 & *F4**
- Farming Policy changes are easy to understand Q90 ***F2**
- Government information on policy change is clear Q95 ***F2**
- EEC & Government policies are helpful for the farmer Q35 ***F2**
- It is easy to apply for grants and subsidies for the farm Q15 ***F2**

- A free market situation would help everyone Q96
- Food mountains are necessary to protect prices Q98
- Governments interfere too much in farming Q85 ***F2**
- There is too much paper work in farming Q101 ***F2**
- Most farmers don't have the administrative set-up to deal with the paperwork for legislation Q5 ***F2**
- Legislation is not always clear Q11 ***F2**
- Legislation in farming involves too much paper work Q126 ***F2**
- Farmers are sometimes informed about legislation too late to put it into practice Q113 ***F7**
- Even advisors can't tell you what the current legislation is Q110 ***F7**
- It is important to get all you are due from current legislation Q124 ***F1**
- There is insufficient information on policy change Q127
- There is no clear overall strategy to government policy Q125 ***F7**
- Government information on legislation is easily come by Q120
- Some current legislation is unrealistic in its demands Q105

7:3 Analysis

The 130 attitude items of the EFAS were analysed initially using Principal Component Analysis (PCA). Principal Components Analysis is a data reduction method used to examine the interrelations (correlations) between a large set of items and to combine them as a smaller set of multi-item components often called factors with the minimum loss of information. (Child, 1990). This allows the underlying structure of the data to be explored without imposing any preconceived ideas on the data. Factor analysis identifies the separate domains and the extent to which the variables are explained by each dimension. The commonest technique used in extracting factors is the latent root technique, where only factors having latent roots above a certain value are extracted. Plotting these eigen values results in a 'scree' slope (Cattell, 1952). Where the 'scree' slope becomes a straight line is chosen as the cut-off point.

In this case the cut-off point on the scree slope was not clear, in this case eigen value of 2 were used to determine the cut off point on the scree slope. It suggested that the final solution could contain 7 to 12 factors. Inspection of the 12 factor solution indicated very few items in the last five factors, suggesting that the smaller number of factors (7) was more likely to contain a n satisfactory number of items. To simplify the factor structure further, the reference axis of the factors are rotated. In this case, orthogonal or varimax rotation gave the most satisfactory solution as a seven factor one. Varimax rotation of the factor axis results in a simpler and more meaningful factor solution with a nearly zero correlation among factors.

Because the factors are represented by their correlation matrix an *a priori* criterion was that the these values (known as the factor loadings) lying between 0.40 and 0.35 were acceptable, if factor loadings are high the more closely related the items are (with the value 1 being a perfect correlation) (Child, 1990), and any item with loadings less than this or which loaded significantly on more than two factors was removed from the analysis. A series of factor analysis was conducted on the data by initially removing those items with low factor loadings, then running the factor analysis again. This was repeated on the improved data set and again items loading highly on more than two factors were removed. This reduced the scale from 130 to 66 items which accounted for 36.4% of the total item variance.

It cannot be assumed that items in a factor are addressing the same underlying theme, therefore the internal consistency of each group of items was measured by the Cronbach alpha test of reliability. If this test result gives a greater than 0.5 and less than 0.9 the group of items may be assumed to have a high degree of reliability (Klein, 1993). Above 0.9 the items may be addressing exactly the

same thing and are therefore not sufficiently diverse group of items to measure the underlying factor. Below 0.5 the disparity of the items may indicate they are not representative of an underlying variable, or, there are too few items to represent the underlying variable, and should therefore be discarded.

These groups of attitudinal items which are highly correlated can be viewed as an attitude domain. The items in the domain are summed to give the individual a score in each domain. High and low scoring individuals will be used to convey the essence of each domain. Scores on each domain are distributed continuously across a the full range of scores, with the majority of farmers attaining intermediate scores. Therefore, a domain confers a score upon a farmer, much as height or age may be measured.

Once the factors had been identified and the items representing each attitude domain are summed to give each individual a score on that factor, a Pearson's 'r' correlation was used to examine the relationship of the factors to the farm structure, financial structure of the business and psychological variables.

Analysis was by Statistical Package for Social Science (SPSS) on a 486 PC. The results are shown in Table 7:1.

Table 7:1. The reduced Edinburgh Farming Attitudes Scale (EFAS).
N=254
The + or - sign after the questions indicates the direction of scoring.
The numbers alongside the items represent each factor loading for that item.

Question	EFAS1	EFAS2	EFAS3	EFAS4	EFAS5	EFAS6	EFAS7
It is important to have the best livestock / crops / pastures. +	**.63**	-.08	-.02	-.05	-.06	.07	.21
Successful farming is the result of cautious planning. +	**.61**	.06	-.04	.16	.03	.09	.07
Farm production is the thing to take most pride in. +	**.56**	-.05	.07	.14	-.14	-.06	.16
It is important to read about farming practises. +	**.55**	.08	-.04	**-.42**	.10	-.04	-.07
It is important to get all you are due from current legislation. +	**.50**	.12	-.07	-.27	.05	-.08	-.02
It is important to have a tidy farm. +	**.46**	-.00	-.01	-.16	-.19	.17	.03
Farming problems are best tackled head on. +	**.46**	.09	-.19	-.03	-.10	-.10	.03
Farmers should make sure they have insurance to cover most loss. +	**.45**	-.10	-.05	-.05	-.23	.19	.05
It is important to pay attention to market prices. +	**.44**	.25	-.08	-.39	.01	-.11	-.19
Farm land should be fully productive. +	**.44**	-.03	.01	.12	.18	-.21	-.02
It is important farmers be respected in the local community. +	**.41**	.19	-.06	-.02	.13	.23	-.12
A farm is a business to be run efficiently. +	**.40**	-.05	-.05	-.12	.10	-.13	.21
Farmers are generally in control of their farm business. +	**.40**	.05	-.22	.12	.20	.14	-.19
Pest control should be dictated by the farmer, not by environmental groups. +	**.40**	.13	-.06	.22	-.04	-.12	.01
Successful farmers take decisions on their own. -	**.39**	.11	.01	.19	.23	-.00	-.01

Important information on new farming ideas can be obtained at agricultural shows. +	**.37**	-.02	-.15	-.01	.07	.01	.14
Farmers are important in a community. +	**.37**	.20	-.16	-.06	.13	.04	-.09
Legislation in farming involves too much paper work. +	.28	**.66**	-.10	.07	.03	.02	-.03
Farming policy changes are easy to understand. -	.23	**-.60**	.03	-.07	.07	.01	-.14
The Government interferes too much in farming. +	.1	**.59**	.16	.10	.11	-.09	.14
There is too much paper work in farming +	.22	**.57**	-.04	.09	.02	.02	-.30
The government control farming too much. +	.22	**.53**	.06	.09	.04	-.17	.15
Legislation is not always clear. +	.16	**.53**	-.09	-.06	-.00	-.03	.08
It is easy to apply for grants and subsidies for the farm.	.16	**-.50**	.00	-.00	.08	-.07	-.10
Government information on farming policy change is clear. -	.23	**-.47**	.10	.18	.22	.18	-.12
EEC & Government policies are helpful for the farmer. -	.10	**-.45**	-.18	.12	.15	.03	-.16
Filling in grant forms is anxiety-provoking, because errors can be penalised. +	.12	**.44**	.09	-.05	.15	.17	-.07
Farmers don't have the administrative set-up to deal with the paperwork from legislation. +	.08	**.42**	.25	.11	.10	.11	.09
Farming is likely to provide a secure retirement. -	.19	**-.39**	-.13	.20	.03	-.10	-.04
It would be nice to give up farming. +	-.13	-.14	**.56**	.09	.02	.10	.13
Farming is satisfying.-	.24	-.09	**-.56**	-.03	.05	.06	.34
Young people should not be encouraged to farm -	-.06	.01	**-.55**	-.07	.04	-.04	.12
Farmers get lots of support from friends and family. +	.25	-.07	**.54**	-.10	.20	-.09	.24
Farmers generally enjoy their job. -	.23	-.05	**-.49**	.09	.11	.09	.00
Farmers in Britain are demoralised. +	-.01	.28	**.49**	-.18	.15	.02	.15
Other employment would be better than farming. +	-.09	.01	**.45**	.02	.16	.10	.21

Farming is depressing. -	.07	.06	**-.45**	.06	.19	-.05	-.11
Farmers should keep themselves to themselves. +	.05	-.16	**.42**	.26	-.11	.03	.02
Prices of crops and stock are bound to fall in the future. +	.03	.14	**.41**	.01	.05	-.15	.02
Farming is a job with a lot of scope to do things your own way. -	.30	-.03	**-.40**	-.07	.18	.11	.08
It is important to have the occasional member of public visit the farm. +	.05	-.13	-.05	**-.57**	.08	.28	.20
Sometimes it is necessary to consult with professional farming advisors before taking decisions. +	-.00	.03	.12	**-.54**	.18	.20	.15
It is not important to monitor the farm production levels.-	.02	.11	.03	**.53**	.19	.16	-.02
It is important to keep up with new farming policies. +	**.43**	.03	.09	**-.51**	.23	.08	-.11
New machinery/ideas in farming have not improved upon traditional techniques. -	-.09	-.02	.12	**.48**	-.11	.33	.22
Modern record keeping systems are unimportant in farming. -	.11	.05	-.01	**.46**	.16	.09	-.02
It is important to visit other farms to look at their methods. +	.04	-.00	.03	**-.45**	.32	.20	.19
Production decisions should be taken by farmers only. -	.27	-.09	.05	**.42**	.09	-.17	-.02
Successful farmers take financial risks. +	.09	.06	-.06	-.08	**.64**	.07	-.01
In starting a new farming venture one should be willing to take out a loan for most of the capital required. +	-.07	-.09	.00	.03	**.63**	.06	-.09
It is appropriate to take financial risks in farming. +	.12	.05	.01	.09	**.60**	-.20	.05
Short term loans are a good thing for farming. +	.16	.01	-.02	-.28	**.42**	.02	.11
To farm successfully one must be in debt. +	-.15	.02	.21	.29	**.47**	-.02	.08
Borrowing money is bad for farming. -	.17	.11	.23	.23	**-.44**	.20	.19
Cheap government loans to farmers would be preferable to grants. +	.00	-.03	.16	-.01	**.41**	.16	.33

It is important to reduce nitrogen application by using non-chemical methods. +	.04	.10	.03	.11	.02	**.75**	-.13
It is important to reduce pest control chemicals by using effective rotations. +	.21	.10	.02	-.06	-.02	**.69**	-.04
'Green' groups are useful. +	-.29	-.04	-.05	-.15	.02	**.61**	.06
Organic farming is a fad. -	.03	.12	.09	.01	-.01	**-.50**	-.01
There is insufficient information on policy changes. +	.04	.33	-.10	-.07	.02	.05	**.66**
There is no clear overall strategy in agricultural policy. +	.15	.19	.09	-.12	.01	-.22	**.60**
Even advisors can't tell you what the current legislation is. +	.16	.23	.04	.10	.00	.02	**.46**
Farmers are sometimes informed about legislation too late to put it into practise. +	.23	.34	.14	-.13	.01	-.06	**.37**
Cronbach Alpha	**.76**	**.77**	**.61**	**.52**	**.62**	**.66**	**.67**

7:4 Results

The seven factors derived from the original 130 item scale and their loadings are shown in Table 7:1. The scale was reduced from 130 to 64 items by the analysis and explained 36.4% of the variance.

Factor One (EFAS1) was identified by questions highlighted as EFAS1 in Table 7:1. This is represented by items such as:

- A farm is a business to be run efficiently.(+)
- Successful farming is the result of cautious planning.(+)
- Farm production is the thing to take most pride in.(+)
- It is important to have the best livestock / crops / pastures.(+)
- It is important to get all you are due from current legislation.(+)

The 18 items that make up this factor appear to address a number of areas. Making a profit is also related to pride in achievement and having a positive business attitude towards farming. This factor will subsequently be termed an *Achieving Attitude*. These items had a high internal consistency, with a Cronbach Alpha of 0.76

Factor Two (EFAS2), was identified by items such as:

- Legislation is not always clear.(+)
- Filling in grant forms is anxiety-provoking, because errors can be penalised.(+)
- Legislation in farming involves too much paper work.(+)
- It is easy to apply for grants and subsidies for the farm.(-)
- EEC & Government policies are helpful for the farmer.(-)

The 12 items representing this factor appear to address an negative attitude toward legislation and will be subsequently labelled *Legislation Attitude.* The internal consistency of this group of items was a high 0.77 when measured by Cronbach Alpha.

Factor Three (EFAS3) identified by questions such as:

- It would be nice to give up farming.(+)
- Farming is satisfying.(-)
- Farming is a job with a lot of scope to do things your own way.(-)
- Farmers generally enjoy their job.(-)
- Farmers get lots of support from friends and family.(+)

- Farming is depressing.(+)

The 11 items representing this factor indicate a pessimistic view of farming and will be labelled *Pessimistic Attitude*. Internal consistency as measured by Cronbach Alpha was 0.71

Factor Four (EFAS4) was identified by questions such as:

- Production decisions should be taken by farmers only.(-)
- It is important to have the occasional member of public visit the farm.(+)
- Modern record keeping systems are unimportant in farming.(-)
- It is important to visit other farms to look at their methods.(+)
- New machinery/ideas in farming have not improved upon traditional methods (-)

The 9 items representing this factor indicate both a positive open minded attitude to farming as well as stressing the importance of information and will be labelled *Open Attitude*. The internal consistency of this group of items as measured by the Cronbach alpha was 0.53.

Factor Five (EFAS5), was identified by questions such as,

- Short term loans are a good thing for farming.(+)
- It is appropriate to take financial risks in farming.(+)
- In starting a new farming venture one should be willing to take out a loan for most of the capital required.(+)
- Successful farmers take financial risks.(+)
- To farm successfully one must be in debt.(+)

The 7 items representing this factor indicate a positive attitude toward financial risk and will be labelled *Risk Attitude*. The Cronbach Alpha for this group of items was 0.62.

Factor Six (EFAS6), was identified by questions such as,

- It is important to reduce nitrogen application by using non-chemical methods.(+)

- It is important to reduce pest control chemicals by using effective rotations.(+)
- Organic farming is a fad.(-)
- 'Green' groups are useful.(+)

The 4 items representing this factor indicate concern about chemical use and will be labelled *Chemical Use Attitude*. The Cronbach Alpha was 0.66 for these four items.

Factor Seven (EFAS7), was identified by questions such as,

- Even advisors can't tell you what the current legislation is.(+)
- Farmers are sometimes informed about legislation too late to put it in practise.(+)
- There is no clear overall strategy in agricultural policy.(+)
- There is insufficient information on policy changes.(+)

The 4 items representing this factor indicate concern regarding policy implementation and will be labelled a negative attitude towards *Policy*. Cronbach Alpha was 0.67 for the four items.

7:4.1 Change in the original constructs of items

From the above and section 7:2.1 it can be seen that the first block of 11 items labelled business attitude towards production and profit was reduced to 5 items, three of which were encompassed in factor 5 which was identified as an attitude towards risk, one in factor one identified as an achieving attitude and one in factor 4 identified as the 'open' attitude. Thus the original production and profit group of items were not identified as such by this group of farmers.

The block identified originally as risk taking attitude had 8 items (section 7:2.2) which was reduced to four items relegated to risk attitude factor 5, and one to the achieving attitude factor 1. Thus, financial risk attitude was identifiable by this original block of items.

The information block of 8 items (section 7:2.3) was reduced to one item in the achieving factor 1, two in the open attitude factor 4 and one item loaded highly on both factor 1 and 4. Therefore, the originally proposed measures of information were inappropriate in that they reflected instead an open and achieving attitudes. Fortunately, the detailed analysis of information gathering was adequately covered by the questions in the section on decision making as already discussed in Chapter 5. This was especially fortuitous as the seven items in the block labelled decisions and who was involved in them (7:2.4), reduced to one item encapsulated in the risk factor 4 and one in the open attitude factor.

Environmental behaviour originally contained 14 items (section7:2.5) but this was reduced to four items contained in an attitude towards chemicals factor 6, and 3 items in the achieving factor 1. It was decided that environmental behaviour was best identified by the four items in factor 6, the attitude towards chemical use.

The nine items of optimism (section 7:2.6) regarding the future of farming were reduced to three items in factor 3 and one item in factor 2. Thus, a measure of optimism-pessimism is identified by this block of items.

Traditional farming was reduced from five items (7:2.6) to two items in factor 4 and one item in factor 1. Traditional farming was shunned by this group of farmers and items retained related to the open and achieving attitudes. Traditional attitudes towards farming are thought to deter innovation and the positive association of the so called traditional attitude items with the achieving attitude suggests that innovative attitude were best described by psychological definitions of innovation and an attitude which was open to new ideas rather than by attitudes to traditional farming.

Farming status reduced from eight items (7:2.8) to four items in factor 4 the open attitude and one item in factor 1 the achieving attitude. It is interesting that the concept of status is linked with the achieving attitude.

Satisfaction with farming (7:2.9), a 12 item block reduced to 6 items in the negative attitude, pessimism, factor 3. Thus satisfaction with farming is strongly related to optimism regarding the future of farming. The fact that pessimism is the identifier label has more to do with the reverse scoring of the items than the farmers actual attitude. Most farmers actually scored highly on this attitude, i.e. they were optimistic not pessimistic.

Stress measured by 11 items (7:2.10) was reduced to one item in factor 2, the negative attitude towards legislation, and the 7 item coping block reduced to two items in the pessimism factor 3 and one achieving item in factor 1. Once more the stress and coping factors were better measured by the standardised psychological tests available. 10 items in the block labelled autonomy reduced to three items in achieving factor 1, suggesting that achievement and independence are closely related.

The 19 item block on policy and legislation (7:2.13) reduced to nine items representing a negative attitude towards legislation (factor 2), three items in the negative attitude towards policy, (factor 7) and one item in factor 1 and one item which loaded on both factor 1 and factor 4. Again much of the negativity surrounding this factor is due to the reverse scoring of the items. Many of the farmers agreed legislation was bothersome but it also provided them with income so could be borne easily.

It may be concluded that what was important to this group of farmers was similar in some ways to what has been measured by other researchers, i.e. risk attitude, satisfaction, achievement, but some of the items appear to fit a different agenda from their original intention such as autonomy and information. What was interesting was that the use of a large number of items had successfully identified the illusive motivation and open-minded attitudes which, although, having a strong theoretical basis are extremely difficult to measure in concrete terms. As would be expected, the 'open' attitude might be seen as the extreme opposite of Salamon & Davis-Brown's 'traditional' farmer. Stress and coping were not measured by the items suggested,

fortunately these areas were more adequately covered by the standardised tests on the market.

Each participant is given a score for each factor by summing the items in each factor.

The seven factors obtained by factor analysis are separate and independent factors, but when the items in each factor are summed the factors may correlate (Hair et al. 1995). The resultant correlations (Pearson's r correlation) are shown in Table 7:2.

Table 7:2 Correlations between the summed score for each of the seven attitude factors. (N=252)

	Achieve	Legislation	Pessimism	Openness	Risk	Chemicals
Achieve	1					
Legislation	**.13***	1				
Pessimism	**-.21****	**.15***	1			
Openness	**.25****	-.04	.11	1		
Risk	.07	-.01	.02	-.12	1	
Chemical	-.01	-.0	-.03	-.07	-.01	1
Policy	**.22****	**.39****	.05	-.11	.04	-.08

* p<.05; **p<.01

The achieving attitude correlates negatively with having a pessimistic attitude (p<.01; r = -.21), having an open minded attitude (p<.01; r = -25) and a negative attitude to policies and legislation (p<.01; r = .22).

A negative attitude towards legislation is correlated with an negative attitude towards policy and both are influenced by a pessimistic attitude.

Attitude is thought to be influenced by farm structural factors, these are examined in Table 7:3

Table 7:3 Correlation of attitude factors and farm structural variables. (N=252)

	Achieve	Legislation	Pessimism	Open	Risk	Chemical	Policy
Acres	.-	.02	05	-.08	.-	**-.26****	-.02
Diversification	.06	-.01	**-.15***	-.07	-.07	**-.15***	-.03
Farm type	-.08	-.07	.09	-.06	.11	-.02	.01
Land type	.08	.05	**-.18****	-.11	-.05	**.26****	-.07
Others on-farm work	-.04	-.10	-.05	.04	-.03	-.02	-.03
Others off-farm work	-.09	-.02	-.08	-.11	.00	-.11	.06
Own off-farm work	.06	-.03	-.07	.11	-.06	**-.14***	-.01
p/t employees	.10	.05	-.01	.05	-.01	-.10	.04
f/t employees	.11	-.00	-.09	-.11	-.09	**.14***	-.06
Size change	.01	-.03	-.02	-.01	-.08	.09	-.10

* p<.05; **p<.01

Very few correlations were observed. A pessimistic attitude is correlated to a small degree with land type (p<.01; r = .18), that is, LFA farmers were more pessimistic regarding the future of farming. Pessimistic farmers were less likely to have diversified (p<.05; r =.-15) but this correlation is so small that it may have been due to a type 1 error. Having a larger farm is related to an attitude which uses less chemicals, this may be due to the fact that larger farms are usually LFA farms and may not require as high a chemical input as arable or mixed farming.

Attitudes are expected to influence financial variables and these relationships are investigated in Table 7:4.

Table 7:4 Correlation between attitude factors and financial variables (N=109)

	Achieve	Legislation	Pessimism	Open	Risk	Chemical	Policy
Assets	.01	.09	.05	-.09	-.14	.16	-.05
Debt	-.05	.01	.12	.11	**.28****	-.07	-.11
gfm/acre	.00	**.19****	-.08	-.07	-.06	**.14***	.03
Liability	.03	.08	-.02	-.17	**-.30****	.17	-.05
Revenue	.06	**.14***	-.03	**-.23****	-.07	**.23****	-.03
Subsidy	.01	-.04	.08	.08	.07	**-.14***	.01
Var. costs	.02	.07	-.03	-.106	-.01	**.14***	-.09

* p<.05; **p<.01

A positive attitude towards legislation is associated with a higher gfm/acre ($p<.01$; $r=.19$), it is also correlated with higher revenue ($p<.05$; $r = .14$). An open attitude is associated with increase revenue ($p<.01$; $r = .23$). Whereas, a risk attitude is correlated with increased debt ($p<.01$; $r =.28$) and less liability ($p<.01$; $r =-.30$). An attitude towards using more chemicals is weakly associated with higher gfm/acre ($p<.05$; $r = .14$), less subsidies ($p<.05$; $r = -14$), more variable costs ($p<.05$; $r = .14$) and more strongly with increased revenue ($p<.01$; $r = .23$).

Attitudes should also be related to demographic variables such as age and education, these correlations are shown in Table 7:5.

Table 7:5 Correlation between attitude factors and demographic details (N=252)

	Achieve	**Legislation**	**Pessimism**	**Open**	**Risk**	**Chemical**	**Policy**
Age	**-.14***	-.04	.01	.11	.00	.04	-.04
Education	**.22****	.05	**-.17****	**-.17****	-.04	.13	-.08
Farm experience.	**-.22****	-.08	-.01	.03	-.06	.06	.03
Number supported	-.05	-.05	-.07	.00	.00	.11	.00
Training	.07	-.04	-.03	**-.18****	-.06	.01	-.05
No. children	.06	-.01	-.10	.04	-.08	.00	.00

* $p<.05$; **$p<.01$

The achieving attitude has the strongest links with demographic variables. It correlates with being younger ($p<.05$; $r = .-14$), less experienced ($p<.01$; $r = -.22$) but better educated than others ($p<.01$; $r = .22$). An open attitude is correlated with more education ($p<.01$; $r = -.17$) and more training ($p<.01$; $r = -.18$). A pessimistic attitude correlates with less education ($p<.01$; $r = -.17$).

Attitudes are expected to correlate with other personality variables and these correlations are shown in Table 7:6. The abbreviations used below relate to the personality traits measured by the NEO-NFI inventory. These are NEO-E extraversion; NEO-O openness to new ideas: NEO-C conscientiousness; NEO-N

neuroticism; NEO-A agreeableness. CISS refers to the Coping in stressful situations inventory and the factors of task coping, emotion focused coping, avoidance and distraction coping.

Table 7:6 Correlation between attitude factors and psychological variables

(Reminder: these attitude factors score 1 for high and 5 for low, therefore, correlations with other scales are negative)

	Achieve	**Legislation**	**Pessimism**	**Open**	**Risk**	**Chemical**	**Policy**
NEO-A	-.02	.01	**.13****	-.08	**.14***	**-.21****	.09
NEO-C	**-.32****	.07	**.18****	-.06	.07	.13*	-.12
NEO-O	.08	.09	-.10	**-.29****	-.14*	-.10	-.08
NEO-N	.07	**-.22****	**-.37****	.05	-.08	-.07	-.02
NEO-E	**-.21****	.07	**.18****	**-.26****	**-.16***	-.04	-.04
CISS avoid	-.05	.02	-.02	-.10	**-.20****	**-.13***	-.05
CISS task	**-.19****	**.13***	**.19****	**-.18****	-.05	-.05	-.04
CISS emotion	-.00	**-.23****	**-.23****	-.01	**-.16***	-.07	-.06
GHQ	.09	**-.24****	**-.26****	.05	-.01	-.07	-.04
KAI	**.14***	.05	.05	**-.14***	-.13	-.08	**-.13***
NART	.13	.02	-.04	**-.23****	.01	-.00	-.04
RAVEN	**.25****	**.14***	-.01	**-.20****	-.02	.12	.04
Total information	-.04	.01	.00	**-.16***	-.12	-.10	-.07

* p<.05; **p<.01

As would be expected the attitude scores had associations with psychological variables. A higher achieving attitude score is associated with a higher intelligence score (p<.0; r = -.25) with greater extraversion (p<.01; r = -.21), and a more conscientious personality (p<.01; r = -.32) who uses task focused coping (p<.01; r = -.19). Interestingly the achieving attitude is associated with a adaptor personality rather than an innovative one (p<.01; r = .14). Those with an negative attitude to legislation are more neurotic (p<.01; r = -.22), less intelligent (p<.05; r =.14) and use emotion focused coping (p<.01; r = -.23) rather than task coping (p<.05; r= .15) and they tend to be more psychologically distressed (p<.01; r = -.24). Those with a pessimistic attitude are more neurotic (p<.01; r =-.37) and use more emotion focused coping (p<.01; r = 23), they are also more psychologically distressed (p<.01; r =.26). On the other hand the optimistic farmer is also more agreeable (p<.01; r = .3), more

conscientious ($p<.01$; $r = .8$), and extravert ($p<.01$; $r = .18$) as well as task oriented ($p<.01$; $r = 19$). Thus the pessimistic attitude is an indicator of a stressed individual.

Those with an open attitude are intelligent ($p<.01$; $r = -.23$; $p<.01$; $r = -.20$), extravert ($p<.01$; $r = -.26$), and have an personality that is open and cultured ($p<.01$; $r = -.29$), are task focused ($p<.01$; $r = -.18$) collectors of information ($p<.05$; $r = -.16$). Those who take financial risks are more introverted ($p<.05$; $r= .16$), less agreeable ($p<.05$; $r = .14$), closed to new ideas ($p<.05$; $r = .14$), and they use more emotion focused and avoidance coping techniques ($p<.05$; $r = .16$; $p<.01$; $r = .20$). Those with an attitude towards less chemical use have more agreeable personalities ($p<.01$; $r = .21$) A positive attitude towards policy is weakly associated with innovativeness ($p<.05$; $r = .13$).

7:5 Discussion

This Edinburgh Farming Attitudes Scale (EFAS) of 130 items was reduced by factor analysis to 64 items. The original items were based on 13 overlapping groups of variables which reduced to seven factors relating to attitudes important to this sample of Scottish farmers. As expected, some of the items in different groups showed considerable overlap. Many of the achieving factor items were derived from the original status and autonomy group with a sprinkling of items from other groups. But the initial concept of an attitude towards production disappeared in its original form and reappeared as an attitude relating to achievement and striving. The achieving factor strongly overlaps with the 'open to new ideas' factor which again indicates the importance of a well run farm, as well as gathering information from a variety of sources. More importantly, it is correlated with the personality trait of conscientiousness which has facets relating to achievement, striving, competence and dutilfulness (McCrae & John, 1992).

Similarly, the new attitude factor 'open to new ideas' derived mainly from the original information concept with a smattering of items from across the other groups. This is significantly linked to intelligence and the personality trait of 'openness to new ideas'

which contains a facet of valuing intellectual matters. Some researchers have attempted to describe this trait as 'intellect' however, McCrae argues this is to limit the function of this trait, as intelligence has links to two traits, conscientiousness and 'openness to new experiences (McCrae 1996). Hence the 'open' attitude is an expansion of the term, permitting culture, intellect and information to ride together.

These attitudes were in some ways predictable from the farming literature but in other ways unexpected. For example, an attitude of achieving motivation and openness to new ideas would appear fundamental to every theory of profit maximisation but, the achieving variable *measured* in the majority of studies is usually profit maximisation. This does not include achieving in the sense of having a well run farm business and products from which to derive perceptions of status.

Attitudes to financial risk and satisfaction were entirely predictable from the literature but not perhaps their correlations with psychological traits.

The attitude factor towards legislation was surprising in that it dropped into two factors, one relating to the worrying aspects of implementing legislation and the other more directed towards policy formation.

Surprisingly few of the original environmental items remained in the factor, the greatest loadings related to the chemical aspect of environmental behaviour rather than to any involvement with conservation schemes. The best psychological measure of a willingness to take on board environmental concerns appears to be the personality trait of agreeableness, although it is not possible to say which facet(s) of this trait is responsible. It may be that the altruistic component of this trait which is the driving force behind the behaviour but it is possible the compliance component could also influence the behaviour.

The achieving attitude although independent of the other attitude factors is associated with legislation and policy attitudes, suggesting that the farmer scoring highly on this attitude is very aware of legislation and policy change, and perhaps perceives legislation as a threat to the future, the correlation with openness to new ideas may be explained by the shared high loading of many of the items in these factors. The achieving and open attitude appear to be related to a fundamental construct which underlies many farming variables. This scale strongly supports the economic and business management theoretical position that achievement motivation is an important feature of farming.

The attitude towards legislation and policy proved to be a very common source of grievance with this group of participants. This may have been the result of the newly introduced IACAS forms which appeared to create havoc in the life of many farmers. The uncertainty regarding the re-introduction or scrapping of set-aside policies, as well as some agricultural policy changes, which took place overnight when the Chancellor of the Exchequer introduced his mini-budget, may also have contributed to these strongly held attitudes. The pessimistic attitude is reflected in the negative personality, which uses complaining or tantrums to cope, rather than facing up to the task when dealing with the legislation.

The media reports many farmers are extremely stressed at this time. The optimistic-pessimistic attitude, if coupled with the stress inventory reported by McGregor et al., (1995) will provide an indication of who is stressed and by what aspect of farming they are stressed. These areas could be considered when policy and legislative decisions are being constructed. The pessimistic attitude must address such questions as, are the high scorers simply the complainers, the farmers who leave farming, or are they neither successful or failing? However, it should also be kept in mind that the greater number of farmers were optimistic about the future of farming.

The measure of financial risk attitude relates to having debt which may or may not be due to the fact these individuals use avoidance coping, are less agreeable, less well educated and less open minded than their counterparts. This scale could be used to investigate those who adopt early, do they take financial risks and is this a successful strategy or a failure?

It is unlikely that any individual will be neatly described by any one factor, and it is important to bear in mind these factors will compete in the decision-making process in which outcome behaviours are being observed. Further work using linear and non-linear modelling techniques will be necessary to show which are the most important considerations in each of the types of decision making studied in this survey and also in the overall picture of decision making. Because of the large number of variables involved and the relatively small number of participants in the sample, it is possible that many of the small correlation values with their 0.05 level of significance are in fact subject to Type 1 errors and only the 0.01 level of significance should be accepted.

It remains to be seen if the realignment of the original attitude sets alters the order of inter-relations between attitudes, objectives and behaviours commonly found in the literature. It is inevitable that such a re-ordering will affect the relationships between attitudes, intentions and behaviours in this study. That is, unless the objective domain sets used in the study also realign themselves in a similar manner to the attitudes domains when they are in turn factor analysed there will be few matching items in both scales.

The scale described by this factor analysis could provide a standard assessment of the domains of attitude areas based either on its use in its entirety or sectioned into its factors and used in conjunction with other measures. This study is unable to validate the scale but increased usage by others would be a possible means of validation. By testing its correlation with suitable outcome measures, the scale might be used to indicate who has a business attitude, and whether this is geared towards the production or sustainability end of the market. The scale taps environmental attitudes my

measuring attitudes towards chemicals, and this could be allied to more specific attitudes and used to predict who might adopt environmental policies.

A test of the scale's usefulness for prediction farming behaviour will be how well it correlates with farming objectives and behaviour is analysed in the following chapters.

CHAPTER 8

ANALYSIS OF THE EDINBURGH FARMING OBJECTIVES SCALE

"The pursuance of future ends and the choice of means for their attainment are the mark and criterion of the presence of mentality in a phenomena". (James, 1890, p8)

8:0 Introduction

This chapter reviews the compilation of the Edinburgh Farming Objectives Scale, the analysis of the scale, and the relationship of the derived factors to other important variables studied.

In social psychology intentions are often used to predict behaviour, but an alternative to intentions is the idea of goal pursuit. It is assumed that because people have the ability to think about the future they can be self-motivated and goal oriented (Bingswanger, 1980; Locke, 1969). Goals help to establish priorities and focus attention on relevant information. Goal setting is a realistic measure of motivation; it cannot explain all motivation phenomena but allows it to be measured in a realistic way (Locke et al., 1981). Values are also considered important in farming (Gasson, 1974), and both goals/objectives and values were felt to be important in this study as they contribute to the attitudes in the Fishbein model (see Chapter 2, Fig. 2:1). Because of the variation in terms used by researchers these two terms will be encompassed in the term 'objectives' in this study.

8:1 Item selection

The Edinburgh Farming Objectives Scale (EFOS) was based upon the above findings and through discussion with farm advisors and a pilot study of local farmers. Items were identified by their importance to the individual farmer, that is, the majority of items began with "It is important....."

As with the Edinburgh Farming Attitude Scale (EFAS) the 39 item Edinburgh Farming Objectives Scale (EFOS) was scored on a 5-point Likert scale of 1 = 'very important' to 5 = 'not at all important to me'. Again the items were randomised throughout the questionnaire, and half of the items were presented with the business enterprise questionnaire and the others were presented two weeks later with the attitude and personality questionnaires. This prevented participants checking their own responses for compatibility across items and hopefully providing more spontaneous attitudes, goals and behaviours. The objectives covered the following domains: off-farm objectives, risk, environment, and the values of quality of life and status. These objectives, where possible, were of a similar nature to the items used in the attitude scale (EFAS). For example, the attitude measure of "A farm is a business to be run efficiently" was thought to complement the objective "It is important to make the largest possible profit". It was assumed that people whose attitudes, and objectives are in harmony are more likely to behave in a predictable manner. The items within these groups are shown below. The question number at the end of the item was its position in the attitude scale presented to the farmers, the *F number occurs when the item is retained by the factor analysis and the number following the F refers to the factor number.

Off-farm work

- Off-farm work is necessary to stay in farming. ***F5**
- It is important to have off-farm investments. ***F5**
- Having interests outside of farming is important. ***F3**
- It is important to have other skills outwith farming. ***F5**

Production and innovation

- Having up-to-date machinery / equipment is important. ***F1**
- It is important to have the best possible livestock / crops. ***F1**
- It is important to try new varieties of livestock / crops. ***F1**
- It is important to make the largest possible profit. ***F1**
- It is important to fully utilise all your resources. ***F1**
- Keeping buildings / fences / dykes in good repair is important. ***F1**
- It is important to have intermediate farming goals.
- Being fully productive is important.
- Adopting modern genetic farming techniques is important.
- It is important to get all that you are due from current legislation. ***F2**
- In adopting new ideas it is important to lead rather than follow.
- It is important to plan for retirement. ***F3**

Risk

- It is important to keep debt as low as possible. ***F1**
- It is important to minimise risk in farming. ***F1**
- It is important to increase the size of the farm.
- It is important to decrease the size of the farm. ***F1**
- Financial commitment should be taken over a long term.
- It is important to keep debt as low as possible.
- Having a successfully diversified farm is important. ***F5**
- It is important to minimise risk in farming.

Status

- It is important to stay in farming whatever happens. ***F4**
- It is important to have the respect of other farmers in the community. ***F4**
- It is important to enter and win at shows. ***F4**

Environment

- Preventing pollution is important. ***F2**
- It is important to use chemicals sparingly. ***F2**
- It is important not to overproduce.
- It is important to encourage wildlife on the farm.

Quality of Life

- the quality of the farm generally is important. ***F2**
- Improving the quality of my life is important. ***F3**
- Improving the living standards of family life is important. ***F3**
- It is important to spend time with the family. ***F3**
- It is important to provide for private education.
- It is important to plan for holidays off the farm.

Tradition and Succession

- It is important to pass on the farm to a member of family. ***F4**
- Making a comfortable living is all that is important.
- It is important just to operate on a day to day basis.
- It is important to leave the land in as good a state as one received it. ***F2**

8:2 Statistical analysis

The items were initially ranked in order of the overall mean score for each item. To inspect what the farmers considered the most important objectives. In this case the lowest scores have the highest ranking (Table 8:1).

The statistical analysis (Principal Component and factor analysis) of the objectives scale was carried out in the same manner as that for the attitudes scale (Chapter 7). Pearson's 'r' correlation was used to investigate the relationship between the factors and the farm structure, financial and psychological variables.

8:3 Results

8:3.1 Analysis of rank ordering of objectives

Those items ranked by the farmers as being very important in the EFOS questionnaire are shown with their mean and standard deviations in Table 8:1.

Table 8:1 Rank order of the mean score of the 39 item Edinburgh Farming Objective Scale (EFOS)

Item No.	Question	Mean Score	Std Dev	N
38	Leave land as good as found it	1.35	0.64	249
35	Get what's due from legislation	1.44	0.67	249
20	Prevent pollution	1.61	0.86	249
24	Improve quality of farm	1.66	0.74	248
17	Plan retirement	1.68	0.98	249
16	Keep debt as low as possible	1.71	1.05	244
31	Have time with family	1.72	0.79	249
29	Improve living standards	1.73	0.74	249
25	Improve quality of life	1.85	0.75	247
39	Utilise your resources	2.01	1.13	244
02	Intermediate goals	2.02	0.94	249
37	Encourage wildlife	2.02	0.95	249
34	Minimise risk	2.05	1.07	244
15	Keep fences/hedges repaired	2.05	1.07	244
19	Have outside interest	2.07	1.11	249
07	Have best livestock/crop	2.08	1.21	244
08	Have respect in community	2.15	1.01	249
22	Use chemicals sparingly	2.17	1.03	249
14	Be fully productive	2.20	1.03	249
12	Make largest profit	2.23	1.08	244
33	Have holidays off farm	2.32	1.14	249
28	Long term financial commitment	2.46	1.06	244
05	Pass on the farm	2.51	1.25	249
13	Have a comfortable living	2.62	1.16	249
36	Not to overproduce	2.64	1.05	249
11	Try new varieties	2.77	1.14	244
03	Have up to date machinery	2.86	1.18	244
18	Off farm investments	2.96	1.32	244
04	Other skills outside farming	2.98	1.23	244
23	Diversify	3.02	1.18	248
21	Modern techniques	3.02	1.07	249
10	Lead with new ideas	3.03	1.05	249
06	Stay in farming whatever happens	3.07	1.32	249
26	Increase the size of the farm	3.35	1.27	244
32	Private education for children	3.39	1.25	248
09	Win at shows	3.89	1.09	249
30	Operate on day to day basis	3.93	1.04	249
01	Have off-farm work	4.04	1.30	244
27	Decrease size of farm	4.36	1.12	244

The items ranked as being most important were those concerned with farmers improving the quality of the land and the farm, the environment, and their way

of life, and getting their due from legislation. Items falling in the mid-range, with means around 2-2.5, were concerned with a wide range of objectives including being fully productive and making the highest profit. Taking on other employment and decreasing the size of the farm were found to be highly unacceptable to the majority of respondents with means of approximately 4 (not at all important). Thus ranking for this sample of Scottish farmers suggests that long term improvements to the farm, intra-generational concerns and living standards are the most important objectives, followed by environmental objectives, economic considerations and status. The order of importance of the above goals would no doubt change if, like Perkin & Rehman (1994), we use a dependent variable of farm income to rank pairs of objectives or if the wording of the questions is changed even slightly. One-dimensional ranking of the data tends to obscure any complex structure. One way of exploring the complexity of the data is to use factor analysis.

8:3.2 Principal Components Analysis

Principal components analysis of the 39 item scale was used to examine the data. It was anticipated that the dimensionality of the scale would reduce as it had been designed to examine multiple objectives, and several items were predicted to refer to common underlying components. An initial Principal Components Analysis (PCA) and examination of the scree slope indicated that a six factor solution might be appropriate (Child, 1990). These six factors together accounted for 42% of the total variance. A subsequent PCA with Varimax rotation indicated twelve questions that either failed to load on any one factor or loaded on two or more components; these were then removed from the analysis (see Table 8:2). The criteria for item retention, based on factor loadings on rotated components, were decided in advance. These

required that retained items should have a loading greater than 0.4 for one factor and less than 0.2 on at least three of the remaining factors. The 27 items meeting these criteria then gave a five factor solution which accounted for 43.8% of the variance (Table 8:2). As the items were scored in the reverse manner i.e. the low scores have the most positive response leading to negative correlations with variables such as age, education etc., which increase in a positive direction.

Table 8:2 Components after Varimax rotation derived from the Edinburgh Farming Objectives Scale (EFOS).

	EFOS 1	EFOS 2	EFOS 3	EFOS 4	EFOS 5
It is important to utilise your resources	**.811**	.014	.094	-.048	.024
It is important to have the best livestock / pastures	**.760**	-.044	.053	.157	.077
It is important to make the largest possible profit	**.724**	-.136	.111	-.018	-.030
Keep building/fences/dykes in good repair is important	**.650**	.199	.097	.034	.066
It is important to keep debt as low as possible	**.554**	.328	-.274	-.030	.219
It is not important to decrease the size of the farm	**.520**	.047	-.028	-.091	-.264
It is important to minimise risk in farming	**.510**	.372	-.315	.074	.145
Having up to-date equipment and machinery is important	**.440**	-.231	.065	.311	.010
It is important to try new varieties of livestock / crops	**.427**	-.158	**.414**	.307	.022
Improving the quality of the farm generally is important	.057	**.671**	.127	.204	.002
It is important to use chemicals sparingly	.007	**.612**	.038	-.060	.155
It is important to leave the land as good as you received it	-.027	**.567**	.188	.159	.010
It is important to prevent pollution	.020	**.546**	.300	-.084	-.021
It is important to get all you are due from current legislation	.018	**.404**	.144	.005	-.126
Improving the living standards of family life is important	.057	.337	**.741**	.113	-.068
Improving the quality of my life is important	.040	.246	**.666**	.139	-.072
It is important to have other interests outwith farming	-.102	.056	**.572**	-.117	.356
It is important to spend time with the family	.019	**.448**	**.520**	.023	-.023
It is important to plan for retirement	-.040	.224	**.480**	-.041	.230
It is important to stay in farming whatever happens	-.017	.161	-.082	**.829**	-.083
It is important to pass on the farm to a member of family	.048	.077	.026	**.750**	.014
It is important to have the respect of other farmers in the community	.062	.348	.190	**.541**	.044
It is important to enter and win at shows	.029	-.172	.031	**.478**	.253
It is important to have other skills outwith farming	.064	-.108	.018	-.028	**.688**
Off-farm work is necessary to stay in farming	-.115	.045	.007	-.039	**.676**
Having a successfully diversified farm is important	.053	-.060	.147	.168	**.569**
It is important to have investments	.089	.141	-.025	.055	**.568**
Cronbach alpha	**.799**	**.668**	**.684**	**.670**	**.564**

8:4 Factor analysis results

Factor 1 (EFOS1) has high loadings for items such as 'it is important to utilise your resources', 'it is important to have the best livestock/pastures', 'it is important to make the largest possible profit'. The nine questions which have factor loadings of greater than 0.4 suggest that this component is associated with general objectives to lead and achieve and be successful in the business aspects of farming. This will subsequently be referred to as the positive *business objectives* but it will be characterised by a low score due to the reverse scoring used.

Factor 2 (EFOS2) has high loadings for questions such as 'improving the quality of the farm generally is important', 'it is important to use chemicals sparingly' and 'it is important to leave the land as good as you received it'. In all, the questions which have substantial loadings on this factor indicate objectives which recognise the link between farmer and the environment. There are objectives which include sustainability and a strong relationship with the farm system and its environment; not just the physical environment but also the social environment and the concern for the succeeding generation of family. This will subsequently referred to as *environmental objectives*.

Factor 3 (EFOS3) is linked particularly with questions such as, 'improving the living standards of family life is important', 'improving the quality of my life is important' and 'it is important to have other interests outwith farming'. These indicate strong self and family related quality of life values. Here, the intrinsic worth of farming is not the dominant interest, rather the family's general quality of life appears as the most important objective. This will subsequently be referred to as the *quality of life objective* (QOL).

Factor 4 (EFOS4) has high loadings for the items, 'it is important to stay in farming whatever happens', 'it is important to pass on the farm to a member of family' and 'it is important to have the respect of other farmers in the community'. Together, the questions most strongly linked with this factor suggest factor tapping farming as a way of life; farmers scoring highly on this factor might be characterised as 'traditional' farmers. A sense of continuity and status and self esteem derived from farming are the main objectives. This will subsequently be referred to as *status objectives*.

Factor 5 (EFOS5) has highest loadings for, 'it is important to have other skills outwith farming', 'off-farm work is necessary to stay in farming' and 'having a successfully diversified farm is important'. This relates to objectives concerning part-time farming, and indicates objectives related to a strong interest in off-farm employment and investment. Other matters of importance outwith farming are emphasised also. This will subsequently be referred to as *off-farm objectives*.

The consistency of (Cronbach Alpha value) of each group of items (Table 8.2, bottom row) was moderate to high, especially in view of the small numbers of items that characterised the later components. Therefore, the five components have acceptable internal consistency in the main, though additional questions would be useful in future revisions for all but the first component. Table 8:3 Indicates the association between the factors.

Unlike the attitude scale the objective items tended to remain within the original construct groups after factor analysis. The only objective construct to

disappear completely was the collection of items relating to traditionalism and succession.

Although the factors are independent, when the factor items are summed for each individual factor then a strong significant association exists between EFOS2, the environmental factor, and EFOS3 the quality of life factor (0.51) (Table 8:3). A comparably strong correlation (0.46) exists between EFOS5, the 'off-farm' goals, and EFOS4 'continuity and status' goals. Other less strongly significant correlations exist between EFOS1, 3 and 4; EFOS2 and 4 and EFOS5 and 3. This indicates these goal domains are not completely independent.

Table 8:3 Correlation among EFOS factor items

	EFOSF1	**EFOSF2**	**EFOSF3**	**EFOSF4**
EFOSF1	1			
EFOSF2	.09	1		
EFOSF3	**.18****	**.51****	1	
EFOSF4	**.19****	**.14***	**.24****	1
EFOSF5	.08	.05	**.16***	**.46****

*p<.05; **p<.01

Objectives are thought to be associated with the structure of the farm. Table 8:4 examines the relationship between the objective factors and the farm structure.

Table 8.4 Correlation of EFOS factors and farm structural variables

	EFOSF1	EFOSF2	EFOSF3	EFOSF4
Hectares	.12	-.08	.07	-.08
Diversification	.03	-.09	-.05	**-.13***
Farm Type	-.03	-.05	.02	-.03
Land type	**-.14***	.11	**-.20****	.02
No. partners	.02	.07	-.05	-.09
p-t employees	.11	.02	-.04	-.01
Size change	**-.18****	.03	.01	.01
No. supported	.02	-.08	-.12	-.04
No. of children	.09	-.03	-.05	-.08

*p<.05; **p<.01

In this sample the high importance attached to business objectives (EFOSF1) are only weakly correlated with arable farms (p<.05; r = -.14) and increase in farm size (p<.01; r = -.18). Quality of life is significantly correlated with arable land type (p<.01; r = -.20) whereas, status is weakly correlated with more diversification (p<.05; r = -.13).

Correlations of Objectives with demographic variables, are shown in Table 8:5.

Table 8:5 Correlation between EFOS factors and financial and demographic variables

	EFOSF1	EFOSF2	EFOSF3	EFOSF4	EFOSF5
Age	.05	-.08	.04	-.07	-.02
Assets	.05	.02	-.08	-.10	-.03
Debt	-.08	-.07	-.00	.01	.05
Education	-.05	.01	-.07	.06	**-.19****
Farm experience	.05	-.03	-.00	-.07	.11
gfm/Ha	.10	.07	-.10	-.01	.00
Liability	-.01	.10	.01	-.03	-.03
No. children	.09	-.03	-.05	-.08	-.01
Other on-farm work	-.07	-.05	.03	**-.15***	-.06
Others off-farm work	.08	-.12	-.06	-.11	**-.16***
Own off-farm work	**.15***	-.03	.08	**-.20****	**-.43****
p-t employees	.11	.02	-.04	-.01	-.09
Revenue	.02	**.16***	.01	-.10	.11
Total information	.06	-.06	**-.16***	**-.18****	**-.18****
Variable costs	.05	.11	.12	.08	.11
f-p employees	.01	.03	-.00	-.03	.06

*p<.05; **p<.01

Farmers who attached most importance to business objectives were those least likely to have off-farm work (p<.05; r = .15). Environmental objectives are related to having lower revenue (p<.05; r = .16). Quality of life objectives are correlated with information gathering (p<.05; r = -.16). Status objectives are related to having *no* off-farm work (p<.01; r = -.20) and not being dependent upon other family members off-farm work (p<.05; r = .15). Unsurprisingly off-farm work is related to having more education (p<.01; r = -.19), and working off-farm (p<.01; r = -.43), information gathering (p<.01; r = -.18) and 'others' off-farm work (p<.05; r = -.16).

The relationship of the objective factors to psychological characteristics of the individual is shown in Table 8:6.

The abbreviations used below relate to the personality traits measured by the NEO-NFI these are NEO-A personality trait of agreeableness; NEO-C = conscientiousness; NEO-N = neuroticism; NEO-O = openness to new ideas; NEO-E = extraversion. The coping styles used by the farmers were measured by the CISS and refer to task coping, emotion-focused coping, avoidance and distraction coping. Raven and NART refer to the intelligence test measures used and GHQ to the measure of psychological distress. Innovation to the KAI measure.

Table 8:6 Correlation between EFOS factors and psychological variables

	EFOSF1	EFOSF2	EFOSF3	EFOSF4	EFOSF5
NEO-A	.02	-.06	-.06	-.09	-.08
NEO-C	**-.20****	**-.16***	-.07	-.08	.10
NEO-E	**-.15***	**-.13***	**-.30****	**-.29****	-.11
NEO-N	.01	.03	.02	-.01	**-.14***
NEO-O	.06	-.09	**-.23****	-.07	**-.16***
CISS Task	-.06	-.12	-.09	-.05	-.07
CISS Emotion	.02	-.06	-.03	-.04	-.10
CISS Distraction	.02	-.02	**-.21****	**-.14***	-.09
CISS Avoidance	.00	-.08	**-.29****	**-.17***	**-.14***
Innovation	**.18****	.05	-.03	-.01	-.04
GHQ	.05	-.01	.11	.04	-.07
Raven	.04	.07	-.01	**.16***	-.08
NART	-.06	-.02	-.10	.11	-.12
Total information	.06	-.06	**-.16***	**-.18****	**-.18****

*p<.05; **p<.01

Both business and environmental objectives were related to an extravert, conscientious personality (p<.05; r = -.15; p<.05; r = -.13). Business objectives were also related to having an adaptive rather than an innovative personality (p<.01; r = .18). Quality of life objectives were correlated with having an extravert, outgoing personality (p<.01; r = -.30), a personality which is open to new ideas (p<.01; r = -.23) and information gathering (p<.05; r = -.16) and a

lack of avoidance coping ($p<.01$; $r = -.29$). Status objectives were similar in that they correlated with an extravert, ($p<.01$; $r = -.29$) and information collecting personality ($p<.01$; $r = -.18$). Having off-farm objectives was correlated with a lack of neuroticism ($p<.05$; $r = .14$), openness to new ideas ($p<.05$; $r = -.16$) and to information collection ($p<.01$; $r = -.18$).

8:5 Discussion

The Edinburgh Farming Objectives Scale (EFOS) has confirmed the recognition of three specific objectives (production oriented, environmental oriented and off-farm objectives) and two more value oriented objectives of 'status' and 'quality of life' were important to farmers in this sample. It is important to note however, that these factors are not independent, indeed factors three and four (the factor relating to the quality of life and status in farming) are significantly associated with all three of the other factors. Confirming the assumptions that values underlie attitudes and objectives, they were also more strongly related to personality variables.

In many ways the objectives identified are similar to other research findings in this field. The two distinct types of economic and job satisfaction objectives are clearly recognisable. Gasson's (1973) expressive, instrumental and social values are reflected to some degree in EFOS 4, EFOS 1 and EFOS 3. The present study has shown that inter-correlations exist between the specific farming objectives and the quality of life and status objectives, but the latter do not stand alone. By using Principal Components Analysis it can be demonstrated that the economic, environmental, quality of life and status objectives although separable factors are in fact intercorrelated in the farmer's aims. That is, the quality of life and status objectives do influence, or are

influenced by, the specific farming objectives of making money and caring for the environment.

Behaviour is not always determined by intentions, either because of external constraints on implementing them, or because the intentions or goals are not clearly defined by the individual. The more clearly defined the objective the more likely it is to influence behaviour (Bagozzi & Yi, 1989; Bagozzi et al., 1990). Quality of Life objectives are in general not very useful variables when relationships with behaviour are under inspection, as they are composed of vague statements. They are the 'why' of the behaviour rather than the 'how' it is implemented in behaviour. Information on which specific actions if implemented would 'improve the quality of my life' would be helpful. Would it for example, require the individual to make more money or, have more time off, or both, and if both, which is of greater importance?

Perkins & Rehman's (1994) factor analysis indicated three independent factors of monetary, life-style and independence objectives. These are similar to those of EFOS 1, 3 and 4. Perkins & Rehman (1994) used multidimensional scaling after introducing assets as a dependent factor. This naturally introduced a farmer type dependent on assets rather than independent factors. Any analysis with any other dependent factor such as age or education would also have produced different 'types'. This is equivalent to introducing external constraints on the independent objectives and would apply only in instances where this constraint is a delineating factor, or where typology is the objective rather than assessing the individual's objectives. This hurdle is bypassed by the use of factor analysis as no constraints are placed on the underlying data structure.

Two of Fairweather & Keating's (1994) management styles found in a study of New Zealand farmers are also confirmed in EFOS 1 - the 'business manager' - and EFOS 2 - the 'environmentalist'. It is less likely that this study would clearly identify their 'market-oriented' farmer due to the significant differences in government policy towards farmers in each of the countries in question. New Zealand, where the Fairweather and Keating study was carried out, has adopted a purely market driven agricultural policy for agriculture since subsidies were removed in 1983, whereas Scottish farmers still receive substantial payments as part of the European Union's Common Agricultural Policy. Finally, Salamon and Davis-Brown's (1986), 'entrepreneur' and 'yeoman' farmers are also represented in EFOS 1 and EFOS 4. Therefore, the EFOS instrument produced here quantifies, expands and integrates previous conceptualisations of multifaceted objectives in farming. At the same time it has been shown that all of the objectives are not unrelated components. It is off interest that the achieving attitude and business objectives should both relate to an adaptive rather than an innovative personality. Is this because the farmers have to conform to legislative demands and it is more applicable to work within the current paradigm than outwith it?

It would appear that there is some consistency in the objectives of farmers within and across countries, although the studies reviewed all pertain to developed country examples. (It is unlikely in subsistence agriculture that conservation concerns would rate above feeding the family). The utility of results such as those described above for policy makers and those involved in introducing new technologies is that an understanding of a farmer's objectives and different types of farmer should help in targeting the introduction of change. However, although an understanding of objectives on their own is useful, when linked to other data such as farming attitudes, farming activities,

and psychological and farm business data it will be possible to develop richer multivariate models of the farmer decision making process.

The Edinburgh Farming Implementation (Behaviour) Scale (EFIS) is analysed in the following chapter and the correlation between the factors of all three scales and the psychological data is examined.

CHAPTER 9

ANALYSIS OF THE EDINBURGH FARMING IMPLEMENTATION SCALE (EFIS).

"Behaviour is a mirror in which everyone displays his own image"
Goethe. Elective Infinities. 1809.

9:0 Introduction

The two previous chapters have described and analysed farming attitudes and objectives. This chapter repeats the procedure for the Edinburgh Farming Implementation Scale (EFIS). This scale investigated self-reported farming behaviour in a number of areas over the past five years. The behaviours most studied in farming research are production, information gathering, innovativness, risk taking and environmental behaviour, diversification and off-farm work (Chapter 3). In view of the stress reported in British farming at the time of this study, stress behaviours were included.

The aim of the study was to model and predict farming behaviours in general although specific behaviours such as the amount of chemicals used or the number of hedges replaced etc., were investigated. A brief review of the farming behaviours investigated is given in the next section followed by the analysis of the EFIS and the relationship of the derived factors to other important variables studied.

9:1 Review of farming behaviours

Unlike attitudes and objectives, behaviours are rarely studied in a composite fashion. Behaviours investigated are generally singular and the farmer either does, or does not, carry them out. Many of the behaviours have already been reviewed in relation to attitudes such as profit maximising, diversification and off-farm work etc. Much of the work of economists focuses on behaviours aimed at increasing production and the early adoption of new methods, crop varieties or technologies. One common behaviour linking both risk and innovation is information gathering (Simon, 1954; Miller & Bottoms, 1989; Ford & Babb, 1989; Robinson, 1983). In a study of 2537 Iowa farmers, it was found that information on grain sale decisions was sought by approximately 60% of the larger farms through brokers and newsletters, whereas smaller farmers relied on their families and friends for such information (Ford & Babb, 1989). In a more qualitative study Miller & Bottoms (1989) identified 13 possible sources of information ranging from accountants, commercial advisors, agricultural shows to family and friends. These types of results are in line with management oriented studies of farming behaviour which have identified ability, record keeping, monitoring production, use of computers, following market trends etc. as important variables (Simon, 1954; Harling & Quail, 1990; Errington & Gasson, 1993).

The environmental conservation behaviours most widely studied concern soil erosion in the USA, water conservation in Australia and chemical pollution and habitat changes in the UK (Barkley, 1982; Novak, 1982; Napier & Foster, 1982; Schertz & Wunderlich, 1982; Kantola, Syme, & Campbell, 1982; 1983; Coughenour & Chamala, 1995). However, it could be argued that farmers, being by nature risk averse, are unlikely to implement all or nothing behaviours; therefore, the behaviour or lack of a specific behaviour, is not likely to

completely inform the study. It would be of greater value to sum over a range of pertinent behaviours relating to production, conservation, information gathering, etc., and use these to indicate overall patterns and consistencies in an individual's behaviour.

The behaviours studied in each area are discussed below.

9:2 The Edinburgh Farming Implementation Scale (EFIS)

Five group headings were used to identify behavioural items. As with attitudes and goals there is some overlap between the groups: some of the risk taking behaviours, production and stress behaviour could be seen as interchangeable. Like the attitudes and objectives scales it was assumed that these items would factor analyse into a reduced scale. However, some behaviours are highly specific and it is possible that such a behaviour would form the outcome of a modelling exercise i.e. 'run the business to maximise profit', therefore the behaviours are of interest in themselves. The items were again scored on a 1-5 Likert scale but unlike the attitudes and objectives the evaluative limits of the scale were not uniform i.e. some limits would be, 1 = a little to 5 =a lot, or 1 = never to 5 = always, or in some case categorical such as debt or no debt. The items were again randomly distributed throughout the Edinburgh Farming Implementation Scale (EFIS) (Appendix B, Section 2). The question number at the end of the item was its position in the attitude scale presented to the farmers, the *F number occurs when the item is retained by the factor analysis and the number following the F refers to the factor number. The groups of items were as follows:

Production

- Has the number of acres farmed for the farm business changed in the last five years? Q1 ***F4**
- What change has your income from the farm business shown over the last five years? Q2 ***F4**
- Has farm business debt changed in the last five years? Q3 ***F3**
- Do you have any definite plans to change the size of the farm business in the next five years? Q4 ***F4**
- Do you manage the farm business to maximise output? Q10
- Do you keep production records? Q11 ***F1**
- Do you monitor farm business performance? Q12 ***F1**
- Have you:- a) increased production when market prices fell?. Q15a
- Have you decreased production when market prices fell?. Q15b
- Do you lease **out** machinery and plant? Q20
- Do you lease machinery and plant? Q21
- Is it easy to manage the farm business to suit yourself? Q17 ***F3**
- Have you made any large investments in the farm business in the past five years? Q23 ***F4**
- Do you manage the farm business to maximise profit, above all else? Q21 ***F1**
- Do you use targets in managing the farm? Q27 ***F1**
- Do you keep financial records? Q28 ***F1**
- Have you negotiated business loans in the past five years? Q30
- How often do you ensure that you have applied for every grant/subsidy you are entitled to? Q35
- Do you replace machinery as soon as you can afford it? Q36
- Do you intend to pass the farm business as an inheritance on to a family member? Q50

Information Gathering

- How frequently do you read the agricultural press? Q46
- Do you discuss new farming policies with advisors? Q47
- Do you discuss new farming policies with neighbours? Q48
- Do you discuss new farming policies with family? Q49 ***F4**
- Is your main hobby related to your farm business? Q53

These items were in addition to the section specifically related to information gathering relevant to farm decision making (Section 3 of the EFIS)

Risk

- To what extent have you diversified the farm business? Q5 ***F2**
- How much farm business insurance do you have other, than for machinery and buildings? Q24
- How much do you use the futures market? Q25
- Do you have any off-farm financial investments? Q29
- Do you participate in any activities, either in work or leisure, which involve physical risk? Q55
- Tick box if you have no debt [ ] Q32b

Stressed behaviour

- How difficult is it to obtain labour locally? Q16
- Have you re negotiated business debts in the last five years? Q31
- Could you reduce the farm business debt whilst still retaining the farm business? Q32a
- Is it difficult to meet your farm business financial commitments? Q33 ***F3**
- Is it difficult to meet your personal financial commitments? Q34 ***F3**
- Is it difficult to find time to meet friends and family? Q54 ***F3**
- How often do you visit your local town? Q23

Off-farm work

- Do you expect to take off-farm work to retain the farm business? Q6
- Is the survival of the farm business dependant on the income from your **own** off-farm work? Q7
- Is the survival of the farm business dependant the income from **other** family members off-farm work? Q8
- How important to the survival of the farm business is the **on-farm work** of other family members? Q9

Innovation

- Do you use new farming methods? Q13 ***F1**
- Do you use AI or MOET? Q14
- How important are new farming methods to you? Q18
- Are you first locally to use the latest methods / technology? Q19

Environmental

- Do you use fertilisers, sprays, chemicals? Q22 ***F1**
- Do you regularly control vermin on the farm? Q37 ***F1**
- Have you taken any active conservation measures in the last five years? Q38 ***F2**
- Do other farmers pick up ideas for their farm business from you? Q39
- Have you taken out fences / dykes / hedges / etc. in the past five years? Q40
- Have you inserted / replaced fences / dykes / hedges / etc. in the past five years? Q41 ***F2**
- Has pollution been a problem to you in the past five years? Q42
- Have you ever been prosecuted for pollution incidents? Q43
- Have you ever tried organic farming? Q44
- Have you ever considered joining a conservation group? Q45 ***F2**
- Do members of the public occasionally visit your farm? Q51 ***F2**

9:3 Statistical analysis

The mean scores and standard deviation of all 57 reported behaviours are shown in Table 9:1. A Likert 1-5 scale was used for scoring purposes, but the nature of the items required the direction of the scoring to vary. The scores are therefore interpreted in the final column. The items asterisked were retained in the final factor analysis.

Principal Component Analysis (PCA) and factor analysis were carried out as in Chapter 7 and 8. PCA suggested a four factor solution and this reduced the 57 items to 23 and explained 41% of the variance. The factors obtained by orthogonal rotation of these items are shown in Table 9:2. The factors were further investigated using a Pearson's 'r' correlations and their association with farm financial, structural and psychological variables investigated.

Table 9:1 Mean and standard deviation of farming behaviours

	Implementation Scale	Mean	Std dev	meaning
*	Has the number of acres farmed for the farm business changed in the last five years?	2.89	1.04	little change
*	What change has your income from the farm business shown over the last five years?	3.18	1.01	slight increase
*	Has farm business debt changed in the last five years?	2.06	1.08	slight decrease
*	Do you have any definite plans to change the size of the farm business in the next five years?	2.36	1.26	slight decrease
*	To what extent have you diversified the farm business?	1.87	1.25	very little
	Do you expect to take off-farm work to retain the farm business?	4.04	1.36	not likely
	Is the survival of the farm business dependant on the income from your **own** off-farm work?	1.62	1.23	very slightly
	Is the survival of the farm business dependant the income from **other** family members off-farm work?	1.46	0.97	very slightly
	How important to the survival of the farm business is the **on-farm work** of other family members?	2.64	1.58	somewhat
	Do you manage the farm business to maximise output?	3.87	0.99	nearly always
*	Do you keep production records?	3.45	1.42	nearly always
*	Do you monitor farm business performance?	3.41	1.39	nearly always
*	Do you use new farming methods?	3.51	0.90	nearly always
	Do you use AI or MOET?	1.72	1.17	hardly ever
	Have you:- a) increased production when market prices fell?	2.62	1.18	occasionally
	Have you decreased production when market prices fell?	2.19	1.05	not usually
	How difficult is it to obtain labour locally?	3.2	1.12	somewhat
*	Is it easy to manage the farm business to suit yourself?	3.41	0.99	somewhat
	How important are new farming methods to you?	2.66	1.05	quite important
	Are you first locally to use the latest methods / technology?	2.58	1.06	middle
	Do you lease **out** machinery and plant?	1.39	0.81	not much
	Do you lease machinery and plant?	1.99	1.22	not much
*	Do you use fertilisers, sprays, chemicals?	3.43	0.99	moderate/heavy
*	Have you made any large investments in the farm business in the past five years?	3.14	1.40	moderate
	How much farm business insurance do you have other, that for machinery and buildings?	2.77	1.12	moderate
	How much do you use the futures market?	1.22	0.68	not much
*	Do you manage the farm business to maximise profit, above all else?	3.45	1.42	nearly always
*	Do you use targets in managing the farm?	2.8	1.29	sometimes
*	Do you keep financial records?	4.23	1.05	always

	Do you have any off-farm financial investments?	2.50	1.33	some
	Have you negotiated business loans in the past five years?	2.23	1.24	a few
	Have you re negotiated business debts in the last five years?	1.98	1.32	not many
	Could you reduce the farm business debt whilst still retaining the farm business?	3.76	1.18	not really
	Tick box if you have no debt [ ]	1=no debt	2=debt	80 no debt
*	Is it difficult to meet your farm business financial commitments?	3.41	1.07	moderately/ difficult
*	Is it difficult to meet your personal financial commitments?	3.57	1.13	moderately/ difficult
	How often do you ensure that you have applied for every grant/subsidy you are entitled too?	4.22	1.02	always
	Do you replace machinery as soon as you can afford it?	2.97	1.1	sometimes
*	Do you regularly control vermin on the farm?	4.13	0.96	always
*	Have you taken any active conservation measures in the last five years?	2.46	1.43	some
	Do other farmers pick up ideas for their farm business from you?	2.16	1.02	a few
	Have you taken out fences / dykes / hedges / etc. in the past five years?	1.13	0.72	not really
*	Have you inserted / replaced fences / dykes / hedges / etc. in the past five years?	2.7	1.41	some
	Has pollution been a problem to you in the past five years?	1.47	0.89	not often
	Have you ever been prosecuted for pollution incidents?	1.05	0.36	never
	Have you ever tried organic farming?	1.18	0.63	never
*	Have you ever considered joining a conservation group?	2.22	1.60	sometimes
	How frequently do you read the agricultural press?	4.50	0.75	always
	Do you discuss new farming policies with advisors?	3.05	1.38	often
	Do you discuss new farming policies with neighbours?	2.83	1.16	sometimes
*	Do you discuss new farming policies with family?	2.35	1.34	occasionally
	Do you intend to pass the farm business as an inheritance on to a family member?	2.14	1.46	likely
*	Do members of the public occasionally visiting your farm?	2.66	1.31	occasionally
	How often do you visit your local town?	3.75	1.13	quite often
	Is your main hobby related to your farm business?	2.86	1.64	moderate assoc.
*	Is it difficult to find time to meet friends and family?	2.98	1.16	moderately
	Do you participate in any activities, either in work or leisure, which involve physical risk?	2.61	1.38	sometimes

* Retained in the final analysis.

As the table indicated the majority of the farmers surveyed were primarily concerned with using 'good' management practices i.e. they managed the business to maximise output (mean = 3.87), kept production records (mean = 3.45), used new methods (mean = 3.51), used chemicals fairly heavily (mean = 3.43) they ensured they got what they were due from grants and subsidies (mean = 4.22).

Information seeking was primarily through reading the farming press (mean = 4.50), they spoke to farm advisors often (mean = 3.05) discussed new policies with neighbours (mean = 2.83) and with the family slightly less often (mean = 2.35)

Environmentally they had diversified very little (mean = 1.87), but some conservation measures had been taken in the past five years (mean = 2.46), some had replaced hedges and dykes (mean = 2.7), very few had experienced problems with pollution in the past five years (mean = 1.47), even less had tried organic farming methods (mean = 1.18) and most of them controlled vermin (mean = 4.50). Vermin was defined by one farmer at one evening meeting as deer, rabbits, foxes and crows and this was upheld by general consensus at other evening meetings.

Stress behaviour in a minority of the sample was indicated by the need to depend upon the on-farm work of other family members (mean = 2.64), and many reported being unable to reduce debt and retain the family business (mean = 3.76), some had re-negotiated their farm debt in the past five years (mean = 1.98), many found it moderately difficult to meet their financial and personal

commitments (mean = 3.41; mean = 3.57) and many found it difficult to find time to meet friends and family (mean = 2.98).

Risk avoidance was indicated by the amount of insurance (mean = 2.77), very few used the futures market (mean = 1.22) and many had off-farm investments (mean = 4.23) and some participated in physically risky sports (mean = 2.61).

Many were satisfied with farming in that their main hobby related to farm business (mean = 2.86), they thought it unlikely they would have to take off-farm work in the near future (mean = 4.04) and were uncertain regarding family succession (2.14). All the items factored out into the following four factors (Table 9:2).

Table 9:2. The Edinburgh Farming Implementation Scale Factor Analysis

Implementation Scale	Factor 1	Factor 2	Factor 3	Factor 4
Do you monitor farm business performance?	**.786**	.231	-.014	-.082
Do you use targets in managing the farm?	**.712**	.097	.023	.000
Do you keep production records?	**.707**	-.229	-.019	-.013
Do you use new farming methods?	**.620**	.016	.002	.101
Do you keep financial records?	**.556**	.163	.062	-.090
Do you use fertilisers, sprays, chemicals?	**.546**	-.223	-.005	.245
Do you manage the farm business to maximise profit, above all else?	**.501**	-.137	.044	.255
Do you regularly control vermin on the farm?	**.471**	.020	.202	-.067
Have you taken any active conservation measures in the last five years?	.057	**.777**	.051	-.044
Have you ever considered joining a conservation group?	.191	**.680**	-.039	.104
Do members of the public occasionally visiting your farm?	.089	**.593**	-.065	.017
Have you inserted / replaced fences / dykes / hedges / etc. in the past five years?	.121	**.585**	.203	.045
To what extent have you diversified the farm business?	-.160	**.464**	-.225	.232
Is it difficult to meet your farm business financial commitments?	.062	-.023	**.780**	.058
Is it difficult to meet your personal financial commitments?	.030	-.087	**.750**	.260
Is it easy to manage the farm business to suit yourself?	.003	.033	**.488**	-.046
Has farm business debt changed in the last five years?	-.021	-.122	**-.476**	.204
Is it difficult to find time to meet friends and family?	.094	-.059	**.460**	.023
Do you have any definite plans to change the size of the farm business in the next five years?	.055	.108	.031	**.650**
Has the number of acres farmed for the farm business changed in the last five years?	.031	-.084	.148	**.640**
What change has your income from the farm business shown over the last five years?	-.064	.239.	.284	**.541**
Have you made any large investments in the farm business in the past five years?	.195	.015	-.260	**.507**
Do you discuss new farming policies with family?	.030	-.053	-.101	**-.418**
Cronbach alpha reliability scores	**.78**	**.66**	**.59**	**.50**

9:3.1 Factor analysis results

Factor one epitomises business oriented behaviour; production and profit go hand in hand as indicated by questions such as, "Do you monitor farm business performance?"; "Do you use targets in managing the farm?"; "Do you use new farming methods?"; "Do you keep financial records?" These were scored in the range 1 = not at all to 5 = a lot. This factor was subsequently labelled 'production behaviour'. The internal validity of these items as measured by the Cronbach alpha was 0.78 indicating high reliability.

Factor 2 behaviour is centred around concern for the environment and the sustainability of the farm. This was subsequently labelled 'environmental behaviour' from such questions as "Have you ever considered joining a conservation group?"; "Do members of the public occasionally visiting your farm?"; "Have you inserted / replaced fences / dykes / hedges / etc. in the past five years?"; "To what extent have you diversified the farm business?" The Cronbach alpha for these items was 0.66.

Factor 3 indicates behaviour that is stressed financially. Farmers scoring high on this factor had difficulty meeting both business and personal financial commitments and were under time pressure. This was labelled the 'stress behaviour', it is a negative behaviour and is characterised by a low score indicating high stress. Cronbach alpha for these items was 0.59 which is satisfactory considering the small number of items in the factor.

Factor 4 indicates behaviour that has the intention of increasing the size and income of the business. This was later called the 'developing farming behaviour

factor or 'emerging' behaviour', because of the nature of the questions, "Do you have any definite plans to change the size of the farm business in the next five years?"; "Has the number of acres farmed for the farm business changed in the last five years?"; "What change has your income from the farm business shown over the last five years?"; "Have you made any large investments in the farm business in the past five years?"; "Do you discuss new farming policies with family?" . The Cronbach alpha for these items was 0.50.

Although these factors are unrelated when the items contained within each factor are summed then it can be seen form Table 9:3 that the summed items in factors 1, 2 and 4 are correlated indicating that the domain items have a degree of compatibility.

Table 9:3 Correlation between behavioural factors

	Production Behaviour	**Environmental Behaviour**	**Stressed Behaviour**
Production Behaviour	1		
Environmental Behaviour	**.20****	1	
Stressed Behaviour	.11	.01	1
Emerging Behaviour	**.13***	**.16***	.01

*p<.05; ** p<.01

As can be seen from Table 9:3 production, environmental behaviour and emerging behaviour all influence each other. As would be expected farmers do not fall cleanly into one or other of these distinct patterns of behaviour, rather they exhibit some or all of them. The profile of each individual farmer on all of these behaviours will be unique and can be arrived at by summating the individuals score for each item within each factor.

The original collection of items within the constructs were reduced as follows. Of the 20 items relating to production behaviour in its original category, 11 were retained, 5 remained in the new production behaviour category, 4 transferred to the new 'emerging' behaviour category, and 2 transferred to 'stressed' behaviour. One item was retained from the information category and this moved into the new production factor, along with one item from the old innovation category. Of the 11 original environmental behaviour items, 4 were retained in the new environmental behaviour factor and 2 items transferred into the new production factor. One risk item moved into the new environmental behaviour factor. 3 of the 7 stressed behaviour items were retained within the new stressed behaviour category. All of the off-farm behaviours failed to load on a factor.

Thus innovation, off-farm oriented behaviour, information gathering and risky behaviour all failed to qualify as important behaviour factors.

Farm behaviours are of importance in their own right but the relationship to the farm structure and finance helps illuminate this complex area even further (Table 9:4).

Table 9:4 Relationship of behaviour to farm structural and demographic variables.

	Production Behaviour	Environmental Behaviour	Stressed Behaviour	Emerging Behaviour
Hectares	-.07	**.22****	-.11	.01
Age	-.05	-.03	.13	**-.21****
Assets	.08	**.22***	.08	**.21***
Debt	-.01	-.06	**.31****	.02
Diversification	-.06	**.52****	**-.13***	**.14***
Education	**.25****	**.18****	-.07	.10
Farm Type	.03	.04	.02	.05
f-t employees	**.14***	**.15***	-.12	.08
gfm/Ha	.09	.00	.02	-.05
Land type	**.33****	**-.16***	.07	.03
Liabilities	.17	.06	-.16	.13
Number of children	-.08	-.01	-.04	-.04
Other on-farm work	.08	.06	**-.16***	**.22****
Others off-farm work	.03	.04	-.04	.02
Own off-farm work	-.11	**.18****	**-.22****	-.12
Number of partners	.01	.06	-.07	**.15***
p-t employees	.00	**.26****	-.01	-.08
Revenue	**.21****	.05	-.04	**.14***
Size change	.11	**.15***	.04	**.62****
Subsidies	-.12	.10	-.10	-.05
Succession	-.06	-.05	.05	-.05
Number supported	.03	-.07	.02	-.08
Training	**.18****	**.15***	-.02	-.01
Variable costs	.10	-.01	-.09	.10

*p<.05; **p<.01

Production oriented behaviour is related to more education (r = .25; p<.01), greater amounts of training (r = .18; p<.01), having an arable farm (r = .33; p<.01), and larger revenue (r = .21; p<.01).

Environmental behaviour however, correlates with a larger farm size (r = .22; p<.01), assets (r = .25; p<.01), diversification (r = .52; p<.01), education (r = .25; p<.01), and having LFA land type (r = -.16; p<.05), off-farm work (r = .18; p<.05) and part-time employees (r = .26; p<.01). Stressed behaviour is strongly correlated with debt (r = .31; p<.01), no diversification (r = .13; p<.05) or off-farm work (r = .22; p<.01). Farm development was associated

with being younger (r = .21; p<.01), having assets (r = .21; p<.01), and other family members working on the farm (r = .22; p<.01). It is also strongly associated with increasing farm size over the past five years (r =.62; p<.01).

Correlates of behaviour with psychological variables are shown in table (9:5)

Table 9:5 Correlation of behavioural factors and psychological variables.

	Production Behaviour	**Environmental Behaviour**	**Stressed Behaviour**	**Emerging Behaviour**
NEO-A	-.09	.01	-.02	-.12
NEO-C	**.30****	.04	.12	**.13***
NEO-E	**.28****	**.22****	.06	.04
NEO-N	**-.14***	-.09	**.21****	-.12
NEO-O	**.19****	**.22****	.01	-.01
CISS Avoidance	.12	.03	.02	-.09
CISS Emotion	-.09	-.06	**.19****	-.05
CISS Task	**.26****	**.15***	.12	.08
Raven	.09	**.17***	-.05	.02
NART	.09	.13	.06	.01
Psychological distress (GHQ)	-.10	-.05	**.31****	-.04
Innovativeness (KAI)	.10	**.25****	-.00	**.18****
Total Information	**.24****	**.22****	-.03	.09

Production oriented behaviour is influenced by a personality which is conscientious (r = .30; p<.01), task coping (r = .26; p<.01), open-minded (r = .19; p<.01), gregarious (r = .28; p<.01), and constantly assessing information from a variety of sources (r = .24; p<.01).

Environmentally oriented behaviour is also associated with extraversion (r = .22; p<.01), task coping (r = .15; p<.05), intelligence (r = .17; p<.05), information gathering (r = .22; p<.01) and an open (r = .22; p<.01) and innovative personality (r = .25; p<.01).

Stressed behaviour is associated with a neurotic personality ($r = .21$; $p<.01$), emotion focused coping ($r = .21$; $p<.01$) and psychological distress ($r = .31$; $p<.01$).

Developing behaviour is associated with innovative ($r = .18$; $p<.05$) and conscientious ($r = .13$; $p<.05$) personality.

Now that we have established the most important factors of attitudes, objectives and behaviours it is interest to measure the degree of correlation between the between all three scales (Table 9:6).

Table 9:6 Correlation of attitude and objectives scale with behaviour scale.

	Production Behaviour	Environmental Behaviour	Stressed Behaviour	Emerging behaviour
Achieving attitude	**-.20****	.04	**-.18****	.01
Legislation attitude	.07	.03	**.16***	-.08
Pessimistic attitude	.06	.04	**.21****	.06
Open attitude	**-.43****	**-.26****	-.01	-.09
Risk attitude	**-.14***	.00	.09	-.08
Chemical attitude	.11	**-.19****	.08	.04
Policy attitude	-.11	-.08	.04	-.09
Business objectives	**-.18****	.12	-.05	**-.23****
Environmental objectives	**-.16***	**-.22****	-.00	.05
Quality of life objectives	**-.30****	-.12	-.05	.03
Status objectives	**-.14***	**-.16***	-.05	.03
Off-farm objectives	**-.14***	**-.35****	.04	.05

Significant correlations between achieving attitudes ($r = -.20$; $p<.01$), business ($r = -.18$; $p<.01$), quality of life ($r = -.30$; $p<.01$) and status ($r = -.14$; $p<.05$) objectives and business behaviour were found. Similarly, environmentally oriented behaviour was significantly correlated with an attitude towards chemical use ($r = -.19$; $p<.01$), environmental goals ($r = -.22$; $p<.01$), status (r

= -.16; p<.05) and off-farm objectives (r = -.35; p<.01). Stressed behaviour was related to not being business oriented (r = -.18; p<.01), pessimistic attitude (r =.21; p<.01) and having a negative attitude towards legislation (r = .16; p<.05).

Emerging behaviour had the least number of correlations, with only business objectives (r = -.23; p<.01) being significant.

9.4 Discussion

The Edinburgh Farming Implementation Scale (or farming behaviour scale) indicates that farming behaviour in this study can be classified into four identifiable factors. These are, business oriented behaviour, environmentally oriented behaviour, financially stressed behaviour and farm development behaviour that is distinct, but closely allied to the business oriented behaviour. Information gathering did not emerge as an independent behaviour and the only item from this scale that loaded on any factor was the involvement of the family in financial decisions. The 'emerging' farmers are younger than average, and they are dependent on the on-farm work of other family members, suggesting that these 'emerging' farmers could be breaking away from the family farm and starting up on their own.

Farm structural variables indicated larger farms were more likely to execute environmental oriented behaviour and to have diversified. These findings are similar to those of Anosike & Coughenour, 1990 and Gasson, as quoted in The Commission of the EC Report, 1986). Off-farm work is generally seen as a risk reducing strategy necessary to curtail innovative practices, but in this

study, farmers with off-farm employment conducted more environmental practices. Although, this may be the result of less intensive farming a more likely explanation is these farmers have fewer working hours on the farm and are therefore less likely to be involved in intensive forms of farming. Arable farmers were more likely to be production oriented in this study.

In both the business and the environmentally oriented factors education and personality are important variables. The personality traits of extraversion and openness and task oriented behaviour influence both production and environmentally oriented behaviour, as does information gathering. The four behaviour factors identified in this study did not include the most commonly reported behaviours, risk avoidance. The behaviour set assumed to be indicators of this important variable were subsumed in the business or environmental interests factors.

As the literature suggests, but often fails to measure, personality traits are shown to be strong contributors to the farmers behaviour. The business oriented farmer is an outgoing information seeker, open to new ideas, who conscientiously applies business practices. Interestingly, in this sample, it is the more environmentally friendly farmer who is more innovative and has the highest cognitive ability, while retaining the openness, information seeking and conscientiousness traits of the business farmer. The strongest correlation of environmental behaviour comes with having diversified. This prompts the question of whether diversification is innovative, or whether it just reduces farm man hours and makes farming less intense. If the former is true, this would be contrary to the findings of Pample and van Es (1977) who observed that the environmental oriented farmer was less likely to use innovative techniques and Taylor & Miller (1978) that these farmers were of lower socio-

economic status. It may be that having an innovative personality is not related to being the first to adopt new technology. Alternatively, it may be that these people are in fact first to adopt the new environmental policies and are in fact behaving in an innovative way if this is measured by psychological means. The correlation of environmental behaviour and innovation lends credence to Roger's hypothesis (1983) that innovators adopt first. However, there is still a possibility that off-farm work, or alternatively, having LFA land, will both reduce the ability to farm intensively, and hence may be more important in the adoption of environmental practices.

The 'financially stressed' farmer is not an unexpected finding in today's financially depressed market. He is typically best described by having a neurotic personality, who uses emotion focused coping, and is likely to be psychologically distressed. This is a similar combination of variables as that identified by Deary et al (1996) in their study of consultant doctors. Whether this behaviour is due to an unusually high level of debt, or type of diversification, would have to be determined separately. It is to be noted that these individuals also have a negative attitude towards legislation. The correlation with diversification is interesting as diversification is generally thought to be a risk reduction measure. However, Pittaway et al. (1995) found farmers who had diversified often regretted this decision. Whether the resulting stress arises from the strain of the new learning curve required in diversifying, or in fact diversifying is a financially risky manoeuvre is unclear at this stage.

'Emerging' farmers are young, innovative, and are busy expanding the farm size but have few corrclates with other psychological variables and it may be they are just younger farmers striking out on their own. Due to the 'emerging'

behaviour factors lack of correlation with other variables it is unlikely this factor will be further analysed.

This study although unlikely to be definitive, does point out the need for the greater inclusion of psychological variables in any study of farmer behaviour. There is also an urgent need to address outcome variables more fully to enable a clearer picture of the relationships involved between the complex interplay of the individual, their behaviour and the outcome of this behaviour.

Knowledge of the enterprise permits correlations and predictions to be made about the way the business may be conducted and the effect of policy on such behaviour. However, better outcome measures are required. Perhaps outcome measures should be factored in much the same way as behaviours and these used in prediction rather than using the global measure of profit or assets only.

A comprehensive study of this nature allows for the correlation of aims, attitudes and behaviour in relation to personality and this will be more fully reported in the following chapters where the data will be modelled using structural equation techniques. This knowledge will allow us to build models using confirmatory factor analysis and identify the direction of effect.

CHAPTER 10

MODELS OF PRODUCTION-ORIENTED FARMING BEHAVIOUR

"There are only two qualities in the world: efficiency and inefficiency; and only two sorts of people: the efficient and the inefficient".
George Bernard Shaw. The Irrational Knot.

10:0 Introduction

In this chapter models of production oriented farming behaviour will be developed and tested using structural equation modelling (EQS; Bentler, 1995). The statistical device known as structural equation modelling will use the factors derived from the analysis of the Edinburgh Farming Scales (EFOS; EFAS; EFIS; EFES) and their correlations with other psychological and farm structural data to test the conceptual model hypothesised in Chapter 2. Structural equation modelling will be used to compare other hypothesised models of farming behaviour.

10:1 Structural equation modelling

The normal method of studying the relationship between many variables is to use measures of correlation among the variables, or in the case of econometrics, multiple regression procedures to test complex linkages. The simplest way to indicate a relationship between variables in a model is to represent the connections in the form of a path diagram. However, these techniques on their own do not allow for the testing of causal theories and alternative models.

Chapter 2 discussed the social science and econometric models currently used in the study of farm decision making. The statistical method known as structural equation modelling is a marriage of both social science and econometric measurement techniques incorporated in path diagrams. In psychology, personality and intelligence traits cannot be measured directly. They must be inferred from the measurement of representative sets of behaviours, and some of the items in the sets are likely to overlap, i.e. the number of personality or intelligence items required to completely describe the individual is prohibitive and has not yet been discovered. It is often necessary to infer latent or 'hidden' variables which can be measured by the responses to these sets of behaviours. Such constructs will also covary because of the overlap among the items.

Economics, on the other hand, is particularly interested in how a dependent variable will predict or 'cause' a relationship between other independent variables. This is usually measured using systems of equations which will operate simultaneously. By merging both techniques with path analysis the EQS programme estimates a series of interdependent multiple regression equations simultaneously by specifying the structural model used by the statistical programme (Byrne, 1994).

The parameters of the model are optimally determined and compared with those achieved by the analysis of the sample data using the method of maximum likelihood (although other methods are available). If the model cannot be rejected statistically, it is concluded that it represents the causal structure, here causal means process or system rather than 'cause' (Bentler, 1980).

Structural equation modelling may then be assumed to test the theory rather than finding the cause (Bentler, 1980). Structural equation modelling provides a means therefore, of testing alternative models (or explanations) so as to account for the covariance among the observed variables in the data. It is equally likely that another model will be able to account for the data just as well, hence the importance of testing more than one model. This ensures the best fitting model for the data can be selected. The strength with which the 'cause' can be assumed lies in the theoretical justification rather than analytical methods (Byrne, 1994; Martin, 1987).

Causal assertions can be made on the strength of the following: correlations between the variables, any temporal antecedence between variables, and the lack of any other known causal variables so long as there is a theoretical basis for the relationship (Hair et al., 1995). The biggest problem in any study lies in the omission of a key predictor variables. For example, if job completion was the variable to be predicted and the theoretical model included an 'attitude to work' measure which specified a positive attitude to the job, along with the intention to complete the job, the results may fail to predict the behaviour if the 'attitude to work' measure was not the correct predictor. It may be that the individual dislikes the job but completes it to a high standard simply because they need the income to support the family. The attitude that would have best predicted behaviour would be that towards the family interests, not the job. Hopefully, in this study because of the breadth of information obtained from the literature and the pilot study, the majority of significant predictor attitudes will have been accounted for.

10:1.2 Assessing the 'goodness of fit' of the model.

There are a number of measures for assessing the methodological fit of a structural equation model. One such measure is the degree to which the standardised covariance residuals are close to zero (Cuttance & Ecob, 1987). These residuals provide a measure of the discrepancy between the hypothesised model and the observed data (Byrne, 1994). The values of the residuals should be small and evenly distributed if the model is to fit well (Byrne, 1994). Another methods of assessment for the 'goodness of fit' of the model is, the independence chi-square statistic. This reports the likelihood ratio test of the Bentler Bonnet null model. It assess the complete independence of all of the variables in the model, i.e. the χ^2 value for the Null model should be high, indicating it is unlikely to fit, allowing the Null hypothesis to be rejected (Byrne, 1994). This is however, sensitive to sample sizes of >200 or <100 (Byrne, 1994).

Another chi-square statistic provides a measure of the likelihood of the model occurring relative to the null hypothesis, this should also have a large χ^2 and be non significant. Other 'goodness of fit' measures are Bentler's (1980; 1990; 1992) normed fit index, non-normed fit index and comparative fit index. The values are derived by comparing the hypothesised model and the null model.

The fit-indices measure complete covariation in the data. A value of greater than 0.9 indicates an acceptable fit of the data, (although there is no hard and fast rule) (Bentler, 1992; Byrne, 1994). The normed fit index tends to underestimate fit in small sample sizes, but the comparative fit index takes sample size into account and should be the index of choice (Byrne, 1994). For all three fit indices values >0.90 indicate well fitting data.

To ensure that the model would not benefit from the inclusion of other pathways between the variables the Lagrange Multiplier test may be used. This assesses the parameter changes and estimates the value that could be obtained by additional pathways. Conversely, the Wald test calculates the benefits of removing pathways.

10:1.3 Graphical representation of the model.

Conventionally in the EQS programme (as in other structural equation programmes) measured variables are drawn as square boxes and latent (unmeasured) variables as circles. The antecedent variables are placed on the extreme left hand side, mediators in the middle and outcome variables on the extreme right hand side of the page, arrows indicate the hypothesised causal direction. As in a multiple regression, weights are assigned to the regression line. In structural equation modelling diagrams, this weight is given as the standardised solution of the path coefficient, which is analogous to a beta weight in multiple regression. These values indicate to what extent a change in the antecedent variable will affect the mediator or outcome variable. The square of this number gives the percentage of the shared variance between adjacent variables.

10:2 The development of a model of production-oriented behaviour.

10:2.1. Usefulness of the data in testing the Fishbein model of reasoned action.

Within social science the Fishbein & Ajzen (1974) expectancy-value model of intentional behaviour has provided a theoretical framework for the influence of attitudes and goals on volitional behaviour.

Fishbein & Ajzen (1974) proposed that attitudes affect behaviour indirectly through the mediation of the intention to act and also the influence of significant others on that intention. However, it has been suggested that the theory is inadequate in that, a) some attitudes will directly predict behaviour, b) that there is a 'crossover' effect between attitudes and significant others, i.e. they may have common antecedents, for example the cognitive aspect of the attitude may already include the expectations of significant others. The importance of significant others has been queried in a meta analysis of 26 studies which suggests that the ratio of importance of attitudes to the importance of significant others opinions is in the region of 5:1 (Farley et al., 1981). c) The model can be improved by including other variables such as a moral norm, habit, or personality or environmental variables known to influence behaviour (Zanna, Olson & Fazio, 1980; Scheier, Buss & Buss, 1978; Gorsuch & Ortberg, 1983; Bentler & Speckart, 1979; Fredricks & Dossett, 1983; Rholes, et al., 1976; Bagozzi & Warshaw, 1992; Manstead, Proffitt & Smart, 1983; Zucerman & Reis, 1978; Vallerand et al., 1992).

The model is best defined when the attitudes, goals and behaviour are closely matched (Fishbein & Ajzen, 1974). Subjective norm was not measured in this study, what was measured was the farmer's attitude and status objectives derived from farming. The subjective norm was assumed to be incorporated in the measure 'the importance of respect from others'.

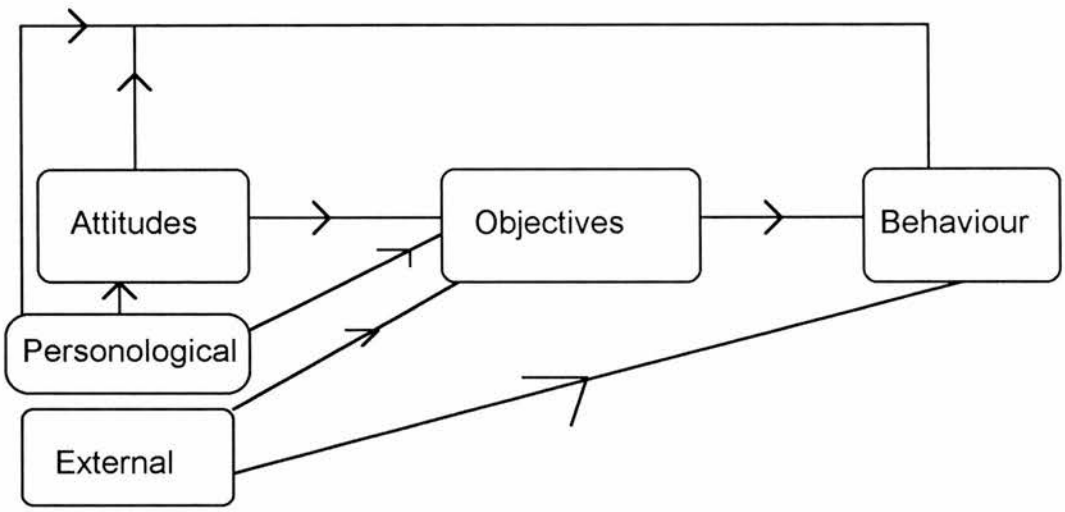
Although the attitudes, objectives and behaviours scales initially contained many matching items, the factor analysis of the scales reduced the ability to directly compare items across these scales as many of the original items in the sets were now paired in new factors. For example, it may be seen from Chapter 6 that of the items in the original group 'business attitude towards production and profit' only one item remained in the 'achieving in business factor' derived by statistical analysis, whereas those in Chapter 7's original 'production and innovative objectives' remained to be included in the statistically derived factor 'business objectives'. What appears to have happened is that risk taking attitudes became a separate identifiable attitude factor but not a separate identifiable objective or behaviour. Thus those specified attitude items thought to closely match the similarly specified objectives no longer did so. This may have affected the strength of the correlations between factors, as well as the ability of the factors to satisfy the criteria for the theory of reasoned action.

This chapter develops and tests a series of increasingly complex models of farming production behaviour culminating in a test of the model discussed and summarised in Chapter 2 (Fig 10:1). The transactional model permits personological and environmental variables to be tested within a theoretical construct. It is further argued that this model provides a theoretical model of

personality structure. The models will be tested using both multiple regression and structural equation modelling (EQS) techniques.

10:2.2. Proposed transactional model of farming behaviour.

Fig. 10:1. Proposed Model of Farming Behaviour.



In the transactional model personological variables antecede attitudes and objectives but are mediated by them, at the same time they directly affect behaviour. Attitudes are considered to influence behaviour directly as well as being mediated through objectives. Thus both the Ajzen & Fishbein (1975) theory of reasoned action and two levels of McAdam's (1995) suggestion of the structure of personality are included and tested in this conceptual model. External variables such as a legislation, finance, farm size, land type etc., are also held to influence behaviour directly as well as be mediated by objectives (Coughenour & Tweeten, 1986).

The transactional model is widely used to model the influence of stress and coping on an individual's behaviour (Lazarus, 1984; Deary et al., 1996; Cox, 1976). In this model the transaction is between an individual's response to the problem and the environment. It is a reciprocal process which assists in explaining behaviour. The antecedent variable(s) can be either personological or environmental variables (Cox, 1976; Lazarus, 1984; 1990; Deary et al., 1996). The antecedent variables effects are mediated by the cognitive response of the individual and the outcome of the transaction is the resulting behaviour. In this fashion a model based on traits (stable characteristics of the individual) or states (temporary conditions) may be developed. In order to test this model basic traits are included as the personological antecedent variables along with environmental variables external to the individual. The main function of this chapter is to examine the constraints of the hypothesised model. However, when modelling, some associations are included in the models based solely on the empirical findings.

It is argued that some of the study's derived factors could be thought of as basic traits of the individual while others were oriented more towards a specific behaviour. For example, the attitude towards achievement and an open information gathering attitude could be thought to influence any farming decision. Other, more specific attitudes such as those towards chemical use would be confined to specific aspects of behaviour. By using variables which generally effect all decision making, it may be possible to predict who will make changes or take risks *in general*. With the addition of the more specific attitudes, goals and behaviours to the model an even better prediction should be possible for specific behaviours.

10:2.3 Descriptive data of farmers business seeking behaviour.

From the data the following is worthy of note when modelling the data relating to production oriented behaviour: 56% of farmers surveyed always keep financial records, 33% always keep farming records, 30% always monitor the business performance and 32% always manage the business to maximise output, but only 10% 'always' use targets in managing the business. This suggests that approximately one third of the sample is strongly business oriented towards production but only 10% used consistent objective directed behaviour. If this is the case we may find that objectives are a poor predictor of behaviour in this study. Other indications of business orientation were, 20% had invested heavily in the farm business in the past five years, but only 18% always maximised profit and 12% always used new methods. Only a few were financially market oriented as only 1% used the futures market a lot. A few (8%) had off-farm investments.

10:3 Hypothesising models of farming behaviour

One of the purposes of the study was to develop measures of farming-related behaviour, objectives and attitudes. These factors derived from the scales will be used to assess the importance of general factors in predicting farming behaviour. The attitude scale factored out seven attitudes important to the participants in this study. Two of the factors were considered to be basic to all farm decision making. These were the achieving attitude factor which referred to the importance of a business-like attitude towards farming, and the open attitude factor which incorporated the importance of knowledge and information in farming.

The first hypothesis was that attitudes would both directly affect behaviour and be mediated through goals. In the Fishbein and Ajzen theory, attitudes do not necessarily have a direct pathway to behaviour, they are mediated by intentions, but Bentler & Speckhart (1979) have shown that past behaviour is a better predictor of behaviour than attitudes and further, there is a direct path from attitudes to behaviour. Thus, this chapter hypothesises that some attitudes will directly predict behaviour.

Corroboration of the intuitive assumption that both the achieving and open attitude should be included in the model was upheld by the correlation matrix (Table 10:1). The model proposes that both those attitudes directly affect profit and production behaviour. The achieving attitude may be seen as relevant to all business oriented production behaviour while the open attitude clearly incorporates information gathering and a willingness to try new ideas. The first model hypothesised was simply that these general attitudes and business goals would influence a specific volitional behaviour to do with business. This was initially chosen because the Fishbein & Ajzen (1980) theory of reasoned action is seen as a good predictor of specific behaviour, and most studies use only one behaviour such as the purchase of coffee, detergent, shampoo etc. (Sheppard et al., 1988). The behaviours chosen were the self reported behaviours that the business was run to, a) maximise production, b) maximise profit above all else as these are the outcome measures most favoured by the economists. The majority of farmers in this study had no off-farm employment or diversification and therefore, did not easily distinguish between maximising profit and maximising production. This was made clear to the researcher by the frequent requests to explain the difference (and by the high correlation between the two items).

Table 10:1 indicates the correlation between the achieving and open attitude factors and the intention to maximise profit and maximise production. As can be seen, all of the variables are correlated. Because all the variables were correlated it was assumed that both attitude factors would directly influence both behaviours and that both the attitude factors and both of the behaviours would be correlated with each other. However, because all of the variables are correlated the EQS model would be just-identified, that is, there would be a one to one correspondence between the data and the structural parameters (Bentler, 1995). This means there are no degrees of freedom, therefore, the model cannot be rejected, and it is of no scientific interest (Popper, 1959).

Table 10:1 Correlation between attitudes and specific reported behaviours of maximising profit and production.

	Achieving attitude	Open attitude	maximise profit
Achieving attitude	1		
Open attitude	**.25****	1	
Maximise profit	**.27****	**.24****	1
Maximise production	**.25****	**.14***	**.47****

*p =<.05; **p=<.01

These results indicate that attitudes do directly affect behaviour, the achieving attitude correlates directly with productive and profit making farming behaviour and the open attitude also correlates with both behaviours. As would be expected production and profit go hand in hand as do, to a lesser extent the open and achieving attitude factors.

These results were analysed using a multiple regression technique. A stepwise multiple-regression with 'running the business to maximise profit' as the dependent variable indicates that for 'running the business to maximise production', an open and achieving attitude factor are significant (Table 10:1).

This explains about 27% of the variance of maximising profit by these three variables.

Table 10:1a Stepwise multiple regression relating the probability of maximising profit, maximising production and attitudes.

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Maximising production	.47	.06	.22	67.82	.00
Openness attitude	-.18	.01	.26	40.09	.00
Achieving attitude	-.13	.01	.27	28.88	.00

However, multiple regression alone does not permit the testing of causal pathways in a model. This is best achieved using structural equation modelling.

The next step in the modelling was to operate on the hypothesis that business oriented objectives were important to most farmers. This is in accord with Gasson (1974) (and others) work on the importance of farmer's goals. It was hypothesised objectives would mediate the open and achieving attitude. The best fitting model was obtained when the open attitude factor was allowed to directly influence behaviour (Model 10:1). Table 10:2 Shows the correlation matrix relating the achieving and open attitude factors to having business objectives and the two self reported behaviours of maximising profit and production.

Table 10:2 Correlation between attitudes, objectives and self reported behaviour

	Achieving attitude	Open attitude	Business Objectives	Production maximising
Achieving attitude	1			
Open attitude	**.25****	1		
Business Objectives	**.17****	.01	1	
Production max.	**.25****	**.14***	**.25****	1
Profit max.	**.27****	**.24****	**.26****	**.47****

*p =<.05; **p=<.01

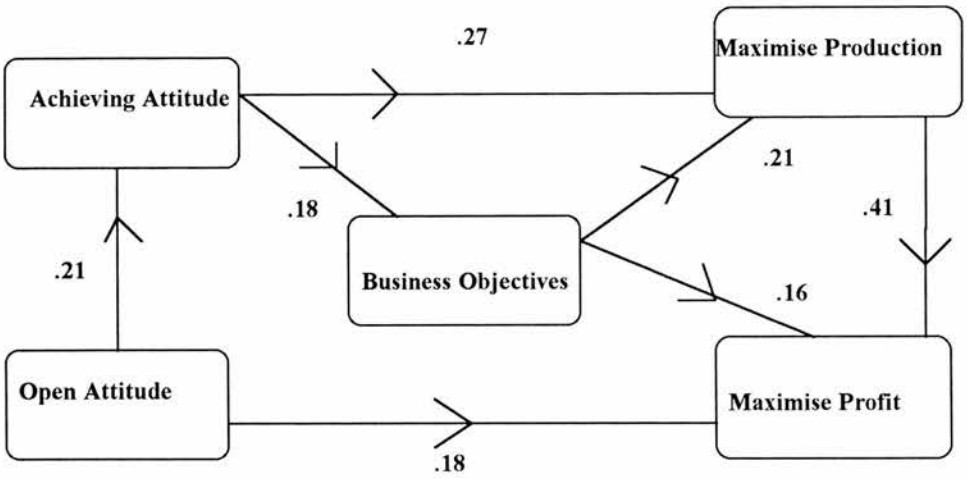
Multiple regression using a step-wise analysis explains about 26% of the shared variance between profit and production behaviour, objectives and attitudes alone.

Table 10:2a Stepwise multiple regression relating maximising profit to maximising production, business objectives and attitudes

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Maximising production	.47	.06	.22	67.82	.00
Openness attitude	-.18	.01	.26	40.09	.00
Business objectives	-.18	.01	26	40.09	.00

In this case the achieving attitude failed to meet the p<.05 criteria and was not entered in the regression analysis. However, once again, this does not test the hypothesised model, this is done using EQS in Model 10:1.

Model 10:2 Modelling the relationship between attitudes, goals and production oriented behaviour



N = 236 Average Standardised Residuals = 0.016
Average off-diagonal Absolute Standardised Residuals = 0.02
Chi-square = 4.89; df 4; p = 0.30
Normed Fit Index =0.96
Non Normed Fit Index =0.98
Comparative Fit Index =1.00
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected and a robust well fitting model is obtained.

In this case we have partial confirmation of Fishbein's model in that the business goals mediated the achieving attitude for both types of behaviour. However, the open attitude remains directly linked to the profit maximising behaviour. This model explains 16.8% of the shared variance between maximising profit and maximising production. 24.4% of the variation in profit maximising is explained by business objectives and an open attitude. Only 10% of the variation in production maximising is explained by business objectives and an achieving attitude.

In this study one of the important behavioural factors obtained by factor analysis of the enterprise questionnaire related to general production oriented behaviour. The two specific behaviours of maximising profit and production are subsumed within this general factor and are replaced by it in the next model (Model 10:2). The correlation values are shown in Table 10:3. By using general attitudes and goals to predict general behaviour we may expect the predictive power of the model to be reduced (Fishbein, 1975), although it is widely accepted that aggregated behaviours across different situations are highly correlated, for example, Small et al. (1983). Small's study were able to observe young people's behaviour over a number of different situations during a summer camp and found correlation across behaviours of .33 to .95 for some characteristics. However, it is not usual to find these being used in attitude modelling partly because of Mischel & Peake (1982) comments. They rejected cross-situation aggregation on the basis that it cancels out too much valuable data about an individual. It amounts, they argue, to treating within-individual differences and the context itself as 'error' (Mischel & Peake, 1982 (p738)). However, Ajzen (1988) argues this is not relevant to the specific actions performed in a given context (p60). Ajzen argues that aggregating behaviour across situations adds little to understanding specific behaviour in specific situations. However, it can be argued that no action is performed in isolation, it generally takes place in a context where actions are considered an appropriate response to the situation. In many instances these will be partly habitual or partly a modified habitual response to the situation. Consider the farmer's behaviour, his actions are determined by the seasons of the year and his experience with his type of farming, the context such as the weather, machinery or labour, grants available etc. will set the scene for his response. It is a general category of action, and the point of this study was to identify what general characteristics of the individual were involved in two broad areas of farm decision making, environmental and production oriented behaviour.

Therefore, it is permissible to use general behaviour rather than specific behaviours in this study.

The problem with most attitude studies arises from the narrowly specific items used to define attitudes, intention and behaviour, they enable a good prediction of that specific behaviour but they do not allow generalisation to other similar behaviours. This study aimed to investigate whether general attitudes and objectives could predict general farming behaviour. Thus, although much of the specificity has been lost by factor analysis, a good range of general attitude and objective measures has been obtained. By modelling these it is hoped to obtain a set of generalised prediction variables which will hold good in most situations where change in behaviour is to be investigated. It may be possible to replace the present ad-hoc sets of variables with a standardised set of variables which will be applicable to all behaviours in general. Specific behaviours will then be predicted using these along with more focused variables.

The correlation matrix (Table 10:3) indicates that business behaviour is correlated with attitudes and objectives and an empirical model should be possible.

Table 10:3 Correlation between general attitudes, production oriented objectives and general production oriented behaviour

	Achieving attitude	**Open attitude**	**Business Objectives**
Achieving attitude	1		
Open attitude	**.25****	1	
Business Objectives	**.17****	.01	1
Production behaviour	**.20****	**.43****	**.18****

*p =<.05; **p=<.01

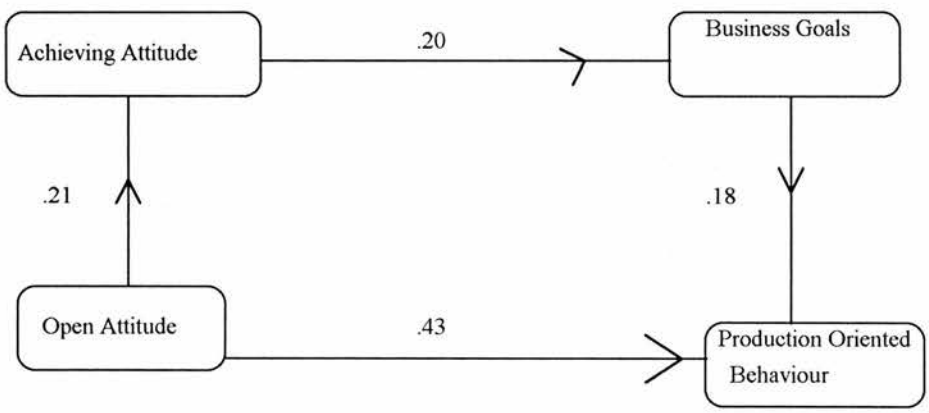
Step-wise multiple regression with general business oriented behaviour as the dependent variable indicated that the open attitude and business goals factors accounted for 22% of the variance.

Table 10:3a Stepwise multiple regression relating production oriented behaviour to business objectives and attitudes

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Open attitude	-.43	.07	.19	54.06	.00
Business objectives	-.43	.07	22	32.91	.00

The achieving attitude was not regressed as the $p<.05$ limit had been reached.

Model 10:3 Modelling general attitudes, goals and general production behaviour



N = 236 Average Standardised Residuals = 0.01
Average off-diagonal Absolute Standardised Residuals = 0.02
Chi-square = 2.2; df 2; p = 0.33
Normed Fit Index =0.97
Non Normed Fit Index =0.99
Comparative Fit Index =1.00
The Wald and Lagrange test did not suggest any modification to the model.

The null hypothesis is rejected and the model is confirmed as well fitting and robust.

This model was found a good fit of the data and confirms the hypothesis that attitudes act both directly and indirectly through goals in general to predict general production oriented behaviour. The open attitude directly affects behaviour and accounts for nearly 20% of the variation in production oriented behaviour, with business objectives contributing only 3% of the variation in behaviour. In this model the achieving attitude is mediated by having business goals and does not directly affect behaviour. This is in accordance with the idea that motivation has to be mediated by goals to predict behaviour. However, the amount of variance explained by objectives is very small compared with the input from the open attitude, which directly influences behaviour. The reason for this may be partly found in the fact that the achieving attitude, business goals and production behaviour share a number of common themes. This does not however, explain why the achieving attitude does not directly influence behaviour. On the other hand, it may explain why the 'open' attitude is not mediated by having business goals, in that it shares fewer themes with the other scales.

The literature has stressed the importance of multiple goals and values in farming (Gasson, 1974; Casebow, 1981; Gilmor, 1986; Ilbery, 1985). The factors obtained from the objectives scale suggested two types of objectives are held by farmers, the straight forward objectives dealing with the means of achieving the individual goals and the two sets of values that underlie all behaviours. The latter values were to achieve a good quality of life (quality of life objectives) and to be respected as a farmer (status objectives). These two values were introduced into the modelling hypothesis.

It was hypothesised that quality of life and status values would mediate the achieving attitude and that they would both influence the business oriented goals and behaviour (Table 10.4). The status objectives could be viewed as analogous to Fishbein's 'subjective norm' variable which weights the involvement and influence of significant others on the intention. The quality of life objectives might be expected to be shared by all the population and thus influence goals i.e. those who wish to improve the quality of their life will be motivated to achieve this aim. However, this speculation was not entirely supported when the model was tested as the quality of life factor did not, a) affect the business goals and, b) status values were not influenced by the achieving attitude factor.

Table 10:4 Correlation between attitudes, goals and behaviours.

	Achieving attitude	**Open attitude**	**Business goals**	**Quality of life goals**	**Status goals**
Achieving attitude	1				
Open attitude	**.25****	1			
Business goals	**.17****	-.01	1		
Quality of life goals	**.28****	**.32****	**.19****	1	
Status goals	**.23****	.09	**.20****	**.25****	1
Production behaviour	**.20****	**.43****	**.18****	**.30****	**.14***

*p =<.05; **p=<.01

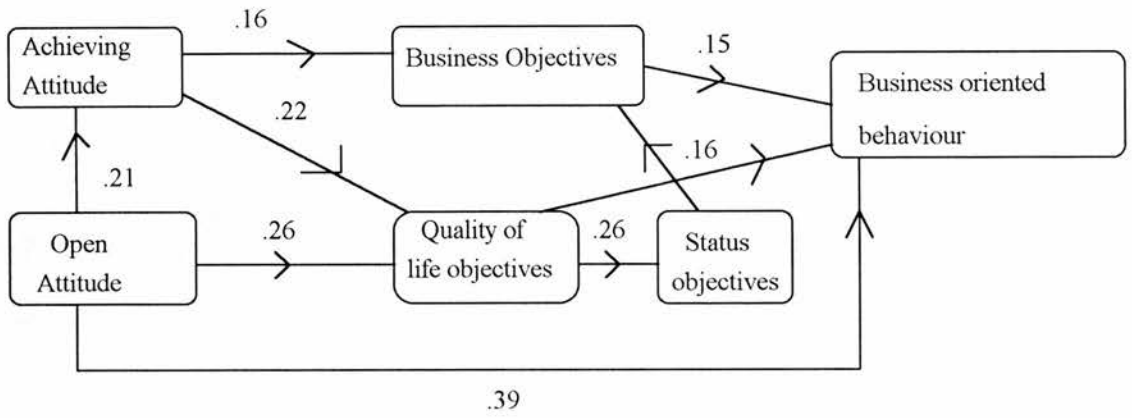
Step-wise multiple regression using the production oriented behaviour factor as the dependent variable indicated the open attitude, business goals, and quality of life accounted for approximately 24% of the variance.

Table 10:4a Stepwise multiple regression relating maximising profit to maximising production, business objectives and attitudes.

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Open attitude	.43	.07	.19	54.06	.00
Business objectives	-.18	.05	.22	32.91	.00
Quality of life	-.15	.11	24	24.39	.00

This model is assessed by EQS in Model 10:4.

Model 10:4 The influence of attitudes and objectives on behaviour



N = 236 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 13.9; df 6; p = 0.03
Normed Fit Index =0.91
Non Normed Fit Index =0.86
Comparative Fit Index =0.94
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected and a model which is a reasonable fit of the data is obtained.

This model indicates that the influence of the achieving attitude on business behaviour is mediated by both business objectives and quality of life objectives. Status objectives mediate both quality of life and influence business objectives, but do not directly influence behaviour. The open attitude directly influences behaviour and is also mediated by quality of life objectives. The open attitude, business objectives and quality of life objectives account for 20% of the variation in general production oriented behaviour.

This model is also a good fit for the data and confirms the influence of objectives on farming behaviour. However, the model fit is not *so* good as the

preceding models. This may be due to the increased number of variables included in the model. The fit may be partly explained by the fact that quality of life and status goals include items which cannot be easily related to the general production oriented behaviour items. For example items such as 'it is important to have more time for the family', or 'it is important to have the respect of others in the community are not matched with any of the behavioural items representing the general orientation towards productive behaviour. This makes the strength of the correlations lower than if these items had been covered by similar accompanying items in the behaviour factor. The values of improving the quality of life and being respected by members of the community may be thought of as the structure through which the more specific goals as to how this might be achieved are structured.

So far the modelling has been restricted to the effect of general attitudes and goals on specific and general farming production behaviour. However, the basis of the arguments of Chapter 4 rested on the importance of personality and other individual traits on behaviour. The literature has suggested that goals are often directed by the trait of conscientiousness and this trait is the best predictor of doing any job well along with the trait of intelligence (Barrick & Mount, 1991; Tett et al., 1991). In our sample the data for extraversion and conscientiousness were correlated with the achieving attitude and business objectives. It was hypothesised that personality traits would influence behaviours through the form of a latent variable. Table 10:5 indicates the correlation between the variables used in this model. A latent variable was postulated as it is generally accepted that personality traits, although useful in describing an individual do not fully describe every facet of personality. Similarly intelligence, because it was not measured as a single variable, is represented as a latent function.

Table 10:5 Correlation between personality traits, attitudes, goals and behaviour

	Conscientiousness	Extraversion	Verbal IQ	Non-verbal IQ	Total Information score	Task coping	Production behaviour	Achieving attitude
Conscientiousness	1							
Extraversion	**-.19****	1						
Verbal IQ	-.10	**.29****	1					
Non-verbal IQ	-.01	**.28****	**.41****	1				
Total information score	-.00	**.16***	-.01	-.00	1			
Task coping	**.36****	.09	-.00	.07	**.14***	1		
Production behaviour	**.30****	**.19****	.07	.09	**.24****	**.26****	1	
Achieving attitude	**-.32****	.08	.13	**.25****	.040	**.19****	**.20****	1
Business Objectives	**.20****	.06	.06	.04	.063	.06	**.18****	**.17****

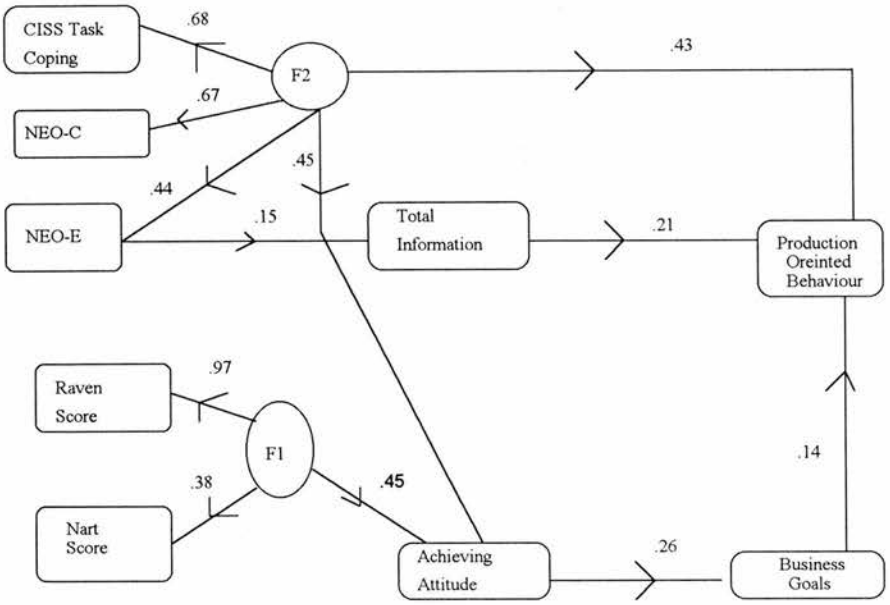
*p =<.05; **p=<.01

Step-wise multiple regression with the business behaviour factor as the dependent variable indicated that task coping, information gathering, and business goals accounted for approximately 20% of the variance. Table 10:5a.

Table 10:5a Stepwise multiple regression relating Production oriented behaviour to psychological traits, business objectives and attitudes

Model	Std.β coefficient	Std. error of β	R^2	F	Significance
Task	.34	.05	.12	24.49	.00
Extraversion	.21	.08	.16	16.89	.00
Total information	.27	.06	.18	13.34	.00
Business goals	-.14	.06	.20	11.20	.00

Model 10:5 Modelling behaviour, personality traits, attitudes and objectives



N = 204 Average Standardised Residuals = 0.03
Average off-diagonal Absolute Standardised Residuals = 0.04
Chi-square = 20.4; df 22; p = 0.56
Normed Fit Index =0.91
Non Normed Fit Index =1.00
Comparative Fit Index =1.00
The Wald and Lagrange test did not suggest any modification to the model.

The model indicates a latent variable which accounts for intelligence and a latent variable which accounts for a personality which is conscientiousness, task coping, extravert and outgoing. It is interesting to note that intelligence is mediated by having an achieving attitude and business goals whereas, extraversion is mediated by information gathering. Behaviour is also directly influenced by the latent variable underlying conscientiousness. This well fitting model indicates the role of intelligence and dutifulness in production behaviour. 25% of the variation in production oriented behaviour is explained by

personality traits, business goals and information gathering. The largest contribution to variation in behaviour arises from a variation in personality (outgoing, conscientious and task coping (18.5%)).

It has been argued that external variables play an important role in farming behaviour (Coughenour & Tweeten, 1986), and the model postulated in Chapter 2 indicates their position as antecedent variables in a transactional model. The variable chosen for this model was land type as the difference between less favoured areas and arable is sharply demarcated by gross farm margin per acre and the number and availability of subsidies. The percentage of average income from subsidies was 20% for arable farms and 40% for LFA farmers.

Table 10:6 Correlation between attitudes and farm structural variables

	Achieving attitude	**Open attitude**	**Business goals**	**Land type**	**Hectares**
Achieving attitude	1				
Open attitude	**.25****	1			
Business goals	**.17****	-.01	1		
Land type	.08	.11	**.14***	1	
Hectares	.00	.08	.12	**-.42****	1
gfm/Ha	.00	.06	.10	**.45****	**-.29****

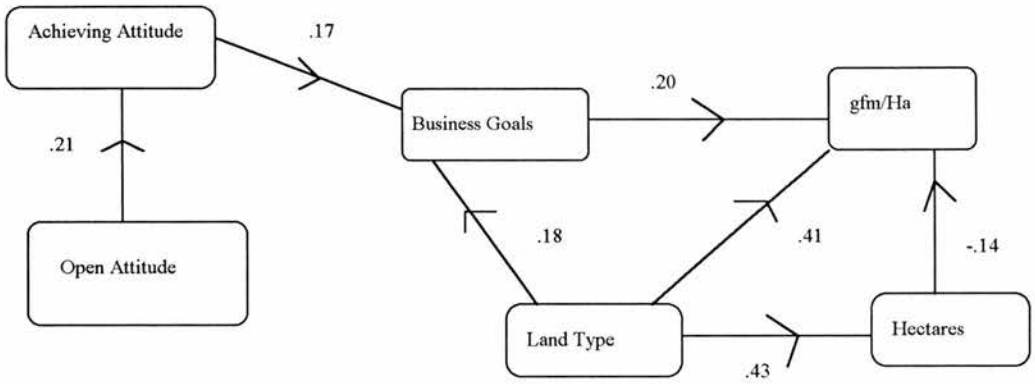
*p =<.05; **p=<.01

Table 10:6a Stepwise multiple regression relating production oriented behaviour to psychological traits, business objectives and attitudes

Model	**Std.β coefficient**	**Std. error of β**	**R^2**	**F**	**Significance**
Landtype	.43	.20	.19	42.10	.00
Business objectives	.18	1.67	.22	25.64	.00
Hectares	.19	.1.6	.24	18.97	.00

Both the open to new ideas attitude and the achieving attitude did not meet the criteria for inclusion. Step-wise multiple regression with the production behaviour factor as the dependent variable indicate landtype, business goals, and farm size account for approximately 24% of the variation in behaviour due to having business objectives, land type and the number of hectares farmed, suggesting these structural variables are important in predicting behaviour.

Model 10:6 Modelling farm structural variables attitudes and objectives.



N = 209 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 14.3; df 8; p = 0.07
Normed Fit Index =0.90
Non Normed Fit Index =0.90
Comparative Fit Index =0.95
The Wald and Lagrange test did not suggest any modification to the model.

Land type influences both goals and behaviour whereas, the number of hectares directly affects the gross farm margin. This is not an unexpected finding but the amount of variation in behaviour explained by landtype is only 16%.

The next step was to bring together all of the relevant variables and compose a complete model of the production oriented behaviour. The model was

hypothesised on the bases of the models already obtained. A latent variable related to attending to the task was postulated and the land type was assumed to influence both goals and behaviour.

Table 10:7 Correlation table of personality traits and farm structural variables

	Hectares	Land type	Business behaviour	Business objectives	Achieving attitude	Task Coping	Conscientiousness	Extraversion
Hectares	1							
Landtype	**-.42****	1						
Business behaviour	-.07	**.33****	1					
Business goals	.12	**.14***	**.18****	1				
Achieve attitude	.00	.08	**.20****	**.17****	1			
Task coping	.03	.06	**.26****	.05	**.19****	1		
Conscientiousness	-.08	.04	**.30****	**.20****	**.32****	**.36****	1	
Extraversion	.01	.10	**.28****	**.15***	**.21****	**.22****	**.28****	1
Information gathering	.10	**.15***	**.24****	.06	.04	**.13***	.00	**.16***

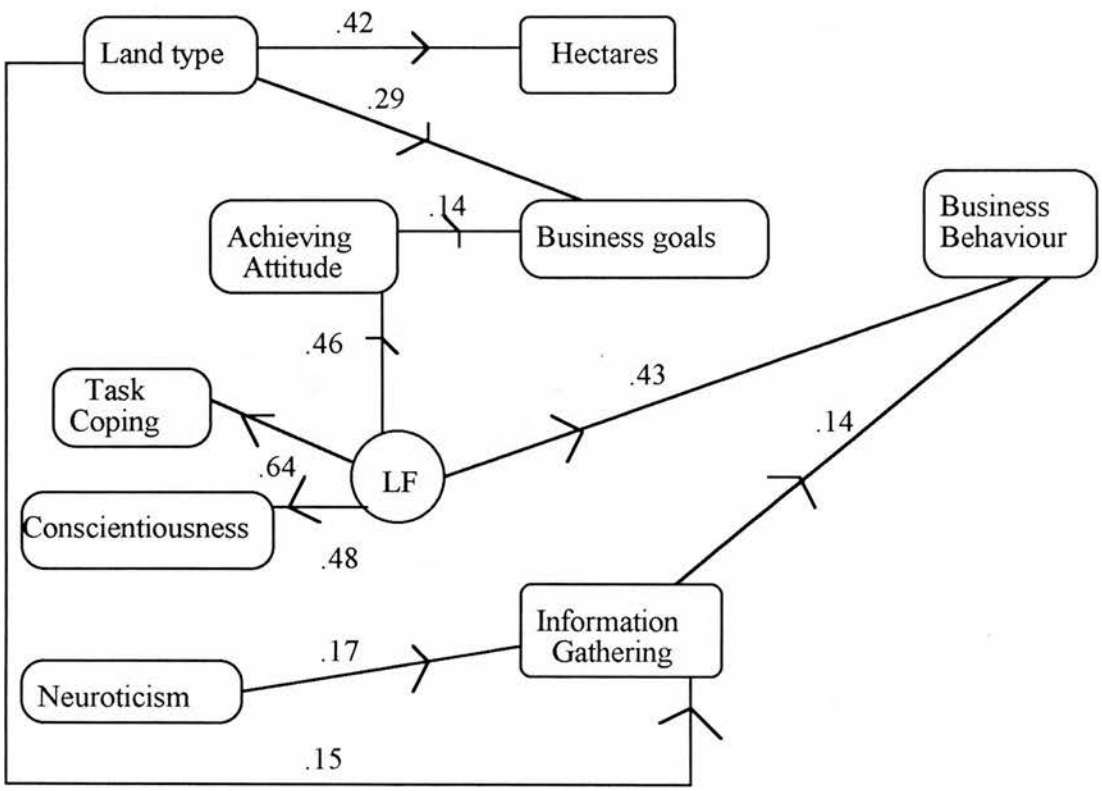
*p =<.05; **p=<.01

Stepwise multiple regression indicated that production oriented behaviour is best explained by personality and land type Table 10:7a.

Table 10.7a Stepwise multiple regression relating production oriented behaviour to psychological traits and farm structure

Model	Std.β coefficient	Std. error of β	R^2	F	Significance
Task coping	.35	.05	.12	25.10	.00
Land type	.30	.74	.21	23.91	.00
Extraversion	.19	.07	.24	19.32	.00

Model 10:7 Modelling the influence of structural variables on production oriented behaviour



N = 185 Average Standardised Residuals = 0.04
Average off-diagonal Absolute Standardised Residuals = 0.05
Chi-square = 25.31; df 23; p = 0.33
Normed Fit Index =0.89
Non Normed Fit Index =0.98
Comparative Fit Index =0.99
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected.

The model indicates that the small robust models hold even when the number of variables are expanded. That is, the personality characteristics and information gathering influence general production oriented behaviour, but land type also influences behaviour.

This enhances the idea that such variables are the key structures in which decision making takes place. However, this does raise a query regarding the use of maximising profit as a good outcome variable. Profit and production are not strictly under the direct control of the farmer due to the influence of weather, pest, market fluctuations etc. but are likely to influence both, therefore, they cannot be truly conceived as volitional behaviour. What the model does suggest is that those using production oriented goals are more likely to succeed than those who do not. It is proposed that a set of well defined behaviours should be identified and used as standardised outcome measures in other studies, as these behaviours inform the nature of change more accurately than the specific models of profit or production oriented behaviours.

10:4 Discussion

Structural equation modelling has proved a valuable tool in this study as it has permitted modelling production oriented behaviour using both confirmatory and exploratory hypothesis. It has also allowed the use of latent variables to account for underlying personality and intelligence traits.

Two traits derived from the attitudes scale play an important role in the influence of production oriented behaviour, these are the 'achieving' attitude and the 'open' attitude factors. However, is possible that the achieving attitude and business goals are under greater volitional control than the 'open' attitude (volitional behaviour is a requirement in the theory of reasoned action (Fishbein, 1975)). It is possible that the open attitude may be accounted for by personality characteristics which are not under strict volitional control. On the other hand, it is equally possible that the open attitude

is another important facet of decision making. The models 10.5 and 10.7, where personality and attitudes are used in the modelling, lend credence to McAdams (1995) idea that personality structure operates at more than one level that the antecedent or stylistic personality traits are the driving force and these are mediated by the motivational concepts (motivation, goals etc.) at level 2 of the personality structure (Chapter 4).

These models confirm attitudes and goals can be used to predict both specific and general farming behaviours. The influence of values such as, improving the quality of life and status seeking values, are also shown to be important. These value related objective factors are difficult to fit into a model in a completely satisfactory manner, due to the vagueness of the items. They lack the substance of the behaviours best described by the 'how' they are achieved rather than the 'why' the behaviour is occurring. Further work on how those values might be realised in practice would be useful. But once again the idea that these values might be operating at the second level of structure of personality is confirmed. Do the individuals require more time off, more money, greater diversity of interests, etc., in order to realise these values, or are they already realised through making increasing profit or producing more? What appears to have been realised is that there is an appreciable difference between goals and values, although they occupy the same place in the hierarchy.

Some attitudes have proved to directly influence behaviour and this is challenges the Fishbein (1975) theory, but does confirm Bentler & Speckhart, (1979) and Bagozzi's (1981) findings. In particular the 'open' attitude directly influences behaviour in all of the models suggesting that this attitude is either very intractable or, it is an individual trait, and not strictly under voluntary control.

Personality characteristics are also shown to have a direct and mediating effect on the production oriented behaviour as postulated in the model. The personality characteristics of intelligence and conscientiousness are known predictors of job

success in any business or profession (see Barrick & Mount, 1989; Tett et al., 1991 for a meta analysis review), and in this study successful farmers as measured by their behaviour shared the same characteristics as other successful business people.

Fishbein & Ajzen's model of reasoned action has been partially confirmed as a useful tool, but it would appear that where inherent traits are used such as in the 'open' attitude factor, the effect is directed at the behaviour rather than mediated through goals. However, it is likely that there are insufficient goal items addressing the specific items in the 'open' attitude factor. The 'open' attitude appears fundamental to the structure of the model in that it was mediated by the diffuse goal items of 'improving the quality of life'. The open attitude nearly always directly influenced behaviour.

The variable of land type was the most decisive external (farm structural) variable influencing goals but the gross farm margin per acre was also important. However, the predictive power is limited. It is, therefore, extremely difficult to build a complete model of the production oriented behaviour, as the complete model was not as good a fit as would have been expected. This may be partly due to the mis-match of items between the attitudes, goals and behaviour factors which developed following the factor analysis. Those factors were aimed at explaining general production oriented behaviour and the inclusion of psychological traits accounted for what in social science is a fairly substantial amount of the variance in behaviour (around 20%). If specific behaviours and intentions are investigated it would be hoped that models using this basic structure of variables would have much greater predictive power.

The question now arises, will these models hold for other farming behaviour? The following Chapter investigates the ability of these factors to explain environmentally oriented farming behaviour.

CHAPTER 11

MODELS OF ENVIRONMENTALLY FOCUSED BEHAVIOUR

"We can interest ourselves in the perfection of production methods which are biologically sound, build up soil fertility, and produce health, beauty and permanence. Production will then look after itself".
Schumacher. Small is Beautiful. Chapter 1.

11:0 Introduction

The previous chapter has investigated a series of models of production oriented farming behaviour. This chapter explores and develops a similar series of models for environmental oriented farming behaviour.

As these two farming behaviours were identified by factor analysis as two separate factors, it is expected that differences will emerge when the behaviours are modelled. Such differences might distinguish specific predictor variables required for that behaviour. For example, some of the important predictors of business oriented behaviour were psychological in nature, such as conscientiousness, task oriented coping etc. If these variables do not occur in the environmental model, but are replaced by other psychological variables, then it may be inferred that these variables influence the environmental behaviour.

As in the previous Chapter, simple models of attitude-behaviour are constructed layer by layer to create increasingly complex and multivariate models incorporating both psychological and farm structural variables.

11:1 Environmental-oriented farming behaviour

The aim is to model environmentally oriented behaviours. However, this farming sample scored poorly on such behaviour. Only 3% *never* used chemicals/sprays/fertilisers, with another 13% using them only rarely, however, 46% used them fairly heavily. Even fewer had tried organic farming methods, (1.5%) and 89% had *never* tried organic farming. Active conservation methods in the past five years were reported by 27% but 52% had taken no active measures. Vermin were actively controlled by 72% with only 5% taking no active measures. 22% of the surveyed group had joined a conservation group but 63.5% never considered joining a group. 27% encouraged members of the public to visit the farm with 44.5% never having members of the public visit. Greater interest was demonstrated in replacing hedges and dykes with 33% reporting they had replaced a lot of hedges/dykes etc. but 42% had not replaced any. The greater interest shown in the latter conservation item may well have arisen from the fact that this was a government supported measure until the mini-budget of 1993 when grants were withdrawn. Taken together, this lack of environmentally oriented behaviour may be difficult to model as so few farmers actually practised such behaviour.

As was hypothesised in the last chapter, the two attitudes of 'openness' and 'achieving' which were derived from the EFAS scale, were thought to be fundamental to all farm decision making processes and will therefore be tested in the environmental models. A further attitude factor derived from the EFAS scale, that of the attitude towards chemical use, will be included in this model as it could be considered a possible related to environmental concern.

11:2 Modelling environmentally oriented farming behaviour

The initial hypothesis was that, like the specific production behaviour models, general attitudes would predict a specific behaviour. In this case two diverse specific behaviours were chosen, one was the extent to which the individual used chemicals/fertilisers/pesticides etc. and the other was the use of organic farming techniques. These were chosen because the environmentally oriented farming could be considered to lie somewhere near, either a reduction in chemical use or total abstinence of chemicals, as in organic farming. Environmentally oriented farming is not generally considered cost-effective, it is unlikely that the achieving attitude will play a large role in environmental farming mainly due to the items which compose this factor being largely related to increasing production and profit. It was therefore, hypothesised that an 'open' attitude would encourage the trial of organic farming and a reduction in the use of chemicals. The attitudes towards chemicals would be expected to influence the amount of chemicals used on the farm. Such a hypothesised model is shown in Model 11:1.

The initial correlation matrix is shown in Table 11:1. Unlike the earliest production model not every item correlated with all of the other items, further, as expected, the achieving attitude is redundant in this model. The hypothesised model using only the open and chemical attitude is tested using structural equation modelling (Model 11:1).

Table 11:1 Correlation between using chemicals, trying organic farming and the achieving, open and chemical attitude factors

	Achieving attitude	Open attitude	Chemical attitude	Chemical use
Achieving attitude	1			
Open attitude	**.25****	1		
Chemical attitude	-.01	.07	1	
Chemical use	-.10	**-.27****	**.30****	1
Organic farming	-.05	-.02	**-.31****	**-.14***

*p<.05; **p<.01

As it is not possible to regress two outcome variables simultaneously using multiple regression, each behaviour is regressed independently. i.e. using the item 'How much chemicals/sprays/pesticides etc. do you use?' (1= None to 5= Heavy-use) as an dependent variable then a separate regression was done for 'Have you tried organic farming methods?' (1= never to 5= always use).

Table 11:1a Step-wise regression of open and chemical attitude on the behaviour of 'using chemicals'

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Chemical attitude	.1094	.0224	.0926	23.98	.00
Open attitude	.1167	.0214	17.78	25.31	.00

In this case only two factors are significant, the chemical attitude and the open attitude, between them they account for approximately 18% of the shared variance with the chemical use behaviour.

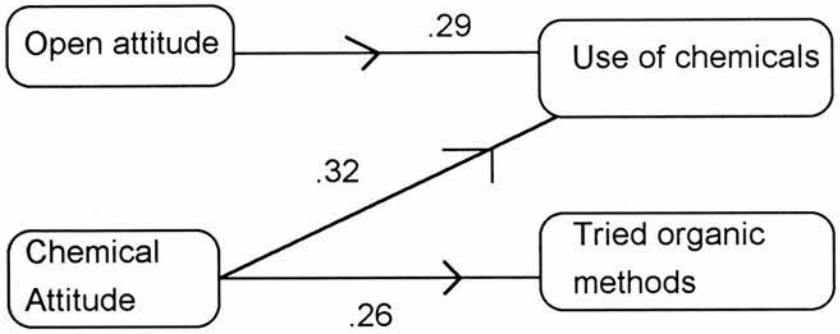
Table 11:1b Step-wise regression of open and chemical attitudes on the behaviour of 'having tried organic farming'

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Chemical attitude	.069	.014	.093	24.10	.00

Only one factor was significant in this regression, that of an attitude towards chemicals and it explained approximately 9% of the shared variance with organic farming behaviour. Contrary to expectations the open attitude did not share a significant portion of the variance with the organic farming behaviour.

However, using multiple regression analysis does not allow testing the model to both behaviours. Therefore, these two variables are simultaneously regressed in the structural equation modelling programme on both chemical and organic behaviour (Model 11:1). The chemical attitude did correlate significantly with organic farming and the use of chemicals. The best fitting model is shown in Model 11:1 below.

Model 11:1 The affect of an open and chemical attitude on two environmentally friendly behaviour



N = 232 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 1.7; df 3; p = 0.62
Normed Fit Index =0.97
Non Normed Fit Index =1.04
Comparative Fit Index =1.00
The Wald and Lagrange test did not suggest any modification to the model.

This model indicated that the chemical attitude directly influences both behaviours, whereas, the open attitude influences chemical use but not organic farming. The pathways from the chemical attitude and the open attitude, explain approximately 19% of the shared variance between attitudes and behaviour, and chemical attitude alone only explains approximately 6% of the organic farming behaviour.

As with the production behaviour, it was assumed that having environmental objectives would be important in influencing behaviour. In the next model the chemical use behaviour is replaced with the environmental behaviour factor derived from the EFIS scale. The environmental objective derived from the EFOS scale is also introduced. These factors are composed of the following items:

Environmental Behaviour factor items

Have you taken any active conservation measures in the last five years?
Have you ever considered joining a conservation group?
Do members of the public occasionally visit your farm?
Have you inserted / replaced fences / dykes / hedges / etc. in the past five years?
To what extent have you diversified the farm business?

Environmental Objectives factor items

Improving the quality of the farm generally is important
It is important to use chemicals sparingly
It is important to leave the land as good as you received it
It is important to prevent pollution
It is important to get all you are due from current legislation

The environmental behaviour factor measures general behaviour rather than a specific aspect of environmentally oriented behaviour. The achieving attitude is now shown to be correlated with general environmental objectives, (Table 11:2). The assumption is made that most farmers wish to achieve a high level of production and profit but at the same time wish to instigate some environmentally friendly practices.

It is hypothesised that the environmental objectives factor will mediate the attitude towards chemicals whereas the open attitude and the achieving attitude are postulated to directly influence the environmental behaviour.

Table 11:2 Correlation table of attitude towards chemical use, open attitude and having environmental objectives and behaviour

	Achieving attitude	Open attitude	Chemical attitude	Environmental behaviour
Achieving attitude	1			
Open attitude	**.25****	1		
Chemical attitude	.01	.07	1	
Environmental behaviour	.04	**.26****	**.19****	1
Environmental objectives	**.44****	**.19****	**.14***	**.22****

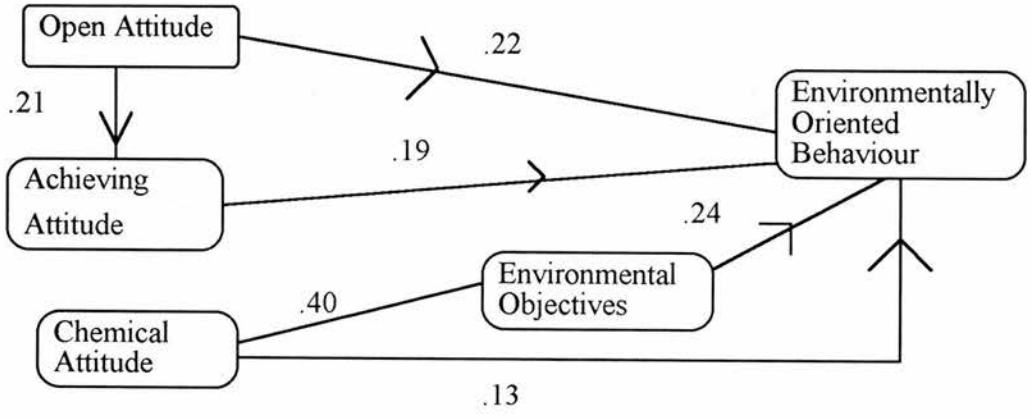
*p<.05; **p<.01

Stepwise multiple regression using the general factor of environmental behaviour as the outcome measure was carried out. The order of contribution to the outcome was from the open attitude, the achieving attitude and having environmental objectives, these factors explained about 15% of the shared variance with behaviour. The model was further tested using structural equation modelling.

Table 11:2a Step-wise regression analysis of attitudes and objectives on environmental behaviour

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Open attitude	.2554	.0612	.0693	17.41	.00
Environmental objectives	.3053	.1005	.1048	13.63	.00
Achieving attitude	.4267	.1072	.1366	12.23	.00
Chemical attitude	.3903	.1078	.1532	10.45	.00

Model 11:2. Relationship between attitudes, objectives and environmentally focused behaviour.



N = 236 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 15.9; df 9; p = 0.07
Normed Fit Index =0.93
Non Normed Fit Index =0.92
Comparative Fit Index =0.97
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected and a well fitting model is obtained.

As suggested by the Fishbein theory of reasoned action, an attitude towards chemical use, influences objectives or intentions which in turn influence behaviour. Interestingly, there are two other pathways which influence behaviour directly, these are from the open and achieving attitude factors. The achieving attitude in this model mediates the open attitude, suggesting that being open minded will influence production maximising behaviour and related environmental behaviour.

As was suggested in Chapter 3, the subjective norm of the Fishbein hypothesis was replaced by the status objectives identified by Gasson (1974). The values

of quality of life also were considered to influence behaviour. These were included in the next attitude-behaviour model hypothesised. In this model it is hypothesised that the open attitude will directly influence behaviour and the chemical attitude will be mediated by holding environmental objectives. From the correlation table it was expected that the attitude towards chemicals would be influenced by the status objectives. Some research suggests that environmental behaviour is more usually carried out by those who have large number farms (Gasson, 1989). Larger farms might be seen as setting standards, it is possible, that status might be gained by other farmers if they incorporate these objectives into their own business. Intuitively, the environmental objectives would be considered to be influenced by the quality of life objectives, that is, any reduction in the handling of chemicals or pollution might be seen as improving the quality of life for the farmer. The achieving attitude which explained so little of the shared variance between the achieving attitude and the environmental behaviour was subsequently dropped from the modelling exercise. The hypothesised model is shown below (Model 11:3).

Table 11:3 Correlation between attitudes, objectives and environmental behaviour

	Environmental behaviour	**Open attitude**	**Chemical attitude**	**Environmental objectives**	**Quality of Life objectives**
Environmental behaviour	1				
Open attitude	**.26****	1			
Chemical attitude	**.19****	.07	1		
Environmental objectives	**.22****	**.19****	**.14***	1	
Quality of Life objectives	.12	**.32****	.07	**.52****	1
Status objectives	**.16***	.09	**.21****	**.13***	**.25****

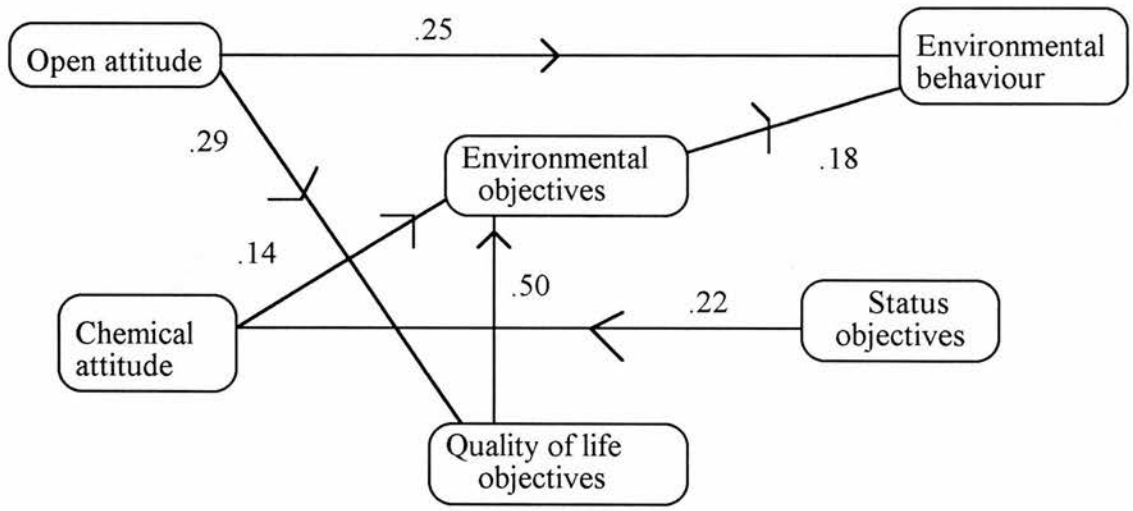
*p<.05; **p<.01

When these variables are regressed stepwise on to the environmental behaviour factor, the open attitude, environmental objectives, and chemical attitude are significant, contributing about 12% of the shared variance with behaviour but the quality of life and status objectives were not significant contributors.

Table 11:3a Step-wise regression analysis of chemical, open attitudes and environmental objectives on environmental behaviour

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Open attitude	.2554	.0612	.0693	17.41	.00
Environmental objectives	.3053	.1005	.1048	13.63	.00
Chemical attitudes	.2227	.0603	.1253	11.08	.00

Model 11:3 The relationship between attitudes, objectives and environmental behaviour



N = 205 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.02
Chi-square = 5.9; df 8; p = 0.66
Normed Fit Index =0.96
Non Normed Fit Index =1.0
Comparative Fit Index =1.0
The Wald and Lagrange test did not suggest any modification to the model.

The null hypothesis is rejected and a well fitting model is obtained.

This model indicates the importance of the open attitude which is mediated by the quality of life objectives but at the same time directly influences behaviour. Environmentally-oriented behaviour is also influenced by environmental objectives which mediate both the chemical use attitude and the quality of life objectives. Interestingly, status objectives are mediated by an attitude towards chemicals rather than environmental objectives. Status objectives, like the subjective norm it replaced is an antecedent variable in this model. This is a robust, well fitting model showing the complex interaction of values on behaviour with attitude and objective accounting for 9.5% of the shared variance.

The next model considers the influence of psychological variables on environmentally focused behaviour. This behaviour would be expected to be influenced by different traits from production oriented behaviour as it was less likely to occur in the present farming population. It was hypothesised that intelligence (presented as a latent variable) and a personality that was open to new ideas would be most likely to influence this behaviour both directly and through the mediation of environmental objectives. As environmentally oriented farming behaviour could be seen as innovative in the present socio-political climate, innovation in terms of the KAI innovator adaptor theory (Kirton, 1979), (that is, high scorers use an innovative cognitive style) was postulated to influence behaviour. However, new ideas also require new information, thus information gathering was also included in the model.

Table 11:4 Correlation between psychological variables, objectives and environmental behaviour

	Verbal IQ	Non-verbal IQ	Openness	Total Information	Innovative	Environmental objectives
Verbal IQ	1					
Non-verbal IQ	**.41****	1				
Openness	**.29****	**.28****	1			
Total information	-.01	-.00	**.16***	1		
Innovative	**.14***	**.16***	**.30****	.05	1	
Environmental objectives	.02	.07	.09	.06	.05	1
Environmental behaviour	.13	**.17***	**.22****	**.23****	**.25****	**.22****

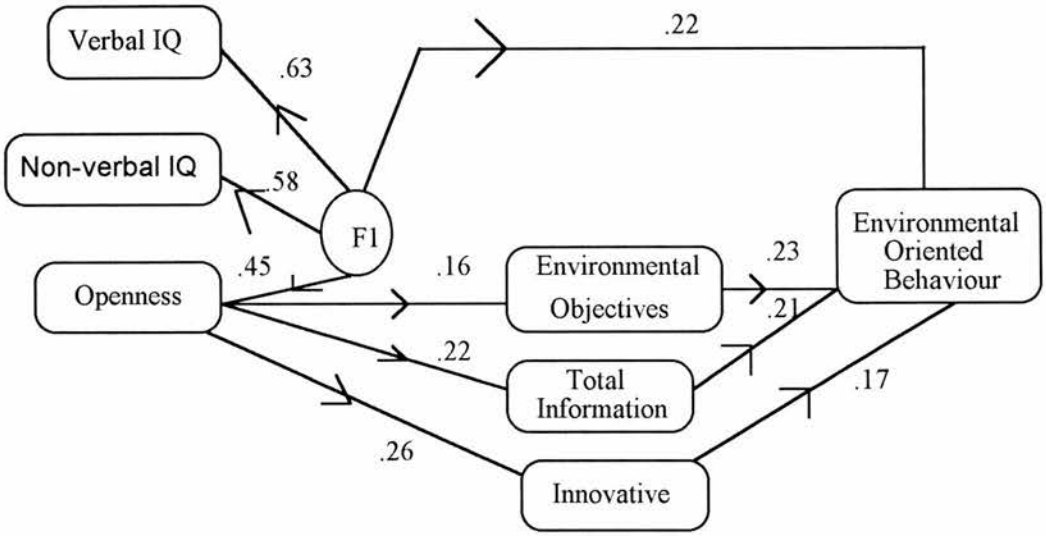
*p<.05; **p<.01

A latent variable was postulated to account for an underlying intelligence variable and this cannot be regressed. However, a stepwise multiple regression of all of the measured variables on environmental behaviour was performed. Information gathering, innovative style, environmental objectives, and intelligence were significant contributors to behaviour, explaining about 17% of the shared variance.

Table 11:4a Step-wise regression of psychological and attitudinal variables against environmental behaviour

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Total information	.0537	.0152	.0578	12.45	.00
Innovative	.0515	.0149	.0996	11.18	.00
Environmental objectives	.3358	.1033	.1446	11.33	.00
Non-verbal IQ	.0926	.0365	.1713	10.33	.00

Model 11:4 Relationship between psychological characteristics objectives and environmental behaviour



N = 206 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 14.46; df 16; p = 0.57
Normed Fit Index =0.90
Non Normed Fit Index =1.02
Comparative Fit Index =1.00
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected and a well fitting model obtained.

Intelligence and a personality open to new ideas were best explained by an underlying variable which directly influences environmental behaviour. However, there existed three other pathways to behaviour which stemmed directly from the personality trait of openness rather than the latent intelligence variable. One is mediated by environmental objectives, one by information gathering and one by innovativeness. This was also a well-fitting model, with

traits, attitude and goals explaining about 18% of the shared variance with behaviour.

The penultimate model considers the influence of external variables on environmental farming behaviour. From the literature it was known that having a larger than average farm was likely to be associated with environmental behaviour. Land type was also assumed to influence chemical use, the LFA farmers having less need to use heavy concentrations of chemical. The greater areas involved were also thought to deter intensive chemical spraying. The model hypothesised was that the open and chemical attitudes along with land type would be antecedent to objectives, which would be expected to mediate the antecedent variables.

Table 11:5 Correlation between attitudes, objectives, farm structure and environmentally oriented behaviour

	Environ. behaviour	**Environ. objectives**	**Open attitude**	**Chemical attitude**	**Land type**	**Hecta res**
Environmental behaviour	1					
Environmental objectives	**.22****	1				
Open attitude	**.16***	.05	1			
Chemical attitude	**.19****	**.14***	.04	1		
Land type	**.16***	.11	.03	**.26****	1	
Hectares	**.22****	.08	.01	**.26****	**.42****	
gfm/Ha	.00	.07	.05	**.14***	**.45****	**.29****

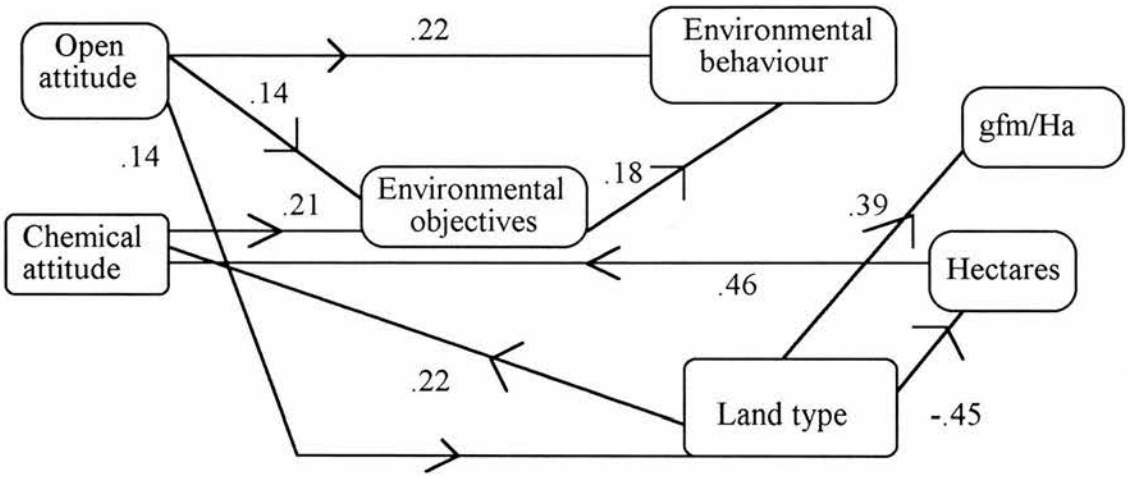
*p<.05; **p<.01

A stepwise multiple regression indicated that the open attitude and land type were the most significant variables to regress against environmental behaviour, explaining 13% of the variance. However such a result does not describe how they influence behaviour, the structural equation model is shown below (Model 11:5).

Table 11:5a Step-wise regression of attitudes, objectives and farm structural variables on environmentally oriented behaviour

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Open attitude	.2350	.0677	.0578	12.45	.00
Land type	1.8873	.5971	10.38	11.30	.00
Environmental objectives	.2819	.1109	.1327	9.90	.00

Model 11:5 Relationship between farm structure, attitudes, objectives and environmental behaviour



N = 236 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 21.4; df 12; p = 0.05
Normed Fit Index =0.87
Non Normed Fit Index =0.89
Comparative Fit Index =0.94
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected and a well fitting model is obtained.

The model suggests that farm structural variables do influence attitudes. As would be expected the land type influences the attitude towards chemical use and is in turn influenced by an open attitude. Land type directly influences the gross farm margin per acre which would also be expected. Chemical use

attitude is also influenced by the acreage managed by the farm. Both the open and chemical use attitudes are mediated by holding environmental objectives. The model suggests a relationship between the attitude chemical use and open attitude with land type. This model explains 7% of the shared variance between open attitude, objectives and behaviour.

The aim of the study was to provide a model which incorporated all the essential variables that influence behaviour. Such a model is presented next. This hypothesises that intelligence, a personality which is open to new ideas and land type will antecede, attitudes and objectives, information and innovativesness as defined by the Kirton adopator/innovator theory (Kirton, 1979).

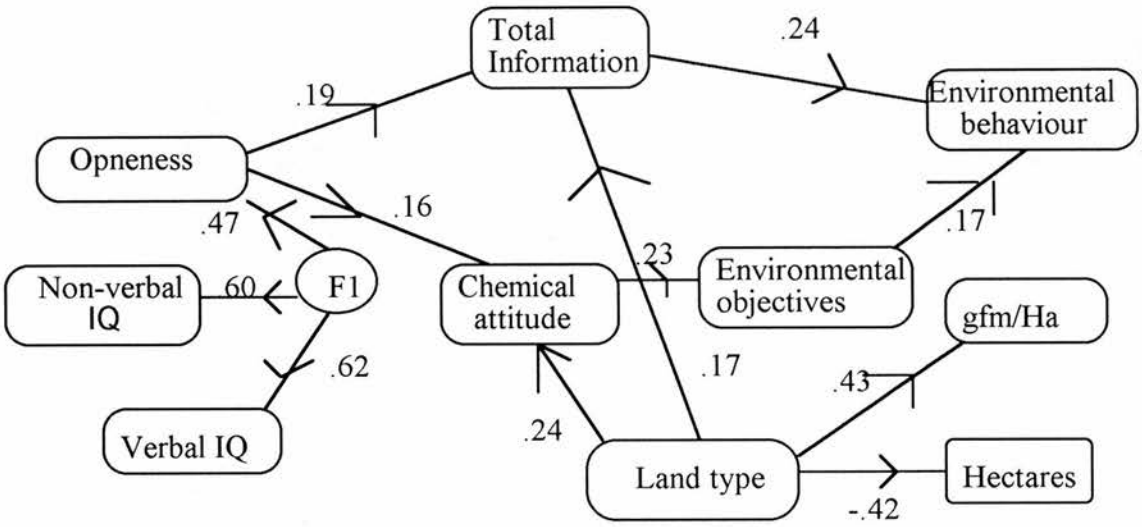
Table 11:6 Correlation between farm structure, psychological variables and environmental behaviour

	1	2	3	4	5	6	7	8	9
(1) Environmental behaviour	1								
(2) Environmental objectives	**.22****	1							
(3) Chemical attitude	**.19****	**.14***	1						
(4) Hectares	**.22****	.08	**.26****	1					
(5) gfm/Ha	.00	.07	**.14***	**.29****	1				
(6) Land type	**.16***	.11	**.26****	**.42****	**.45****	1			
(7) Verbal IQ	.13	.02	.00	.01	.07	.08	1		
(8) Openness	**.22****	.09	.09	.05	.13	.04	**.29****	1	
(9) Non-verbal IQ	**.17***	.07	.11	.05	.08	.04	**.40****	**.28****	1
(10) Total information	**.22****	.06	.10	.10	**.30****	**.15***	.01	.15*	.01

*p<.05; **p<.01

As the model postulated a latent variable (F1) to represent intelligence a multiple regression analysis was omitted for this hypothesis as latent variables, by definition, cannot be regressed.

Model 11:6 Relationship between farm structure, psychological variables and environmental behaviour



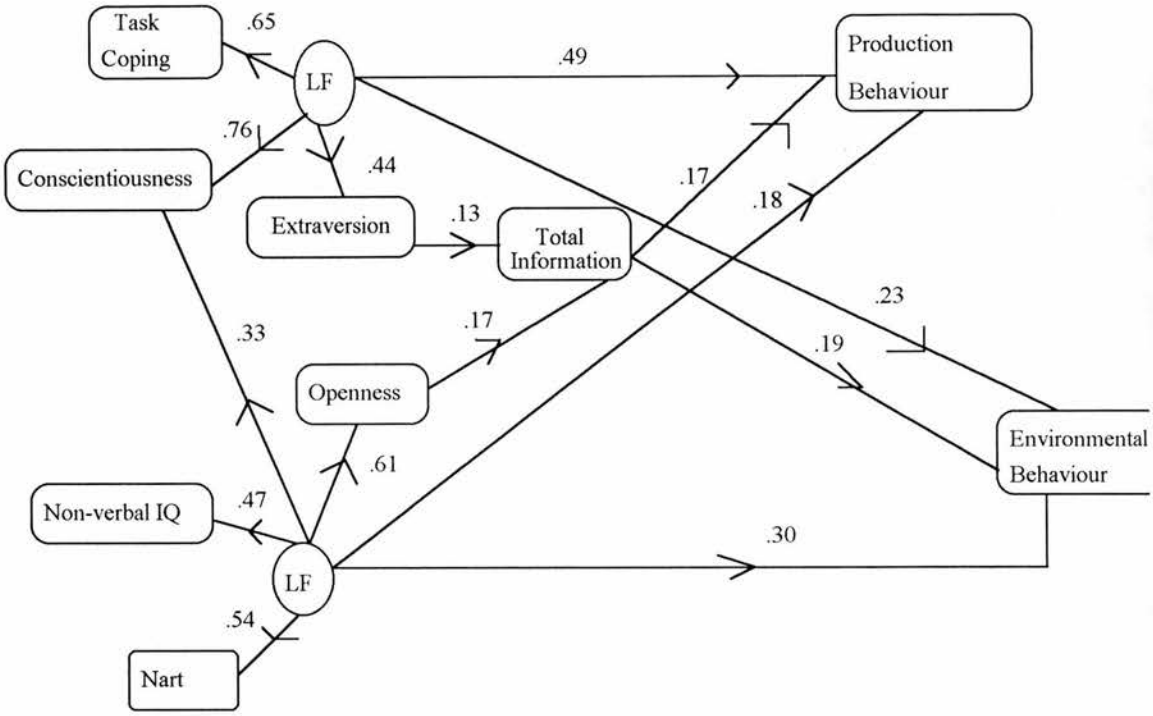
N = 185 Average Standardised Residuals = 0.05
Average off-diagonal Absolute Standardised Residuals = 0.05
Chi-square = 68.98; df 31; p = 0.001
Normed Fit Index =0.73
Non Normed Fit Index =0.74
Comparative Fit Index =0.82
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected.

This model confirms the durability of the smaller models which together compose this overall model of environmentally oriented farming behaviour. The importance of a personality which is 'open' to new ideas is confirmed, this is mediated by information gathering, and also by attitudes and objectives. The influence of attitudes and goals on behaviour partially supports the Fishbein model. Farm structure however, also affects attitudes and objectives.

As occurred with the production behaviour model the goodness of fit is only satisfactory when so many variables are used, but it does suggest that these variables and pathways are of importance.

However, the majority of farmers must make a living from farming, they cannot completely orient their behaviour to be exclusively environmentally focused. Therefore, it is important to build a basic structure of a model which accounts for both environmentally and production oriented behaviours. The psychological variables responsible for the behaviour may supply the clues to behavioural change. Such a model is demonstrated in Model 11:7 (correlation of the various variables have already been shown in the above tables).

Model 11:7 Modelling the direct influence of individual psychological differences on the two types of farming behaviour



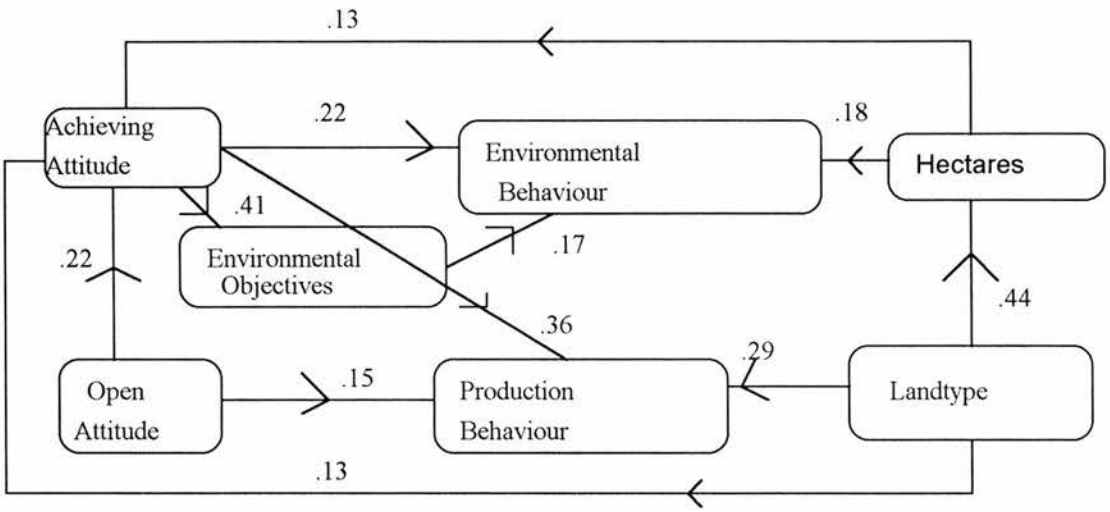
N = 205 Average Standardised Residuals = .02
Average off-diagonal = .03 Absolute Standardised Residuals = .04
Chi-square 25.2 df 21 p = .24
Normed Fit Index =0.90
Non Normed Fit Index =0.97
Comparative Fit Index =0.98
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected.

This model shows three pathways to both production and environmental behaviour, these are from the latent variables of personality and intelligence, one which arises from conscientiousness, and a personality which is open to new ideas and extravert, both of which are mediated by information gathering.

These pathways explain 30% of the shared variance with production behaviour and 17% of the environmentally oriented behaviour.

Economists and business mangers measure the predicted decision, not on the basis of self reported behaviour, but by the income generated by the behaviour. However, in farming, income may be adversely affected by variables such as weather or market fluctuation or government policies all of which are outwith the farmers control. Other external constraints on behaviour is the type of farm and the land type. Land type is one of the largest contributors to a difference in measured outcome of gross farm margin per acre in this study. Thus, the final model considers the influence of farm structure on attitudes, objectives and behaviour (Model 11:8). In this model the number of hectares and the landtype are considered to influence how motivated to achieve a farmer will be. That is, those with LFA farms will not be able to maximise their production and profits to the same extent as an arable farmer for two reasons. Firstly, livestock profits have fallen and the market shrunk in the wake of the BSE scare and secondly, as shown in the descriptive statistics LFA farm income has a higher contribution from subsidies than those of arable farmers.

Model 11:8 Modelling the relationship between the psychological variables, farm structural variables and the environmental and production oriented behaviours



N = 231 Average Standardised Residuals =
Average off-diagonal = Absolute Standardised Residuals =
Chi-square 27.4, df =10, p = .003
Normed Fit Index =0.89
Non Normed Fit Index =0.84
Comparative Fit Index =0.92
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected.

This model explains 11% of the shared variance with environmental behaviour and 23% of the shared variance with production oriented behaviour.

This model indicates that behaviour is influenced by attitudes, objectives and farm structure.

11:3 Discussion

By modelling successive hypothesis it is possible to show that certain variables are stable contributors to all of the models. This enables the identification of the most important variables influencing farming behaviour.

Initial modelling of attitudes and environmentally oriented behaviours does indicate the direct effect of attitudes on behaviour, in particular, the open and chemical use attitudes are identified as important influences.

The Fishbein Theory of Reasoned Action holds that attitudes, goals and the opinion of others is important and this is broadly confirmed in this study. However, as the study has used summed general objectives rather than a single specific intention, the correlation between objectives and behaviour is low. This is probably due to the lack of matched themes between the empirically derived factors. Multiple stepwise regression of measured variables on behaviour confirms the Fishbein hypothesis to the extent that attitudes and objectives are important contributors. But it remained for structural equation modelling to establish the influence of the 'quality of life' and 'status' factors in the equation. Structural equation modelling also permitted the use of latent variables and the transactional model allowed a greater number of variables to be incorporated in the model. These models by permitting the entry of psychological and farm structural variables expand and enrich the hypothesis.

The importance of the psychological variables on environmental behaviour is shown in the models 11:4, 11:6, and 11:7. Behaviour is not only influenced by intelligence, a personality that is open to new ideas, information gathering and having an innovative personality is also important. It is of interest to note that

a personality 'open to new ideas' and one which is 'conscientious' are related to the latent variable underlying the intelligence measures used in the study. This is a common finding in the literature (McCrae, 1996). It is however, more noteworthy that these personality characteristics perform a different role for the different behaviours, suggesting that regardless of the generality of the traits, the model has the power to distinguish between the effects. It is this openness to new ideas construct which is mediated through separate pathways of objectives, information gathering and creative behaviour.

Interestingly, the innovative personality is a mediator of behaviour in Model 11.4, and it has a shared variance with a personality which is open to new ideas, as one would expect from the literature definitions of this concept (McCrae, 1996). This model (11.4) suggests that the structure of personality at least, at the levels 1 and 2, describes farming behaviour well in terms of the personality traits and motivation. The traits being the antecedents and the objectives, innovative style and information gathering the motivators of the behaviour.

When both environmental and production oriented behaviour are modelled together intelligence and personality directly influence both behaviours. However, information gathering mediates both an extraverted and 'open' personality before influencing both behaviours to almost to same extent, (3% of the shared variance). In the case of production behaviour, personality has the greatest influence, whereas intelligence has a slightly greater influence on environmental behaviour.

Farm size and land type are antecedent to chemical use and open attitudes, these in turn are mediated by environmental objectives and simultaneously farm size and land type influence behaviour and attitudes directly. Transactional modelling of farming behaviour indicates the multivariate influences on behaviour and the importance of psychological constructs in modelling general farming behaviour. These psychological constructs are powerful predictors of general farming behaviour and it is assumed that by incorporating them in specific farming behaviours the models power would be increased.

Model 11.1 confirms that attitudes do, on their own, significantly influence behaviour and that the open and chemical use attitude factor developed for this study contributes significantly to all types of environmental behaviour. Having environmental objectives is also found to be important, and values and quality of life which, although, difficult to define and measure in practical terms are also influential.

In this study, because the factors used in the modelling were empirically derived, rather than items specially selected for modelling, there is a reduction in the amount of shared variance which can be accounted for between attitudes, objectives and behaviour factors. However, they do highlight the need to capture such values when modelling behaviour.

Unlike other researchers (Morris & Potter, 1995) no correlation with age and environmentally oriented behaviour was found. This may have occurred because we investigated general rather than specific environmental behaviours. Specific behaviours which require large investments may be more likely to occur in the younger age group and the more environmentally friendly

behaviours such as set aside are often related to older or less able farmers. However, when the general items of behaviour are summed these age related effects disappear in this study.

Model 11:4 suggests the type of farm influences the farmers' attitudes in some cases. This may not be as counter-intuitive as it first appears as many farmers are raised on the farm they eventually manage, and their friends and family may well live on similar farms. For example, an LFA farmers may never expect to make many changes in his farm therefore there will be little requirement to pursue information on new technologies in the shape of mechanisation. Only new management or husbandry methods may be investigated. Such a culture may well exist within the family and community which influences farmers' attitudes. The land-type factor relationship is largely determined by the occurrence of the farm in LFA and non-LF areas.

There is a clear physical, biological and economic difference between the dairy and arable farms of the non-LFA with the large extensive sheep and beef farms of the LFA, and different farming methods will be required in each location, regardless of farm type. While there is clearly a need to investigate this relationship more deeply, it does highlight the complex nature of the farmer decision process. The fact that environmental behaviour does not affect the gross farm margin may be the result of environmental behaviour not being cost-effective at this stage in the 'sustainability' process outlined by European Governments. Or, it may be that gross farm margin is not a suitable outcome measure as both the production and marketing of crops and livestock depend on many factors outwith the farmer's control.

The last model developed (11.7) indicates that land type and farm size although influencing both production and environmental behaviour have less impact than attitudes and objectives combined and contribute less than the psychological variables tested.

When psychological variables are included in the model then it is possible to substitute an 'open to new experiences' personality trait for the open attitude factor and show three possible pathways to environmental behaviour from this trait alone. Another pathway is through the trait of intelligence. These personality characteristics alone can explain nearly 30% of the shared variance for both production and environmentally oriented behaviour. Model 11:6 confirms the complex interaction between personality, attitudes, behaviour and the farm structure.

In conclusion it appears that the personality traits of intelligence, innovative cognitive style and openness to new ideas are of greater importance to environmentally oriented behaviour than the conscientiousness and task oriented traits which are required for production oriented behaviour.

The following chapter moves from production and environmentally oriented behaviours and investigates definitions and models of risk and off-farm behaviour.

CHAPTER 12

MODELLING RISK AND RISK REDUCING MEASURES

12:0 Introduction

This chapter attempts to address some of the problems raised in the literature reviewed in Chapter 3. That is, the problems associated with the differing definitions of risk and the controversy over the importance of off-farm work. These issues are addressed through transactional modelling and the use of the factors derived from the Edinburgh Farming Scales. In this chapter as in the previous two chapters the models are partially derived from the data, and partially from the literature and intuitive assumptions. Modelling was the primary vehicle of investigation of the hypothesis and the validity rested on the statistical fit of the model and interpretation of the correlation and multiple regression patterns found among the multiple variables used in the survey. The models are used to challenge or and verify some assumptions in the literature about financial risk.

12:1 Modelling financial risk taking

Psychological theories of risk are closely akin to the economic models of risk but there is increasing awareness that these theoretical models do not, in general, provide an accurate picture of an individual's choice or decision (Machin, 1987; Lopes, 1983; Frisch & Clemen, 1994; Hastie, 1991). Empirically made decisions often violate the assumptions of the utility model and have led to the development of alternative models (such as those proposed by Kahneman & Tversky, 1979; Tversky & Kahneman, 1992; Machina, 1982;

Lopes, 1987). Simon (1957) argued that the merging of learning and game theory permitted the 'rational' individual to maximise something other than profit. In this situation the rational actor is not required to believe that the payoffs would be the same for every outcome, as in 'game' theory, but that each goal would have different aims and payoffs.

The importance of knowledge in perceived 'risky' situations has been identified by many as an important component of risk taking (for example, Simon, 1957; Roger, 1983). Risk taking itself is viewed as largely due to individual differences (Sorrentino et al., 1992) and to changes in the risk takers fortunes such as, risk taking when there is a threat to survival and risk taking when there is 'slack' in the business (March & Shapiro, 1992). Lopes, (1987) in describing a two factor theory of risk, argues that risk averse individuals are motivated by a desire for security whereas risk seekers desire opportunity. If this is the case we might expect the achieving attitudes factor identified in the survey to be involved in risk taking.

In this modelling exercise, financial risk taking is examined using information gathering and individual differences as well as goals leading to profit maximising and the incurrence of debt. As in previous modelling chapters the transactional model will be used to assess the individual/environmental interaction on behaviour. In farming, profit maximising is not always something a farmer can control as markets and prices can fluctuate markedly over a twelve month period. In the first model therefore, production maximising behaviour as described by the business oriented behaviour factor will be used as an outcome measure. This incorporates an assumption of profit maximisation but it is not the only consideration of this business oriented behaviour factor.

The risk taking attitude factor is introduced into the attitude/goal/behaviour model discussed in the previous chapter (Chapter 11). In this model it was hypothesised that risk would moderate the open attitude, which in turn would influence behaviour.

Table 12:1 Correlation between business behaviour risk and other attitudes and objectives derived from the Edinburgh Farming Scales

	Business behaviour	Achieving attitude	Open attitude	Financial risk attitude	Business goals
Business behaviour	1				
Achieving attitude	**.20****	1			
Open attitude	**.43****	**.25****	1		
Financial risk attitude	**.14***	.07	.11	1	
Business goals	**.18****	**.17****	.01	.07	1

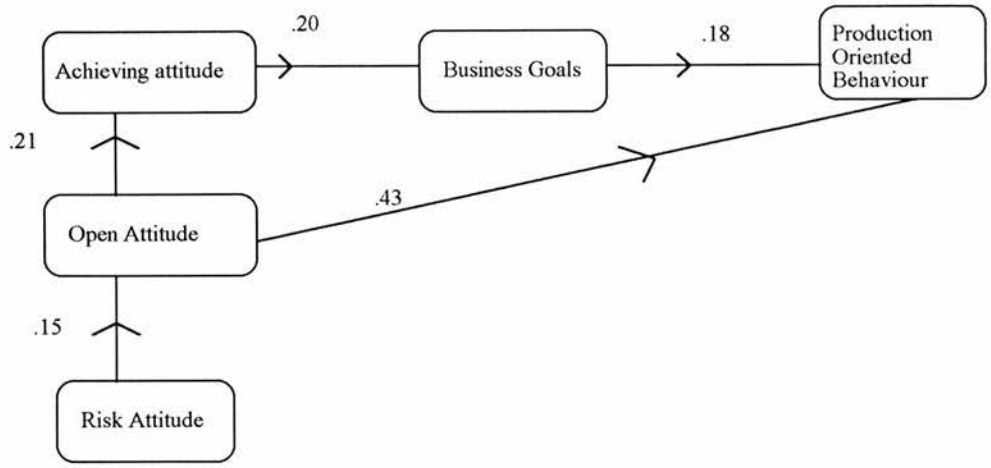
*p<.05; **p<.01

Step-wise multiple regression using business goals factors as the dependent variable with the above attitude and objectives variables indicated that the open attitude and having business objectives accounted for approximately 22% of the shared variance with business oriented behaviour (Table 12:1a)

Table 12:1a Multiple step-wise regression of attitudes and business objectives factors against business behaviour factor

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Open attitude	-.5371	.0730	18.77	54.06	.00
Business objectives	-.1734	.0556	22.03	32.91	.00

Model 12:1 Risk and other attitudes as predictors of production oriented behaviour



N = 236 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 6.61; df 5; p = 0.25
Normed Fit Index =0.93
Non Normed Fit Index =0.96
Comparative Fit Index =0.98
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis was rejected and a well fitting model obtained.

The model indicates that the risk taking attitude factor is mediated by the openness attitude factor, but does not directly predict business oriented behaviour. The behaviour is directly influenced by an open attitude and through having business goals. This model explains 22% of the shared variance between the attitudes, goal and behaviour.

Another outcome predictor often used in assessing the productivity of the farm is the gross farm margin per hectare. Although a risk taking attitude was not directly correlated with a large gfm/Ha in this sample, it was possible to postulate a pathway through which risk might influence the gfm/Ha.

Information is known to be an important determinant of risk taking behaviour (Simon, 1957) and a personality which is open to new ideas is hypothesised to influence information gathering. This model therefore, postulates that a personality which is open to new ideas and a risk taking attitude will be mediated by information gathering which will in turn affect the gfm/Ha (Model 12:2).

Table 12:2 Correlation between attitudes, information, personality and gfm/acre

	gfm/Ha	Financial risk attitude	Openness
gfm/Ha	1		
Financial risk attitude	.06	1	
Openness	.13	**.14***	1
Information	**.30****	.12	**.15***

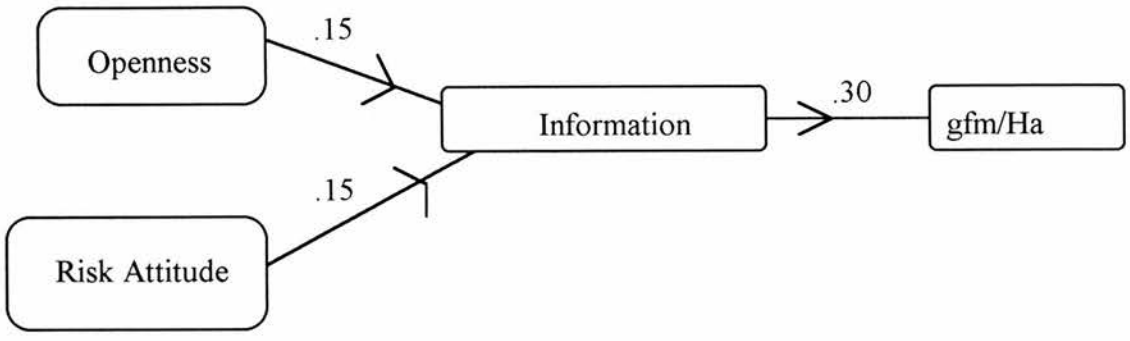
*p<.05; **p<.01

Step-wise multiple regression using gfm/Ha as the dependent variable indicated that information alone, accounted for 7% of the shared variance with gfm/Ha (Table 12:2a).

Table 12:2a Step-wise multiple regression of personality, attitudes and in formation gathering on gfm\Ha

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Information gathering	2.2901	.5789	.0709	15.654	.00

Model 12:2 Hypothesised pathway of the influence of a risk taking attitude on gross farm margin per acre (gfm/Ha)



N = 206 Average Standardised Residuals = 0.03
Average off-diagonal Absolute Standardised Residuals = 0.04
Chi-square = 4.5; df 3; p = 0.21
Normed Fit Index =0.87
Non Normed Fit Index =0.89
Comparative Fit Index =0.95
The Wald and Lagrange test did not suggest any modification to the model.

This model fits adequately, confirming the perspective that when a risk taking attitude is attended by an open personality and mediated by information gathering the gfm/Ha will be higher. This will however, only apply to the successful risk taker. This model explains 9% of the shared variance between information and gfm/Ha.

This raises the question; do those who are already in debt have the same characteristics? Do they also strive to attain a higher gfm/Ha? The next model hypothesised is that personality traits and attitudes will influence debt levels. In this model the correlations with personality traits and coping responses, neuroticism and agreeableness are modelled in relationship to a risk taking attitude with an outcome measure of debt. These personality traits are chosen because increased debt levels are associated with stress, which in turn is known

to be influenced by the negative personality of neuroticism, and the use of poor coping techniques (Deary et al., 1996). Some studies have indicated that a good manager is often low in the personality trait of agreeableness, hence its inclusion in this model (Tett et al., 1991). Debt was measured by the Q26 item 'Could you reduce the farm business debt whilst still retaining the farm business?' (scored from 1= not at all to 6= no debt).

Table 12:3 Correlation between personality traits and risk attitude

	Neuroticism	Agreeableness	Risk attitude	Avoidance coping
Neuroticism	1			
Agreeableness	**-.17****	1		
Risk attitude	**.14***	.08	1	,.
Avoidance coping	**.19****	.02	**-.14***	1
Debt	-.12	.02	.05	-.10

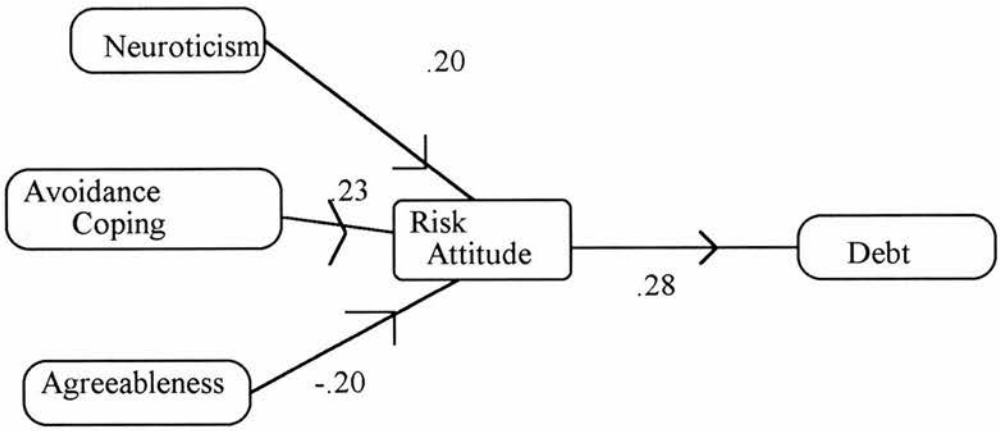
*p<.05; **p<.01

Step-wise multiple regression with debt level as the dependent variable indicated that financial risk taking attitude accounted for 7.6% of the shared variance between risk attitude and debt.

Table 12:3a Step-wise multiple regression of personality and attitudes on debt level

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Risk taking attitude	.09714	.0222	.0760	19.18	.00

Model 12:3 The role of personality and risk attitude on debt level



N = 234 Average Standardised Residuals = 0.03
Average off-diagonal Absolute Standardised Residuals = 0.04
Chi-square = 6.2; df 6; p = 0.4
Normed Fit Index =0.89
Non Normed Fit Index =0.99
Comparative Fit Index =1.00
The Wald and Lagrange test did not suggest any modification to the model.

This well fitting model suggests a risk taking attitude when accompanied by a negative personality may, in a percentage of individuals, lead to a failure to cope with financial pressure. This model explains 8% of the shared variance between risk attitude and debt. However, it is possible that these individuals still maximise their profit or perceive they are running the business to maximise profit, as the debt may be only recently incurred, or temporary. Therefore, a model of running the business to maximise profit as an outcome variable was hypothesised, with increased debt in the past five years as a mediating variable. This item asked if the debt level had increased or decreased over the past five years.

Table 12:4 Correlation Table of risk attitude and profit and production maximisation

	Avoidance coping	Risk attitude	Debt	Q2	.Q26
Avoidance coping	1				
Risk attitude	**-.20****	1			
Debt	-.10	**.28****	1		
Q2*	-.08	.01	-.01	1	
Q26*	.05	**-.17****	-.06	.05	1
Distraction coping	**.91****	**-.16****	-.08	**-.14***	-.02

*p<.05; **p<.01

*Q2 Has your income changed over past 5 yrs? (1 = Increased-5 = decreased)

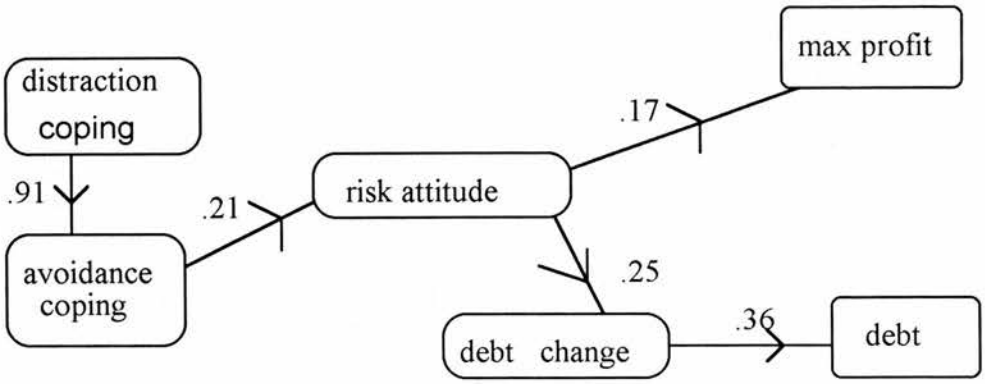
*Q26 Do you run the business to maximise profit above all else? (1 = completely-5 = not at all)

Step-wise multiple regression with the self reported behaviour of running the business to maximise profit as the dependent variable indicated that financial risk taking attitude, accounted for only approximately 3% of the variance.

Table 12:4a Step-wise multiple regression of business behaviour and attitudes

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Risk taking attitude	-.0445	.0168	.0288	6.97	.01

Model 12:4 Risk attitude and maximising profit



N = 237 Average Standardised Residuals = 0.03
Average off-diagonal Absolute Standardised Residuals = 0.04
Chi-square = 22.8; df 10; p = 0.01
Normed Fit Index =0.95
Non Normed Fit Index =0.96
Comparative Fit Index =0.97
The Wald and Lagrange test did not suggest any modification to the model.

This well fitting model confirms that debt change is a contributing factor in the debt outcome, but the individual may perceive themselves running the business to maximise profit. The model suggests that avoidance coping is mediated by risk attitude which, in turn, leads to changes in debt level and also maximising of profit.

This model does not contradict the previous model where a negative personality was observed to influence a risk taking attitude resulting in increased debt, it merely suggests an explanation for the debt, that is, farmers may perceive themselves incurring the debt to increase the profit.

12:2 Discussion of risk models

In the first model an open attitude was partly influenced by a financial risk taking attitude, but risk taking itself did not directly affect farming goals and behaviour. The implication that risk takers might be achievement motivated was not upheld in this study, rather the emphasis lies on the influence of risk taking attitude on information and openness to new farming ideas. As in other farming studies risk aversion as opposed to a risk taking attitude was apparent in this sample.

The importance of information as a mediator of a risk taking attitude is further confirmed in Model 12.2 where the emphasis is on its role as a predictor of greater gfm. This confirms the influence of cognitive influences inherent in risk taking. Models 12:3 and 12:4 indicate that those with negative perceptions and a negative coping style are likely to have increased debt thus partly confirming the role of emotion in risk taking as suggested by Brehmer (1987).

In conclusion it can be asserted that these models indicate the importance of the psychological aspects of risk in farming behaviour as well as the importance of information. The cost-benefits of such behaviour can be seen in the outcomes of either profit maximising or increased debt to the farmer depending upon the use of cognitive senses or emotional facets of personality.

12.3 Models of off-farm work

Part-time farming is a relatively stable and permanent feature of Western farming. It has been defined as one or more of the farm family members

gainfully employed in off-farm work for more than 30 days per year (Gasson, 1983).

Britain, Holland and Denmark have the lowest rates of off-farm work by operators possibly because of these countries having the most intensive agricultural systems in Europe (Commission of the EC, 1986). In Britain, Ireland and Germany most of the part-time farmers are semi or unskilled labourers, unlike France where most are blue collared workers (Commission of the EC, 1986).

In 1986 one third of part-time farmer's spouses had off-farm employment and more than 50% of these also worked on the farm. Unlike other Western countries in the three most intensive agricultural nations indicate part-time farming is not confined to the smaller farms: the larger farms also have a proportion of part-time operators (Commission of the EC, 1986).

Two theories for farmers taking off-farm work while retaining the farm are 1) that it is a transitory stage in the farmer's life time and is the result of younger farmers building up capital to enable them to buy larger farms (Cougheneur & Wimberly, 1983; Heffernann, 1981; Gasson, 1983). 2) It is farmers who have sufficient capital who can afford to take off-farm employment (CAP, 1986).

The first model hypothesised was that the survival of the farm was dependent upon the farmers and spouses off-farm work (dependent variable). Their objectives in taking off-farm work where related to improving the quality of life, status objectives in relation to retaining the farm and having off-farm goals along with their perception of the need for off-farm work. A latent variable

was originally thought to account for the perception of need for the off-farm work of the spouse and farmer. The perceptions of need were identified by Q7 and Q8 of the EFES scale. which inquired if the survival of the farm was dependent upon the farmers own, or partners, off-farm work.

Table 12:5. Correlation between goals and the need for off-farm work

	Q7	Q8	Off-farm objectives	Quality of life objectives	Status objectives	Own off-farm work
Q7♦	1					
Q8♦	**.23****	1				
Off-farm objectives	**.43****	**.16***	1			
Quality of life objectives	08	. 06	**.17****	1		
Status objectives	**.20****	.11	**.45****	**.25****	1	
Own off-farm work	**.27****	-.08	**.15***	**.13***	.06	1
Spouses off-farm work	.05	**.37****	.01	.03	.04	**-.24****

*p<.05; **p<.01

♦Q7 = Survival of business dependent upon own off-farm work.

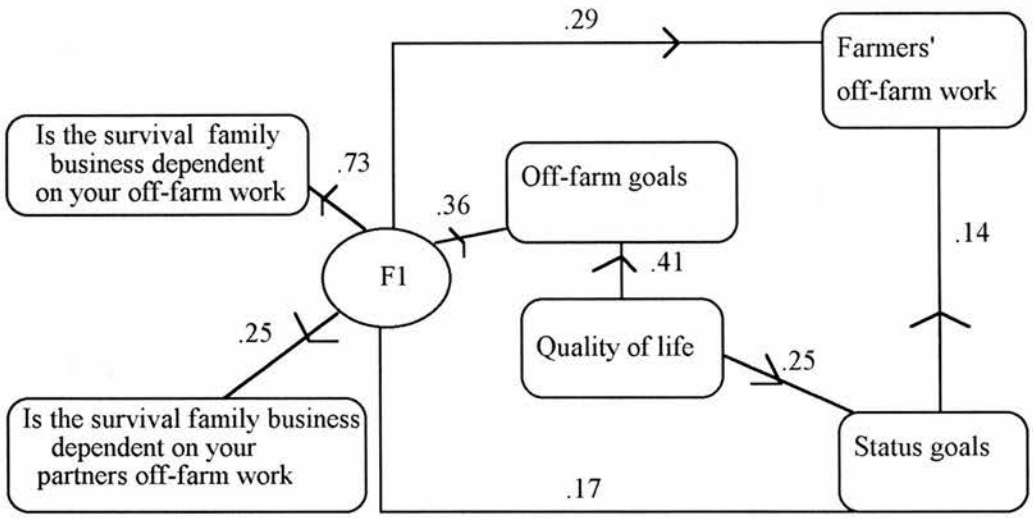
♦Q8 = Survival of business dependent upon other family members off-farm work.

Table 12:5a. Stepwise multiple regression with own off-farm work as the dependent variable.

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
q7	.2242	.0293	.1997	57-8.37	.00
Spouse's off-farm work	-.1842	.0282	.2623	41.43	.00

The question that the survival of the farm was dependent on their own off-farm work and that of their spouse were the two significant variables and accounted for 26% of the shared variance.

Model 12:5 perceptions of the need for off-farm work and Off-farm goals and work and quality of life and status objectives



N = 204 Average Standardised Residuals = 0.05
Average off-diagonal Absolute Standardised Residuals = 0.06
Chi-square = 15.2; df 6; p = 0.02
Normed Fit Index =0.90
Non Normed Fit Index =0.82
Comparative Fit Index =0.93
The Wald and Lagrange test did not suggest any modification to the model.

The perceptions of need were mediated by off-farm goals this also mediated the quality of life objectives and interestingly the off-farm work mediated the status objectives. This well fitting model explained 50% of the shared variance between behaviour, perceptions and goals.

However, need alone will not be sufficient if education is inadequate and the individual is not open-minded regarding the form of employment. The next model investigates the role of necessary qualities required for off-farm work.

Table 12.6 Relationship between attitudes, goals and education

	Education	Status objectives	Open attitude
Education	1		
Status objectives	.06	1	
Open attitude	**-.17****	.09	1
Own off-farm work	**-.13***	.06	**.25****

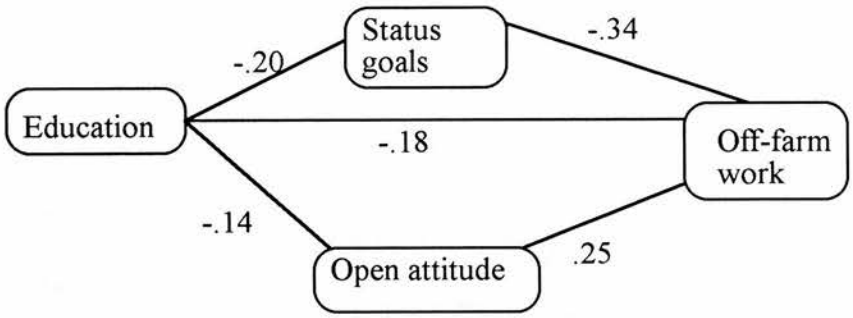
*p<.05; **p<.01

Table 12:6a Regression of education, open attitude and off-farm objectives against own off-farm work

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Open attitude	.0332	.0083	.0642	15.85	.00
Off-farm objectives	-.0447	.0147	.1005	12.86	.00

Neither status objectives or education were significant in this model, only an open attitude and off-farm objectives which explained 10% of the shared variance.

Model 12:6 The role of education and status in taking off-farm work



N = 227 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 2.7; df 1; p = 0.1
Normed Fit Index =0.96
Non Normed Fit Index =0.81
Comparative Fit Index =0.97
The Wald and Lagrange test did not suggest any modification to the model.

Although a well fitting model, this model had only 1 degree of freedom suggesting it was the most useful model that could be obtained. It explained 18% of the variance.

This model suggests unsurprisingly that lack of education and status negatively affects off-farm work, whereas an open minded personality contributes positively to off-farm work.

12.4 Discussion of off-farm work models

The first model of off-farm work indicated that having off-farm goals was necessary in the equation, however, in this case they did not appear to greatly influence off-farm employment. There are a number of possible reasons why

this was so. It is possible that farmers may have off-farm goals but insufficient opportunities to fulfil them, or as Fishbein & Ajzen has suggested, the 'intention' is not sufficiently embodied in the perception that they will take off-farm work. However, it is equally probable that quality of life and status goals require further defining in terms of what actually would improve the quality of their life. It is possible accepting having a lesser remuneration from the farm is to be preferred to becoming a paid employee. The second model (Model 12:6) is interesting in that lack of education influences status and openness to new ideas and it is the positive contribution that these make which determine whether off-farm work will be taken up. This model explains a greater amount of the variance than the first one.

12:5 Explaining the 'irrational' behaviour of increasing production following a fall in market prices

One behaviour often referred to in the literature is that farmers tend to increase production when the market value of the crop falls. This is not considered a 'rational' behaviour by economists, who observe that the crop becomes a glut and the prices drop even further. However, most of this sample of farmers reported they did not alter their behaviour, 7% reduced their production levels but the remaining 18% increased production. Although not rational by econometric standards it is the behaviour that the farmer is most familiar with and about which they have the greatest knowledge and policy is often viewed as geared towards production. It was also hypothesised that this would be most likely to occur when farmers are younger and less experienced and this is incorporated in the factor entitled 'emerging' farming behaviour which is closely related to production oriented behaviour and is correlated with being younger and less experienced in this sample of farmers. Most of these young

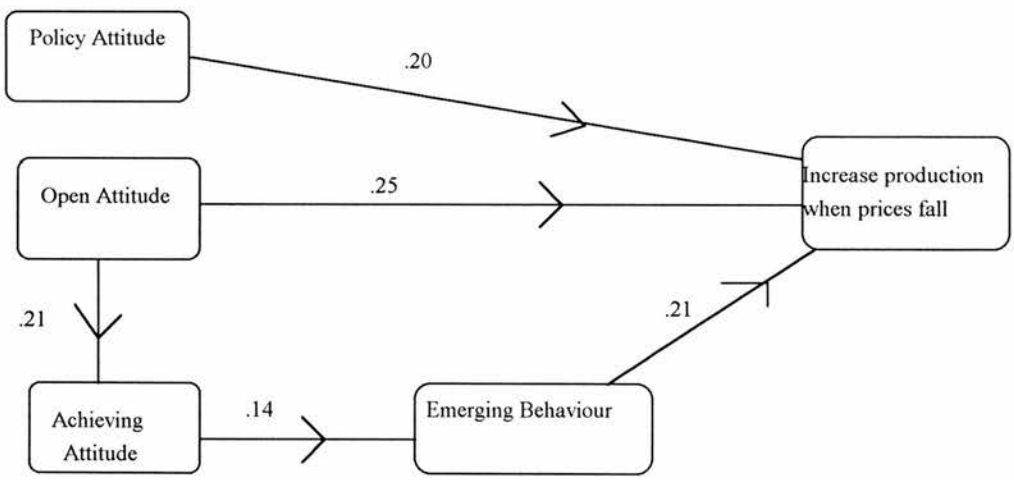
farmers' behaviour was geared towards achieving and producing. The correlation between the attitudes and behaviours are shown in Table 12:7.

Table 12:7 Correlation between attitudes, behaviour and increasing production when market prices fall

	Achieving attitude	Open attitude	Policy attitude	Emerging Behaviour
Achieving attitude	1			
Open attitude	**.25****	1		
Policy Attitude	**.22****	.11	1	
Emerging behaviour	.01	.01	.09	1
Increase production	.11	**.26****	**.22****	**.23****

*p<.05; **p<.01

Model 12:7 Model of increased production when market prices fall



N = 234 Average Standardised Residuals = 0.03
Average off-diagonal Absolute Standardised Residuals = 0.05
Chi-square = 8.72; df 5; p = 0.12
Normed Fit Index =0.92
Non Normed Fit Index =0.92
Comparative Fit Index =0.96
The Wald and Lagrange test did not suggest any modification to the model.

The model indicates that emerging farming behaviour is a mediating factor in this behaviour but the open attitude also directly influences this behaviour. It must be assumed that this is through the role of information and knowledge relating to production and not to the market in this instance.

The following chapter discusses some of the queries relating to the influence of personality variables on aspects of farming behaviour and models some of the results.

Chapter 13

Modelling the influence of psychological variables on farming behaviour

13:0 Introduction

This chapter examines in greater detail some of the specific contribution made by psychological variables to farming behaviour. The three scales relating to the innovative measure of personality are examined. Models of farming stress in relation to psychological and debt variables are considered. Finally, the role of conscientiousness in relation to farming objectives is examined.

13:1 Models of innovative behaviour

Risk and innovation go hand in hand. However, like risk, the term innovation has multiple meanings in farming research, it can be applied to the creative individual, to a group process which is creative in the sense they are willing to adopt technological advances and other new ideas, methodologies etc., or simply to the rate with which the technology diffuses throughout a region or country (Rogers, 1995; Brown, 1981). As the interests of this study lie within the contribution of individual differences to the successful running of the farm, the definition which describes the innovative individual as having a cognitive style which 'thinks differently' was used (Kirton 1979). The difference in cognitive style is thought to lie within an normal distribution curve of improving on a situation by using

what is already at hand, to generating many original ideas which may having nothing to do with the current set-up at the other end of the continuum. Normally only the summed score on this scale is used to predict innovative behaviour; the reason for this is that the scale is usually thought of as unidimensional. However, the scale does consist of three factors (Bagozzi & Foxhall, 1993; Kirton, 1987). These factors are thought to be measures of originality (a tendency to proliferate ideas), efficiency (the level of interest in being methodologically efficient) and rule conformity (the extent to which the individual is willing to conform to the group or society norms). This study confirmed three factors in the survey sample (Appendix F). These three factors are of individual interest in this study and are used to assess the role of innovation in farming behaviour.

It has been observed in the earlier chapters that the KAI score on innovativeness correlated with environmentally-oriented farming behaviour, however, it has also been observed that reducing chemicals used on the farm is not only an environmentally friendly act, it may also be construed as saving money either directly or through a reduction in the possible risk of pollution (Blunden & Curry, 1985). In this study there is a further consideration, most LFA farms are large and do not require the same input of chemicals as does the arable farm. Thus, the correlation with an innovative style could arise from either efficiency or originality. It is of interest therefore to investigate the sub-scales of the KAI in relation to farming behaviour as well as the determining personality traits which influence it or are influenced by the concept of creativity.

Kirton (1987) argues that although the scales are correlated there is sufficient lack of correlation that they may be considered distinct scales in their own right.

Table 13:1 Correlation of total KAI score to sub-scale scores

	KAI Total (style)	SO (originality)	R (conformity)
KAI total (style)	1.00		
SO (originality)	**.65****	1.00	
R (conformity)	**.82****	**.22****	1.00
E (efficiency)	**.50****	-.10	**.41****

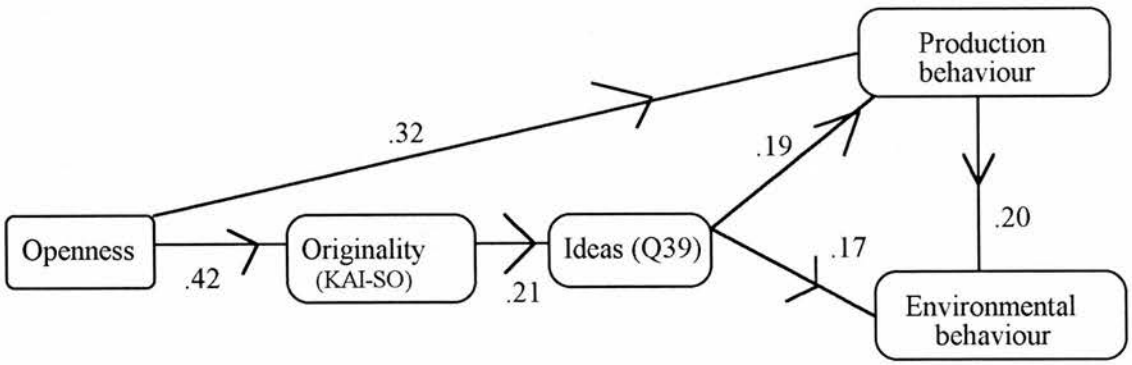
If the relationship between farmers attitudes (EFAS), objectives (EFOS), and behaviour (EFIS), and the psychological variables are examined (Table 13:2), it is observed that the environmentally oriented behaviour correlates with originality and 'rule-bounded' sub-scales of the KAI, suggesting the possibility of a significant pathway between environmental behaviour and original thinking. This led to a series of models exploring the association of the sub-scales with farming behaviour.

Table 13:2 Correlation between sub-scales and other personality traits and farming measures

	Agreeableness	Conscientiousness	Extraversion	Neuroticism	Openness	Task coping	Nart	Raven	Ideas	EFAS1	EFIS1	EFIS2	EFOS1	EFOS2
Style (KAI total score)	**-.24****	-.07	**.24****	**-.16***	**.30****	**.22****	**.14***	**.16****	**.31****	**.14***	.10	**.25****	**18****	..05
Originality (SO)	**-.25****	**.27****	**.38****	**-.31****	**.16***	**.46****	.03	.13	**.20****	**-.11**	**.29****	**.18****	.04	-.02
Efficiency (E)	.07	**-.45****	.08	.13	**.27****	**-.17****	.09	.09	**.24****	**.24***	**.13***	.09	.15*	.08
Conformity (R)	**-.22****	-.06	.06	-.06	**.22****	.07	**.15***	.11	**.21****	**.22****	.00	**.17***	**.19****	.07

If environmentally oriented behaviour could be termed innovative then by modelling the KAI sub-scale of originality along with environmental behaviour it may be possible to indicate a pathway between the two. In previous farming studies one of the important items investigated in relation to innovation is the early adoption of innovative or new ideas. The item, 'Do other farmers pick up ideas from you?' (1=little - 5= a lot) (Q39 of the implementation scale) was used to represent this idea. This item was correlated with all the sub-scales of the KAI inventory and was therefore deemed relevant to the model. However, it was not possible to hypothesise and obtain a well-fitting model of environmental behaviour alone. Inspection of the correlations in Table 13:2 indicated one of the reasons for this may be the fact that although the total KAI score was correlated with environmental behaviour the sub-scale SO (proliferation of ideas) had an even stronger correlation with business oriented behaviour ($r = .25$) than environmental behaviour ($r = .18$). As has been argued previously production-oriented behaviour and the environmental behaviour do not occur in isolation rather they occur in conjunction with one another, therefore, it is necessary to include production oriented behaviour in the model.

Model 13:1 Modelling innovative measures and farming behaviour



N = 232 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 7.1; df 4; p = 0.13
Normed Fit Index =0.94
Non Normed Fit Index =0.93
Comparative Fit Index =0.97
The Wald and Lagrange test did not suggest any modification to the model.

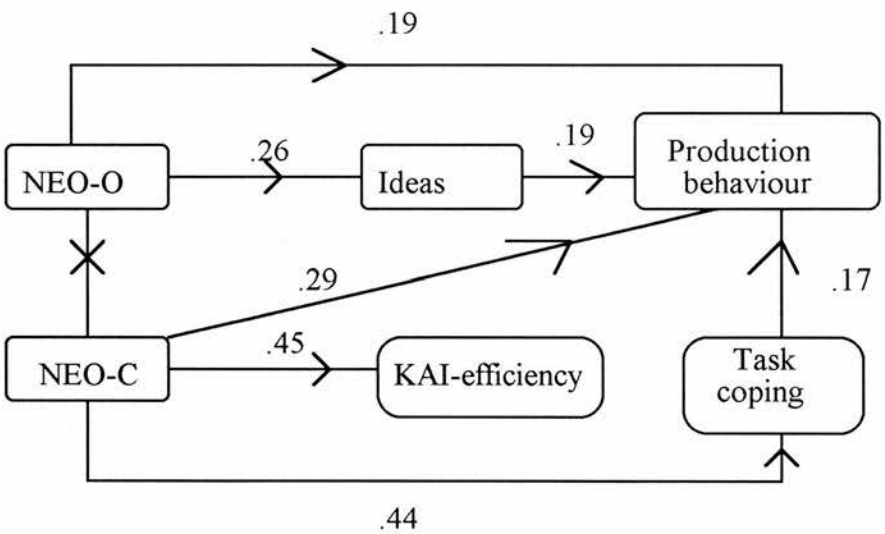
This model indicates that original thinking as measured by the KAI mediates a personality which is open to new ideas and in turn is mediated by the perception of being first to introduce new ideas, which in turn affects both environmental and business oriented behaviour. The model explains 19% of the shared variance of ideas with production oriented behaviour but only 4% of the shared variance of ideas with environmentally oriented behaviour.

It is possible that there is greater scope to be original in business oriented farming than in environmentally oriented farming, but this conclusion would have to be tempered by the knowledge that few farmers in this sample were

environmentally oriented. It is possible that 'original thought' measure requires an incentive more in keeping with the 'rule-boundedness' of the KAI sub-scale with which it is correlated (r = .22).

On the other hand the 'efficiency' sub-scale should be related to conscientiousness. Perhaps this will permit a clearer picture of farming innovativeness. However, a well-fitting model of behaviour incorporating the efficiency sub-scale was more difficult to achieve.

Model 13:2 Incorporating KAI efficiency sub-scale in the model of behaviour

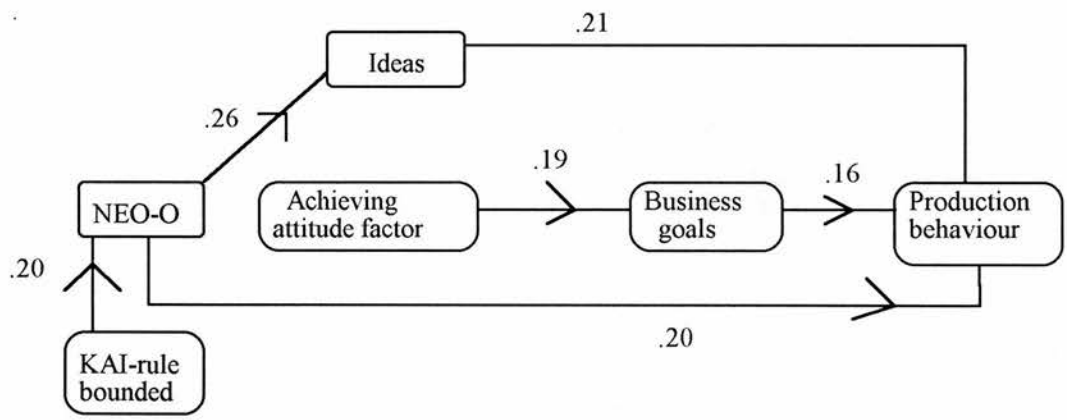


N = 232 Average Standardised Residuals = 0.04
Average off-diagonal Absolute Standardised Residuals = 0.06
Chi-square = 30.7; df 7; p = 0.01
Normed Fit Index =0.86
Non Normed Fit Index =0.75
Comparative Fit Index =0.88
The Wald and Lagrange test did not suggest any modification to the model.

This model is a satisfactory fit, rather than a good fit for the data but reinforces the role of conscientiousness in production oriented behaviour as it mediates the personality trait of conscientiousness but has no direct influence on behaviour.

The final sub-scale of the KAI inventory is that of rule-boundedness. This sub-scale is strongly correlated with the total KAI score (r = .82). Intuitively, 'rule-boundedness' is more likely to be expressed in production behaviour, adherence to policy and legislation considerations. However, there was a lack of correlation with other variables in the study and a well fitting model incorporating 'rule-boundedness' was difficult to achieve.

Model 13:3 Role of 'rule-boundedness' in farming behaviour



N= 232 Average Standardised Residuals = 0.04
Average off-diagonal Absolute Standardised Residuals = 0.05
Chi-square = 22.44; df 7; p = 0.09
Normed Fit Index =0.87
Non Normed Fit Index =0.86
Comparative Fit Index =0.93
The Wald and Lagrange test did not suggest any modification to the model.

This model (13.3), interestingly, suggests that a personality open to new ideas is mediating 'rule-boundedness' reinforcing the idea that statutory rather than voluntary policies may be more likely to produce innovative farming ideas in that area. Once again the importance of personality traits as antecedents is observed, with openness and ideas alone contributing about 8% of the shared variance with behaviour.

The use of the KAI sub-scales in the modelling does not confirm the role of original thinking in environmentally-oriented farming behaviour. Rather, it indicates the importance of high scoring on both farming behaviours is dependent more upon the personality variables of openness to new ideas rather than on original thought, although this was a mediator in both behaviours. This encouraged an investigation of the relationship between innovativeness and personality traits.

Table 13:3 Correlation between personality traits and innovativeness

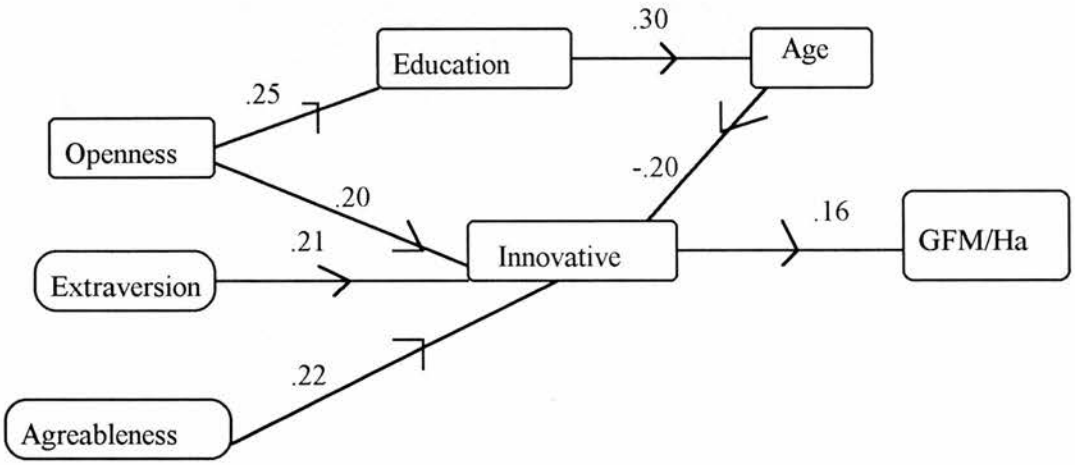
	Agreeableness	**Extraversion**	**Openness**	**Education**	**Innovative**	**Age**
Agreeablenes s	1					
Extraversion	.08	1				
Openness	-.10	.12	1			
Education	-.08	-.02	**.25****	1		
Innovative	**-.24****	**.24****	**.30****	**.18****	1	
Age	.06	-.07	-.09	**-.32****	**-.24****	1
gfm/Ha	-.06	**.16***	.13	.08	**.16***	.03

*p<.05; **p<.01

The next model hypothesis (Model 13.4) uses Rogers (1983) assumptions that younger better educated, information gatherers extravert individuals

will be more likely to innovate, here a personality which is open new ideas is also included.

Model 13:4 Model of links between personality, innovativeness and profitability

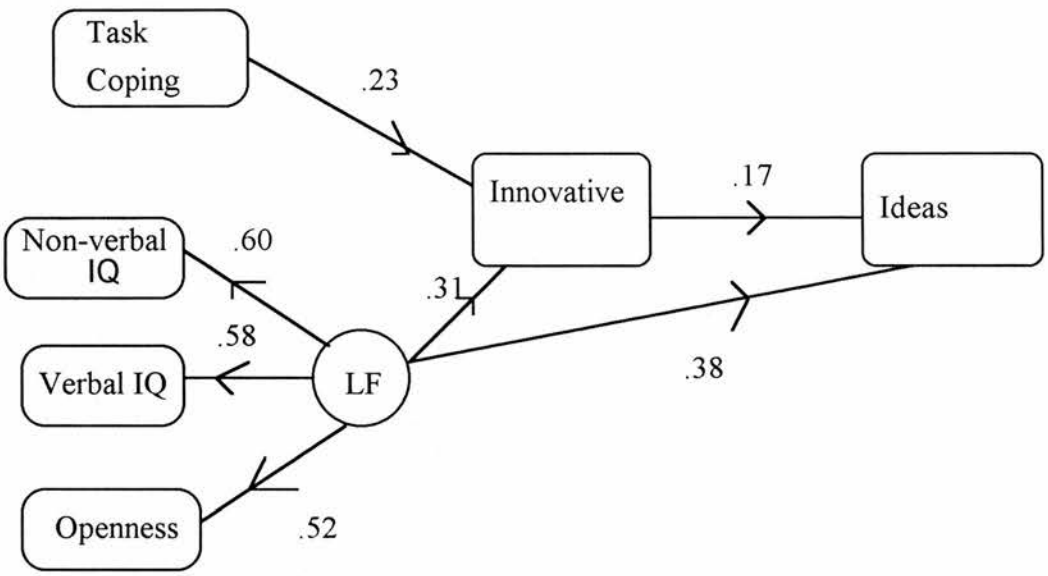


N = 201 Average Standardised Residuals = 0.04
Average off-diagonal Absolute Standardised Residuals = 0.06
Chi-square = 20.8; df 14; p = 0.11
Normed Fit Index =0.80
Non Normed Fit Index =0.89
Comparative Fit Index =0.92
The Wald and Lagrange test did not suggest any modification to the model.

This model indicates that an innovative style mediates the contribution of the personality characteristics of openness to new ideas, agreeableness, and extraversion to farm profitability. Age and education are seen as mediating variables of innovative style, with younger better educated individuals being more innovative, as noted by Rogers (1983). Thus innovativeness in terms of cognitive style does increase gross farm margin per acre.

One of the items in the business questionnaire asked if the farmer thought he was the first in his area to use new ideas; around 10% reported this was so. New ideas suggest innovation, therefore a model relating innovative style was postulated (Model 13:5).

Model 13:5 Model of relationship of intelligence and innovativeness and being the first to use new ideas.



N = 210 Average Standardised Residuals = 0.03
Average off-diagonal Absolute Standardised Residuals = 0.05
Chi-square = 12.40; df 7; p = 0.09
Normed Fit Index =0.91
Non Normed Fit Index =0.90
Comparative Fit Index =0.95
The Wald and Lagrange test did not suggest any modification to the model.

The model indicates an underlying variable is required to account for an intelligence related factor (LF). This factor directly influences an innovative style and whether the individual is the first to use new ideas.

There is also a pathway from intelligence to new ideas through innovative style. The model explains approximately 16% of the shared variance between intelligence, innovation and behaviour.

Another measure of innovative behaviour would be the adoption of new method or new idea in farming. For example, in this case the few individuals who used computers in running the business may be considered innovators. There are a number of farm oriented computer programmes available using expert systems, but few farmers use these methods. In this sample only 66 of the 254 farmers in the sample had a computer, of these 35% had specialist programmes and 48% used a financial package, 21% used it for farm accounts and 21% for stock management. A more detailed measure of innovative behaviour might be thought to be one related to computer use. However, there was no direct relationship with an innovative personality and computer use and attempts to model these variables were unsuccessful. A correlation table of the variables related to computer ownership is shown in Table 13:4

Table 13:4 Correlation table of variables related to computer ownership

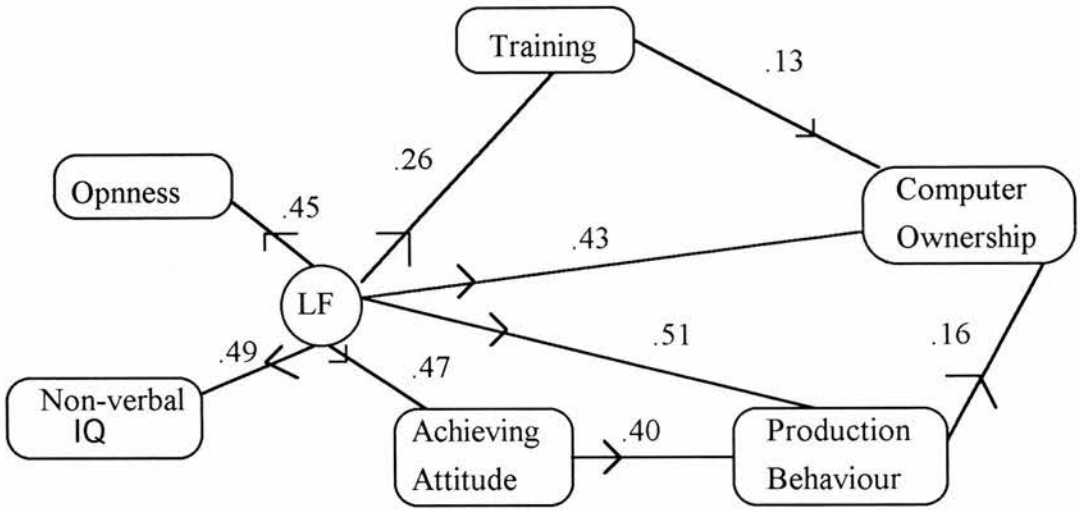
	Achieve attitude & Computer		**Production behaviour & Computer**		**Innovativeness & Computer**		**Verbal IQ Computer**
	yes	no	yes	no	yes	no	yes
Achieve attitude	1	1					
Production behaviour	-.05	**-.31****	1	1			
Innovative	.22	.09	.18	.04	1	1	
Verbal IQ	.07	.10	.14	.03	.06	**.18***	1
Open	.09	**.11***	**.27***	.10	**.44****	**.20****	**.43****
Non-verbal IQ	**.33***	**.20***	.11	.08	.17	**.16***	**.47****
Training	-.03	.09	-.03	**.21****	.06	-.08	.22

*p<.05;**p<.01

Because computer ownership is a dichotomous variable there is a problem fitting it to ordinary multiple regression techniques because negative values or values greater than one can be obtained, thus violating the basic probability theory. The solution is to use logistic regression procedures, this method assumes a logistic shape to the cumulative distribution curve (Hair, 1995). Logistic regression of variables chosen from the correlation table which loaded with computer ownership were used in the structural equation modelling programme (which allows for the specification of categorical variables).

The initial model hypothesised was that intelligence, openness to new ideas, an achieving attitude and innovativeness would be antecedent to computer ownership and that production oriented behaviour and training would be mediating variables. Training was chosen as a variable simply because most specialised programmes could not be used without prior training. However, this model although quite a good fit, indicated that all the variables were directly influenced by the latent intelligence function. The innovativeness variable mediated intelligence but did not directly predict computer ownership or consequent behaviour. This was dropped from the model. The resulting model is shown below (Model 13:6).

Model 13:6 The influence of psychological variables on computer ownership.



N = 190 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 7.1; df 5; p = 0.21
Normed Fit Index =0.93
Non Normed Fit Index =0.93
Comparative Fit Index =0.98
The Wald and Lagrange test did not suggest any modification to the model.

This model indicated that an underlying variable accounting for intelligence and openness to new ideas was an important antecedent variable in this model. This latent variable directly influences production oriented behaviour and computer ownership. There are two other pathways to computer ownership from intelligence, one mediated by training and one by an achieving attitude and production oriented behaviour. This model accounts for nearly 23% of the shared variance.

13:2 Discussion of innovative behaviour models

The measure of innovativeness used in this study was the Kirton/Adaption Inventory (KAI; Kirton, 1987). This measure of ability to think differently was correlated with environmentally oriented behaviour. However, when the sub-scales of this inventory were examined the 'originality' scale was even more highly correlated with production oriented behaviour than the overall scale. By modelling both farming behaviours it was found that the mediating variable through which the originality sub-scale operated on farming behaviour was through Q39 'Do other farmers pick up ideas from you?' The 'efficiency' sub-scale mediated the trait of conscientiousness while the 'rule-boundedness' sub-scale mediated the personality trait of openness to new ideas but neither sub-scale directly influenced behaviour.

From this it can be inferred that the role of original thinking is not confirmed in environmentally oriented farming behaviour. Rather, it indicates that high scoring on both behaviours is dependent more upon the personality trait of openness to new ideas, although 'innovation' as measured here is a mediator of the 'openness' trait. In this summary both the open personality and KAI measures have strong links with cognitive ability. It may be that both measures could be subsumed within a latent function of intelligence.

The KAI innovative measures were influenced by the personality traits of extraversion, openness, agreeableness and intelligence and mediate all of them.

In farming the operators who used computers are generally thought of as innovative. However, it was not 'innovativness' that best predicted

computer use and productive behaviour, it was the underlying function of intelligence.

In conclusion it should be noted that creativity or innovativeness, although a mediating variable, lacks predictive power for generalised farming behaviours.

13:3 Models of stressed farming behaviour

The literature reviewed in chapter 3 indicated that stress influenced an important aspects of farmer's behaviour. This study identified such a behaviour factor (EFIS3). This was closely correlated with a pessimistic attitude, although it should be borne in mind that the majority of farmers in this study were not distressed and had an optimistic attitude towards the future of farming. However, the majority of farmers interviewed reported some stress due to legislation and government policy (or the lack thereof). This study was conducted around the time the new IACS forms were introduced and this stress may have been short lived. However, other factors must have been involved as Jones (1994) reports farmers are twice as likely to commit suicide as the general population. This study investigates the precursors of farming stress and the impact of legislation on behaviour. The table below indicates the correlations of farming stress.

Models of Farming stress

It is widely recognised (chapter 4) that personality and coping factors are involved in stress behaviour and in the farming community, debt is considered to be one of the most influential variables (Ekstrom & Leistritz,

1986; Belyea & Laboa, 1990; Armstrong & Schulman, 1990; Rosenblatt & Keller, 1983; Walker & Walker, 1987). The table below shows the correlation between the stress measures and personality.

Table 13:5a Correlation of stressed behaviour, personality, attitude traits, and psychological distress measures.

	Neuroticism	Achieving attitude	Legislation attitude	Pessimistic attitude	Emotion coping	Distress	Stressed behaviour
Neuroticism	1						
Achieving attitude	.07	1					
Legislation attitude	**-.22****	**.13***	1				
Pessimistic attitude	**-.37****	**.21****	**.14***	1			
Emotion coping	**.68****	.00	**.23****	**.23****	1		
Distress	**.56****	.09	**.24****	**.26****	**.44****	1	
Stressed behaviour	**-.21****	**.18****	**.16***	**.21****	**.19****	**.31****	1
Debt	-.12	.05	.01	.12	-.11	.00	**.31****

*p<.05; **p<.01

Step-wise multiple regression using the stressed behaviour factor as the dependent variable indicated that psychological distress (GHQ), the achieving attitude, and the legislation attitude factors accounted for 22% of the variance.

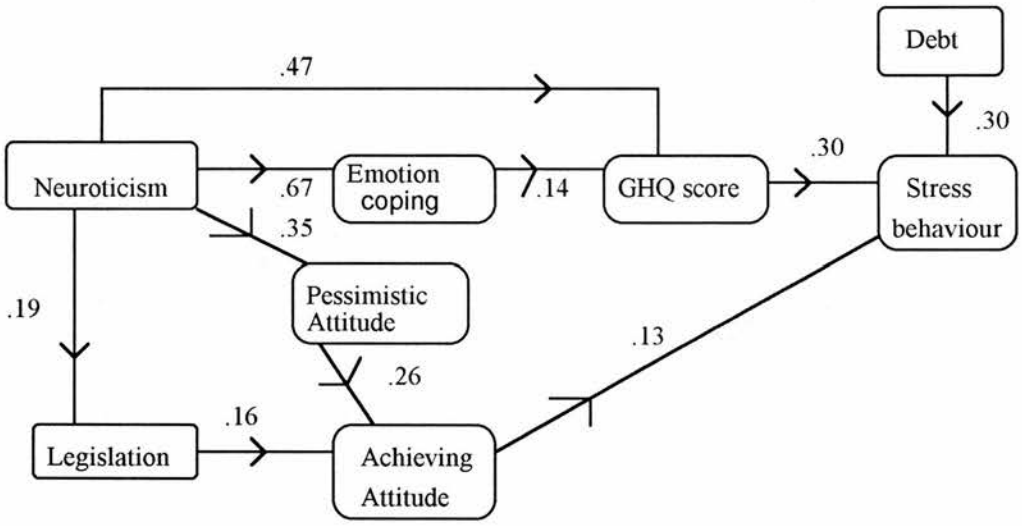
Table 13:5b Step-wise multiple regression of stressed behaviour with personality, attitudes, debt and psychological distress

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Debt	.7354	.1491	.0946	24.34	.00
GHQ	-.1346	.0259	.1891	27.06	.00
Achieving attitude	-.0592	.0270	.2057	19.93	.00
Pessimistic attitude	-.0684	.0272	.2206	16.28	.00

In the first model hypothesised (Model 13:7), the stressed behaviour factor derived from the EFIS scale is used as the dependent variable, while personality, psychological distress and debt are independent variables.

The correlations shown in Table 13:5 suggest that personality traits are the precursors of stress and they may be mediated by the individuals ability to cope with stress, their attitude towards the future and their perceptions of achieving good management techniques. This is a common finding in the stress literature (Deary et al., 1996).

Model 13:7 Suggested model of farming stress

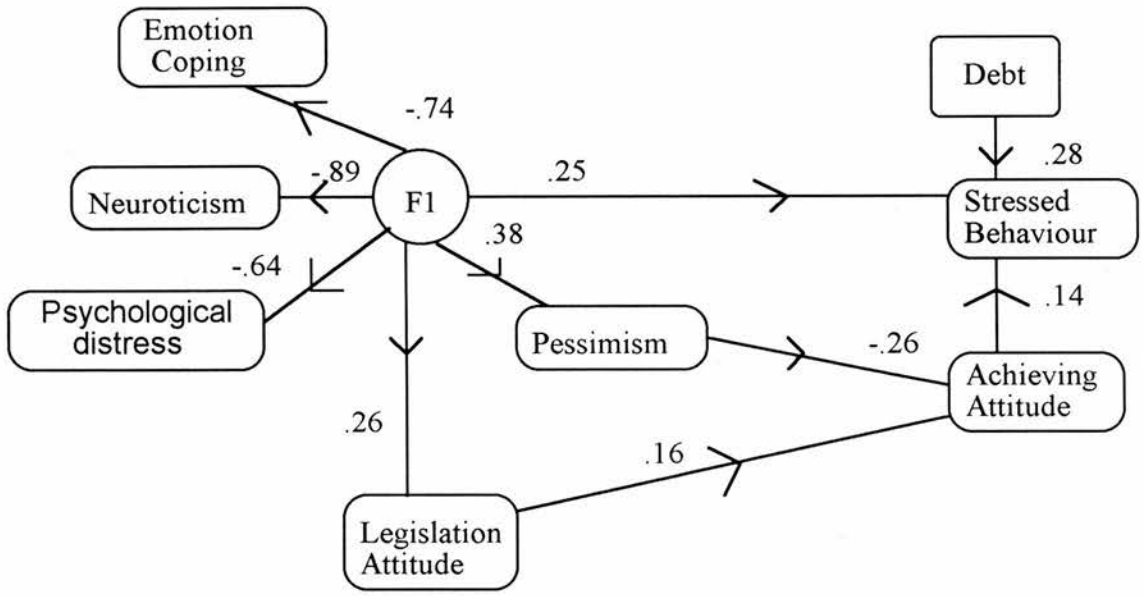


N = 233 Average Standardised Residuals = 0.04
Average off-diagonal Absolute Standardised Residuals = 0.05
Chi-square = 24; df 18; p = 0.15
Normed Fit Index =0.93
Non Normed Fit Index =0.97
Comparative Fit Index =0.98
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected and a well fitting model obtained.

This model suggests that a negative personality trait, is mediated by an negative attitude towards legislation and the future of farming, this is further mediated by a pessimistic attitude towards the future which in turn influences stressed behaviour. A negative personality is linked directly to psychological distress but it is also mediated by the form of coping used. If emotion focused coping is used this leads to psychological distress which in turn influences stressed behaviour. This model explains 20% of the shared variance between achieving attitude, psychological distress, debt and stressed behaviour.

The concentration of negative affect (i.e. NEO-N, GHQ, pessimism factor, emotion focused coping etc.) suggests that a latent variable underlying negative affect might be an appropriate descriptor. The following model (13:8) postulates such a variable.

Model **13:8 Modelling 'negative affect' and stressed farming behaviour**



N = 233 Average Standardised Residuals = 0.03
Average off-diagonal Absolute Standardised Residuals = 0.04
Chi-square = 33.5; df 17; p = 0.01
Normed Fit Index =0.91
Non Normed Fit Index =0.92
Comparative Fit Index =0.95
The Wald and Lagrange test did not suggest any modification to the model.
The null hypothesis is rejected and a well fitting model is obtained.

This model explains 16% of the stressed behaviour. The underlying latent variable has three pathways to behaviour, one direct and two which are mediated by negative attitudes towards legislation and a pessimistic outlook regarding the future of farming. Pessimism and legislation pathways are mediated by an achieving attitude. Self reported debt in this model proportionally accounts for more of the explained variance than the other variables.

Like model 13:7, this model is also a good model of farming stress. However the goodness of fit is not quite so good as obtained in the former model and it does not explain quite so much of the shared variance.

13:4 Discussion of models of stressed behaviour

Once again the important role of psychological variables in farming stress is confirmed. It is interesting to note the complex interplay of attitudes in the first model (13:7). The achieving attitude is influenced by a negative attitude towards farming and also by an negative attitude towards legislation which contribute to the stressed behaviour. However, it is the role of a high neuroticism score accompanied by emotion focused coping which contributes to psychological stress, contributing equally with high debt levels to the shared variance with stressed behaviour. When these negative aspects of an individual are accounted for as an underlying variable it is the individual contribution of personality traits and the effect of a pessimistic attitude which account for much of the model's variance.

13:5 Other models

The importance of personality traits in relation to job performance has been highlighted by large scale meta-analysis (Barrick & Mount, 1989; Tett et al., 1991). Conscientiousness and intelligence have been found to be the best predictor of job competency. This is attributed to two facets of conscientiousness, achievement and dependability, it is suggested that these two facets are related to having goals. Chapter 2 suggested that goals are

volitional acts of self motivated behaviour. It was further suggested that goals are part of the internal standards of an individual which are used to assess others. They have to be organised and pursued with some intensity if they are to be achieved. Barrick et al., (1993) argued individuals who are high on conscientiousness are 'plannful and organised' and they are also 'achievement oriented, persistent and hardworking' and have high expectations for themselves. These individuals would be expected to perform better and have different goals from less conscientious individuals (Hollenbeck & Brief, 1987; Hollenbeck et al., 1989). Thus by using the measure of a personality trait of conscientiousness we have covered two important aspects of behaviour, achievement motivation, and commitment. It was thought to be important to investigate this assumption and the following models explored the role of conscientiousness in farming behaviour.

13:3.1 Exploration of the role of conscientiousness on farming behaviour

The first hypothesis was that environmental goals will be pursued by conscientious individuals who have positive attitudes towards the reduction of chemicals.

Table 13:6 The effect of conscientiousness on environmental goals

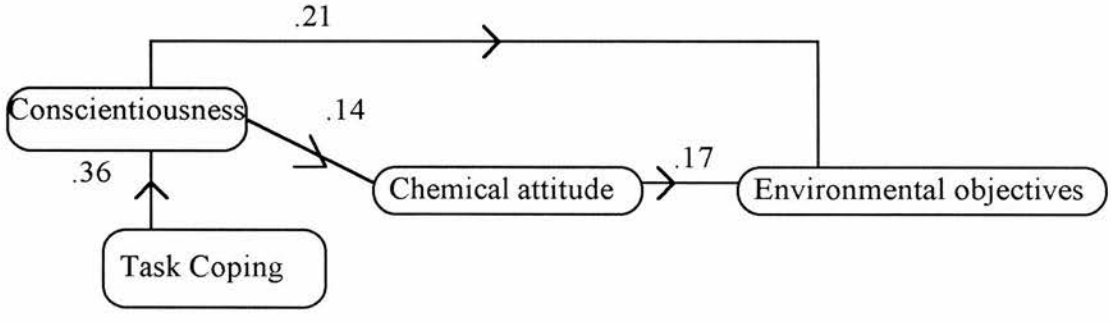
	Conscientiousness	**Task Coping**	**Chemical Attitude**
Conscientiousness	1		
Task Coping	**.36****	1	
Chemical Attitude	**.13***	.05	1
Environmental Goals	.04	**.15***	**.19****

*p<.05; **p<.01

Table 13:6a Step-wise regression of psychological and attitude variables on environmental behaviour

Model	Std.β coefficient	Std. error of β	R^2	F	Significance level
Environmental objectives	-.3627	.1033	.0505	12.33	.00
Chemical attitude	-.2593	.1052	.0748	9.34	.00

Model 13:9 The role of conscientiousness, and attitude on environmental goals



N = 234 Average Standardised Residuals = 0.01
Average off-diagonal Absolute Standardised Residuals = 0.02
Chi-square = 2.7; df 2; p = 0.30
Normed Fit Index =0.95
Non Normed Fit Index =0.99
Comparative Fit Index =0.99
The Wald and Lagrange test did not suggest any modification to the model.

This well fitting model suggests that a conscientious personality directly influences environmental goal setting and is mediated by attitudes towards chemical use. This attitude directly predicts 6% of the shared variance with behaviour.

Confirmation of the importance of this influence on behaviour was sought through investigating production oriented behaviour. In the second model conscientiousness and task coping are represented by a latent variable to account for the underlying agreement between these variables.

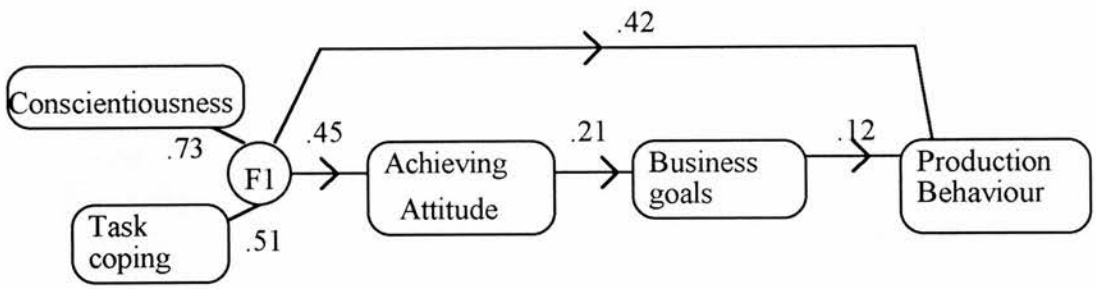
Table 13:7 Correlation patterns of conscientiousness and production goals

	Conscientiousness	**Task coping**	**Achieving attitude**	**Business objectives**
Conscientiousness	1			
Task coping	**.36****	1		
Achieving attitude	**.32****	**.19****	1	
Business objectives	**.20****	.06	**.17****	1
Production behaviour	**.30****	**.26****	**.20****	**.18****

*p<.05; **p<.01

As a latent variable was postulated it was not possible to use regression analysis.

Model 13:10 Conscientiousness, attitudes and goals influence on production oriented behaviour



N = 234 Average Standardised Residuals = 0.02
Average off-diagonal Absolute Standardised Residuals = 0.03
Chi-square = 6.1; df 3; p = 0.10
Normed Fit Index =0.95
Non Normed Fit Index =0.90
Comparative Fit Index =0.97
The Wald and Lagrange test did not suggest any modification to the model.

This model fits less well than model 13:9 and explains 18% of the shared variance between conscientiousness, goals and behaviour. Conscientiousness contributes an even greater amount to production oriented behaviour than to environmental objectives.

13:6 Discussion of the role of conscientiousness

Conscientiousness and task coping influence goal setting and both production and environmentally oriented behaviour but the measures of conscientiousness used in this study are better at explaining production oriented behaviour than environmental goals. A conscientiousness personality is a better predictor of goal oriented behaviour than goals alone, underlining the importance of individual traits on behaviour.

However, because the NEO-NFI 60 item scale was used, it was not possible to split the conscientiousness score into achieving and task related scores for the individual farmers, and thus specifically test these parts of the model. It is possible that what has been measured here is primarily a task effect model. The observation that the amount of variance explained is higher for production oriented behaviours may be due to the fact that this behaviour is the norm for the majority of farmers. Grants, EU and government policies are primarily concerned with this behaviour. If environmental behaviour was enforced by legal contract and policy induced grant aid then it is likely the conscientious, task oriented farmer would rise to the behaviour.

This chapter concludes the analysis and discussion of the results. The final chapter reviews the results and draws some conclusions.

CHAPTER 14

SUMMARY AND CONCLUSIONS

"The end of man is an action, and not a thought".
Thomas Carlyle. 'Past and Present' ch.6

14.0 Introduction

The aim of this thesis was to study farming behaviour from a multivariate position. Scales were developed to measure farming behaviour, objectives, and attitudes. The factors derived from these scales were studied in relationship to psychological measures of individual differences, and to farm structural variables. These relationships were then examined using a transactional model of behaviour and structural equation modelling. Farmer behaviour was studied in a broad strategic manner, rather than in a narrow more focused manner of examination of a single behaviour, such as, whether a farmer did or did not engage in a specific type of diversification behaviour.

The study was unique because of the inclusion of both multiple attitudinal and personological traits, and in its attempt to identify which of the various disciplines definitions of the same factors were the most important. The reasons for doing so were as follows, a) To establish which attitude variables had the greatest impact on decision making in general and to do so in such a manner that the study could readily be replicated b) to establish whether measures of individual differences would contribute significantly to the shared variance with farming behaviour, and c) if individual differences could be measured reliably in a sample of farmers. Finally, an attempt to integrate the

important variables by structural equation modelling was made by generating a number of models. As was argued in Chapter 2, theory needs to be supported by empirical results if it is to be developed in the long term interests of psychology or farming research.

This chapter examines how far these aims have been met, and draws some conclusions.

14:1 Factors important in the composition of the Edinburgh Farming Scales

14:1.1 Attitudes important in all farmer decision making.

Thirteen attitudinal areas were identified in the literature as important influences of farm decision making. Items were compiled to cover the constructs which related to farming attitudes, goals and behaviour in those areas (production and profit orientation, risk taking, information seeking, optimism, satisfaction, status, legislation, environment, stress and coping). Many of the items were seen as overlapping, but the use of factor analysis reduced the number of items to more manageable dimensions. This was done by identifying the most parsimonious number of items accounting for the greatest amount of the variance. However, in the case of the attitude constructs not all of these constructs remained after factor analysis, rather new relationships emerged. These new grouping of items were not so much 'new' as a realignment of items which had previously been considered attached to other constructs. However, their realignments were quite comprehensible

when the new item groupings were inspected. These new groups of items possibly reduced the scope for testing the resulting correlations between intentions and behaviour factors in this study because the domains of the attitudes, intentions and behaviours were no longer closely matched.

Factor analysis resulted in seven attitudinal factors, five objectives and four behaviours. All of the summed items of the factors identified had a moderate to high reliability score (correlation among the items).

Two of the 'new' attitudinal factors were found to be important in all farmer behaviour, these were the 'achieving' and 'open to new ideas in farming' attitudes. These were observed to be closely related to 'motivation to achieve' and 'information gathering', confirming the many studies of innovation that postulate these as two of the most important variables in innovative studies (Rogers, 1995). However, achievement and information are rarely identified in this manner. Individuals scoring highly on these attitudes was conscientious and task oriented as they were also related to, and mediated, personality traits of intelligence, conscientiousness and openness to new ideas (Rogers, 1995; Hoyer & Ridgway 1984). These two factors and the items contained within them would appear to partially target the elusive measurements of achievement orientation and openness to new ideas in farming.

In the literature motivation is recognised as an important variable by economists and business managers alike, and sociologists often equate it with values (Sachs, 1984). Achievement motivation is generally recognised as a necessary feature of a successful individual, but it is usually defined as setting targets, taking risks, being goal oriented, having a firm set of values etc.

(Latham & Locke, 1991). This study suggests that having an achieving attitude is not only antecedent to setting goals but will directly affect the behaviour under examination.

In this study the attitudinal factor of achievement motivation had two facets, one relating to being organised and efficient and the other to gaining the respect of significant others. The latter may be considered akin to Fishbein & Ajzen's (1974) definition of 'subjective norm'. This finding lends confirmation to the hypothesis that attitude and subjective norm overlap i.e. the 'crossover' effect discussed by Farley et al. (1981). Empirical research therefore appears to support the idea that achievement motivation is hierarchical in nature and further, that the idea of 'subjective norm' (or the influence of significant others) is partly accounted for within this attitude measure.

The second attitude found to be important in all aspects of farm decision making was the 'open to new ideas in farming' attitude. In this case there appears to be only one facet, that of welcoming new ideas, information, technology etc. but it is equally likely that this factor might be improved by the addition of more diverse items. Similar to the achieving attitude, it both directly affects and mediates behaviour. Openness to new ideas has been identified in the literature in terms of 'cosmopolitanism', being the first to introduce new ideas in that area, 'ventureness', being more receptive to the unfamiliar etc. (Rogers, 1995; Hoyer & Ridgway, 1984). The set of items tested appear to have been suitable as an identifier of such an attitude, especially as it was found to be significantly related to the personality trait of 'openness to new ideas'.

The other attitudes found to be important in specific decisions were noted to have only one facet. This may be due to the limited number of items contained within the original scale, rather than any pre-requisite of the factor. Expansion and exploration of these scales in the future may increase the knowledge base. The remaining attitudinal factors of risk taking, chemical use, legislation, policy concern and pessimism, although important in specific contexts, were not significant for *every* farm decision, only for appropriate behaviour measures. Interestingly the often quoted factor of 'satisfaction with farming work' became subsumed within the 'pessimism/optimism with the future of farming' factor. Factor analysis may be considered to have satisfactorily indicated the most useful, parsimonious number of items and factors in the areas thought to be important in influencing behaviour. The two attitudes of achievement and openness were powerful determinants of behaviour both directly and through mediation of individuals intentions. The use of factor analysis permitted the reduction of the concepts of 'management of the business', 'respect of others', 'openness to new ideas' and 'information gathering' to two factors, 'achievement' and, 'openness to new ideas'.

14:1.2 Goals important in all farmer decisions

Goals (or intentions or objectives) are seen as very important in the literature, but there is little evidence that more than 10% of this sample set targets, and only one third actually kept consistent records relating to the business.

In general the farming goals considered important in the study were broadly similar to those previously reported in the literature (Gasson, 1973; 1974, Illberry, 1985; Salamon & Davis-Brown, 1986; Harper & Eastdman, 1980; Perkin & Rehmen, 1994; Fairweather & Keating, 1994).

Goals or objectives which were found to *always* influence other goals and behaviours were those relating to quality of life and status seeking. These two 'why' goals were related to the achieving attitude and influenced the other 'how' goals of orientation towards production or the environment. It was not clear whether these goals were overlapping the achieving and openness attitudes or, if they were distinct driving influences on the more concrete goals of management practises. Further work is required to tease out the distinct nature of these goals and their relationships. It is possible that goal content and intensity have to be examined in much greater detail.

It was suggested in Chapter 4 that the personality traits of conscientiousness and task coping are possibly better predictors of motivation, or at the very least, they must be included when goal commitment and values are considered. As was suggested by Dember (1975) goal commitment can be shown simply by enforcing assignment, because the fact goals are assigned implies they can be achieved. This may be what is being observed when environmental behaviour and goals are implemented. But further work to separate the commitment from monetary inducement of set-a-side or woodland tree planting schemes, along with the size of the farm, is required.

As Hollenbeck & Brief (1987) have shown, goal setting and realisation of goals is related to a personality which is conscientious and knowledgeable regarding the task in hand. The models of the role of conscientiousness confirm this in the surveyed farmers. In fact the role of conscientiousness explains more of the variance associated with setting goals than do attitudes. These three factors (conscientiousness, achieving and open to new ideas) must be seriously considered for inclusion in any model of behaviour.

14:1.3 Behavioural items as factors

In this study farming behaviour items were also factor analysed. This method was pursued with the aim of producing a set of highly correlated behaviours which might replace the single outcome behaviours as a measure of either profit or production maximising behaviour. Linder (1991) has argued that many models of innovation use only univariate statistics resulting in low level explanatory power and poor model specification. By encouraging the use of a construct composed of closely correlated behavioural items obtained by Principle Component analysis it may be possible to pinpoint areas of change. This may, in the future assist in quickly determining who would be likely to, or be ready to, adopt new policy issues.

14:1.4 Influence of psychological variables on farming behaviour

It was argued in Chapter 4 that the attributes found to be predictors of job success in industry would also be useful predictors of farming success. As in all efficiently managed businesses, intelligence, conscientiousness, and task oriented coping have been shown to be of marked importance in farming behaviour (Boswell, 1972; Barrick & Mount, 1991; Tett et al., 1991). These variables, in this sample, directly influenced both production and environmentally oriented farming behaviour, explaining between 20-30% of the variance in both cases. Such a high contribution from inherent traits must be important contributors to the total variance in any model of farming behaviour. It is interesting to note that the achieving attitude factor is best explained by conscientiousness, task coping and intelligence, suggesting this factor may be a suitable method of measuring these attributes in a farming sample.

As predicted by the literature, information gathering was found to be important as a mediator of behaviour. Neuberg & Neuson (1993) reported information gathering as related to a personality which was open to new ideas. In our sample this was also related to being extravert and outgoing.

The role of innovativeness as described by Kirton (1976) was found to be important in describing environmentally oriented farming behaviour. Even when the subscales were modelled separately, the role of original thinking was the only direct contributor to new ideas in farming and farming behaviour. This may be a suitable method of measuring how likely farmers are to change their behaviour. Innovativeness was associated with higher gfm/Ha but also with age and education as well as with the self-perception of being one of the first to implement new ideas. This is partly to be expected as Kirton defines innovativeness as a cognitive style of thinking, therefore education and intelligence would be linked, as would age in a sample of farmers whose average age was 48 years.

Farming stress is widely reported in the media. However, this sample of farmers showed no greater levels of stress than that found in the general population. The reason for this is most likely to lie within the voluntary nature of the study, any farmers highly stressed were unlikely to participate in a study which made such a large demand on their time and energies. This highlights the problem of all studies which are voluntary in nature, the sample is unlikely to be fully representative of the whole community from which it is drawn.

Farmers in this sample fitted the normal population criteria for nearly all of the psychological tests and the GHQ measure of psychological distress. The

exceptions being the lower mean scores on 'openness' and agreeableness' and a higher than average score of 'task' coping.

14:2 Structural equation modelling of farming variables

By allowing the data to partially drive the models, it is possible to test a series of models for each behaviour under study. This permits a better basis for formulating a strong theoretical platform for further studies (McGuire, 1986).

By examining a series of models the robustness of each hypothesis could be examined. When modelling production oriented behaviour it was observed that no matter how many variables the model was expanded to incorporate, the achieving attitude, the open to new ideas attitude and having business oriented goals were the best predictors of production oriented behaviour. The predicative capability of the model could be improved by the addition of personality traits of intelligence, conscientiousness and information gathering. The achieving attitude mediated both goals and quality of life variables whereas the open attitude directly influenced behaviour and mediated quality of life. The value of status influenced the business goals and quality of life variables. Thus quality of life and status objectives although containing rather vague items continued to occupy a place in the models even when other more concrete variables were introduced into the model. These values must therefore be considered part of the motivation for goal directed behaviour. Further investigation of how they might be quantified in more concrete terms would be useful.

Modelling environmentally oriented farming behaviour was less easy although, as in production oriented behaviour, attitudes did directly predict behaviour as well as mediate goals. Interestingly the values of quality of life and status served different purposes in these models. The value of status became an antecedent variable on the chemical attitude whereas the quality of life value was a mediator between the open attitude and the environmental goals. Unlike production oriented behaviour environmental practises is much better predicted by intelligence and a personality trait of openness and innovativeness. This ability of the model to show such differences suggests that it may be a good model of personality structure.

Modelling financial risk taking indicated that in the presence of a personality trait of openness linked to information, farm profit was likely to be high. However, when the personality traits of neuroticism and emotion focused coping be dominant when linked to a financial risk taking attitude the results were likely to be increased debt. This confirms the complexity of measuring a financial risk taking attitude, and provides further support for the importance of personality traits in modelling farming behaviour.

Modelling farming stress indicates that the stressed behaviour is fuelled by debt and by personality traits of neuroticism, emotion focused coping and having negative attitudes towards legislation and the future of farming. The models obtained for stress behaviour in farmers are similar in many ways to those obtained by other researchers in different fields.

Investigation of forms of innovative farming behaviour was elusive. Computer ownership was not directly associated with innovativeness, rather, it was best

explained in terms of intelligence and a personality which was open to new ideas. The psychological innovative measure used in the study however, correlated with a personality which was open to new ideas, suggested creativity and intelligence are inextricably linked to innovativeness. Perhaps the more intelligent and open an individual is, the more he/she will know about a wide range of subjects and the more likely he/she is to be able to generalise across subjects. Hence, the greater the ability to appear creative in many situations.

14:3 Farm structural variables

The most important structural variables in this sample were land type, and farm size. In this sample farm size was partly determined by the land type. LFA farms are likely to be larger and livestock oriented whereas non LFA are more likely to be smaller mixed or arable farms. Subsidies and incomes from these land types also differ, the income from LFA farms is on average composed of about 40% of subsidies compared with the 20% dependence on subsidies for the non LFA farms.

14:4 Conclusion

The thesis has fulfilled what it set out to achieve in that three scales were developed and analysed. These scales may be usefully developed further in farming research, but in general they indicate the strong relationship between some attitudes and personality characteristics and this may prove an improved method of measuring motivation to achieve. Both concrete and abstract objectives play a part in determining farming behaviour. Behaviour was best predicted when items were summed prior to use.

The role of personality characteristics is shown to be important when modelling farming behaviour. In particular intelligence, conscientiousness, task oriented coping, and openness to new ideas are important, but the personality traits of extraversion and agreeableness also play a role. Stress behaviour and risky investments are linked to personality traits of neuroticism and emotion focused coping.

Modelling the results using a transactional model permitted the inclusion of internal and external variables to be included without violating the models assumptions. The Fishbein & Ajzen model although useful in indicating the relationship between attitudes, goals and behaviour constrained the modelling in that, personality and external variables can not be included as separate variables. Thus the use of the transactional model, and its testing by structural equation modelling statistics, permitted the comparison of differing hypothesis. Interesting results were obtained allowing the comparison of production and environmentally oriented farming behaviours. They indicate that these two behaviours have common origins in intelligence and personality traits but in each case the relationships between the variables was subtly different. No individual is likely to be either wholly environmentally oriented *or* wholly production oriented. This type of modelling and testing is able to highlight differences in the quality of interaction between the same variables for the different behaviours.

Further work on the validation of the Edinburgh farming scales is required to confirm their validity and usefulness in predicting behaviour. Their hypothesised use in the various model requires further testing, refining and extending to include specific attitudes, goals and behaviours. This could be done by building on the existing items in each factor, using only the individual

factor of interest, e.g. achievement motivation say. Or by using the existing items in their entirety in a further study of general farming behaviour or decision making.

APPENDIX A

The Edinburgh Farming Attitude Scale

SECTION ONE

	STATEMENT	strongly agree				strongly disagree
1.	It is important to have intermediate farming goals.	1	2	3	4	5
2.	It is important to pass on the farm to a member of family.	1	2	3	4	5
3.	It is important to stay in farming whatever happens.	1	2	3	4	5
4.	It is important to have the respect of other farmers in the community.	1	2	3	4	5
5.	It is important to enter and win at shows.	1	2	3	4	5
6.	In adopting new ideas it is important to lead rather than follow.	1	2	3	4	5
7.	Making a comfortable living is all that is important.	1	2	3	4	5
8.	Being fully productive is important.	1	2	3	4	5
9.	It is important to keep debt as low as possible.	1	2	3	4	5
10.	It is important to plan for retirement.	1	2	3	4	5
11.	Having interests outside of farming is important.	1	2	3	4	5
12.	Preventing pollution is important.	1	2	3	4	5
13.	Adopting modern genetic farming techniques is important.	1	2	3	4	5
14.	It is important to use chemicals sparingly.	1	2	3	4	5
15.	Having a successfully diversified farm is important.	1	2	3	4	5
16.	Improving the quality of the farm generally is important.	1	2	3	4	5
17.	Improving the quality of my life is important.	1	2	3	4	5
18.	Improving the living standards of family life is important.	1	2	3	4	5
19.	It is important just to operate on a day to day basis.	1	2	3	4	5
20.	It is important to spend time with the family.	1	2	3	4	5
21.	It is important to provide for private education.	1	2	3	4	5
22.	It is important to plan for holidays off the farm.	1	2	3	4	5
23.	It is important to minimise risk in farming.	1	2	3	4	5
24.	It is important to get all that you are due from current legislation.	1	2	3	4	5
25.	It is important not to overproduce.	1	2	3	4	5
26.	It is important to encourage wildlife on the farm.	1	2	3	4	5
27.	It is important to leave the land in as good a state as one received it.	1	2	3	4	5
		strongly agree				strongly disagree

The Edinburgh Farming Attitude Scale

SECTION TWO

	STATEMENT	strongly agree				strongly disagree
1.	Financial aspects of farming cause the most stress.	1	2	3	4	5
2.	It is important to visit other farms to look at their methods.	1	2	3	4	5
3.	It is important to win prizes at farming shows.	1	2	3	4	5
4.	Most farmers find it hard to relax.	1	2	3	4	5
5.	Farmers don't have the administrative set-up to deal with the paperwork from legislation.	1	2	3	4	5
6.	Farming is a job like any other.	1	2	3	4	5
7.	Farming is a lonely job.	1	2	3	4	5
8.	When things go wrong on the farm it is often due to govt. policies.	1	2	3	4	5
9.	Farmers in Britain are demoralised.	1	2	3	4	5
10.	A farm is a business to be run efficiently.	1	2	3	4	5
11.	Legislation is not always clear.	1	2	3	4	5
12.	The weather causes most stress in farming.	1	2	3	4	5
13.	'Green' groups are useful.	1	2	3	4	5
14.	In farming religious belief and worship are important.	1	2	3	4	5
15.	It is easy to apply for grants and subsidies for the farm.	1	2	3	4	5
16.	The nature of farming is stressful.	1	2	3	4	5
17.	Modern record keeping systems are unimportant in farming.	1	2	3	4	5
18.	Farming is satisfying.	1	2	3	4	5
19.	Farming is a job with a lot of scope to do things your own way.	1	2	3	4	5
20.	Families should be consulted about farm financial decisions.	1	2	3	4	5
21.	Farmers are important in a community.	1	2	3	4	5
22.	Farming folk are very supportive of each other.	1	2	3	4	5
23.	It is appropriate to take financial risks in farming.	1	2	3	4	5
24.	It is important farmers be respected in the local community.	1	2	3	4	5
25.	Many farmers will look for another job in the near future.	1	2	3	4	5
26.	Farmers generally enjoy their job.	1	2	3	4	5
27.	Environmental grants are not helpful to the farmer.	1	2	3	4	5
28.	Useful farming information can be obtained from advisors.	1	2	3	4	5
29.	Useful farming information can be obtained from commercial reps.	1	2	3	4	5
30.	New machinery/ideas in farming have not improved upon traditional techniques.	1	2	3	4	5
31.	Farmers get a bad press.	1	2	3	4	5
32.	Being a farmer should be a source of pride.	1	2	3	4	5
33.	The quality of farming life could be better.	1	2	3	4	5
34.	It is important in farming to use tried and tested ideas.	1	2	3	4	5
		strongly agree				strongly disagree

	STATEMENT	strongly agree				strongly disagree
35.	EEC & Government policies are helpful for the farmer.	1	2	3	4	5
36.	Physical risk is part of farming.	1	2	3	4	5
37.	If prices fall the best thing to do is cease production.	1	2	3	4	5
38.	In starting a new farming venture one should be willing to take out a loan for most of the capital required.	1	2	3	4	5
39.	Day to day farming decisions should be taken by employees without reference to the farmer.	1	2	3	4	5
40.	Farming is depressing.	1	2	3	4	5
41.	Farming problems are best tackled head on.	1	2	3	4	5
42.	Farmers get lots of support from friends and family.	1	2	3	4	5
43.	Farming is too financially risky.	1	2	3	4	5
44.	Pest control should be dictated by the farmer, not by environmental groups.	1	2	3	4	5
45.	Farming neighbours should be used as a source of farming information.	1	2	3	4	5
46.	Farming decisions should be made by the family.	1	2	3	4	5
47.	Nobody understands farming problems.	1	2	3	4	5
48.	Successful farmers take decisions on their own.	1	2	3	4	5
49.	It is important to read about farming practices.	1	2	3	4	5
50.	Farmers are pessimistic about the future of farming.	1	2	3	4	5
51.	It is important to serve in the community.	1	2	3	4	5
52.	Farming problems may be ignored until they go away.	1	2	3	4	5
53.	Farmers should keep themselves to themselves.	1	2	3	4	5
54.	It is important to have a tidy farm.	1	2	3	4	5
55.	Green groups should not dictate to the farmer.	1	2	3	4	5
56.	A good living can be made from farming.	1	2	3	4	5
57.	Farmers should make sure they have insurance to cover most loss.	1	2	3	4	5
58.	The media are a useful source of farming information.	1	2	3	4	5
59.	The media is very supportive of farmers.	1	2	3	4	5
60.	Farmers need to pray for help with farming.	1	2	3	4	5
61.	Sometimes farming neighbours should be consulted before taking major decisions.	1	2	3	4	5
62.	It is easy to discuss farming financial problems with other farmers.	1	2	3	4	5
63.	Other employment would be better than farming.	1	2	3	4	5
64.	Successful farmers take financial risks.	1	2	3	4	5
65.	Organic farming is a fad.	1	2	3	4	5
66.	Important information on new farming ideas can be obtained at agricultural shows.	1	2	3	4	5
67.	Farm land should be fully productive.	1	2	3	4	5
68.	The government control farming too much.	1	2	3	4	5
69.	Prices of crops and stock are bound to fall in the future.	1	2	3	4	5
70.	To farm successfully one must be in debt.	1	2	3	4	5
71	It is more important to use your own experience and farming knowledge than ask others for information.	1	2	3	4	5
		strongly agree				strongly disagree

	STATEMENT	strongly agree				strongly disagree
72.	The weather is generally to blame when things go wrong in farming.	1	2	3	4	5
73.	Sometimes it is necessary to consult with professional farming advisors before taking decisions.	1	2	3	4	5
74.	Successful farming is the result of the farmers hard work.	1	2	3	4	5
75.	Current level of subsidises can't last.	1	2	3	4	5
76.	Current conservation grant schemes are good.	1	2	3	4	5
77.	Farmers are generally in control of their farm business.	1	2	3	4	5
78.	Borrowing money is bad for farming.	1	2	3	4	5
79.	Cheap government loans to farmers would be preferable to grants.	1	2	3	4	5
80.	It is important to pay attention to market prices.	1	2	3	4	5
81.	It is important to pay attention to your cash flow position.	1	2	3	4	5
82.	It is **not** important to monitor the farm production levels.	1	2	3	4	5
83.	It is important to keep an eye on the futures market.	1	2	3	4	5
84.	Borrowing money over a long period to ensure future farm investment is necessary.	1	2	3	4	5
85.	The Government interferes too much in farming.	1	2	3	4	5
86.	Money is **not** the most important thing in farming.	1	2	3	4	5
87.	Farming is likely to provide a secure retirement.	1	2	3	4	5
88.	If farmers will benefit, then they will take a risk in farming.	1	2	3	4	5
89.	Farming is so rewarding I never intend to retire.	1	2	3	4	5
90.	Farming policy changes are easy to understand.	1	2	3	4	5
91.	It is important to take debt management advice.	1	2	3	4	5
92.	The long term outlook for farming is good.	1	2	3	4	5
93.	It is important to keep up with new farming policies.	1	2	3	4	5
94.	If there was a compensation scheme that would allow farmers to clear debt and leave farming, it should be taken.	1	2	3	4	5
95.	Government information on farming policy change is clear.	1	2	3	4	5
96.	A free market situation would help everyone.	1	2	3	4	5
97.	It is important to make maximum profit.	1	2	3	4	5
98.	Food mountains are necessary to protect prices.	1	2	3	4	5
99.	Successful farming is often due to luck.	1	2	3	4	5
100.	Young people should **not** be encouraged to farm.	1	2	3	4	5
101.	There is too much paper work in farming.	1	2	3	4	5
102.	EEC & Government policies are geared towards the conservationist.	1	2	3	4	5
103.	Farming is a way of life.	1	2	3	4	5
104.	Farming is a relaxing job.	1	2	3	4	5
105.	Some current legislation is unrealistic in its demands.	1	2	3	4	5
106.	Farm production is the thing to take most pride in.	1	2	3	4	5
107.	It doesn't matter what the farm looks like as long as its productive.	1	2	3	4	5
108.	For most farmers the past year has been very stressful.	1	2	3	4	5
109.	Successful farming is the result of cautious planning.	1	2	3	4	5
110.	Even advisors can't tell you what the current legislation is.	1	2	3	4	5
		strongly agree				**strongly disagree**

	STATEMENT	strongly agree				strongly disagree
111.	Farmers should be cautious in adopting / applying new farming methods.	1	2	3	4	5
112.	Production decisions should be taken by farmers only.	1	2	3	4	5
113.	Farmers are sometimes informed about legislation too late to put it in practice.	1	2	3	4	5
114.	It is important to have the best livestock / crops / pastures.	1	2	3	4	5
115.	The work load involved in farming cause stress.	1	2	3	4	5
116.	It would be nice to give up farming.	1	2	3	4	5
117.	Short term loans are a good thing for farming.	1	2	3	4	5
118.	Filling in grant forms is anxiety-provoking, because errors can be penalised.	1	2	3	4	5
119.	Bankers don't help farmers like they used to.	1	2	3	4	5
120.	Government information on legislation is easily come by.	1	2	3	4	5
121.	It is the farmers fault when things go wrong.	1	2	3	4	5
122.	It is important to reduce nitrogen application by using non-chemical methods.	1	2	3	4	5
123.	It is important to reduce pest control chemicals by using effective rotations.	1	2	3	4	5
124.	It is important to get all you are due from current legislation.	1	2	3	4	5
125.	There is no clear overall strategy in agricultural policy.	1	2	3	4	5
126.	Legislation in farming involves too much paper work.	1	2	3	4	5
127.	There is insufficient information on policy changes.	1	2	3	4	5
128.	Conservation measures should be paid for by increased prices to the farmer.	1	2	3	4	5
129.	When prices fall farmers have to produce more.	1	2	3	4	5
130.	It is important to have the occasional member of public visit the farm.	1	2	3	4	5
		strongly agree				**strongly disagree**

APPENDIX B
THE EDINBURGH FARMING BUSINESS SCALE

THANK YOU FOR TAKING PART IN THIS SURVEY.

Each question should have only one answer.

There is no right or wrong answer, it is important to answer the questions to indicate how the situation applies to you as a farmer.

All of the responses are confidential, and the questionnaires will not be identified by name to ensure anonymity of all the participants.

Please answer all of the questions.

Instructions for completing the questionnaire are given at the beginning of each section.

THE EDINBURGH FARMING BUSINESS QUESTIONNAIRE

SECTION ONE

1.	Which describes your farm business best?	**Tenanted**	☐
		Owned outright	☐
		Owned subject to loan	☐
		Tenanted + Owned	☐
2.	Did you inherit the farm business?	**Yes**	☐ **No** ☐
3.	If you own the farm when was it purchased?	**Year**	☐☐☐☐
4.	If you own the farm how is it owned?	**Sole Trader**	☐
		Company	☐
		Partnership	☐
5.	**If you rent the farm**		
	When did you sign the tenancy agreement?	**Year**	☐☐☐☐
	a) For what period is the tenancy agreement?	**Years**	☐☐☐
	b) How long do you have left on the tenancy agreement?	**Years**	☐☐☐
6.	How many farms are in your farm business?	**Number**	☐☐
7.	Is your farm business located at separate sites?	**Yes**	☐ **No** ☐
	If Yes, then:-	**Number of sites-**	☐☐
		Miles apart-	☐☐☐
8.	What type of farm(s) do you have?	**Arable**	☐
		Livestock	☐
		Mixed	☐
9.	How many acres do you farm?	**Acres**	☐☐,☐☐☐
10.	What acreage of your land is		
		Severely disadvantaged	☐☐,☐☐☐
		Disadvantaged	☐☐,☐☐☐
		Non LFA	☐☐,☐☐☐
11.	Do you have dairy cows on the farm?	**Yes**	☐ **No** ☐
	If Yes, how many cows do you have?	**Number**	☐,☐☐☐
	What quantity of milk does the farm produce annually?	**Litres**	☐☐,☐☐☐,☐☐☐
12.	How many **non-farm** diversified enterprises make up the farm business?	**Number**	☐☐
13.	How many **full-time** non-family individuals do you currently employ in the farm business?	**Number**	☐☐
14.	How many **full-time** non-family employees did you employ 5 years ago?	**Number**	☐☐
15.	How many **part-time** non-family individuals (excluding casuals) do you employ in the farm business?	**Number**	☐☐
16.	How many **part-time** non-family employees (excluding casuals) did you employ 5 years ago?	**Number**	☐☐
17.	How many formal partners are in your farm business?	**Number**	☐☐

18. Were you brought up on a farm? **Yes** ☐ **No** ☐

19. Was your spouse brought up on a farm? **Yes** ☐ **No** ☐

20. How much farming experience do you have? **Years** ☐☐

21. Do you live on your farm? **Yes** ☐ **No** ☐

If no, how far do you live from it? **Miles** ☐☐☐

22. How far do you live from your nearest off-farm neighbours? **Miles** ☐☐

23. How far do you live from your local town? **Miles** ☐☐

24. When do you plan to retire?

Early ☐
Normal age ☐
Later than normal age ☐
Only partially ☐
Never ☐

25. Have you ever worked abroad for more than 2 weeks? **Yes** ☐ **No** ☐

26. Do you pick up ideas for the farm business from other farmers? **Little** 1 2 3 4 5 **Lot**

27. Do you exchange information with other farmers? **Little** 1 2 3 4 5 **Lot**

28. How many training courses, to do with your farm business, have you attended in the last five years? **Number** ☐☐

29. Where do you mainly meet other farmers?

Their farm ☐
Town ☐
Market ☐
Meetings ☐
Other (Please Specify)

30. Do you have a computer on the farm? **Yes** ☐ **No** ☐

If **Yes**,

Do you use it for farm financial management?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐
Do you use it for some specialist use, e.g. for managing a dairy herd?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐
Do you use it for farm accounts?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐
Do you use it for farm stock management?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐
Do you use it for the household?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐
Do you use it with specialist programmes?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐
Do you use it for writing letters?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐
Do you use it to complete grant and tax forms?	**Never**	☐	**Occasionally**	☐	**Frequently**	☐

31. Which agricultural suppliers do you usually use?

Local ☐
Neighbours ☐
Phone around ☐
Most competitive ☐
Same as always ☐

32. Could you please complete the following table for each member of your immediate family?

Relationship	Sex	Age	Number of years of full-time education for those working (including school and higher education)	Do they live on the farm?
Self	**M / F**			**Yes / No**
Wife / Husband	**M / F**			**Yes / No**
Child	**M / F**			**Yes / No**
Child	**M / F**			**Yes / No**
Child	**M / F**			**Yes / No**
Child	**M / F**			**Yes / No**
Child	**M / F**			**Yes / No**
Mother	**M / F**			**Yes / No**
Father	**M / F**			**Yes / No**
Other (Specify)	**M / F**			**Yes / No**
Other (Specify)	**M / F**			**Yes / No**

33. Please complete the following table for any immediate members of the family who have **off-farm** work?

Relationship	Sex	% of time working off-farm	% of time working on-farm	Job title for off-farm work
Husband / Wife	**M / F**			
Child	**M / F**			
Child	**M / F**			
Child	**M / F**			
Child	**M / F**			
Other (Specify)	**M / F**			
Other (Specify)	**M / F**			
Other (Specify)	**M / F**			

34. We are interested in the asset to liability ratio for the farm business. Your latest balance sheet shows the level of liabilities and assets for the farm business. If these are not available as totals in your current accounts, then you can calculate them by adding all the liabilities together, and similarly assets can be calculated by adding them together.

Liabilities.

These are the current debts, which include such items as Loans, Unpaid Debts, and Overdraft.

Assets.

These are current valuations, which include such items as Land, Cattle, Stores, Buildings, Business Value and Cash in Hand.

Divide the assets by the liabilities to obtain the ratio. **Ratio =** ☐☐

If you would rather have us calculate the ratio we need the following information:

Total Liabilities **£** ☐☐☐,☐☐☐

Total Assets **£** ☐☐☐,☐☐☐

35. What was **a)** your total revenue for last year? **£** ☐☐☐,☐☐☐

What was **b)** your total variable cost for last year?
(not taking account of capital costs) **£** ☐☐☐,☐☐☐

a) - b) = **£** ☐☐☐,☐☐☐
(Gross Farm Margin)

36. What proportion of the farm business revenue will be derived from EEC / Government subsidy?

None ☐
10% ☐
20% ☐
30% ☐
40% ☐
50% ☐
60% ☐
70% ☐
80% ☐
90% ☐
100% ☐

37. How many grants / subsidies are you eligible for? **Number** ☐☐

38. Have you claimed for all that you are eligible for? **Most** ☐ **Some** ☐ **Few** ☐ **None** ☐

39. Do you have a retirement pension fund? **Yes** ☐ **No** ☐

THE EDINBURGH FARMING BUSINESS QUESTIONNAIRE

SECTION TWO

1.	Has the number of acres farmed for the farm business changed in the last five years?	**Decrease**	1	2	3	4	5	**Increase**
2.	What change has your income from the farm business shown over the last five years?	**Decrease**	1	2	3	4	5	**Increase**
3.	Has farm business debt changed in the last five years?	**Decrease**	1	2	3	4	5	**Increase**
4.	Do you have any definite plans to change the size of the farm business in the next five years?	**Little**	1	2	3	4	5	**A Lot**
5.	To what extent have you diversified the farm business?	**Little**	1	2	3	4	5	**A Lot**
6.	Do you expect to take off-farm work to retain the farm business?	**Definitely**	1	2	3	4	5	**Not at all**
7.	Is the survival of the farm business dependant on the income from your **own** off-farm work?	**Not at all**	1	2	3	4	5	**Very**
8.	Is the survival of the farm business dependant on the income from **other** family members off-farm work?	**Not at all**	1	2	3	4	5	**Very**
9.	How important to the survival of the farm business is the **on-farm work** of other family members?	**Not at all**	1	2	3	4	5	**Very**
10.	Do you manage the farm business to maximise output?	**Never**	1	2	3	4	5	**Always**
11.	Do you keep production records?	**Never**	1	2	3	4	5	**Always**
12.	Do you monitor farm business performance?	**Never**	1	2	3	4	5	**Always**
13.	Do you use new farming methods?	**Never**	1	2	3	4	5	**Always**
14.	Do you use AI or MOET?	**Never**	1	2	3	4	5	**Always**
15.	Do you:-							
	a) increase production when market prices fall.	**Never**	1	2	3	4	5	**Always**
	b) decrease production when market prices fall.	**Never**	1	2	3	4	5	**Always**
16.	How difficult is it to obtain labour locally?	**Very difficult**	1	2	3	4	5	**Very easy**
17.	Is it easy to manage the farm business to suit yourself?	**Very difficult**	1	2	3	4	5	**Very easy**
18.	How important are new farming methods to you?	**Very important**	1	2	3	4	5	**Not important**
19.	Are you first locally to use the latest methods / technology?	**Never**	1	2	3	4	5	**Always**
20.	Do you lease **out** machinery and plant?	**Little**	1	2	3	4	5	**A Lot**
21.	Do you lease **in** machinery and plant?	**Little**	1	2	3	4	5	**A Lot**
22.	Do you use fertilisers, sprays, chemicals?	**Never**	1	2	3	4	5	**Heavily**
23.	Have you made any large investments in the farm business in the past five years?	**Little**	1	2	3	4	5	**A Lot**
24.	How much farm business insurance do you have other than for machinery and buildings?	**Little**	1	2	3	4	5	**A Lot**
25.	How much do you use the futures market?	**Little**	1	2	3	4	5	**A Lot**
26.	Do you manage the farm business to maximise profit, above all else?	**Never**	1	2	3	4	5	**Always**
27.	Do you use targets in managing the farm?	**Never**	1	2	3	4	5	**Always**
28.	Do you keep financial records?	**Never**	1	2	3	4	5	**Always**
29.	Do you have any off-farm financial investments?	**None**	1	2	3	4	5	**A Lot**

30.	Have you negotiated business loans in the past five years?	**None**	1	2	3	4	5	**Many**
31.	Have you re negotiated business debts in the last five years?	**None**	1	2	3	4	5	**All**
32.	Could you reduce the farm business debt whilst still retaining the farm business? Tick box if you have no debt ☐	**Not at all**	1	2	3	4	5	**Completely**
33.	Is it difficult to meet your farm business financial commitments?	**Very difficult**	1	2	3	4	5	**Very easy**
34.	Is it difficult to meet your personal financial commitments?	**Very difficult**	1	2	3	4	5	**Very easy**
35.	How often do you ensure that you have applied for every grant / subsidy you are entitled too?	**Never**	1	2	3	4	5	**Always**
36.	Do you replace machinery as soon as you can afford it?	**Never**	1	2	3	4	5	**Frequently**
37.	Do you regularly control vermin on the farm?	**Little**	1	2	3	4	5	**A Lot**
38.	Have you taken any active conservation measures in the last five years?	**Little**	1	2	3	4	5	**A Lot**
39.	Do other farmers pick up ideas for their farm business from you?	**Little**	1	2	3	4	5	**A Lot**
40.	Have you taken out fences / dykes / hedges / etc. in the past five years?	**Little**	1	2	3	4	5	**A Lot**
41.	Have you inserted / replaced fences / dykes / hedges / etc. in the past five years?	**Little**	1	2	3	4	5	**A Lot**
42.	Has pollution been a problem to you in the past five years?	**Never**	1	2	3	4	5	**Frequently**
43.	Have you ever been prosecuted for pollution incidents?	**Never**	1	2	3	4	5	**Frequently**
44.	Have you ever tried organic farming?	**Never**	1	2	3	4	5	**Practicing**
45.	Have you ever considered joining a conservation group?	**Never**	1	2	3	4	5	**Member**
46.	How frequently do you read the agricultural press?	**Never**	1	2	3	4	5	**Always**
47.	Do you discuss new farming policies with advisors?	**Frequently**	1	2	3	4	5	**Infrequently**
48.	Do you discuss new farming policies with neighbours?	**Frequently**	1	2	3	4	5	**Infrequently**
49.	Do you discuss new farming policies with family?	**Frequently**	1	2	3	4	5	**Infrequently**
50.	Do you intend to pass the farm business as an inheritance on to a family member?	**Very likely**	1	2	3	4	5	**Very Unlikely**
51.	Do members of the public occasionally visit your farm?	**Never**	1	2	3	4	5	**Frequently**
52.	How often do you visit your local town?	**Never**	1	2	3	4	5	**Frequently**
53.	Is your main hobby related to your farm business?	**Not at all**	1	2	3	4	5	**Closely**
54.	Is it difficult to find time to meet friends and family?	**Very difficult**	1	2	3	4	5	**Very easy**
55.	Do you participate in any activities, either in work or leisure, which involve physical risk?	**Little**	1	2	3	4	5	**A Lot**

56. **SPOUSE / PARTNER**

How often do you involve your SPOUSE / PARTNER in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	The farm household?	**Never☐**	**Occasionally☐**	**Always☐**
j.	The family garden?	**Never☐**	**Occasionally☐**	**Always☐**
k.	Family leisure time and activities?	**Never☐**	**Occasionally☐**	**Always☐**
l.	Off-farm work?	**Never☐**	**Occasionally☐**	**Always☐**
m.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**
n.	Day-to-day running of the farm business?	**Never☐**	**Occasionally☐**	**Always☐**

57. **BUSINESS PARTNER (other then spouse)**

How often do you involve your BUSINESS PARTNER in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	The farm household?	**Never☐**	**Occasionally☐**	**Always☐**
j.	The family garden?	**Never☐**	**Occasionally☐**	**Always☐**
k.	Family leisure time and activities?	**Never☐**	**Occasionally☐**	**Always☐**
l.	Off-farm work?	**Never☐**	**Occasionally☐**	**Always☐**
m.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**
n.	Day-to-day running of the farm business?	**Never☐**	**Occasionally☐**	**Always☐**

58. **CHILDREN**

How often do you involve your CHILDREN in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	The farm household?	**Never☐**	**Occasionally☐**	**Always☐**
j.	The family garden?	**Never☐**	**Occasionally☐**	**Always☐**
k.	Family leisure time and activities?	**Never☐**	**Occasionally☐**	**Always☐**
l.	Off-farm work?	**Never☐**	**Occasionally☐**	**Always☐**
m.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**
n	Day-to-day running of the farm business?	**Never☐**	**Occasionally☐**	**Always☐**

59. **BANK MANAGER**

How often do you involve your BANK MANAGER in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**

60. **ACCOUNTANT**

How often do you involve your ACCOUNTANT in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**

61. **AGRICULTURAL ADVISOR / CONSULTANT**

How often do you involve your AGRICULTURAL ADVISOR / CONSULTANT in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**

62. **COMMERCIAL REPRESENTATIVES**

How often do you involve COMMERCIAL REPRESENTATIVES in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**

63. **LAWYER**

How often do you involve your LAWYER in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**

64. **EMPLOYEES**

How often do you involve EMPLOYEES in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
g.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**
j.	Day-to-day running of the farm business?	**Never☐**	**Occasionally☐**	**Always☐**

65. **OTHERS** (PLEASE SPECIFY)

We may have missed some individuals off these lists who you involve in making decisions in the farm business. How often do you involve OTHERS in making decisions in the following areas?

a.	Book keeping?	**Never☐**	**Occasionally☐**	**Always☐**
b.	Involving the farm business in contracting for others?	**Never☐**	**Occasionally☐**	**Always☐**
c.	Involving outside contractors in the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
d.	Financial decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Investment decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
f.	Marketing decisions for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
e.	Future planning for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
h.	Size of enterprises for the farm business?	**Never☐**	**Occasionally☐**	**Always☐**
i.	Diversification?	**Never☐**	**Occasionally☐**	**Always☐**
j.	Day-to-day running of the farm business?	**Never☐**	**Occasionally☐**	**Always☐**

THE EDINBURGH FARMING BUSINESS QUESTIONNAIRE

SECTION THREE

	OBJECTIVE	Very important to me				Not very important to me
1.	Off-farm work is necessary to stay in farming.	1	2	3	4	5
2.	Having up-to-date machinery / equipment is important.	1	2	3	4	5
3.	It is important to have other skills outwith farming.	1	2	3	4	5
4.	It is important to have the best possible livestock / crops.	1	2	3	4	5
5.	It is important to try new varieties of livestock / crops.	1	2	3	4	5
6.	It is important to make the largest possible profit.	1	2	3	4	5
7.	It is important to fully utilise all your resources.	1	2	3	4	5
8.	Keeping buildings / fences / dykes in good repair is important.	1	2	3	4	5
9.	It is important to keep debt as low as possible.	1	2	3	4	5
10.	It is important to have off-farm investments.	1	2	3	4	5
11.	It is important to minimise risk in farming.	1	2	3	4	5
12.	It is important to increase the size of the farm.	1	2	3	4	5
13.	It is important to decrease the size of the farm.	1	2	3	4	5
14.	Financial commitment should be taken over a long term.	1	2	3	4	5

| | | Very important to me | | | | Not very important to me |

Appendix C

Pilot letter

«Name»
«Farm»
«Town»
«District»

August 3rd 1993

Dear «Title»,

It has been suggested by Mr George Barton, of the College Advisory Service, that you may be interested in assisting us with a Scottish Office project we are working on. We are setting up a study to look at factors that affect decision making in farming families. Factors included are, stress, legislation, attitudes towards risk, personality preferences,and farming objectives. We have compiled a questionnaire and require local farmers to participate in and discuss its contents. We would therefore like to invite a group of farmers for a working lunch (or supper) in a Haddington hotel one day during the week of August 23rd to discuss and comment on it. We appreciate this is an extremely busy time of year for you, but the main study is scheduled to start in October, therefore it has become rather urgent to have your comments before we begin. May we call you on Monday or Tuesday of next week to ask if you would be willing to participate and which day and time would be most suitable? Thank you for your attention.

Yours sincerely

Joyce Willock

Appendix D

Study Letter

Dear Mr

The Scottish Agricultural College, the Institute of Ecology and Resource Management and the University of Edinburgh have been funded by the Scottish Office to investigate decision-making on Scottish farms. Decision-making is very important at any time but particularly so in this time of recession and change. Decisions are influenced by many factors and we shall investigate these by asking the farmers themselves to complete a questionnaire.

We hope that all of the large group of farmers we approach will take part in this study. The results will be relevant to important aspects of farming practise, and it is with your co-operation that we will succeed in accurately representing what farmers think.

On obtaining your agreement to participate in this study we will send you questionnaires to be completed at your leisure; we estimate the time required to be approximately 45-60 minutes. Shortly after that, we would arrange a personal meeting with you to complete the study.

Your responses will be completely confidential as the questionnaire will be identified by number only. On completion of the study you will be sent a summary of the findings.

The researchers involved in this project are Mrs Joyce Willock and Mr Alister Sutherland one of whom will contact you in the near future to discuss the project further and obtain your agreement to take part in this study. Please help by expressing your views, they are very important and should be heard in times of change.

Thank you for your co-operation.

Yours sincerely,

Dr Murray McGregor
Head of Rural Resource Management Dept.
SAC

Appendix E

Instructions given at evening talk.

Good Evening, Ladies & Gentlemen, thank you for coming tonight to help us with our decision making study.

Could you please give Alister your Business Questionnaire.
As you have seen in the business questionnaire decision making is influenced by a wide range of factors. But decision making is primarily about problem solving and I would like to start the evening with 15mins of solving simple problems.

Could you open the book entitled Raven's Matrices please. Inside the first page you should find a scoring sheet. (Demonstration with enlarged set of pictures and form). At the top of the page it says SET A, This is A1. You see what it is. The upper part is a pattern with a part missing. Each piece below is the right shape to fit the space but they do not all complete the pattern. Numbers 1, 2, 3, are all the right shape, they fit the space but not the pattern, 6 is the right pattern but there is a piece missing, that leaves,.. which one as the correct piece? yes 4. So the answer to A1 is 4 On the scoring sheet you have a similar column marked A1. (point) please put a diagonal line through the 4 on this sheet.
On every page of the book there is a pattern with a piece missing. You have to decide each time which bit is the right one, and put a line through that number on the answer sheet. The problems are simple at the beginning, but get harder as you go through. There is no catch, if you pay attention to the easy ones then you will find the later ones less difficult. Try each one in turn from the beginning, don't turn back, just work at your own pace and I will stop you after 15mins.

The next set of questions I would like you to tackle are on the yellow sheet, labelled KAI. This is asking you how easy or difficult it is to be seen as the type of person in the question, in general, rather than in particular instances. Number one, do you find

it easy or difficult to be seen as a patient person? Put a cross on the spot that best describes you.

You should each have a folder with even more questionnaires in them. The uppermost one should be the Edinburgh Stress Questionnaire, one way of fighting stress is to increase your drinking or smoking so this asks about changes to these habits.

The next one is entitled The General Health Questionnaire (GHQ), could you please underline the statement most appropriate for you. Please note that there are questions on both sides of this sheet.

Now all of the other questionnaires are scored on a scale from strongly agree to strongly disagree, 1 = strongly agree with the statement, 2 agree, 3 maybe, 4 disagree, 5 strongly disagree. They all ask for your opinion so please don't think about your response for too long, your first thoughts are likely to be the most useful ones. The last one is the Edinburgh Farming Attitudes Scale. This is a series of statements that farmers have made and you are asked for your opinion on these items.

The other questionnaires are scored along the same lines but they are more general. So please bear with us when they don't seem to be about farming. I'll tell you briefly about them now and you can ask me anything you like about them before we have the meal.

The NEO tells us a little about your personality, whether you are extrovert or introvert, that kind of thing.

The CISS tells us what strategy you prefer to use in coping with problems.

All of these things are relevant to decision making and these tests are used in industry to help place managers in different types of jobs.

Lastly, the funny one called the Nart word test. This is a list of words found in various types of official documents, don't worry I'm not going to ask you if you know what they all mean - because I don't know either! All I'm going to ask is for you to have a go at pronouncing them. When you want a break you can go over to the far corner with me and try saying them. We are using this to tell us the level of difficulty that should be used in official documents.

Appendix F

Factor Analysis of the Kirton Adaptor/Innovator Inventory

Three factors were determined from the 'scree' slope when all 32 items were analysed. Only loadings of 0.4 and above were permitted. The scale was reduced from 32 items to 24 items by the use of varimax rotated factor analysis. The internal relaibility of these items (Cronbach alpha) is given at the bottom of the factor table.

Table A.1 Factor Loadings of the item scores of the Kirton Adaptory/Innovator Inventory.

Item	Factor 1	Factor 2	Factor 3
Q16	.73	-.05	.13
Q23	.66	-.05	-.06
Q26	.61	.31	-.04
Q21	.60	-.16	.17
Q18	.52	-.05	.01
Q3	.58	-.01	.16
Q19	.57	-.07	-.05
Q11	.42	-.02	-.03
Q14	-.27	.68	04
Q22	-.37	.66	-.02
Q4	-.16	.54	-.01
Q8	.20	.50	.10
Q9	.05	.49	.22
Q7	.12	.44	.29
Q27	-.15	.44	.48
Q29	.08	-.04	.71
Q30	-.06	-.06	.64
Q33	.02	.08	.51
Q20	.00	.11	.51
Q24	.24	.26	.48
Q32	.01	.22	.47
Q15	.13	.11	.45
Q28	-.39	.12	.36
Cronbach Alpha reliability	**.65**	**.73**	**.70**

Appendix G

List of Journal and Conference Publications pertaining to this study. (Reverse Date Order)

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1997). Development of agricultural attitudes, goals and behaviour scales. *Journal of Vocational Behaviour*. (In press).

Edward-Jones, G., Deary, I., & Willock, J. (1997). Incorporating psychological variables in models of farmer behaviour:does it make for better prediction? *Etudeas et Researcheres sur les Systemes Agraivas a le development.* (Accepted subject to minor revision).

Austin, E. R., Willock, J., Deary, Gibson, G., Dent, B., Morgan, O., Edward-Jones, G., Grieve, R., and Sutherland, A. (1997). Empirical Models of farmer behaviour using psychological, social and economic variables. *Agricultural Systems* (In press).

Willock, J., Deary, I., Edward-Jones, G.,(1997). Modelling the influence of psychological variables on farming decision making. Submitted to *Journal of Agricultural Economnics. (accepted subject to minor revision).*

Deary, I., Willock, J., McGregor M. (1997). Stress in farming. *Journal of Stress Medicine, 13*, 131-136.

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1996) The importance of farm structure and psychological variables on farm behaviour. *Seminar given at the Scottish Agricultural College,* December 2nd 1996

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1996). Modelling psychological aspects of farming behaviour. *Proceeding Vol 5, (2), August 1997 BPS Conference November 1996* Crieff.

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1996). Personality and intelligence in environmentally friendly farming behaviour. *8th European Conference on Individual differences.* Poster presentation. Abstract. University of Ghent. Belgium July 1996.

McGregor, M., Willock, J., & Deary, I. (1996). Links between psychological factors and farm decision making. *Farm Management Vol. 9 No 5* Spring.

Sutherland, A., Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Dent, B., Grieve, R (1996). The Edinburgh farm decision making study: Elements for consideration in training and policy uptake. *2nd European Symposium on Rural and Farming Research Proceedings*. Granada. Spain. March 1996.

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1996). Modelling information in farm decision making. *Proceedings of BPS No.* 100 p99. BPS Occupational Psychology Conference. Eastbourne January 1996.

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1995). Modelling the relationship between personal characteristics, attitudes and behaviour. A model for stress. *Scottish Agricultural College, Economics Research Conference*. September 1995.

McGregor, M., Willock, J., & Deary, I. (1995). Farming Stress. *Farm Management* August.

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1995). Modelling the relationship between personal characteristics, attitudes and behaviour. A Model for Stress. *46th EAAE Conference Proceedings* Landbouwuniversiteit, Wageningen, Netherlands, October 1995.

Morgan, O., Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1995). The use of cluster analysis to develop a taxonomy of farmers based on the Edinburgh study of farm decision making. *46th EAAE Conference Proceedings* Landbouwuniversiteit, Wageningen, Netherlands, October 1995.

Sutherland, A., Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Dent, B., Grieve, R (1995). Edinburgh farm decision making study: Elements important to the farmer. *46th EAAE Conference Proceedings* Landbouwuniversiteit, Wageningen, Netherlands, October 1995.

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1995). Do farmers use objectives in farm decision making? Poster presentation. BPS Conference. Warwick April 1995. *BPS Conference Proceedings.*

Deary, I., Willock, J., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1995). Modelling stress in farmers. *BPS Work & Well-Being: An Agenda for Europe. Conference Proceedings.* Reading University Dec. 1995.

Willock, J., Deary, I., Edward-Jones, G., McGregor, M., Sutherland, A., Dent, B., Grieve, R (1994). Decision making on Family farms. *Proceedings from the 38th EAAE Conference*, Copenhagen, Denmark. Institute of Agricultural Economists and Royal Veterinary and Agricultural University, Copenhagen, Denmark. pp63-75.

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