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GOALS AND ASPIRATIONS AND THE LOW INCOME FARM PROBLEM

by

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ABSTRACT

GOALS AND ASPIRATIONS AND THE LOW INCOME FARM PROBLEM

by

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This study was concerned with the low income farm sector in Canada. The motivational problem associated with low income farmers formed the specific problem for the study. Two aspects of the motivational problem were investigated: (a) the extent to which it exists in the Canadian agricultural sector, and (b) whether this problem is a significant limitation to the economic achievement of low income farmers.

Two hypotheses were tested. Hypothesis one was: High income farmers are motivated more towards monetary goals, and have higher levels of aspiration; while low income farmers are oriented towards non-monetary goals, and have lower levels of aspiration. Hypothesis two was: Ceteris paribus, the differences in motivational characteristics between the low income and high income farmers are significant determinants of the differences in economic attainment between the two farm income groups.

To test the first hypothesis, data on goal orientation and levels of aspiration of farmers were obtained from a survey, carried out in the Carman area of the province of Manitoba. Analyses of the data

showed that the high income farmers did have significantly higher levels of aspiration, and were more significantly oriented to monetary goals than the low income farmers. These results supported hypothesis one.

A theory of entrepreneurial decision making on the farm firm was developed for testing the second hypothesis. An analytical form of this theory was utilised to incorporate a representative pattern of goal orientations and levels of aspiration of low income farmers in the survey, into a production decision model. Similarly, a second production decision model, representative of the goal orientations and levels of aspiration of high income farmers in the survey, was formulated.

The production decision models were then introduced into two farm firm growth models, which were used to trace the development of two hypothetical farm firms over a 20 year planning horizon. The first growth model was for a representative low income farmer, while the second was for a representative high income farmer.

The growth models were run under various conditions, with ceteris paribus conditions being maintained for all but motivational factors. All tests indicated that the economic attainment of the representative high income farmer was always significantly higher than the economic attainment of the representative low income farmer. These tests therefore supported the second hypothesis, and demonstrated that motivational characteristics have a significant effect on the levels of economic attainment of the farmers. This is a major contribution of the study.

One of the policy conclusions from the study was that it may be

possible to alleviate the motivational problem of the low income farmers. If these farmers can exceed their expectations of income attainment, this could lead to an increase in their levels of aspiration, and the adoption of monetarily oriented goal patterns.

It is therefore suggested that governmental action, with respect to the motivational problem of the low income farmers, should take the form of a Farm Income Improvement Programme. This programme would aim directly at widening the margin of financial returns received by farmers. Such a programme would represent a change in the orientation of current governmental policies concerning the low income farm problem, since these policies remain focused on resource development and resource adjustment on low income farms.

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Chapter 1

INTRODUCTION

The motivation to undertake the study reported in this thesis resulted from an examination of the impact of governmental policies and programmes on the low income farm problem in Canada. The evidence seemed to indicate that governmental activity was not having the desired effect, despite the number and variety of programmes tried. It was therefore decided that this research effort should re-examine the low income problem to determine if new approaches to the problem could be devised.

This chapter will present the low income farm problem, and the particular aspect of this general problem on which the study concentrates. This chapter will also provide an outline of the organisation of the thesis.

The Problem

Nature of Low Income Problem

In the literature three aspects of the low income farm problem have been emphasised (5). They are:

(a) the physical asset problem,

(b) the resource adjustment problem, and

(c) the preference problem.

These aspects will be examined from the resource level of the farms. The income obtained by a farmer can be defined as the sum of the products of the resources held by the farmer and the earning rates of these resources. This can be described mathematically as:

$$Y = \sum_{i=1}^{n} r_i \, e_i \qquad \text{where;}$$

Y = income of the farmer, n = number of resources held,

r_i = the holding of resource i, and

e_i = earning rate per unit of resource i.

If the quantity of resources held by the farmer is small, regardless of the earning rates of these resources, his income may never reach acceptable levels. Closely related to the problem of the quantity of resources is the question of their productivity. To the extent that the productivity of resources held by the farmer could be improved, this would increase the real (physical) quantity of output. Thus his resources could earn him greater income because of an increase in their earning rates (given constant output prices). The physical asset problem is concerned with these two aspects of the low income farm problem - resource limitations and resource productivity.

The resource adjustment problem is concerned with the earning rates of the resources held by the farmer. In the competitive environment of the markets for agricultural resources, the earning rates are largely determined by the supply and demand forces in the sector. If the supply of resources is very large (compared to demand) and declining slowly, this could cause the earning rates to be low, especially if demand is not growing at a fast enough pace. Low earning rates of resources in agriculture may have been characteristic of the agricultural sectors of most Western developed economies in the years following World War II, though there is some doubt as to the general relevance of a resource adjustment problem in the present day economic milieu.

The last aspect (c), the preference problem is concerned with the

fact that some farmers may have low incomes by choice, since they are not motivated to seek high monetary incomes. These individuals may choose to employ their resources in lower earning uses or in leisure. No real income problem may exist as far as these individuals are concerned. Rather there is a conflict of interest between the use that society thinks the individual should make of his resources, and personal goals and values. National income is usually taken as an index of social welfare, therefore only goods and services which are sold through the market count as contributing to social welfare. Individuals who prefer non-monetary to monetary returns, thus are frequently accused of using their resources inefficiently.

Lipsey (39: 435-437) suggests that if some individuals in a sector derive greater non-monetary benefits in the use of their resources, ceteris paribus, they should be prepared to accept lower monetary incomes to remain in that sector. Thus within the sector, income differentials will persist even into the long run. In this way if a preference problem exists in agriculture, it could be expected to give rise to a sub-sector deriving lower money incomes from farming.

Extent of Low Income Farm Problem in Canada

The question that arises is to what extent a low income farm problem exists in Canadian agriculture. In discussing the Small Farm Development Programme (SFDP)[1] in August of 1973, Mouelhi and Burns (54) stated that there were between 125,000 and 150,000 low income farm families in Canada, who required assistance under governmental programmes

[1]This programme along with other previous governmental programmes will be discussed in detail in the next subsection.

such as SFDP. Such assistance, they stated, is necessary ". . . to provide them with the opportunity of bringing their income up to an acceptable level by Canadian standards."

In this study, the low income farm sector is defined as all farm families with total family net income below $6363.[2] Statistics Canada income tax data for 1973 (71) states that there were 167,257 farm tax filers with total net income below $6363. To the extent that more than one farm tax filer live in the same family, the income tax data would tend to overstate the size of the low income farm sector. However, these data do support the contention of Mouelhi and Burns that the low income sector in Canada is somewhere in the region of 150,000 farm families.

The 1971 Census of Agriculture (69) reported that there were 365,068 farms in Canada, which would suggest that the low income farm sector comprises approximately 41 percent of the agricultural sector. The 1973 income tax data indicated that the low income tax filers (total income less than $6363) comprised 43 percent of the total number of farm tax filers. The similarity of the percentage of low income farm tax filers in 1973 (43 percent), and the percentage of low income farmers based on the 1971 Census (41 percent) is again noted.

Review of Governmental Policies

For at least 40 years, there have been governmental programmes in Canada designed to provide assistance to low income farmers. Buckley and Tihanyi (8) have provided a detailed review of three of these

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[2]This definition is fully developed in Chapter 3, which deals with the definition of farm sector boundaries.

programmes. They are the Agricultural Rehabilitation and Development Act (ARDA), the Prairie Farm Rehabilitation Act (PFRA) and the Maritime Marshland Rehabilitation Act (MMRA).

PFRA was launched in the drought years around 1935, when repeated crop failures and widespread farm abandonment gave rise to fears that large areas of Western Canada would be lost to agriculture. A resource development type approach was taken, and it concentrated on water and land development. Buckley and Tihanyi (8: 11) concluded that PFRA had little direct effect on the incomes of low income farmers, who had relatively few resources which could have received benefits from the developments. Generally however, it did assist in halting soil destruction on the Prairies and introducing improved farming methods.

MMRA was passed by the Federal Parliament in 1948, and was developed to ensure the protection of agricultural lands from salt water flooding in the Fundy Region of New Brunswick and Nova Scotia. The resource development type approach was again adopted. It was reported that there was no evidence that the programme of protective structures had extended marshland agriculture, or provided for more intensive utilisation of the protected lands. Buckley and Tihanyi concluded that the Fundy Region appeared to remain an area of land abandonment and low income farming, and they expressed concern that the investment in the project failed to produce significant additions to farm income.

While PFRA and MMRA were exclusively federal undertakings, the ARDA agreements were joint programmes of the federal and provincial governments. The first ARDA agreement of 1960 was more clearly aimed at solving the low income farm problem. It was however dominated by the resource development type approach of PFRA, and this fact probably

explains the minimal impact it made on the problem. The second ARDA agreement (renamed the Agricultural and Rural Development Act) was signed in 1965. This programme did include aspects of rural adjustment in addition to resource development. These adjustment policies included comprehensive manpower and farm purchase programmes, to assist the needs of rural people wishing to re-establish themselves in non-farm employment. However the emphasis in this second ARDA programme remained centred on land resource development.

By 1969, it seems that the policy makers became aware of the general inadequacy of the then current governmental programmes for solving the low income farm problem. The Federal Cabinet thus established an Interdepartmental Committee to give careful consideration to governmental policies and programmes to alleviate the problem. The report of the Interdepartmental Committee (9) provided the framework that led to the Small Farm Development Programme (SFDP) which was announced on December 6th 1971 (54).

The SFDP has two main thrusts. The first is to assist those farmers who wish to leave agriculture to liquidate their assets and undertake non-farm employment or retire. This assistance includes manpower programmes to upgrade the training of those farmers willing to undertake non-farm jobs, and the provision of services to facilitate communication between prospective vendors and purchasers of farms.

The second thrust is to assist those farmers, who have the potential for growth of their farm incomes, to enlarge their land holdings and improve their operations. These farmers would be provided with adequate credit for land purchases, and would have first choice in the purchase of assets of farmers leaving agriculture. They would also

receive intensive assistance by farm management specialists to improve the managerial and resource efficiency on the farm.

In general then, the SFDP aims to remove as many low income farmers as possible from the agricultural sector, and to transfer their resources to those low income farmers who remain. The farmers who remain will be provided with credit and managerial assistance to improve their income position, and become economically viable.

An evaluation of the orientation of governmental programmes in the context of the previous discussion on the nature of the low income problem is now attempted. The resource development approach of the earlier programmes (PFRA, MMRA and the first ARDA agreement) was aimed at increasing the productivity of resources under the control of farmers. This is one aspect of the physical asset problem. However, as noted by Buckley and Tihanyi (8: 11), given that low income farmers are particularly affected by the second aspect of the asset problem - too few resources - the benefits they receive from resource development programmes will be relatively small. Thus these programmes cannot be expected to significantly affect their incomes.

The second ARDA agreement and the SFDP contained provisions for dealing with both aspects of the physical asset problem. In addition to resource development, these programmes provide assistance to low income farmers to expand their resource base. These programmes therefore seem adequately equipped to handle the physical asset problem.

Starting from the second ARDA programme more attention was paid to the second aspect of the low income farm problem - the resource adjustment problem. These adjustment policies have figured prominently in all further programmes especially in the SFDP, and have emphasised

manpower training to assist farmers to leave agriculture. These policies seem well founded when it is also considered, that low income farmers localised in small regions of rural Canada constitute a large portion of the present problem.

Only one aspect of the low income farm problem remains--the preference problem. The programmes and policies discussed do not seem to have recognised the possibility of a preference problem being a limitation to income achievement on low income farms. In the case of SFDP, the Interdepartmental Committee Report did mention the possibility of a preference problem. They stated (9: 13): "It is sometimes argued that the human element is the most limiting input in the profitable development of Canadian agriculture." Aspects of the human input identified were:

(a) mores, values and preferences of individuals,

(b) low levels of managerial skills of the farmers,

(c) inadequate sources of highly skilled management consultation services, and

(d) insufficient farm management information available to the farmer.

In their policy recommendations however, the Interdepartmental Committee completely neglect the first set of human limitations, mores, values and preferences of individuals. The formulators of the SFDP followed likewise and also ignored this aspect. What is not known is whether the preference problem is sufficiently important that failure to appreciate its limiting effects could be a serious flaw in the governmental programmes.

Specific Problem Set for Study

The specific problem set for this study is to provide knowledge that could assist in the determination of the importance of the preference problem on low income farms in Canada. Two ideas are included here. First the study is interested in the extent to which a preference problem exists on low income farms. Secondly the study will try to determine whether the preference problem is in fact a significant limitation to economic achievement on low income farms in Canada.

The previous discussion has already identified two reasons which justify the need for the present study - the large number and percentage of low income farms in the agricultural sector, and the possibility that the preference problem could be limiting the success of governmental aid programmes to the low income sector. There is one other reason which justifies the need for a study of this type. This particular juncture in Canadian economic development may be providing the agricultural sector with its best opportunity to bring agricultural incomes up to parity with non-farm incomes. While general economic conditions in the non-farm sectors have led to recession along with high inflation, the agricultural sector has benefited from high commodity prices (with the possible exception of beef) and increasing real incomes. These conditions provide a genuine opportunity for decreasing or even eradicating the low income farm sector, by ensuring that the increasing incomes reach the lowest groups in the agricultural sector. Any limitations to this process should be quickly identified and remedied.

Organisation of Thesis

The study proceeds as a comparative one. If a preference problem exists, it may be a significant factor limiting economic attainment of low income farmers. On the other hand it could be argued, that the preference structure of high income farmers should be conducive to their attainment of higher economic performance. Therefore, if the preference structure of high income farmers is compared to that of low income farmers significant differences should be observed, and these differences should be an important determinant of economic achievement. These arguments are developed into hypotheses and objectives for the study in Chapter 2.

Chapter 3 presents the definition of boundaries for the different income sectors comprising Canadian agriculture. These boundaries are necessary to identify the different income sectors, so that their preference structures can be compared. This chapter also attempts to formalise the concepts of low incomes and acceptable living standards.

Given the hypotheses and objectives in Chapter 2, the next stage is the formulation of an analytical framework to be used in testing the hypotheses. This analytical framework involved the development of a multiple goal theory of entrepreneurial decision making on farm firms, and is the subject of Chapter 4. Underlying the developments in this chapter are theoretical concepts from the body of psychological theory, especially the theories of motivation.

To provide the data to test the hypotheses and the theoretical framework developed in Chapter 4, a survey of farmers was done in the Carman-Morden-Manitou area of the province of Manitoba. The survey was completed in the fall of 1975, and included the personal interview of 103 respondents. The development and nature of this survey, as well as

the results obtained are detailed in Chapter 5.

The survey provided data to determine whether significant differences existed between the preference structures of low income and high income farmers. To test whether the differences in preference structures could account for differences in economic achievement between the two groups of farmers, preference structures representative of the two groups are incorporated into two separate farm firm growth models. One model is for a representative low income farmer, and the other model is for a representative high income farmer. These models then simulated the development of two hypothetical farms over a 20 year planning horizon. The levels of economic achievement attained by the representative farmers are then compared. The development of the farm firm growth models and the actual test procedures are described in Chapter 6.

Chapter 7 starts with a summary of the study and the results obtained. Then the question of the implications of the results for policy decisions is examined. An analysis of the ways in which the study could be expanded to provide a more comprehensive investigation of the low income problem over the whole of Canada is then given. The chapter ends with a brief discussion of the applicability of the theoretical constructs developed in the thesis to the study of problems of the small farm sector of developing economies.

Since some of the psychological terms used in the thesis may be unfamiliar to the readers in the field of agricultural economics, a glossary of psychological terms used is appended to this thesis.

Chapter 2

HYPOTHESES AND OBJECTIVES

Introduction

As set out in Chapter 1, the specific problem with which this study is concerned is to determine whether the preference problem constitutes a significant aspect of the overall low income farm problem in Canada. For methodological purposes, it is necessary to specify the problem in terms of specific hypotheses, which could be subjected to systematic examination and testing. The purpose of this chapter is to set out these hypotheses. Once the hypotheses are formulated, the objectives for the study will be clarified.

As seen in the last chapter, the preference problem suggests that some farmers may have low incomes by choice, since they are not motivated to seek high monetary incomes. The preference problem is thus a behaviouristic element in the study of low income farmers. In fact it is best referred to as the motivational problem.[1]

Two approaches have been taken in the study of the differences in economic attainment of groups of individuals. The first approach has been to explain these differences in terms of social factors. The second approach has been to explain these differences in terms of

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[1] In Chapter 4 where the analytical framework is developed, it will be seen that individual behaviour is more complex than being a function of preference structures alone.

psychological factors especially motivational factors. The psychological approach was taken in this study. Before it is dealt with however, a brief review of the sociological approach is given.

After the review of the sociological approach, the chapter will discuss previous works that have investigated the relationship between motivational attributes and economic achievement in the context of the farming community. This sets the stage for the enunciation of the hypotheses to be tested in the study.

Relation of Social Factors to Economic Achievement

Featherman (22) has reviewed the recent literature on the relationship between economic and occupational achievement and social and residential background factors. Four factors are identified as major determinants of the level of economic and occupational achievement. They are (1) years of formal education completed, (2) father's occupation, (3) size of family of origin and (4) residential background.

Featherman cites the works of Blau and Duncan (20) and Duncan, Featherman and Duncan (21). These studies, he states, have shown that years of formal education completed proves to be the most important single variable in estimating current occupational achievement. Educational attainment of the son also explains most of the total relationship between paternal and filial occupational statuses.

Blau and Duncan also showed that education is the critical variable in understanding the differential achievement of males with farm and non-farm backgrounds. Featherman's work also showed that men with farm and rural rearing have an educational handicap to their

economic career, which men of urban backgrounds do not suffer. The fact, he states, that those with non-urban backgrounds have fewer years of schooling can be explained in part by the relatively large sizes of their families of origin.

Featherman's study also showed that when the father's occupational status, size of family of origin, and years of schooling completed are controlled statistically, the residential variable has no direct net effect on occupational and income career achievements. Featherman (22) states that there are a large number of studies that support the conclusions of Blau and Duncan (20) and Duncan et al (21).

Haller (26) reports that sociologists interested in stratification have become concerned with goal orientation variables, because such factors promise to help explain educational and occupational attainment. Thus the psychological approach, relating motivational attributes to attainment can be viewed as a more fundamental approach to the problems of income attainment in groups of individuals. Since an abundance of evidence has been amassed on the relation between social factors and economic attainment, it was decided that little purpose would be served in this study by following this approach.

Attention is now turned to the psychological approach which attempts to relate economic achievement in rural and farming environments with motivational attributes of the individuals. As stated previously, this approach was taken in this study. The psychological approach utilises concepts that are common to the field of economics, especially that of goal maximisation. The study of the fundamental concepts in this approach also was considered advantageous to the study.

The Hypotheses

Relation of Motivational Attributes to Economic Performance

In this subsection three studies, which investigated the relation between motivational characteristics and economic performance, will be reviewed. The first study was done by three rural sociologists Hobbs, Beal and Bohlen (28) around 1960. They based their work on four premises. They are:

(1) Human behaviour is goal oriented.

(2) Individuals make choices concerning both goals and the means employed to attain these goals.

(3) The goals selected by individuals are a function of their beliefs, values and attitudes, perceptual and cognitive abilities, and their social psychological environment.

(4) Human behaviour is economically rational when oriented towards the attainment of economic goals.

From the four premises above, Hobbs et al developed their major hypotheses. The one of concern to us here stated that inter alia economic productivity of entrepreneurs will depend on five general value orientations:

(1) the relative value placed on economic ends,

(2) the orientation towards science and scientific methods,

(3) the relative value placed on independence in decision making,

(4) the relative value placed on mental as opposed to physical processes in farm operation, and

(5) the relative value placed on risk aversion.

They postulated a positive correlation between the first four

value items and economic productivity, while the fifth value item was hypothesised to be inversely related to economic productivity. The hypotheses of their study were tested on a sample of 131 farmers belonging to the Central Iowa Farm Business Association. The testing was done by determining correlation coefficients between each of the five value items and the economic productivity of the operators, as measured by management return.

While Hobbs et al stated that the statistical analysis supported the hypotheses, they reported that the levels of correlation were, in their own words, "rather low". For example the correlation coefficients obtained between the productivity measure and the value items, were as follows: item (1) "economic motivation" .222, item (2) scientific orientation .171, item (3) independence .371, item (4) mental activity .113, and item (5) risk aversion .267 (28: 163).

One reason for the "low" results obtained may be in the rather selective sample they dealt with. As they stated (28: 162): ". . . the sample was found to be atypical when compared with averages from the Agricultural Census." It is most likely that the sample did not contain a wide enough range of values of the variables for the results to more strongly indicate the underlying relationships.

The second study also had a strong sociological orientation. This study was done by Rushing (64) around 1967. The study was clearly focused on two questions. The first question was: "Are members of the lower (class) and (members of the) middle class equally oriented to 'monetary success', 'to getting ahead' (and) to economic achievement . . .?" The second question was: "Is socioeconomic status associated with different aspiration levels in reference to the same goals?" In

addition to differences in goal orientations between groups (or as Hobbs et al put it "differences in relative value placed on economic ends"), this study was also concerned with differences in the levels of aspiration between groups.

Rushing conducted two rather elaborate surveys. The first was of 1029 "low class farm workers" from six eastern and central Washington State counties. These farm workers were mainly Mexican-Americans. The second sample consisted of 240 ". . . affluent wheat and pea 'ranchers' from . . . a wealthy agricultural county in the eastern part of the state (of Washington)."

Rushing stated: "It is clear that farmers and farm workers represent distinct class groups." Consequently he adds: ". . . a comparison of the two samples should provide a crucial test of the hypotheses that class does (or does not) make a difference in goal orientations and levels of aspiration" (64: 381).

Rushing does not present any statistical analysis with his results. When the large sample sizes used are considered the reasons for this are unclear but no explanation is given. Rushing does present definite conclusions. He states that the evidence indicates that lower-class and middle-class to upper-class individuals, as represented by farm workers and farmers, differ considerably in their goal orientations. The goal orientations of most farm workers revolve around matters of basic physical and economic survival. On the other hand, farmers are more apt to be concerned with economic enhancement and continued monetary success, with peace, and with quality of government.

On aspirations, Rushing concluded that the level of aspiration tends to increase as reported family income increases, and to drop as

income status drops, even when the income is already very low. Even in areas of similar goal orientations he states, the level aspired to is lower for the lower-class farm workers.

The final study in this review was done by Ruth Gasson (24) at Cambridge University in England, and reported in 1973. Gasson described her research as ". . . a pilot study . . . carried out with the object of exploring the range of values relevant to the farming occupation" (24: 528). Information was gathered in various ways from open-ended discussions to forced-choice questions. Hence she describes her conclusions as merely tentative. She interviewed three samples of farmers. The first sample consisted of large scale farmers, the second sample was of 100 "small farmers", and the third sample consisted of 100 "commercial farmers".

Gasson attempted to assess the relationship between value orientations and size of business. Farmers with large businesses appeared to be more economically motivated, although expansion seemed to be more salient than maximising present income. Smaller farmers, she stated, put more stress on intrinsic aspects of work, particularly independence. She cautioned against reading too much into her conclusions, since she stated: ". . . the indications are vague and sometimes conflicting, and a great deal more research must be done to establish whether the variation in value systems occur consistently" (24: 534). No doubt, the lack of a genuinely consistent sampling procedure contributed to the unreliability of the results obtained.

The conclusions from the three studies bear a close similarity on one important point. They all indicate that some relationship probably exists between the income levels of farmers and their goal and

value orientations. The studies of Rushing and Gasson also seem to indicate that larger or higher income farmers were more oriented to economic success or monetary goals, while Rushing states that low income individuals are more oriented to economic and physical survival. Rushing's study included the aspect of aspiration levels, and here he reports that differences can be expected in aspiration levels between low and high income groups.

Hypotheses to be Tested

As indicated in Chapter 1, a comparative approach is taken in this study, somewhat along the lines of Rushing's work. In the present study, low income farmers are compared to high income farmers. The general conclusions of the three studies just reviewed provide the basis for the development of the hypotheses.

Low and high income farmers in Canadian agriculture may not exist as separate and distinct socioeconomic classes. However if attributes of these two groups of farmers are compared, differences may be found in goal orientations and aspiration levels similar to these noted by Rushing. In fact, if a preference problem exists on Canadian farms, then it can be hypothesised that the low income farmers and the high income farmers would differ in both goal orientations and levels of aspiration. The first hypothesis to be tested in the study is thus: High income farmers are motivated more towards monetary goals and have higher levels of aspiration; while low income farmers are oriented more towards non-monetary goals and have lower levels of aspiration.

It was seen in Chapter 1 that apart from its very existence, another aspect of the preference problem was to be investigated in the study. This was whether, ceteris paribus, motivational characteristics

are a significant limitation to economic achievement on low income farms. This second aspect of the problem for this study provided the second hypothesis to be tested. This hypothesis is that, ceteris paribus, the differences in motivational characteristics between the low income and the high income farmers are significant determinants of the differences in economic attainment of the farm income groups.

No evidence could be found in the literature to support or refute this second hypothesis, as this aspect of the preference problem may not have been investigated previously. The findings of the study with respect to this hypothesis, will thus be one of the major contributions of this research.

Objectives of Study

Attention will now be given to the major objectives of this study. The first objective is to provide tests to determine whether there is any justification for support of the two hypotheses set out in the previous section. This objective can be stated succinctly as: to provide a detailed examination of the preference problem in Canadian agriculture, to determine its extent, and its significance as a factor limiting economic achievement. This, of course, does not rule out other factors, such as resource availability or managerial expertise, as also being significant. To provide a test of the second hypothesis, special methodological procedures had to be devised based largely on the theoretical framework developed as part of the research. Once this first objective is completed, an attempt will be made to suggest appropriate governmental policies to help alleviate the preference problem, if one in fact exists.

The second objective of the study is to contribute to the introduction into the methodology of agricultural economics, measurement techniques and theoretical constructs of other disciplines of the social sciences, especially psychology. There exists a large body of work from other social sciences, which can be used to enable accurate determination of variables of importance to agricultural economic research. This body of information remains largely untouched. The present study attempts to demonstrate that the judicious use of measurement and theoretical concepts from other social sciences has much to contribute to efficiency and accuracy in research in agricultural economics.

The third objective of the research described in this thesis is the development of a theory of entrepreneurial decision making on the farm firm, encompassing multiple goal orientations, uncertainty and levels of aspiration. The theory is also formulated in terms that allow it to be used in the normative analysis associated with testing hypothesis two.

Chapter 3

DEFINITION OF FARM SECTOR BOUNDARIES

The hypotheses set out in Chapter 2, involved comparisons of the behaviour and economic achievement of low and high income farmers. In order to identify these farm groups, it is necessary to define boundaries for the different income groups. This is done in this chapter. The chapter starts with a definition of the concept of "low" incomes.

Low Income and Poverty Lines

Canadian agriculture can be divided up into three sectors on an income basis:

(1) The high income or commercial sector,

(2) the medium income sector, and

(3) the low income sector.

The initial problem is to arrive at a definition of the low income sector. The first problem that is encountered here is the concept of "low" income. Low income in this study is equated with poverty as discussed in The Report of the Special Senate Committee on Poverty (59). Among the definitions of poverty that the Senate Committee endorsed was that given by The Economic Council of Canada (59: 1). They defined poverty as ". . . insufficient access to certain goods and services, and conditions of life which are available to everyone else and have come to be accepted as basic to a decent, minimum standard of living." The concept that has been widely used to define poverty is the poverty line, which the Senate Committee described as ". . . the level of income

which divides the families of a particular size, place, and time into the poor and the non-poor." (59: 5). The poverty line, in addition to being conceptual, is also statistical. As an operational definition of poverty, it permits a definition of the scope of poverty in a society by providing the means of counting the numbers of the poor.

There are two basic approaches to the establishment of poverty lines:[1] the absolute approach and the relative approach. In the absolute approach, the poverty line is defined in terms of the income that is necessary to provide families with the basic needs of food, shelter and housing. The line is adjusted for family size, and the income granted for these needs is calculated according to the minimum necessary for a family's survival. No consideration is given to the standard of living of others in the society, and it is in this sense that this approach is absolute.

It is difficult to ignore the living conditions of those people surrounding the poor, and the average living conditions of the society should be taken into account when defining poverty lines. The relative approach is built on the realisation of income inequality and deprivation in society. In its extreme form, this approach would require an equal distribution of income, so that everyone could achieve the average standard of living. However this extreme is seldom aimed at, and the relative approach generally takes into consideration ". . . the need to maintain the family's and individual's dignity, and stresses the social

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[1]The discussion on poverty lines is taken from Canadian Fact Book on Poverty published by the Canadian Council on Social Development (63). Further information on technical aspects of poverty lines is given in an Appendix to the Report of The Special Senate Committee on Poverty (59: 199-218).

survival of the family, whereas the absolute approach stresses only physical survival." (63: 6).

In Canada, there is no single agreed upon poverty line or even an "official" poverty line. There are, however two widely known and discussed poverty lines, those of Statistics Canada (used by the Economic Council of Canada) and those of the Special Senate Committee on Poverty. These two poverty lines shall be used in this analysis so brief descriptions are now given.

The Statistics Canada poverty lines were devised in 1961 on the absolute approach. Data from consumer expenditure surveys showed that the average Canadian spent 50 percent of his income on basic essentials. Statistics Canada therefore established fairly arbitrarily that if an individual or a family was required to spend more than 70 percent of its income on the basic necessities, it could be considered as living in poverty.

In 1973, Statistics Canada revised its poverty lines. The first adjustment made was the recognition that Canadians spent a smaller percentage of their income on basic necessities since 1961. This percentage in 1973 stood at 42 percent. Therefore Statistics Canada now considers any family or individual who has to spend more than 62 percent of its income on basic essentials, to be living in poverty.

The second adjustment was the definition of poverty lines for different areas, depending on the size of the population of the area. This was done to reflect the fact that generally, it costs more to live in large metropolitan areas than in rural areas. Table 1 presents the revised Statistics Canada poverty lines for January 1975.

The Senate Committee poverty lines were designated in 1971 to

Table 1. Statistics Canada Revised Poverty Lines Estimated for January 1, 1975

Family Size	Population of Area				
	500,000 or more	499,999 to 100,000	99,999 to 30,000	Small Urban	Rural[1]
	.....Dollars.....				
1	3,459	3,238	3,145	2,893	2,514
2	5,013	4,694	4,558	4,192	3,647
3	6,397	5,991	5,815	5,351	4,652
4	7,608	7,123	6,915	6,363	5,532
5	8,504	7,962	7,731	7,114	6,186
6	9,336	8,741	8,487	7,808	6,789
7	10,236	9,583	9,305	8,559	7,444

[1]Rural includes farm and non-farm areas.

Source: Canadian Fact Book on Poverty (63: 8).

take account of the minimum subsistence level budgets of Statistics Canada in 1961 (mentioned previously), cost of living adjustments for family size, and relative income deprivation (59: 7-8). These poverty lines take the basic budgetary needs as a starting point, and allow adjustments which reflect the conception of poverty as economic conditions change. Hence these poverty lines are definitely more along the relative approach. The Canadian Fact Book on Poverty (63: 10-11) reports that analysis of the Senate lines consistently worked out to be 56 percent of average Canadian family income, and that they exceed even the revised lines of Statistics Canada. Table 2 gives the Senate Committee poverty lines for January 1, 1975.

Table 2. Senate Committee Poverty Lines for January 1, 1975

Family Size	Poverty Line In Dollars
1	3,372
2	5,620
3	6,744
4	7,871
5	8,992
6	10,116
7	11,240
8	12,364
9	13,488
10	14,612

Source: Canadian Fact Book on Poverty (63: 10).

Low Income Farm Boundary

Since the average Canadian family has two children (the 1971 population census gives a figure of 1.7 children (68: 13-1)), January 1975 revised Statistics Canada poverty lines for a family of four are adopted as the boundary of the low income farm sector (Table 1). The agricultural sector is not limited to rural areas, and in some places farms may cluster around small urban areas. Using the rural area poverty lines may thus unnecessarily understate the low income farm boundary. The small urban poverty line for a family of four is thus taken as the low income boundary in this study. This value is $6363. Hence farm families with total net income[2] less than $6363 are defined as belonging to the low income farm sector. It is assumed that any family in this sector would be living in poverty in the absolute sense, that is barely having enough income to afford the commodities essential to survival.

High Income Farm Boundary

The high income boundary is defined as all farm families with total net income greater than $10,236. The concept here is that farm families with income greater than $10,236 would be above all the revised Statistics Canada poverty lines, even the one for families of size seven or more living in large metropolitan areas. The Senate Committee lines exceed all other lines, as stated earlier, and the Senate Committee poverty line for a family of six is $10,116 (Table 2). Hence by the

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[2]The definition of total net income used here is that of Statistics Canada as given in the Advance Bulletin of the 1971 Census of Canada (70: iii), and is basically the definition used for income tax purposes.

above definition, families in the high income farm sector would be above the Senate Committee poverty line for a family of six. They would also receive an income that is greater than 73 percent of average Canadian family income, which would put them in a relatively favoured position in Canadian society. Some caution should be noted however that the term "high income" here is only a relative one, and it should not be implied that these farmers belong to some wealthy class.

Medium Income Farm Boundary

The boundaries for the medium income farm sector are now already defined. The medium income farm sector consists of farms with total net income greater than $6363, and less than $10,236.

Boundaries in Terms of Farm Gross Sales

The next problem is to relate farm sector boundaries given in terms of total net income to the kinds of data usually obtained in agricultural censuses and surveys. Farm censuses and surveys usually report farm income data in terms of farm gross sales rather than net farm income or total family income. Also these data on farm gross sales are not usually related to size of family data or to off-farm incomes. Accurate data on net farm income and total family income, and their relation to size of family data and off-farm income are very difficult to obtain except by very detailed and expensive sample surveys. Hence the usual procedure adopted in agricultural surveys has been to collect more easily obtainable data on farm gross sales, and convert these data to net farm income and total income by making use of conversion data obtained from more detailed surveys of the agricultural sector. This technique is also

used in this study where the farm sector boundaries defined in terms of total family net income (as given previously) are converted to definitions in terms of farm gross sales.

The first major attempt at a detailed survey of total family net income, off-farm income and family size in Canada was the 1958 Farm Expenditure and Income Survey (23). The results of this survey are given in Table 3.

The data in Table 3 show that non-farm income made a significant contribution to total income, especially for low income farmers. The survey indicated that the main source of this non-farm income was off-farm employment. Indications are that since 1958, farmers have been obtaining declining net incomes from gross sales, because of the increased dependence on the non-farm sectors of the economy for goods and services essential to farm production. This has resulted from technological changes in production during the last decade.

Legislative changes in 1971 provided Statistics Canada with the authority to annually tabulate information submitted by individuals to the Department of National Revenue, Taxation. Cross-classifications and distributions can now be provided to users upon request. This information source was utilised in the definition of farm sector boundaries in terms of gross farm sales. In a very recent article Anderson (1: 41-51) has discussed the relative usefulness of tax data. In general he concluded (quoting Gellner (25)) that although there are conceptual differences between income tax data and other data sources, income tax statistics can stand as an independent data source for the analysis of a variety of problems. The conceptual differences he argues should not detract from the usefulness of income tax data.

Table 3. Average Farm Net Income and Off-Farm Family Income Canada, by Value of Agricultural Products Sold, 1958.

Value of Agric. Products Sold $	Average Farm Net Income $	Off-Farm Family Income $
Less than 250	27	2503
250 to 1,199	518	1831
1,200 to 1,999	1038	1315
2,000 to 2,499	1382	1181
2,500 to 3,749	1870	989
3,750 to 4,999	2469	832
5,000 to 9,999	3795	899
10,000 to 14,999	6005	1002
15,000 to 24,999	7176	1199
25,000 and over	15193	1741

Source: FitzPatrick and Parker (23).

The income tax data used here are given in Table 4, and are for the year 1973.[3] This is the latest year for which data are available. Any error involved in using the 1973 tax data in conjunction with the poverty lines for January 1, 1975 is assumed to be insignificant.

Table 4 shows the continuing importance of off-farm income for low income farmers. The results of the 1971 Census of Agriculture state that 41 percent of farmers with farm gross sales under $2500 obtained between 75 percent and 100 percent of their total income from non-farm sources. The high amount of off-farm income for low income farmers

[3]These data were obtained via personal communication with R.B. Proud and J. Le Blanc-Cooke, Agriculture Division, Statistics Canada.

Table 4. Distribution of Average Net Farm Income, Average Net Off-Farm Income and Average Total Net Income, by Gross Farm Income, Canada, 1973

Gross Farm Income	Average Net Farm Income	Average Net Off-Farm Income	Average Total Net Income
1 - 624	-1261	10026	8765
625 - 1249	- 778	7940	7162
1250 - 1874	- 505	7112	6607
1875 - 2499	- 359	6568	6209
2500 - 3749	- 25	6203	6178
3750 - 4999	423	5476	5899
5000 - 6249	809	5057	5866
6250 - 7499	1273	4394	5667
7500 - 8749	1719	4057	5776
8750 - 9999	2122	3588	5710
10000 - 12499	2666	3064	5730
12500 - 14999	3462	2618	6080
15000 - 17499	4073	2559	6632
17500 - 19999	4714	2195	6909
20000 - 22499	5270	2064	7334
22500 - 24999	5940	1880	7820
25000 - 29999	6720	1894	8614
30000 - 34999	7656	1715	9371
35000 - 39999	8371	1854	10225
40000 - 44999	9006	1827	10833
45000 - 49999	9511	2061	11572
50000 and over	10807	2552	13359

Source: Statistics Canada (71).

explains the apparent aberration in average total net income in 1973 for the first seven categories of farms (that is, farms with gross farm income less than $6250) given in Table 4. For these seven categories, as gross farm income increases, average total net income falls because of lower levels of off-farm income received by the farmers.

By the definition of the low income farm boundary given previously (total family net income less than $6363), it can be seen in Table 4, that all farms with farm gross sales less than $15,000, and greater than $1874 fall within the low income farm sector. Persons with farm gross sales less than $1875 would seem to have substantial alternative sources of income. This group may include a large number of the so called "hobby" farmers, in contrast to commercial farmers, with whom this study is concerned. However to the extent that there are genuine commercial farmers with farm gross sales less than $1875, these farmers must be included in the low income farm sector. The low income farm sector thus consists of all commercial farmers with farm gross sales less than $15,000.

From Table 4, it can be seen that farms with gross sales greater than $39,999 fall within the high income farm sector, since the boundary of this sector is defined as farms with total income greater than $10,236. The medium income farm sector is thus defined as farms with gross sales between $14,999 and $39,999.

Chapter 4

ANALYTICAL FRAMEWORK

Introduction

As was noted in the introduction to Chapter 2, this study, by investigating the preference problem is interested in behavioral aspects of low income farmers. One of the objectives of the study (as stated in Chapter 2) is to make judicious use of methodological and theoretical concepts from other social sciences, to improve the accuracy and reliability of the results obtained. In this chapter these concepts are set out, and they are utilised to develop an analytical framework for the methodological procedures described in later chapters.

It should be stated at the outset, that no attempt is made to provide a review of psychological theory, nor to encompass the full range of opinions that might exist with respect to particular issues. Instead all that is attempted is to include as much of psychological thought as is believed necessary to provide a meaningful basis for subsequent discussions.

Economic Research and the Social Sciences

Inputs of other social sciences into the theoretical and methodological aspects of economic research is not a recent phenomenon. Simon (66: 389) in discussing the reintegration of the social sciences in 1954 stated:

> The social sciences - weakened by a half-century of schisms among economists, political scientists, sociologists, anthropologists, and social psychologists - are undergoing a very rapid process of reintegration . . . . The common diplomatic language for the scientists participating in the process is the language of sociology and social psychology, and the common core of theory . . . (is) drawn primarily from these two fields.

Simon attributed the trend to reintegration to two causes. The first he said, was that in attempting to understand and analyse the large events in the political and economic scene, social scientists have been forced to a recognition that all such events are aggregated from the interrelated behaviour of human beings. The theoretical models, and the predictions based on these models, have required the social scientists to make assumptions about the motives, understandings and abilities of these human beings. Thus he stated:

> Critical attention to these assumptions, and a desire to validate them in a scientifically respectable manner, has gradually . . . driven social science back to the molecular phenomena of behaviour in a social environment.

The second cause identified by Simon was the fact that the student of aggregative phenomena (like the economist) is now confronted with a growing body of psychological and sociological theory with empirical verification, which places a check on his free imagination. This requires him to reconcile his postulates with this theory and data. He stated: ". . . social psychology and sociology are . . . reaching a stage of development where they can make a positive contribution toward the foundations on which the more aggregative theories are built" (66: 389).

In the early 1950's, ideas similar to Simon's were being propounded particularly by Katona (30: 31), who urged all social scientists including economists, that they could contribute to the

development of the different disciplines by exploring areas of common concern without regard to traditional demarcations.

As the present day state of the social sciences shows, little real integration of the social sciences has occurred in the intervening decades, especially among university faculties. However in the very recent past some amount of rejuvenation of the integrative aspects of social sciences has been reappearing especially in research in agricultural economics and the administrative sciences. In the field of agricultural economic research reference can be made to the work of Gasson (24), Hobbs et al (28) and Patrick and Eisgruber (55). In the administrative sciences, reference can be made to the seminar on multiple criteria decision making held at the University of South Carolina in October 1972. The publication that resulted from this conference, edited by Cochrane and Zelery (17), contains many papers that deal with research projects which involved inputs from various social science disciplines. Another recent research effort was the work of Johnsen on multi-objective decision models in Sweden (29). The present study is in the spirit of the most recent trend towards reintegrative social science study.

Goal Directed Behaviour

The statement of the preference problem in Chapter 1 suggests that preferences or goal and value orientations are a major determinant of the behaviour of individuals. This section will examine whether or not this view is supported by psychological theory.

Goal Striving Behaviour - A Developmental View

The first view of goal striving behaviour to be discussed is the

work of Alfred Adler, a psychoanalyst and associate of Sigmund Freud.[1] Adler saw man as a goal striving entity. When the individual, at some early stage of his development, decides upon his particular avenue of success, he develops what Adler terms, his life style. This he saw as the unity in each individual - in his thinking, feeling, acting; in his conscious and unconscious; and in every aspect of his personality. The life style determines the values which functions as guide posts for goal striving behaviour, throughout the person's existence. A picture thus emerges of humans as individuals each having some well defined mission in life, which he (or she) tries to accomplish by multiple goal behaviour. Adler saw, as the primary mission of life (or primary driving force) the development of social interest which could be defined as a feeling of identification, sympathy and affection for mankind.

Goals supply the individual with the criteria for making the innumerable choices with which he is confronted in his daily life. Adler saw goal striving as always taking the form of a movement from a relatively minus to a relatively plus situation - that is, from a feeling of inferiority to a goal of superiority. These goals can take a variety of forms, yet they all seem to make the individual a worthy human being, depending upon the individual's own interpretation of what constitutes success or perfection.

The Theory of McClelland and Atkinson

It is generally argued by psychologists that goal attainment is an important characteristic of human behaviour. An examination is now

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[1]This description of Adler's theory is adapted from Ansbacher (2: 108-117).

made of the motivational processes that develop in goal attainment. This is accomplished by a brief review of the theory of McClelland and Atkinson and co-workers (42).[2] The sequence of activities associated with goal directed behaviour in this theory is illustrated in Figure 1.

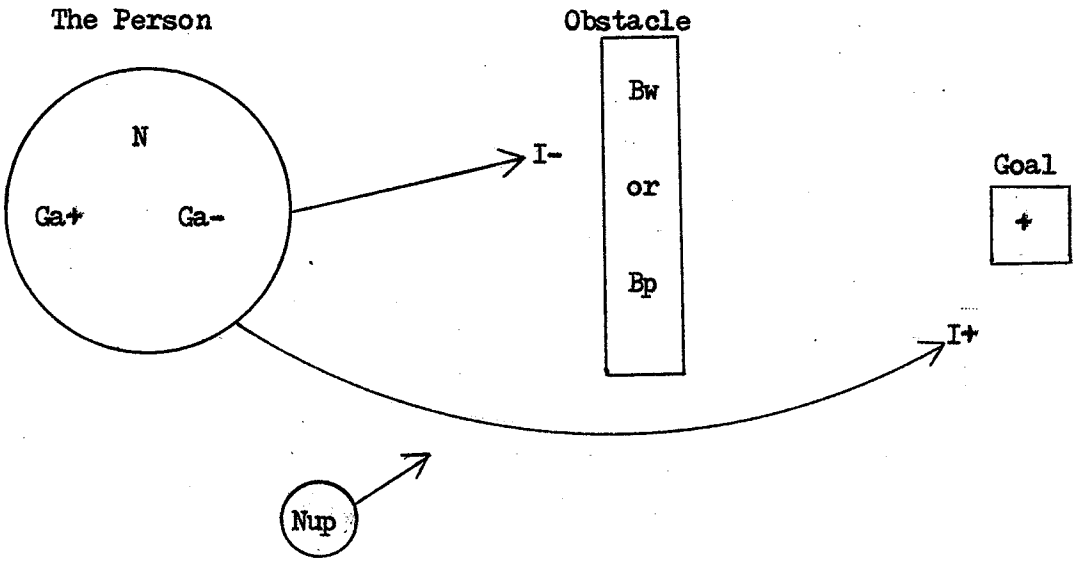

Figure 1. Adjustive Behaviour Sequence (Details in Text).

Source: McClelland, Atkinson et al (42: 109).

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[2]Atkinson was the closest co-worker of McClelland in the early work (42). Since then, however, Atkinson has been occupied with theoretical elaboration of the theory, while McClelland has continued with empirical studies and applications of the theory. Further discussion of the direction towards a separate Atkinson's theory, and a detailed review of the relevant literature, are given in Madsen (46: 268-288).

A brief overview of the sequence is given first.[3] Let us suppose that an individual is experiencing a very pleasant emotion or affect. While this experience is occurring, he is also receiving various stimuli or cues from his environment, his body, his thoughts, and his emotional state itself. Because of the simultaneous occurrence of the emotion and the cues, these cues become associated with the emotional state. Thus on later occasions the cues can reactivate part of the state. This fractional reactivation is apparently motivating, and the individual will engage in instrumental activity, which will bring him to approach the circumstances under which he will experience the pleasant affect or emotion. If the emotion had been unpleasant cues would likewise reactivate some of this state, which would lead the individual to avoid the situation which would fully reproduce the unpleasantness (avoidance).

The behavioral sequence associated with the instrumental activity as given in Figure 1 can be described as follows (42: 108-109). The sequence is thought to originate when an individual experiences a state of need or a motive (N).[4] He may be anticipating success of his goal (Ga+) or anticipating failure (Ga-). He may engage in activity instrumental to goal attainment. This activity may be successful (I+) or unsuccessful (I-).

Sometimes his goal directed activity will be blocked. The obstacle or block may be located in the world at large (Bw) or it may be some personal deficiency in himself (Bp). He may experience strong

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[3]This overview is adapted from Cofer and Appley (18: 374-386).

[4]The terms in brackets refer to the symbols given in Figure 1.

positive or negative affective states while attempting to gratify his motive. He is likely to experience a state of positive affect (Ga+) if the goal is attained, or a state of negative affect (Ga-) if his goal directed activity is thwarted, or he fails. Often someone will help or sympathise with him (Nup) which will aid in his goal directed behaviour.

This theory has been the basis of the measurement procedures (particularly Thematic Apperception Tests (TAT)) of McClelland, Atkinson and co-workers (42). These workers have mainly dealt with investigations of one aspect of human motivation - achievement motivation. Based on further empirical analysis, Atkinson has developed further theories which have placed him and his co-workers to quote Madsen (46: 288) ". . . in a leading position in motivational psychology proper . . . ."[5]

Levels of Aspiration

Attention is now turned to the last aspect of goal oriented behaviour to be reviewed - the subject of levels of aspiration. The concept of the level of aspiration was developed by Kurt Lewin and his students, to investigate the ways that goals are set, and the reaction of individuals to perceived success or failure in the achievement of goals (37: 250-254). The discussion of this concept will begin with a look at the work of Lewin, Dembo, Festinger and Sears (38) (hereafter Lewin et al).

Lewin et al recognised that almost any set of psychological problems involve goals and goal directed behaviour. Furthermore, they

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[5]See footnote 2, page 37. Emphasis is Madsen's.

stated that the importance of setting up goals in behaviour is accentuated in a culture with a competitive emphasis. They suggested the level of aspiration as an operational concept, that can be used to observe goals and goal directed behaviour.

They viewed the level of aspiration as simply a state of affairs measurable in space and time. They illustrated the sequence involved in setting a level of aspiration (or goal setting) as:

(1) given some knowledge of past performance,

(2) setting a level of aspiration which is equivalent to deciding how high the goal should be set,

(3) execution of action, and

(4) reaction to the level of attainment, such as a feeling of success or failure, leaving the activity altogether, or continuing to a new level of aspiration.

Lewin et al recognised three goal levels, the action level, the ideal goal and the low level goal. The ideal goal they describe as ". . . what the individual would really like to do . . ." (38: 335). The action goal is some moderated level governed by what is perceived as being possible for the individual at the time in question. The ideal goal is not necessarily some high dream goal which the individual has no expectation of ever achieving. It is presumably some level to which the individual can come close, if not actually attain when all possible factors are in his favor. The action goal is a more realistic level, which is usually taken as the criterion for the level of aspiration for an individual at a given time. Lewin et al suggest that the low level goal is some minimum goal level that the individual thinks could be attained even if all possible factors are not in his favour.

Haller (26) has stated that levels of aspiration play a very important function in explaining and predicting levels of behaviour with respect to various goals. Mathematically the relation could be described (for low to moderately high values of A_c and F) as:

$A_c = G(A,F)$ where;

$\frac{\partial A_c}{\partial A}$ and $\frac{\partial A_c}{\partial F}$ are positive; and

$\frac{\partial^2 A_c}{\partial A^2}$ and $\frac{\partial^2 A_c}{\partial F^2}$ are also positive

A_c = level of attainment,

A = level of aspiration, and

F = level of facilitation that is offered by the environment of the aspiration including both intra and extra - personal elements.

Studies on the effect of levels of aspiration have also provided two main conclusions. The first is that most subjects tend to state levels of aspiration that are in excess of what they actually expect to achieve. The stated levels of aspiration appear to be moderated by a subjective estimate of the likelihood of failure to achieve the goal at the stated level.

The second conclusion of these studies is that, to some extent, people adjust their levels of aspiration so that they are usually not totally out of line with the prospects of attaining them. In their many attempts to enact a level of aspiration, they learn something about their chances of success and failure, and ". . . there is probably a real but imperfect feedback of attainment on aspiration" (26). Successful performance generally leads to an increased level of aspiration,

while unsuccessful performance leads to a reduced level of aspiration.

Conclusions

The review of theory given in this section confirms the view held by Hobbs et al (28)[6] that much of human behaviour is goal oriented. Also humans would in general have multiple goal orientations concerned with the various activities associated with their existence.

The work on levels of aspiration also supports the view that levels of aspiration are a major determinant of the achievement levels reached with respect to the goals sought by individuals. In Haller's formulation, increasing the aspiration level would have an accelerating effect on the level of attainment. Assuming this formulation to be well founded, this would imply that small increases in the level of aspiration would have increasingly larger positive effects on the levels of performance at goal related tasks.

Returning to the discussion of the preference problem in Chapter 1, it can be seen that this problem, since it is concerned with the levels of economic performance of low income farmers involves goal oriented behaviour. This section has indicated that this type of behaviour is governed by a complexity of factors, that cannot be simply described as "preference structures". It is for this reason that it is suggested that a more apt name is the "motivational problem", and this designation will be used hereafter in this thesis.

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[6] A review of their work is given in Chapter 2.

Theory of Farm Firm Decision Making

The preceding section has identified two factors that are of major importance in understanding much of human behaviour - goal orientations and levels of aspiration. In this section, these two concepts are utilised to develop a theory of entrepreneurial decision making on the farm firm. This theory is necessary to provide a model of farm firm decision making that can be utilised in testing hypothesis two. The development of an operational model of the theory will be dealt with in the final section of this chapter.

Elements of a Behavioral Theory

Patrick and Eisgruber (55) have set out what they describe as elements of a behavioral theory of the farm firm. They state that a behavioral theory of the firm:

> ". . . would show how changes in the internal characteristics of the firm, resulting from changes in the relative importance of various goals, would cause a firm to respond differently to the same conditions . . . ."

The main elements can be stated as follows:

(a) Human behaviour is goal oriented. Values influence the selection of goals, modes and means. Goals provide direction to the individual's motivation and hence to his behaviour.

(b) An individual does not strive solely for the satisfaction of a single goal. Instead he is positively oriented to the attainment of a number of goals simultaneously. The farm firm is influenced by the goals of the operator, and the goals of other members of his family. Often there is conflict, either in the goals themselves or in the relative importance attached to them by the farmer, and other members of the family.

(c) Goals can change in relative importance over the course of time. These goals form multivariate objective function against which the expected outcomes of various alternatives are evaluated. The multivariate form of the objective function forces the decision maker to strive for an operational organisation, such that all goals are attained at a satisfactory level.

(d) Imperfect knowledge with regard to the future forces the farmer to rely on his expectations in planning. The decision maker must allow for uncertainty, particularly the possibility of incorrect expectations in deciding to commit resources to a particular combination of enterprises.

(e) Limitations of time and computational ability cause the farmer to consider only a subset of the possible alternatives available to him. Personal, institutional and business factors, among others, determine the alternatives considered.

(f) At various points, new information may cause the farmer to redefine his problem, seek more information, set up other alternatives, or accept a previously evaluated alternative.

The elements of Patrick and Eisgruber are considered quite appropriate as a basis of a decision making theory of the farm firm, since they are in accordance with the psychological theory of goal directed behaviour reviewed earlier in this chapter. These elements are therefore used in the development of a more comprehensive treatment of an entrepreneurial theory of farm firm decision making. The major addition in the new treatment is the inclusion of levels of aspiration as another major behavioral factor.

Entrepreneurial Theory of Farm Firm Decision Making

The first observation here is that this formulation is concerned solely with entrepreneurial decision making. In particular, the theory deals with the process by which the entrepreneurs decide on the combination of enterprises to pursue, and the levels at which these enterprises will be operated during the planning period (the so called production decisions). Consumption and investment decision making may follow similar general principles, and a brief discussion of extensions into this related area is given in Chapter 7.

The entrepreneur is assumed to have a number of goals, which he (or she) seeks to attain. These goals may be competitive, complementary or independent. The individual is able to assign relative weights to the goals, and to incorporate them into a single goal or utility function. His objective in making decisions is to maximise his goal function, or to attain the highest level of goal gratification (or utility).

To aid him in the process of attainment, the entrepreneur sets for each goal, some mentally perceived value, which becomes the level of aspiration associated with the goal. These levels of aspiration become the objective in goal attainment. Also for each goal some minimum level is set which the entrepreneur considers to be the lowest that could possibly be attained, if all factors went totally against him. This can be referred to as his low level goal.

The entrepreneur is aware of the uncertainty associated with the decision environment, since he is not able to predict unerringly, variables that affect his decisions. He therefore subjectively discounts

his expectations of the level of achievement, and does not normally expect to attain the levels set by his aspirations. His expectation level will thus be between his level of aspiration and his low level goal.

The entrepreneur views the production alternatives available to him as discrete investment projects or budget activities involving large (or significant) combinations of the various resources in his possession. For example, one budget activity may involve growing 320 acres of wheat utilising the machinery and building capital and variable resources necessary to produce that acreage of the crop.

For all budget activities known to him, the entrepreneur assesses the relative contribution of each activity to the various goals that comprise his goal function. At this stage, he is able to remove from his consideration, activities that give no contribution to his goals. The decision as to which activities to pursue is made by maximising his goal function, striving to attain his levels of aspiration. This maximisation leads to the selection of those budget activities which give the greatest contribution to the goals he hopes will be attained. His levels of aspiration and his resource endowments limit the maximisation process.

Once his decision is made and executed, the forces of the decision environment will determine the actual outcome or payoff. This decides whether in fact the entrepreneur's levels of attainment are near to or far away from his levels of expectation, and his levels of aspiration. The levels of expectation are most likely used to assess the degree of success or failure at achieving the various goals. Successful performance may lead to an increased level of aspiration, while

unsuccessful performance may lead to a reduced level of aspiration.

Operational Formulation of Entrepreneurial Decision Theory

The entrepreneurial theory given in the preceding section can be put in the operational framework of an analytic decision model to enable it to be used in the normative analyses associated with testing hypothesis two. This section will set out this operational decision model. First a digression will be made on the subject of practical optimisation models, and the need to introduce practicality into the model eventually developed.

Practical Decision Models

Much of the work on practical optimisation models is due to the work of Podkaminer (56). He states that in recent years there has been an increasing amount of theoretical work done on optimal farm plans. However very few of the theoretical conclusions have been applied practically. This he states, may be due to two reasons. The first is what he refers to as ". . . the great flood of theoretical publications". One model follows another at such a rate that it is impossible for even those farmers with the will, to keep abreast in the implementation of the practical conclusions of these models.

The second reason is more complex. Optimisation models can be said to have two main properties. The first is theoretical value (hereafter simply called value), which denotes the extent to which the model's solutions are regarded as desirable (in the sense of meeting desired mathematical properties such as global optimality). The second property is practical value, hereafter called utility, which is the

degree of influence exerted by the model's solutions on the farmer.

A high value does not necessarily imply a high utility. If the programme of action suggested by the model is not trusted and hence not accepted by farmers, its utility will be small regardless of its value. This fact that models need not have high utility and value simultaneously is the second reason that Podkaminer gives for the non-acceptance of optimisation models by farmers.

Farmers, he states, even without the use of mathematical tools reach decisions which by definition, must have high utilities. The aim of optimisation models should be to provide solutions not too far removed from those of farmers. To achieve this, the premises of the model should not break the inward logic used by farmers in arriving at their high utility practical solutions.

Podkaminer's arguments are supported by the author. Hence, at all stages of the model development, and in the methodological procedures described in Chapter 6, ways were always sought to introduce utility into the analyses. These ways will be described as the analyses proceed. Generally though, they consist of developing a picture of the farmer's decision logic from the sample survey conducted as part of the study (described in Chapter 5). This survey provided the goal and aspiration orientations, the picture of the decision making environment, and the budget activities (or production alternatives) utilised in the methodological procedures of Chapter 6.

The Optimisation Model

An optimisation model is utilised in the operational formulation of the decision making theory. This is consistent with the theory which

suggested that the entrepreneur tries to achieve as far as possible the goal levels set by his levels of aspiration.

Optimisation models also have several advantages. The first is that these models can provide unique solutions, which provide rational conclusions to empirical analyses. Another advantage of the optimisation method is that it allows the use of powerful techniques such as linear programming and the calculus.

In accordance with the entrepreneurial theory, the technique of budgeting is incorporated as part of the optimisation model. Budgeting is a technique that has been in use in farm management circles since the 1920's. This suggests that the technique has high utility in the worldwide farming community. Typically the approach has been to develop a plan of a finite set of discrete organisation of enterprises on the farm. These organisations are then compared, and the one that appears to give the highest expected net return is selected. This choice process cannot consider a wide range of alternative organisations if it is done manually. This means that since farm management budgeting is usually done manually, it cannot be expected to arrive at a globally optimal organisation.

The technique of capital budgeting has been widely developed to aid in the investment decision making procedures of business firms, government agencies, and military facilities. Here the decision process can be set out as follows (74: 258). The firm considers a large number of independent proposals for investment (that is, independent investment alternatives). Proposal j requires a total outlay of K_j dollars, and the funds M for all such capital investments are fixed. The expected return on the investment j is R_j dollars, and the company seeks to

maximise its overall return. There is also however, a limit N to the total number of projects undertaken in any one year, perhaps due to the limited availability of supervising management. Since each project is unique, the firm must decide to either accept or reject the proposal for that year. To represent this decision, let the variable associated with Proposal j be restricted to $Y_j = 0$ (reject) or $Y_j = 1$ (accept). The problem becomes:

Maximise: (i) $\sum_{j=1}^{s} R_j Y_j$

Subject to: (ii) $\sum_{j=1}^{s} Y_j \leq N$ (project limit)

(iii) $\sum_{j=1}^{s} K_j Y_j \leq M$ (budget limit)

(iv) $Y_j = 0$ or 1 for each j

The budgeting technique as used in this study is somewhere between the typical farm management model and capital budgeting. A small number of discrete investment projects are considered. These projects are referred to as budget activities, in line with the theory. Instead of choosing the activities on an accept-reject basis as in capital budgeting, the decision model in this case chooses integer levels of the different budget activities. As in capital budgeting, analytical procedures based on linear programming are utilised to obtain the globally optimal organisation of budget activities.

Attention is now given to the incorporation of multiple goals into the optimisation process. The entrepreneurial decision theory suggests that a weighted function of these goals serves as the objective function of the optimisation model. Also, some means have to be found to assess

the relative contribution of each budget activity to the various goals comprising the objective function, in accordance with the theory. Candler and Boehlje (12) have dealt with these problems, and have developed a rather novel model which will be utilised in this analysis. The model of Candler and Boehlje can be set out as follows:

Maximise: $Z = \bar{0}X + \lambda G$ (1)

Subject to: $AX + \bar{0}G \leq b$ (2)

$RX - IG \leq \bar{0}$ (3)

$X \geqslant \bar{0}$ and integer (4)

$G \geqslant \bar{0}$ (5)

$\sum_{i=1}^{k} \lambda_i = 1$, and (6)

$\lambda_i \geqslant 0$, $i = 1, \ldots, k$ (7)

where;

Z is a function of the individual goals,

X is a n x 1 vector of levels of budget activities,

λ is a 1 x k vector of weights,

G is a k x 1 vector of goal functions,

A is a m x n matrix of technical coefficients,

R is a k x n matrix of goal coefficients,

b is a m x 1 vector of resource constraints,

$\bar{0}$ is a 1 x n, a 1 x k, or a k x 1 null matrix,

I is a k x k identity matrix.

A look at the simplex tableau for the model will illustrate its structure. This is given in Table 5, and is adapted from Morse (53 : 454).

The individual goals (g_i, $i = 1 \ldots, k$) are assumed to be a function of the budget activities (X_j, $j = 1 \ldots, n$). The budget

Table 5: Model of the Simplex Tableau for Multiple Goal Model

Objective:	Max	0	0	0	...	0	λ_1	λ_2	...	λ_k
							Goal Functions			
Restraint	B	x_1	x_2	x_3	...	x_n	g_1	g_2	...	g_k
1	b_1	$\geqslant a_{11}$	a_{12}	a_{13}	...	a_{1n}	0	0	...	0
2	b_2	$\geqslant a_{21}$	a_{22}	a_{23}	...	a_{2n}	0	0	...	0
.	.	.				.	.			.
.	.	.				.	.			.
.	.	.				.	.			.
m	b_m	$\geqslant a_{m1}$	a_{m2}	a_{m3}	...	a_{mn}	0	0		0
Goal 1	0	$\geqslant r_{11}$	r_{12}	r_{13}	...	r_{1n}	-1	0	...	0
2	0	$\geqslant r_{21}$	r_{22}	r_{23}	...	r_{2n}	0	-1	...	0
.	.	.				.	.	.		.
.	.	.				.	.	.		.
.	.	.				.	.	.		.
k	0	$\geqslant r_{k1}$	r_{k2}	r_{k3}	...	r_{kn}	0	0		-1

Source: Adapted from Morse (53: 454).

activities contribute to each goal via equation (3), where each element of the matrix R, r_{ij} (i = 1, ..., k, j = 1, ..., n), gives the relative contribution of the budget activity j to goal i.

The objective function can be written in its general form as:

Maximise: $$Z = Z\left[g_1(X),\ g_2(X),\ \ldots, g_k(X)\right] \qquad (8)$$

The model assumes that the functions $g_i(X)$ and Z are linear. The goal functions $g_i(X)$ are weighted in the objective function by the vector λ. The objective function thus acts as a linear goal or utility function in accordance with the entrepreneurial theory.

Equation (2) contains the usual technical constraint functions of linear programming. As discussed earlier, the budget activities (X_j, j = 1, ..., n) are only allowed to take integer values, so that the model chooses those levels that maximise the goals of the decision maker. The model thus succeeds in incorporating two important elements of the entrepreneurial theory. These elements are a weighted multiple goal objective function, and the contribution of budget activities to the goals of the entrepreneur.

The final aspect of the decision theory to be included in the optimisation model is the concept of levels of aspiration. The model of Candler and Boehlje was modified to include this dimension. For each goal (g_i i = 1, ..., k), two goal levels are stated. The first is the level of aspiration, and the second is the low level goal. These two goal levels are indicated as upper and lower bounds on the level of the goal. Thus for goal g_i these become:

$Lo \leq g_i \leq La$ where;

Lo = low level goal, and

La = the level of aspiration.

This formulation is consistent with the entrepreneurial decision making theory. In this theory it was seen that the low level goal represents some minimum goal level. The level of aspiration on the other hand represents some level of goal attainment that the entrepreneur aims at, but would not normally expect to attain, because of discounting due to uncertainty.

The analytical decision making model that results from the entrepreneurial theory can thus be stated as:

Maximise: $$Z = \bar{0}X + \lambda G \quad (9)$$

Subject to: $$AX + \bar{0}G \leq b \quad (10)$$

$$RX - IG \leq \bar{0} \quad (11)$$

$$Lo \leq G \leq La \quad (12)$$

$$Lo \geq 0 \quad (13)$$

$$La \geq 0 \quad (14)$$

$$X \geq \bar{0} \text{ and integer} \quad (15)$$

$$\sum_{i=1}^{k} \lambda_i = 1, \text{ and } \lambda_i \geq 0 \quad i = 1, \ldots, k \quad (16)$$

Where;

La is a k x 1 vector of levels of achievement

Lo is a k x 1 vector of low levels goals, and the rest of the model is defined identically to the model set out as (1) to (7) on page 51.

The decision model set out as (9) to (16) above served as the basis for the production decision models, which were an integral part of the farm firm growth models developed to test the second hypothesis of the study. The testing procedure for hypothesis two is the subject of Chapter 6. This chapter follows a description of the survey carried

out as part of the study, given in the next chapter, Chapter 5. Further discussion of the specific decision models developed for the test procedure for the second hypothesis is thus reserved until Chapter 6.

Chapter 5

SURVEY METHODOLOGY AND RESULTS

In order to obtain reliable data necessary to test the hypotheses stated in Chapter 2, a detailed survey was designed and carried out as a part of the study. This chapter sets out the methodology that was used in the survey, and the results obtained. The survey provided the data that were used directly to provide a test of hypothesis one. Other data from the survey were incorporated into the methodological procedures used to test hypothesis two. These procedures are described in the next chapter.

Initially in the survey, a random sample of farmers was personally interviewed. At a later stage however, other data were needed to be utilised in an analysis of the validity of the survey results, and also to be utilised in the analytical models of Chapter 6. The respondents obtained from the random sample were therefore interviewed over the telephone. This chapter will deal first with the personal interview sample survey, then the telephone interviewing will be described.

The Survey Area

The first aspect of the survey that had to be determined was its geographical location. The hypotheses stated for the study are not specific to any geographical area, and indeed postulate that the influence of goals and aspirations on economic performance is universally

valid. It was necessary to limit the testing of the hypotheses to a single area. Such a restriction on the location of the survey may not limit the generality of the results obtained. In the final section of the chapter, there will be an analysis of the validity of the survey. This analysis will provide some perspective on whether the results obtained in the survey are representative of the farm populations in the survey area, and in the province of Manitoba.

The survey was carried out in Census Division 2, and Census Subdivisions 2 and 4 of Census Division 3 in the Province of Manitoba.[1] An idea of the location of this survey area can be obtained from the map of Manitoba given in Figure 2.

The survey area was chosen for several reasons. The first is that there was no reason to expect that the results from this area would differ significantly from those that could be expected from a survey of the province as a whole. As stated earlier, in the final section of this chapter an analysis is made to determine whether these expectations were justified.

The second reason for choosing the region was that this area has been the subject of several studies and projects in the recent past, so that important secondary data could have been obtained to facilitate later analyses. Especially important in this regard were the financial data for the Carman District Farm Business Association, and crop yield and fertilizer data available from the Manitoba Crop Insurance Corporation.

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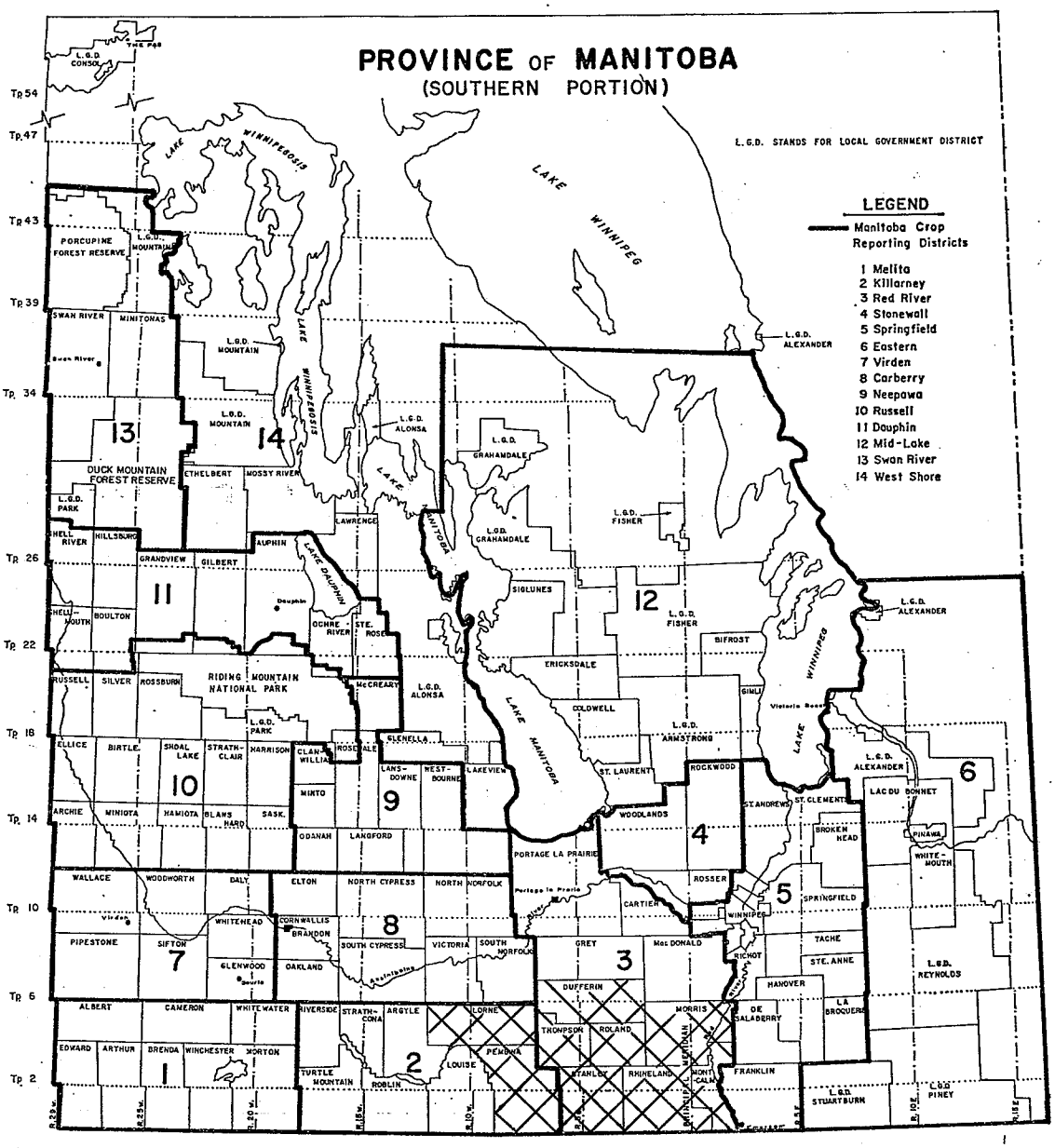
[1] Details of the boundaries of Census Divisions and Subdivisions and the names of the subdivisions can be obtained from the 1971 Census of Canada, Agriculture, Manitoba (69: C13).



Survey Area

Figure 2. Map Showing Survey Area.

The third reason for the choice of the region as the survey area is directly related to the nature of the study. Since the study had as its aim to determine whether behavioral factors have a significant effect on economic achievement, it was necessary that the survey provide information on behavioral factors for farmers of different income levels, so that appropriate tests could be performed between the income levels. It was essential therefore that the area chosen for the survey should have a good representation of farmers of all income levels, to allow reliable estimates to be obtained from the sample survey. Table 6 gives the distribution of census farms by the value of agricultural products sold for Manitoba from the 1971 Census of Agriculture by Census Divisions.

In Table 6 it can be seen that Census Divisions 2 and 3, among others, have a large enough number of farms at all income levels to allow effective random sampling within the farm income groups. The situation was not expected to have changed significantly since 1971.

Design of the Survey

The Sample Frame

Having chosen the survey area, the next logical step was to obtain a sample frame of the region. This frame should have had the farms classified according to income levels, using the classifications of low, medium and high income developed in Chapter 3. However no such frame was available for Manitoba for the survey.

Since no other suitable frame was available, the only alternative open was to utilise the Manitoba Provincial Exchange Telephone Directory (48) (effective November, 1974) to obtain a listing of farmers in the

Table 6: Distribution of Farms by Value of Agricultural Products Sold, in Dollars, Manitoba, 1971

Census Division	Under 2500	2500 to 4999	5000 to 14999	15000 to 34999	35000 to 49999	50000 and over
1	829	377	778	345	73	79
2	594	623	1291	478	77	71
3	313	423	1265	435	66	62
4	208	268	987	355	24	27
5	1436	385	440	116	15	27
6	393	382	771	268	33	57
7	377	385	937	322	60	71
8	244	324	916	290	33	34
9	388	259	361	154	31	36
10	477	460	822	199	18	18
11	351	394	654	153	13	11
12	1082	576	777	174	15	16
13	221	220	749	233	15	13
14	225	222	351	54	3	3
15	400	348	605	129	8	11
16	52	28	49	17	0	0
17	536	469	746	156	22	20
18	631	474	519	98	11	5
19	673	232	159	48	8	10
20	178	39	70	40	6	17
Province	9608	6888	13247	4064	531	606

Source: Statistics Canada, 1971 Census of Canada, Agriculture, Manitoba (69: Table 32).

area. Since the distribution of farms of all income levels in the region chosen as the survey area appeared to be very good, it was considered that all farm income levels would be well represented if a single sample was obtained for the region.

The Manitoba Provincial Directory lists all residences with telephones outside the City of Winnipeg under the provincial exchange associated with the residence, which is usually located in a nearby small urban area. The address is given for residences in rural areas by their location in terms of the township, range and section number. Within the urban areas the addresses are given in terms of streets, avenues and so on. Hence it is fairly simple to separate the residences in the rural areas from those of urban areas.

Using the Telephone Directory listings of persons with rural addresses as a frame for the survey however, appeared to have two serious limitations, which had to be taken into account before its use could be justified. Firstly, the fact that a particular residence has a rural location does not necessarily mean that the occupants are engaged in agricultural activity. Secondly, there may be many active farmers, in rural areas who do not have telephones, or who reside in small urban areas, and so do not have rural addresses. Since the Telephone Directory was being used to derive the frame for the study, it was decided to determine the extent of these limitations, and their implications for the sampling procedure adopted.

Accuracy Tests of Telephone Directory

The first test was of the limitation that many active farmers may not have telephones, or may live in urban areas, and in either case will not be listed with rural addresses in the Telephone Directory.

This test was conducted by obtaining a sample of names of persons known to be farmers, trying to locate them in the Telephone Directory, and noting the percentage listed with rural addresses. The sample of farmers was taken from the results of a 1971 mail survey of farmers done as part of a thesis research project in the Department of Agricultural Economics, University of Manitoba. From the list of farmers who responded to the survey and voluntarily supplied their names and addresses, a sample of 93 farmers was chosen.

Of the 93 farmers, 62 or 66 percent were listed in the Telephone Directory with rural addresses; 16 or 17.2 percent were listed in the directory with urban addresses, and 15 or 16.1 percent were not in the directory. The percentage of the sample not in the directory may be due to the changes that have occurred in the three years between the mail survey in 1971, and the compilation of the directory in 1974. There is a definite trend towards declining farm numbers in Manitoba and Canada.[2] It is thus quite possible that most of the 15 farmers not in the Telephone Directory have discontinued farming, and are no longer at their 1971 addresses.

Overall, the results indicated that confining the survey to persons with rural addresses should provide a good basis for obtaining a sample of farmers, as most farmers seem to have telephones (83.9 percent), and the majority have rural addresses. On the basis of this test then, it was concluded that the Telephone Directory gave a fair indication of the farm population in Manitoba.

The second test of the Telephone Directory was designed to give

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[2]For example, reference can be made to the work of MacMillan, Tung and Tulloch (45).

some indication of the percentage of persons who had rural addresses in the Telephone Directory who did not undertake any agricultural activity. This was a more difficult test to undertake, and in fact to be really accurate this test would have required a survey of its own. Finance and time however, did not permit this. Instead the procedure adopted was to compare the listings of persons with rural addresses, with the results of the 1971 Census of Agriculture for a selected number of subdivisions within the two divisions comprising the survey area. The selected subdivisions were: Subdivisions 1 and 6 of Division 2 (the rural municipalities of Dufferin and Stanley), and Subdivisions 2 and 4 of Census Division 3 (the rural municipalities of Lorne and Pembina). The comparison of the Telephone Directory listings with the results of the 1971 Census of Agriculture is given in Table 7.

Table 7 shows that in the 1971 Census there were 1994 farmers in the selected subdivisions. The first test of the Telephone Directory suggested that 16.1 percent of the farmers may not have telephones. Thus assuming that 1672 farmers have telephones, there is a difference of 667 between the listing of all persons with rural addresses in the 1974 Telephone Directory, and the number of farmers with rural addresses. Therefore it was estimated that approximately 25 percent of the persons in the Telephone Directory with rural addresses were not engaged in agricultural activity. This limitation had to be taken into account in designing the sampling procedures.

The results of the survey (as given in Table 8) indicate that 16.9 percent of the persons contacted were not engaged in agriculture. This figure was lower than the one estimated from the figures in Table 7 (25 percent). This lower figure suggests that perhaps a smaller

percentage of farmers than 16.1 do not have telephones.

Table 7: Comparison of Telephone Directory Listings with 1971 Census

Census Division 2	Rural listing in Directory, 1974	No. of Farmers in 1971 Census
Sub Division		
1 Dufferin	551	479
6 Stanley	883	620
Census Division 3		
2 Lorne	406	432
4 Pembina	499	463
Total	2339	1994

Sources: Manitoba Telephone System, (48).

Statistics Canada, 1971 Census of Canada, Agriculture, Manitoba, (69: Table 32).

There were also two advantages to the use of the telephone listings as a frame for the study. Firstly these listings were very up to date, and possibly represented the most recent listing of the present occupants of rural residences. The second advantage was that the Telephone Directory listings provided the actual home address or location of the person, and not simply a mailing address, which is mainly given with respect to the nearest post office usually located in a small urban area. This was important for a personal interview survey, since all interviews were carried out at the home of the respondents. Rural address listings in terms of township, range and section number,

also allow ready location of respondents on large scale municipal maps.

Sampling Procedure

The next step in the survey design was developing the sampling procedure. A two stage procedure was adopted. The survey area was defined as the seven subdivisions of Census Division 2 and Subdivisions 2 and 4 of Census Division 3. The first stage of the sampling procedure was the choice of four of the nine subdivisions comprising the survey area, by the use of a table of random numbers (32). The subdivisions chosen were numbers 1 and 6 of Census Division 2 (the rural municipalities of Dufferin and Stanley), and Subdivisions 2 and 4 of Census Division 3 (the rural municipalities of Lorne and Pembina). These are the subdivisions used in the second test of the accuracy of the telephone listings discussed earlier, and they will be referred to as the sample area.

This first stage was necessary to further limit the scope of the survey attempted. Since personal interviewing was used to obtain the information needed, a few locations within the survey area were dealt with, to minimise the time spent by the interviewers in getting from one respondent to another. Even with this localisation however, each of the subdivisions chosen encompasses an area greater than 300 square miles.

The second stage involved preparing a list of persons with rural addresses from the directory for the four subdivisions chosen at the first stage. Then a random sample of 336 persons was chosen from the listings of persons obtained. This random sample served as the final sample for the survey. This sampling again utilised a table of random numbers (32).

Size of Sample

The sample size chosen was determined by the financial resources available for the study. It was approximated before the survey started that the resources available would enable at least 200 personal interviews to be done, along with the pretesting and preparation of the questionnaires. Since approximately 25 percent of the persons contacted may not be farmers, owing to limitations of the sampling frame, and allowing for non-respondence due to inability to locate persons, it was assumed that a non-response rate of 33 percent could have been expected. The sample size was thus chosen at 336, which was the number of persons chosen at the third stage of the sampling procedure. It was hoped to contact approximately 309 of these persons, yielding 225 respondents suitable to be included in the analysis.

Between the planning stage and final execution of the survey however, it was realised that costs had been underestimated, and when the survey started the costs escalated. At the end of the survey only 189 persons had been contacted.

Details of Sample

The details of the sampling carried out are given in Tables 8 and 9. In Table 8 it is seen that of the 189 persons contacted, 103 were respondents. The non-response rate of 45.5 percent was higher than anticipated.[3] The percentage of the non-respondents not engaged in agricultural pursuits was 16.9 percent, which was lower than the anticipated figure (25 percent). A fairly low percentage of persons,

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[3] A respondent was defined as a person in the sample who engaged in agricultural activity (a farmer), and who supplied a response to all questions on the questionnaire.

6.3 percent, could not be located, and the refusal rate was 3.7 percent. The refusal rate is also fairly low, especially when the nature of the information requested is taken into account.

Table 8: Details of Sample - Analysis of Non-Response

Description	Numbers
Number of persons in sample	336
Total number of persons contacted	189
Number of respondents	103
Non-Respondents	
Not engaged in farming	32
Persons not at home	25
Refusals	7
Moved, deceased or not known	12
Total non-respondents	86

Source: The Survey.

It can be seen in Table 9 that there were 34 high income farmers in the sample and 39 medium income farmers, by the definitions given in Chapter 3. There were 28 farms with gross farm sales between $1,875 and $14,999. There were also two farmers with gross farm sales below $1,875. The background information provided by the interviewers revealed that these two farmers were in fact low income farmers, and not "hobby" farmers with only an agricultural sideline. Hence, these two farmers were included in the low income farm sector, making a total low income sample of 30 farmers.

Table 9: Details of Sample - Distribution of Respondents by Census Subdivision

	Total No. of Farms	Total Value of Gross Sales in Dollars			
		Under 1875	1875 to 14,999	15,000 to 34,999	Greater than 35,000
Census Division 2			Number of Farms		
Subdivision					
1 Dufferin	42	1	11	11	19
6 Stanley	18	1	77	5	5
Census Division 3					
2 Lorne	35	0	8	20	7
4 Pembina	8	0	2	3	3
Total	103	2	28	39	34

Source: The Survey.

Nature of Information Collected

In this subsection the nature of the information collected in the survey is described. This will be done by reviewing the major methodological procedures used. In the next subsection, the questionnaire used in the study will be described.

The nature of the information collected in the survey was determined by the data needs required to provide tests for the hypotheses of Chapter 2. In Chapter 4 a theory was developed to provide the basis for the tests of the hypotheses; the information collected in the survey was determined by the elements of that theory.

The first major postulate of the theory is that farmers have multiple goal orientations, and they attempt to maximise these goals by striving to attain perceived levels of aspiration. The first aim of the survey was to obtain a picture of the goal orientations and levels of aspiration of farmers. This was achieved by utilising the measurement procedures devised by Cantril (14: 21-27, 15) and those of Kilpatrick, Cummings and Jennings (33: 52-85, 61: 34-43).

Cantril's method was devised to get a picture of the goals and aspirations of individuals (which he referred to as "the reality world") in their own terms. The aim is to do this in such a way that, without sacrificing authenticity or prescribing any boundaries or fixed categories, it would still be possible to make meaningful comparisons between different individuals, groups of individuals and societies. Cantril argues that an accurate appraisal of an individual's reality world can never be obtained if he is forced to make choices or selections between categories, alternatives, symbols or situations as they are posed in the usual type of questionnaire.

Cantril therefore developed what he called the Self Anchoring Striving Scale, to measure aspiration levels and also obtain goal orientations. A person is asked to define on the basis of his own assumptions and goals, the two extremes or anchoring points of the spectrum on which the scale measurement is derived. The technique consists of first asking two open-ended questions. The first question is: "All of us want certain things out of life. What are <u>your</u> wishes and hopes for the future if you are to be happy?" It is assumed that responses to this question are concrete expressions of meaningful life goals. After responses to this question are recorded, the following

question is asked: "Now taking the other side of the picture, what are your fears and worries about the future?" Statements of fears and worries may give clues to a subject's goals, since they may be opposite to the goal states that he would like to achieve.

The respondent is then presented with a 10 rung "picture ladder", and is instructed to let the top represent the best possible life, and the bottom the worst possible life. He is asked to indicate where he thinks his life is on the scale at the present time; then he is asked where he thinks his life will be in five years.

The response to the second question (ladder level in five years) provides a generalised measure of the level of aspiration of the respondent. The ideal goal or best possible life, and the low level goal-- the worst possible life--are in terms of the respondent's own conceptions. Hence, the respondent's level of aspiration is given with respect to the goals that he would like to see achieved in his life. It can be assumed that the level of aspiration stated here represents an average value of the levels of aspiration for the various goals comprising his goal structure.

There are some limitations to Cantril's technique (14: 24-26). First the technique does not get at everything that is important to the individual. People will not readily reveal to an interviewer subjects that are highly personal or socially unacceptable, such as sexual frustration or petty thefts. Also individuals may not mention aspects of life that they take for granted. Hence the method will not get at as total a picture of the individual's personality as may be required for say clinical psychology. Cantril maintains however, that the method is sufficient to afford an insight into problems of social

psychology. Despite this reassurance, it was decided to supplement Cantril's technique by obtaining another picture of orientations of the respondents' with respect to occupation, usually termed occupational values.

It was seen in Chapter 4, that values arise from the life style of the individual, and function as guideposts for goal striving behaviour throughout the subject's existence. Hence an analysis of occupational values of the individual would provide another perspective on his goal orientation. The data obtained would be secondary to the life goals obtained from Cantril's method.

The method of Kilpatrick et al (33: 58-85, 61: 34-43) was used in the investigation of occupational values. This technique consists of the respondent rating occupational value statements on a nine point agree-disagree scale. These statements cover the range of occupational values--economic, extrinsic, achievement, affiliation, influence and general values. The advantage of this agree-disagree scaling is that since it presents all individuals with the same statements, it has direct comparability between respondents. However this type of scaling has the disadvantage of suggesting images to the individual, some of which may in fact be foreign to him.

Kilpatrick et al therefore utilised an adaptation of the Self Anchoring Striving Scale to obtain some open ended information on occupational value orientations. The respondent is again shown a picture of a ladder, but this time the top of the ladder represents the best possible occupation, and the bottom the worst possible occupation, and the respondent is asked: "Where on the ladder do you feel that <u>your occupation of farming</u> stands at the present time?" The

answer to this question provides a measure of occupational satisfaction. The respondent is then asked about the factors about farming that prevented him from giving it a lower rating on the occupational ladder. Answers here would provide another picture of occupational value orientations, this time in terms of the respondent's own conceptions.

Two other kinds of data were obtained in the survey. Firstly general farm data were obtained. These consisted of the income level of the respondents in terms of total farm gross sales, land owned and rented in and rented out, and a picture of the enterprises carried out on the farm. These data were important for the development of the farm firm growth model of Chapter 6. The last kinds of data obtained were concerned with obtaining a picture of the respondent's perception of the decision making environment. Two elements were included here, the general area of risk and uncertainty, and the private enterprise free market system. A question was also asked about the way that the respondent dealt with the risky features of farming, if indeed he did find that it was risky.

The Questionnaire

The questionnaire used in the survey is given in Appendix 1. The first section contains the questions related to general farm data--land ownership, income and enterprises on the farm. Section 2 contains the questions related to Cantril's methodology.

Part 1 of Section 3 consists of the occupational value statements related to the method of Kilpatrick et al. The value statements actually used were modified from those given in Kilpatrick et al, so that they were relevant to the study being conducted. For example, the statements in the questionnaire referred specifically to the occupation

of farming.

Five of the statements (11, 12, 13, 15, 16) were concerned with the economic aspects of farming, while one statement (14) investigated the extrinsic factor of risk. Five statements (17 to 21) were designed to provide an indication of achievement orientation, two statements (22 and 23) affiliation orientation, three statements (24, 25, 26) influence orientation, while five statements (27-30) were designed to obtain an idea of general value orientations.

Question 31 in Part 2 of Section 3 contained the occupational satisfaction measurement, and question 32 was designed to obtain the open-ended information on occupational values. These questions were the last two related to the occupational value technique of Kilpatrick et al.

The last six questions (32-36) were concerned with the decision environment of the farmer. Questions 33, 34 and 35 dealt with the aspect of risk, and questions 36 and 37 dealt with the free market system.

After its preparation, the questionnaire was submitted to extensive pretesting. First discussions were held with members of the author's Committee in the Department of Agricultural Economics, and with members of the Department of Psychology. Then the questionnaire was pretested on seven farmers in the Winkler-Miami area of Manitoba. From the pretesting various modifications to the questionnaire were done, and the final questionnaire prepared. After the survey started, it was found that certain phrases still presented some difficulty to the understanding of some farmers, so these were clarified without changing the substance of the question asked. The final revised questionnaire is

the one presented in Appendix 1. The answer sheets and charts were kept separate from the questionnaire to minimise the duplication costs. These are also presented in Appendix 1.

The answer sheet contained three further questions (38, 39 and 40) related to the sex of the respondent, and the reliability of the information collected. Since this aspect of the reliability of the results is better related to the interview procedure adopted for the survey, a description of these questions is left to the next subsection.

Interview Procedure

The personal interview technique was chosen to obtain information in the survey for two reasons. Firstly, it was very important to have the entire questionnaire completed for all respondents to obtain a complete picture of the motivational factors. Incomplete questionnaires would have severely biased the results, by preventing meaningful aggregation for the different farm income groups to arrive at representative goal and aspiration orientations. Since, as was seen before, the questionnaire tried to discover fairly personal aspects of the respondent's behaviour, it was felt that if the questionnaire was simply put in the mail for the farmer himself to fill out, he may not have responded to the more personal aspects on which information was most urgently needed.

The second reason for the personal interview technique was to be able to conduct the survey in the shortest possible period of time due to limitations on time set for the study. Also, because of the dynamics of prairie agricultural production, it was considered essential that the survey should be completed in the period January - May 1975, which seemed to be the period that farmers could most easily devote time

to the exercise. To ensure this, personal interviews were done in this period.

The interviewing was done by persons who were familiar with the agricultural sector and rural life in Manitoba. This was to allow for easy rapport with the farmers to facilitate obtaining the information. To minimise the errors associated with interviewing, a special set of instructions was prepared to provide guidelines to the interviewers. This guide is given in Appendix 2. Instructions to the interviewers were also given on the answer sheet accompanying the questionnaire. These instructions were specific to the questions being asked, and can be seen on the answer sheet given in Appendix 1. Also during the survey, the author visited with the different interviewers to observe the conduct of the interviewing. Three interviewers were used in the survey, all agricultural graduates of the University of Manitoba, two themselves being farmers and the third a postgraduate student.

An informative letter was sent to all persons on the sampling list approximately one week before it was anticipated that they would be interviewed. This letter was designed to improve the response rate of the survey, and may have contributed to the low refusal rate obtained.

The data were designed to test a theory of entrepreneurial decision making. Hence it was considered essential to uncover the farmer's own viewpoints with respect to the question asked, without prompting or undue influence from others members of his family who may be present during the interview, as this influence would lead to bias in the study. However, it is generally impossible to remove the influence of other family members on an interview, as an attempt to do this may lead to a termination of the interview. The most that is usually

possible is to note the influence of the other family members on the answers of the respondent, and to determine subjectively whether the answers in fact are reliable. This was attempted in the survey.

The interviewers were instructed to note whether the presence of other persons influenced the information collected in an undue manner. These questions were included on the answer sheet as questions 39 and 40. Table 10 gives the results of this check on reliability classified according to farm income groups. Table 10 shows that 54 of the 103 respondents (or 52.43 percent) were interviewed alone. For the low income farmers only two interviews were considered to be subject to error. One of the respondents was influenced by the presence of other members of the family, but the other was not.

In the case of the medium income farmers, the information from eight respondents (or 20.5 percent) was considered to be subject to error. Here six of the respondents may have been influenced by family members, and two may have misunderstood parts of the questionnaire. The occurrence of errors in the information for the high income farmers was insignificant.

Personal interviewing was conducted between February 1, 1975 and February 14, 1975 and April 7, 1975 to May 5, 1975. It took approximately one half hour to have a questionnaire completed. The farm gross sales data were obtained for the year January 1, to December 31, 1974.

Results of Personal Interviewing

This section presents the results of the personal interview described above. The results are presented classified by farm income groups, and are preceded by a discussion of the significance testing used.

Table 10: Reliability Check on Data Collected

Description	Farm Income Group		
	Low Income	Medium Income	High Income
Number of respondents interviewed alone	16	19	19
Someone present most of interview	10	14	10
Someone present some of interview	4	6	5
Information considered reliable	28	31	33
Information reliable but may contain errors	2	8	1
Information not reliable	0	0	0
Male respondents	29	39	34
Female respondents	1	0	0

Source: From the Survey.

Significance Testing

It was decided at the planning stage of the study to use a significance level of 95 percent for all significance testing in the study. This level was thus used to test the significance of differences in characteristics between the farm income groups based on the data obtained in the survey. Because of the small sample size obtained, the sizes of the groups of farms when the sample is classified according to income, were even smaller. Hence it would become even more difficult to obtain significant results in the sample, which may in fact exist in

the population. Hence for illustration of the differences that could be expected if a larger sample were possible, the differences that are significant at the 90 percent level are also noted.

Goal Orientations

Table 11 gives the results that were obtained for the question on wishes and hopes for the future (Question 8). Responses here are an indication of goal orientations of farmers. Table 12 presents the results obtained for the question on worries and fears of the respondents (Question 9). Responses here may represent states that are opposite to goal orientations held, and hence also provide clues to goal orientations.

The results in Table 11 show that high income farmers have a significantly greater orientation to goals that require high monetary returns such as having "a sound economic future" than low income farmers, who are more oriented to goals to achieve just about enough to get by. What is also revealing is that medium income farmers are significantly more monetarily oriented than the low income farmers, even though the medium income farmers themselves are significantly less monetarily oriented than the high income farmers. Further evidence of the greater monetary orientation of the higher income farm groups is seen in Table 12, where both medium and high income farmers are significantly more worried about the cost-price squeeze (commodity prices lagging input costs) affecting the profitability of their operations, than the low income farmers.

One fifth of the farmers in all groups want to own more resources especially land, and high income farmers in particular, are concerned with the possibility that governmental intervention in the

Table 11: Goal Orientations of Farmers: Wishes and Hopes*

Response	Low Income N=30	Medium Income N=39	High Income N=34
	.....percent.....		
A. ECONOMIC			
1. Sound Economic Future	10	25.6[a, b]	44.1[a]
2. Own More (Money, Land, etc.)	20	20.5	20.6
3. Better Commodity Prices	16.7	10.3	17.7
4. Have Enough to Earn Living	20	12.8[d]	2.9[a]
5. Other Economic	20	20.5	32.4
6. Total Economic	66.7	69.2	79.4
B. NON ECONOMIC			
7. Good Health and Family Well Being	20	25.6	32.4
8. Retain Control of Farm	16.7	20.5[b]	5.9[c]
9. More Leisure	3.3	7.7	14.7[c]
10. Other	23.3	25.6	20.6

*Percentage of Farmers giving the particular response.

a - significantly different from low income at 95% level
b - significantly different from high income at 95% level
c - significantly different from low income at 90% level
d - significantly different from high income at 90% level

Source: The Survey.

Table 12: Goal Orientations of Farmers: Fears and Worries*

Response	Low Income	Medium Income	High Income
	.....percent.....		
A. ECONOMIC			
1. Cost Price Squeeze	3.3	23.1[a]	29.4[a]
2. General Economic Conditions	30	23.1	32.4
3. Losing Farm Business	26.7	15.4	11.8[c]
4. Other Economic	20	23.1	17.7
B. NON ECONOMIC			
5. Government Control of Agriculture	16.7	5.1[c, b]	29.4
6. None	23.3	15.4	8.8[c]
7. Other	13.3	30.8[a]	32.4[a]

*Percentage of Farmers giving the particular response.

For explanation of symbols a, b, c, d, see Table 11.

Source: The Survey.

land market may prevent them from achieving this goal (Table 12). The goal of maintaining family well being is also important to all groups, and there is some evidence of an increasing desire for leisure on the part of high income farmers. General economic conditions, especially inflation and strikes, and losing the farm business are two other worries of all farm groups.

Occupational Values

Table 13 presents the results obtained from the use of the agree-disagree scaling of Kilpatrick et al in providing a picture of the respondents' occupational value structure, and Table 14 presents the results of the open ended question (No. 32 of questionnaire) again designed to obtain a picture of occupational value orientations.

The results given in Table 13 give further support to the hypothesis that low income farmers are oriented more towards non-monetary (or non-maximising) economic goals. There it is seen that the low income farmers agree more strongly with (economic) non-monetary value statements than the high income farmers. On the other hand, all groups of farmers show equal agreement with the economic monetarily oriented value statements. Table 13 also shows that a significantly higher percentage of low income farmers are oriented towards affiliative goals such as making friends and helping people.

Table 14 also provides some important results. High income farmers place a significantly higher value on achievement than low income, and also medium income farmers. High income farmers also have a greater personal liking for farming than low income farmers. All farm income groups value highly the influence aspect of the occupation (particularly, being their own boss). This high regard for independent

Table 13: Occupational Values of Farmers*

Description	Low Income	Medium Income	High Income
	.....Average Scale Rating[1].....		
A. EXTRINSIC			
1. Economic Monetary (11,12,13)	4.1	4.2	3.9
2. Economic non-Monetary (15,16)	3.6	3.8[b]	4.9[a]
3. Economic Overall (11,12,13,15,16)	3.9	4.0	4.3
4. Effect of Luck (14)	5.8	5.8[b]	6.8[c]
B. INTRINSIC			
5. Achievement (17,18,19,20,21)	4.0	4.0	3.7
6. Affiliation (22,23)	3.2	4.1[a]	4.1[a]
7. Influence (24,25,26)	3.5	3.4	3.5
8. General (27,28,29,30)	3.1	3.0	3.1

*Based on disagree-agree scaling of statements 11 to 30 on questionnaire. Statements have been arranged in categories to drive meaningful measures of occupational values: brackets give the statements aggregated to form the category.

[1]Scale had 9 points-from 1, strong agreement, to 9, strong disagreement.

For explanation of symbols a, b, c, d, see Table 11.

Source: The Survey.

action is also seen in Table 13.

The results in Table 13 provide another interesting insight. Except for Questions 14 to 16, on average all the farm groups at least mildly agreed with all the occupational value statements. When the farmers had to formulate the occupational value orientations based on their own reality worlds (as given in Table 14, many of these same

Table 14: Occupational Values: Factors that Prevented Lower Occupational Rating*

Factor	Low Income	Medium Income	High Income
	..... per cent		
A. Extrinsic			
1. Income and love of outdoors	20	20.5	20.6
B. Intrinsic			
2. Achievement derived	20	12.8[b]	52.9[a]
3. Influence (Own boss)	53.3	51.3	61.8
C. General			
4. Personal Liking	13.3	20.5	32.4[a]
5. Good way of (family) Life	13.3	20.5[d]	8.8
6. Other	23.3	30.8	29.4

*Based on answer to Question 32, per cent of farmers giving response. For explanation of symbols a, b, c, d, see Table 11.

Source: The Survey

values were not mentioned especially with regards to general occupation values such as farming being of service to God, or being a good builder of character.

Levels of Aspiration

Table 15 presents the results that were obtained with the use of Cantril's Self Anchoring Striving Scale, and also the results of the modification of Kilpatrick et al to deal with occupational satisfaction. The results support the postulate that high income farmers have significantly higher levels of aspiration than low income farmers.

Table 15: Aspiration and Satisfaction Scores for Farmers

Description	Low Income	Medium Income	High Income
	..... Mean Ladder Level		
ASPIRATION			
1. Present Life Level	5.8	6.4	6.7[a]
2. Life Level in Five Years	6.1	6.6	7.3[a]
OCCUPATIONAL SATISFACTION			
3. Present Level	7.4	8.0[d]	8.6[a]

1. Based on ladder levels 10--the best possible life (or occupation) to 0--the worst possible life (or occupation), given in Questions 10 and 31 of questionnaire.

[a]Significantly different from low income at 95% level.

[d]Significantly different from high income at 90% level.

Source: The Survey.

The ladder level in five years is used as a measure of a generalised level of aspiration for the respondent as noted earlier. In Table 15 it is seen that the mean level of aspiration of the high income farmers (7.3) is significantly higher than the mean for the low income farmers (6.1). The occupational ladder provides a measure of occupational satisfaction. Table 15 shows that high income farmers have a significantly higher level of occupational satisfaction than low income farmers.

The conclusions arrived at from Table 15 are in keeping with those given in Table 14, where it is seen that high income farmers are more achievement oriented, and also have a greater personal liking for their occupation of farming. The consistency of the results from the different measures adds further support to the postulate, since it demonstrates the reliability of the measurement procedures used.

Decision Making Environment

This subsection presents the results obtained on the conceptualisation of the decision making environment by the farmers. Table 16 gives the uncertainty factors that farmers considered important in their operations, and Table 17, the ways in which these uncertainty factors were handled.

Table 16 shows that while all groups of farmers did generally consider the same factors as causing uncertainty in farming, the low income farmers differed significantly from high and medium income farmers in considering weather as an uncertain factor. Medium income farmers were more concerned with uncertainty caused by livestock diseases, than the farmers in the other two groups. Two other

uncertainty factors identified were commodity price fluctuations, and taking loans without accurate knowledge of ability to repay.

Table 16: Percentage of Farmers Stating Different Uncertainty Factors*

Factor	Low Income	Medium Income	High Income
	..... percent		
1. Weather	50	74.4[a]	82.4[a]
2. Commodity Price Fluctuations	50	48.7	52.9
3. Investment and debt	26.7	18.0	20.6
4. Diseases of Livestock	13.3	28.2[bc]	8.8
5. Physical Injury and Health	10	18.0	8.8
6. Other	26.7	23.1[d]	44.1[e]

*Answers to Question 34 of questionnaire

a - significantly different from low income at 95% level
b - significantly different from high income at 95% level
c - significantly different from low income at 90% level
d - significantly different from high income at 90% level

Source: The Survey.

Table 17 shows that there are significant differences in the way that the three groups of farmers handle the uncertainty associated with farming. A significantly larger proportion of high income than low income farmers, used insurance. On the other hand a significantly larger proportion of low income farmers than both high and medium income farmers, take no action in dealing with uncertainty. Medium income

farmers differ significantly from low income farmers in the use of insurance and planning and diversification, and differ significantly from high income farmers in the use of good farm management techniques.

Table 18 gives the final results associated with the decision environment. Here it can be seen that in general, farming is considered a fairly risky occupation. Perhaps surprisingly, farmers do not generally believe that the free market system works, or even that they understand it. Only in the high income group do the majority of the farmers think that they understood the free market system and how it works.

Table 17: Percentage of Farmers Giving Different Responses to Uncertainty.*

Response	Low Income	Medium Income	High Income
	..... percent		
1. Capital Rationing	2.0	12.8	11.8
2. Good Farm Management	13.3	12.8[b]	29.4[c]
3. Insurance	3.3	25.6[a]	23.5[a]
4. Planning and Diversification	10.0	28.2[a]	20.6
5. No Economic Action	60.0	38.5[a]	32.4[a]

*Answers to Question 35 of questionnaire.

For explanation of symbols a, b, c, d, see Table 16.

Source: The Survey.

Table 18: Farmers' Opinions of Decision Environment*

Description	Low Income	Medium Income	High Income
	..... percent		
1. Farmers Stating Farming Risky	86.7	87.2	88.2
2. Farmers Stating they Understood the Free Market System	40.0	25.6[b]	52.9
3. Farmers Stating Free Market System Works	30.0	43.6	52.9

*Row 1 from Question 33, row 2 from Question 36 and row 3 from Question 37.

b - significantly different from high income at 95% level.

Source: The Survey.

Summary of the Results

The survey provides the data to directly test hypothesis one. This hypothesis states that high income farmers are motivated more towards monetary goals, and have higher levels of aspiration, while low income farmers are motivated more towards non-monetary goals and have lower levels of aspiration. The results support the postulate that high income farmers are more significantly oriented to monetary goals than low income farmers. Both groups have similar goals of owning more resources, especially land, and of seeing to the well being of their families and themselves. The results obtained also support the postulate that the levels of aspiration of high income farmers are significantly higher than those of low income farmers.

The results show that high income farmers derive greater

satisfaction from their occupation, which also provides them a greater level of achievement value. Both groups of farmers value being their own boss, and low income farmers are more oriented to affiliative values such as making friends and helping people.

With regards to the decision environment, all groups agree that farming is risky, and they identify basically the same factors as the causes of uncertainty in farming. A significantly smaller proportion of low income farmers use insurance, while a significantly larger percentage are content to sit back and do nothing about uncertainty, than in the other two groups. Just over half of the high income farmers said they understood the free market system, while the percentage is less for the low and medium income groups.

The medium income farm group did not display as many of the differences from the low income farmers that were evident for the high income farmers, especially with respect to aspiration levels. In fact, the results for this group were always consistent with, and somewhere in between, those of the other two groups with no major contradictions, providing a valuable check on the reliability of the results obtained for the high and low income groups.

It can be concluded that the survey results support the first hypothesis set to be tested in the study.

The Telephone Interviewing

As stated in the introduction to the chapter, after the personal interviewing was complete and other methodological procedures started, it was realised that additional information was required from respondents. These data were required to provide an analysis of the representativeness

of the results, obtained from the survey, and to be utilised in procedures to be described in Chapter 6.

Two data items were required from respondents--the number of children living in the family, and the age of the farm operator. Of the original 103 respondents, 72 responded to the telephone interview. The majority of those not responding could not be contacted at home. Two of the original respondents did not wish to participate further in the study, and one had since changed his residence.

The information was collected in an average of two minutes per respondent. Two recalls only were done, and the telephone interview was done in the fall of 1975. Table 19 gives the results obtained from the telephone interviewing.

In Table 19, it is seen that of the 72 respondents, 24 are low income, 27 are medium income, and 21 are high income farmers. The mean age of the low income farmers is 51.58 years, while that of the medium farmers is 44.44 years, and the high income 47.47 years. The medium income farmers are significantly younger than the low income farmers. There is no significant difference however, between the mean age of the low income and high income farmers.

On the average, the farmers in the survey have three children. The mean number of children for the low income farmers is 2.48, for the medium income farmers 3.62, and the high income farmers 2.68. The medium farmers have a significantly higher number of children in the family than the low income farmers. These results are in keeping with the mean ages referred to earlier, since they refer to the number of children presently in the family. Many of the older low and high income farmers reported that their children had grown up and left the family

Table 19: Age and Number of Children of Farmers[1]

Description	Number of Respondents	Mean Age of Farmers	Mean Number of Children
Low Income	24	51.58	2.48
Medium Income	27	44.44[a]	3.62[ad]
High Income	21	46.67	2.68
All Farmers	72	47.47	2.97

[1]Based on a telephone interview of 72 of the respondents.

a - significantly different from the mean for low income farmers at 95% level.

@ - significantly different from the mean for high income farmers at 90% level.

Source: The Survey.

home. The medium income farmers being the youngest group could thus be expected to have a higher number of children in the family home.

Reliability and Validity of Survey

The reliability of the survey is concerned with the degree to which the survey method would yield consistent results if it were to be repeated a number of times. The reliability of the survey can be determined by several methods. The method which corresponds most closely to the conceptual notion of reliability is the test-retest method. This requires that the survey be carried out on the same respondents at two different times, and the correlation between the two sets of results computed. This correlation coefficient is taken to be the

reliability estimate.[4] The test-retest method of reliability estimation could not be attempted in this study.

The method of reliability estimation used was a modification of the equivalent forms method. In this method two different measures of the same characteristic are included in the survey. After these measures have been administered to the respondents, the two sets of scores are correlated to obtain an estimate of reliability. The method was modified as follows: For one important factor in the study, two measurement procedures were included in the questionnaire. Since the aim of the survey is to discover differences in motivational factors between the farm income groups, the scores from these measurement procedures are compared by noting the differences that they discover between the farm income groups. If the measurement procedures give the same pattern of differences between the income groups, this can be taken as an indication of the reliability of the survey method.

The behavioral factor for which two measurement procedures were included was the goal orientation of the respondent. Here the measurement method of Cantril based on an analysis of life goals was supplemented by the measurement procedure of Kilpatrick et al on occupational values as described earlier.[5]

As was seen earlier in this chapter, the two procedures provide the same general pattern of goal orientations. Cantril's method found

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[4] Further technical details on the reliability and validity of sample surveys is available in Campbell and Katona (10: 41-48).

[5] These measures are described in the section on Nature of the Information Collected.

that the high income farmers have a significantly greater orientation to monetary goals, and the low income farmers have a significantly greater orientation to non-monetary goals. This method also found that low income farmers were more oriented to affiliative values like helping other people and making friends. The two measures were therefore consistent in their results, and this suggests that the survey results are reliable.

Consistency within the measurement procedures themselves has already been noted. Reference can be made to the questions on wishes and hopes and fears and worries in Cantril's method,[6] and the occupational satisfaction measure and the open ended information on personal liking, based on the method of Kilpatrick et at.[7] The consistency of the results obtained for the medium income farm sector has also been noted.[8]

In the section on the interview procedure, another aspect of the reliability of the results was discussed. This aspect was that of prompting or undue influence from other members of the family, who may have been present when the interview was conducted. There it was noted that the results for nine of the 103 respondents were possibly in error, because of family influence. Two other respondents may have misunderstood parts of the questionnaire.

In general it can be concluded that there is no reason to believe that the results obtained for the study are unreliable. The respondents found little difficulty in answering the questions, except

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[6] See pages 78 to 81.

[7] See page 85.

[8] See page 89.

in the few cases where there was undue family influence. The measures used were consistent in the results they yielded. This consistency was found in the measures themselves, and also when the results from the different measures were compared.

Validity of the Survey

The validity of the survey is concerned with the degree of confidence that could be placed in the results of the survey. Hansen Hurwitz and Madow (27: 10) report that in statistical analysis there are two measures of the validity of a survey. The first is the accuracy of the survey. This measure is the difference between the sample result for the variable under study and the true value of the variable. The second measure is the precision of the sample result. Precision is the difference between the sample result from the variable under study, and the result from a complete count (or census) taken under the same conditions of measurement, questionnaire, interview procedure and so on.

Hansen et al report that while it is the accuracy of the survey that chiefly interests statisticians, it is only the precision which is measured in most instances. They state that when probability sampling methods are used, and provided the samples are reasonably large, the precision of the results of the sample can be measured by the sample itself. The standard error of the sample estimate provides a measure of its precision. If the standard error of an estimate is known, bounds can be established around the estimated value, in such a way that the true value that is being estimated will almost certainly lie within its bounds (27: 121). These results follow from the Central

Limit Theorem.

The precision of the sample results will now be discussed. As noted earlier (see page 65), the sampling procedure used in the survey was two stage cluster sampling. The survey area was composed of Census Division 2 and Subdivisions 2 and 4 of Census Division 3 of the province of Manitoba. The first stage in the sampling was the random selection of four subdivisions from the survey area. These four subdivisions comprised the sample area. From a listing of most of the farmers in the sample area, a simple random sample of farms was taken at the second sampling stage. This simple random sample served as the final sample for the study.

Statistical precision analysis of the results was limited to the final simple random sampling done for reasons that will now be discussed. The number of respondents obtained in the survey was much less than anticipated (103). When the sample was classified into the three farm income groups, the sample sizes for these groups were 30 low income, 39 medium income and 34 high income farmers. These group sample sizes were too small for a consideration of the precision of the results for the whole survey area.

It has been noted that the standard error derived from a single sample gives a fairly precise measure of the precision of the sample estimate for samples of moderate size. Most authorities agree that sample sizes of 30 and over are generally large enough (76: 83, 77: 163). Cluster sampling increases the sampling error associated with estimates. Hence in general, much larger samples are necessary in cluster sampling, in order to obtain the same precision as with simple random sampling (27: 48-51). Since the sample sizes for the

groups of farmers were not large, it was decided that to improve the precision of the results obtained, the statistical analysis should be confined to the simple random sampling carried out at the second stage of the sampling procedure. The results are therefore stated for, and are representative of the sample area from which the simple random sample was obtained.

This study was in the nature of a pilot study, and as such there were no estimates of variance available to the study to determine the sample sizes needed for obtaining samples of desired precision. The precision estimates provided by the study can therefore serve as the basis for sample sizes for subsequent surveys in the area. These precision estimates are given in Appendix 4. As stated earlier, the sample estimates and their precisions are given for the sample area.

As noted in the subsection on the sample frame (see page 61), a simple random sample of farmers in the sample area was taken. This was dictated by the unavailability of separate frames for the populations of low, medium and high income farmers. It was therefore assumed that the simple random sample obtained when classified into the three income groups, represents samples taken from the populations of these groups. This assumption was necessary to allow the use of standard statistical test procedures to compare the characteristics between the groups of farmers.

As has just been discussed, the number of respondents obtained in the survey precluded an extended statistical analysis of the absolute precision of the results obtained for the entire survey area. In social science and public opinion surveys, other analyses are customarily used to assess the validity of surveys carried out.

Campbell and Katona (10: 46) report that one procedure used for establishing the validity of social science surveys is through comparison with outside criteria. However, they note that in most cases no acceptable criteria are available when the survey data are gathered, since the survey may have been designed just because of the said unavailability. This was the case for the present study. They also report that a common (though less precise) method of demonstrating survey validity consists of comparing survey distributions of demographic characteristics, with those of preceding censuses and surveys (10: 46).

Hansen et al (27: 483) have reported on the types of analyses just discussed. They state that in general, if there is a high enough correlation between the values of the direct measure (as obtained in the sample), and the related information from a different source (as obtained say from censuses of the area), then the survey results may be extendable to the other areas with acceptable average precision.

It was decided to attempt validity tests of the sample results for the entire survey area and the province of Manitoba. These tests utilised the method of comparison of survey distributions of demographic characteristics with those of preceding censuses and surveys. These tests provide validation of characteristics such as behavioral factors only if these factors are highly related to the demographic factors.

Two demographic characteristics were used, age of the respondent and the gross farm income of the respondent. Statistical analyses reported earlier in this chapter, showed that there was a strong relation between the behavioral factors of goals, values and

aspirations and the gross farm income of the respondents. Similar analyses showed that there was little relationship between the behavioral factors and the age of the respondent. The results with respect to income therefore, should provide the more important test of validity of the survey results.

As stated previously, these tests are not statistically precise and they can only illustrate the absence of gross errors if the sample results are extended to the survey area, or the province. The analyses are provided to give some indication of whether such gross errors exist. It would be necessary, however, to conduct more elaborate and detailed surveys of the province itself to obtain statistically valid information of the variables studied in this research. The value of the tests will be to indicate to future research workers whether any confidence could be placed in the results of this study in planning such detailed surveys. In a similar vein, these tests would provide some indication of the extent to which policy conclusions derived from the study, could be tentatively accepted as having a wider range of applicability than the sample area.

The comparison tests done with respect to income distribution are first described. Comparisons were done of the distribution of farm gross sales of the respondents of the survey with gross farm income distributions for farm tax filers of Census Division 2 of the province of Manitoba, representing most of the survey area,[9] and for farm tax filers of the province of Manitoba. These income

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[9]For a description of the survey area see the section The Survey Area, page 56 .

distributions are given in Table 20.

The distribution given in Table 20 were compared using chi-square tests. The first observation is that the survey data refer to the year 1974, while the income tax data are for the year 1973, the latest year for which data are available. Chi-square tests did not support the hypothesis that the survey income distribution was the same as the income distribution for Census Division 2. (Chi-square value obtained was 21.288 compared to the test statistic of 16.919 at the 95 percent level of significance.) Similarly, chi-square tests did not support the hypothesis that the survey income distribution was the same as the income distribution for the province of Manitoba. (Chi-square value obtained was 34.391 compared to the test statistic of 16.919.)

The income distribution from the survey gave a larger percentage of farmers in the higher income groups. This may be a reflection of the increasing incomes in the agricultural sector from 1973, the year of the tax data, to 1974, the year of the survey data.

The age distributions utilised in the analysis are given in Table 21. Chi-square tests support the hypothesis that the age distribution of the respondents in the survey was the same as the age distribution of farm tax filers in Census Division 2. (Chi-square value obtained was 9.699 compared to the test statistic of 12.592.) Similarly, chi-square tests did support the hypothesis that the age distribution of survey respondents was the same as the age distribution of farm tax filers in the province of Manitoba. (Chi-square value obtained was 6.362 compared to the test statistic of 12.592.)

The validity test with respect to the farm gross income

Table 20: Distributions of Gross Farm Income for Survey Respondents and Farm Taxfilers for Census Division 2 and Manitoba[1]

Gross Farm Income $	No. of Respondents In Survey	No. of Farm Tax filers Census Division 2	No. of Farm Tax filers Manitoba
1250-2499	4 (3.9)	245 (7.0)	3084 (8.5)
2500-3749	2 (1.9)	216 (6.2)	2528 (7.0)
3750-4999	3 (2.9)	192 (5.5)	2212 (6.1)
5000-7499	9 (8.7)	286 (8.2)	3560 (9.9)
7500-9999	2 (1.9)	261 (7.5)	3161 (8.8)
10000-14999	10 (9.7)	503 (14.5)	4998 (13.8)
15000-24999	22 (21.4)	642 (18.5)	6720 (18.6)
25000-34999	17 (16.5)	418 (12.0)	3476 (9.6)
35000-44999	9 (8.7)	256 (7.4)	1863 (5.2)
45000 and over	25 (24.3)	461 (13.3)	4525 (12.5)
TOTAL	103 (100)	3480 (100)	36127 (100)

[1]Percentages in brackets.

Sources: Statistics Canada (71).
The Survey.

Table 21: Distribution of Ages for Survey Respondents, and Farm Tax Filers for Census Division 2 and Manitoba.[1]

Age Years	No. of Respondents in Survey	No. of Farm Tax Filers Census Division 2	No. of Farm Tax Filers Manitoba
Less than 25	0 (0.0)	238 (6.4)	2511 (6.2)
25-34	12 (16.7)	592 (15.8)	6219 (15.3)
35-44	14 (19.4)	682 (18.2)	7383 (18.2)
45-54	26 (25.5)	826 (22.1)	9671 (23.8)
55-59	7 (9.7)	429 (11.5)	4876 (12.0)
60-64	6 (5.9)	392 (10.5)	4229 (10.4)
65-69	4 (5.6)	273 (7.3)	2721 (6.7)
70 years and over	3 (2.9)	307 (8.2)	2972 (7.3)
Total	72 (100)	3739 (100)	40582 (100)

[1]Percentages in brackets.

Sources: Statistics Canada.
The Survey.

distributions did not give a positive indication of validity. The chi-square tests on age distributions gave a positive indication of validity. However, as stated earlier, these tests with respect to the age of the respondent are not a strong indication of validity of the

survey results since age is not strongly related to the behavioral attributes under study.

The results of the validity tests with respect to the age and income distributions indicate that the sample results are not extendable to the entire survey area or to the province of Manitoba. This does not mean that the characteristics of farmers in these two areas are different from those in the sample area. The tests indicate that further research is needed to determine whether in fact, the behavioral characteristics in the two areas are the same as those in the sample area.

Chapter 6

FARM FIRM GROWTH MODELS

Introduction

It was seen in Chapter 5, that the results of the survey indicated that significant differences in goal orientations and levels of aspiration exist between the high and low income farmers in the survey. These results support the first hypothesis set for the study. This chapter deals with the procedures used to test the second hypothesis. This hypothesis states that ceteris paribus, the differences in the goal orientations and levels of aspiration between the low and high income farmers are sufficient to account for significant differences in their economic attainment. The chapter starts with an overview of the test procedure.

Overview of Test Procedure

The test procedure is concerned with the effect of goals and levels of aspiration on production decision making on the farm firm. The aim is to discover whether ceteris paribus, differences in goal orientations and levels of aspiration, acting via production decisions on the farm firm, are significant factors in the determination of the levels of income achieved. In Chapter 4, an analytical farm firm decision model was developed, which allows the incorporation of different goals and levels of aspiration into the production decision process. This model forms an essential part of the test procedure.

The test procedure is as follows: Two production decision models are constructed based on the entrepreneurial decision model. All factors except the behavioral factors are kept the same for both models, to maintain ceteris paribus conditions. One model is for a representative (and hypothetical) high income farmer, based on the goals and levels of aspiration of high income farmers as obtained in the survey. The other model is for a representative (and hypothetical) low income farmer, based on the goals and levels of aspiration obtained for low income farmers in the survey.

The two decision models are then incorporated into two separate farm firm growth models, one for the representative high income farmer, the other for the representative low income farmer. Using the growth models, the developments of two identical (and hypothetical) farm firms over a 20 year planning horizon are simulated. At the end of the planning horizon, the mean annual economic attainments of the two farmers are compared to determine whether significant differences exist. Hypothesis two suggests the representative high income farmer should achieve a significantly higher mean annual economic attainment.

The Growth Models

Introduction

As described in the last section two farm firm growth models were developed to test the second hypothesis. However it should be noted that these models were not designed to monitor the growth of the farm firms per se, but to monitor the economic attainment of the representative farmers. The primary measure of economic attainment used was net farm income since this measure reflects the returns from farming that are

available to the farm family.

An interesting by-product of the analysis was a comparison of the growth rates of the two farm firms over the planning horizon. The measure of growth chosen was value of output (gross farm output). Strickland (72) has evaluated the alternative means that have been used to measure growth. In recommending the use of value of output, he states that this measure can be obtained with relative ease and accuracy, and it reflects managerial input at all levels, including both producing and marketing systems. The fact, he states, that it does not reflect the decline or accumulation of resource ownership is immaterial since ownership is a measure of wealth, not size of operation.

Comparison of Farm Firm Growth Methods

Boehlje and White (6) report that three methods have been proposed in the literature to study firm growth: simulation, dynamic programming and multiperiod linear programming. Most of the studies done have used multiperiod linear programming, with simulation being used largely for dealing with stochastic elements of production such as yields and prices. They report however that dynamic programming formulations have not been applied to problems of the growth of the total farm firm. This subsection analyses, in the context of this study, the relative advantages and disadvantages of the use of dynamic programming, simulation and multiperiod linear programming for farm firm growth models.

Multiperiod linear programming provides for an overall optimum over the entire planning horizon (such as maximising terminal net worth

for a 20 year period),[1] by considering the constraints for all periods simultaneously. The dynamic programming approach attacks an optimisation problem by splitting the problem into a sequence of stages in which lower dimension optimisation takes place (74:263).[2]

One advantage of the stage-wise optimisation of dynamic programming is that it allows for the incorporation of the sequential nature of decision environments. Uncertainty aspects of these decision environments can be introduced at each period. This advantage would allow dynamic programming growth models to more readily conform to the reality of natural processes, thus adding to their practicality.

There was one major disadvantage that precluded the use of multiperiod linear programming in the study. The production decision model used was the multiple goal mixed integer linear programming model developed in Chapter 4. In a later section of this chapter,[3] this model will be detailed. An examination of this model will reveal that because of its dimensions, it would have been methodologically difficult to incorporate it into each period of a 20 period multiperiod linear programming model. The resultant mixed integer problem would also most likely be insoluble given the present size limitations of computer codes.

Dynamic programming does have one major disadvantage. This is that there are no set computer codes that could be used in solving

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[1] For details of such a model see Boehlje and White (6).

[2] Further details of the structure of dynamic programming models is given in the subsection starting page 109.

[3] See page 119.

such models. This is dictated by the fact that the models differ greatly in their construction, and also because dynamic programming assumes no set optimisation procedure. This is in contrast to multi-period programming which incorporates the optimisation procedure of linear programming. Dynamic programming models thus lack the mathematical elegance of multiperiod models and require more elaborate computational procedures.

As stated at the start of this section, simulation has mainly been used in studies of farm firm growth to deal with stochastic elements of the decision environments. Simulation analysis, particularly the Monte Carlo method, is especially suited for dealing with stochastic elements, since it can utilise historical or theoretical distributions of the stochastic variables to incorporate uncertainty. The Monte Carlo method is used in the growth models developed in this chapter, and this simulation subroutine will be described in a later subsection (Simulation Subroutine, page 127).

Simulation procedures were not utilised for the other facets of the growth models for two main reasons. The first is that simulation remains as Wagner (74:500) puts it, "a method of last resort." Simulation models have no general structural form, mathematical properties or computational procedures. Most models have to be devised to suit the individual requirements. This entails considerable effort to develop the models, though the use of simulation languages such as SIMSCRIPT and GPSS provide general guidelines.

The second reason is that simulation techniques when used in decision models, provide at best near optimal solutions. This is because most simulation procedures have to rely on statistical search

techniques to provide the solutions. Boehlje (7) has given a detailed description of the various search procedures that can be used in simulation models, and while undoubtedly efficient procedures have been developed these procedures remain non-error free.

Candler, Cartwright and Penn (13) have discussed the problems of the selection of analytical[4] (error free) versus simulation (non-error free) algorithms. Many problems may seem to have intractable features, and it may appear that simulation techniques provide the only means to solve these problems. Candler et al show however that skilful use of programming formulations can overcome some of the seeming intractability.

Candler et al agree that when reliable software for analytical algorithms is not available to the researcher, he may have no alternative to developing a simulation procedure. However they state that when codes for analytical algorithms are available or can be developed, the selection of a solution procedure becomes non-trivial. The relative costs of developing or purchasing computer codes, differences in computing time, and differences in the characteristics and volume of information generated are all relevant variables. They claim however that ". . . given equal total costs, an optimising analytic solution will be preferable to an approximation derived from simulation" (13:238). In the development of the farm firm growth models for this study, analytical models were given preference over simulation techniques in keeping with the conclusions of Candler et al.

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[4]Analytical search techniques refer to techniques that arrive at error free optimal solutions. These techniques are usually based on, or derived from, linear and non linear programming and dynamic programming.

Dynamic Programming Farm Firm Growth Models

Wagner (74: 262-264) has described the dynamic programming approach as consisting of the following structure:

(a) The decision variables with their associated constraints are grouped according to stages, and the stages are considered sequentially.

(b) The only information about previous stages relevant to selecting optimal values for the current decision variables is contained in a so-called state variable vector, which may be n-dimensional.

(c) The current decision, given the present state of the system, has a forecastable influence on the state of the next stage.

(d) The optimality of the current decision is judged in terms of its forecasted economic impact on the present stage and on all subsequent stages.

Unlike linear programming which refers to a specific mathematical model that can be solved by a variety of techniques, dynamic programming deals with a particular analytical approach, which can be applied to a variety of mathematical models (74: 263). In other words various types of mathematical models can be used to perform the selection of optimal values of the decision variables at each stage of the decision process in dynamic programming.

Minden (50) has conceptualised the formulation of dynamic programming procedures for use in farm firm growth models. In this article he discusses the mathematical models that can be used in selecting optimal values of decision variables. In the original formulation of Bellman (4), the mathematical model used was a recursive exhaustive search procedure. This search procedure eliminates from

consideration a considerable number of possibilities by making use of Bellman's principle of optimality:

> An optimal policy has the property that, whatever the initial state and decisions, the remaining decisions must constitute an optimal policy with respect to the state resulting from the first decision (4).

Minden has formulated a dynamic farm firm growth model utilising Bellman's principle in a forward solution procedure. However, the exhaustive search procedure of Bellman, while an improvement on a total search procedure (or a complete enumeration of possibilities) is still impractical for problems of the size that would normally occur in farm firm growth models.[5] Minden states that this is a major limitation to the use of the dynamic programming approach.

As stated in the last paragraph, dynamic programming possesses a major disadvantage that limits its use in farm firm growth models. However, several features of the dynamic programming approach were suited to the conditions required for the growth models for the study. These features, discussed in the last subsection, were that it allows for the incorporation of the sequential nature of decision making environments, and optimisation at every period of the model.

It was therefore decided to use a modification of the dynamic programming approach for the growth models used in this study. The dynamic programming approach was modified as follows: The farm firm growth models were solved in a forward solution procedure. Period 1 or year 1 was the first stage of the models, and the solution

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[5] Wagner (74: 260) provides an interesting account of this problem by considering the applicability of dynamic programming procedures to solve integer programming models.

proceeded from Year 1 to Year 20. Instead of using solely exhaustive search procedures, the farm firm growth models used an analytical search technique as well as exhaustive search procedures. The analytical technique used was multiple goal mixed integer programming.

The farm firm growth models developed did include the aspects of optimisation at each period, and the sequential nature of the decision environment in common with dynamic programming models. Further details of the farm firm growth models are given in the next subsection.

General Structure of Farm Firm Growth Models

An outline of the general structure of the farm firm growth models used in the study is given in Figure 3. The model assumes a 20 stage planning horizon, where each stage comprises one calendar year. Starting with the initial resources of the firm, the production decision environment is simulated for Year 1 to generate a certain farm income as a payoff from the activities pursued in the production period of the stage. These activities are determined by the optimum allocation of the resources arriving at Year 1. The income from the production activities passes on to the consumption-investment model which decides on the consumption and investment activities for the period. New resources obtained from the investment model, along with those resources remaining from the production decision environment (at Year 1), are then passed to Year 2. These available resources are then used in the production decision environment of Year 2.[6]

[6]The resources obtained from investment in year t, plus the resources left over from the production activity in year t form the available resources for the production decision environment of year t+1.

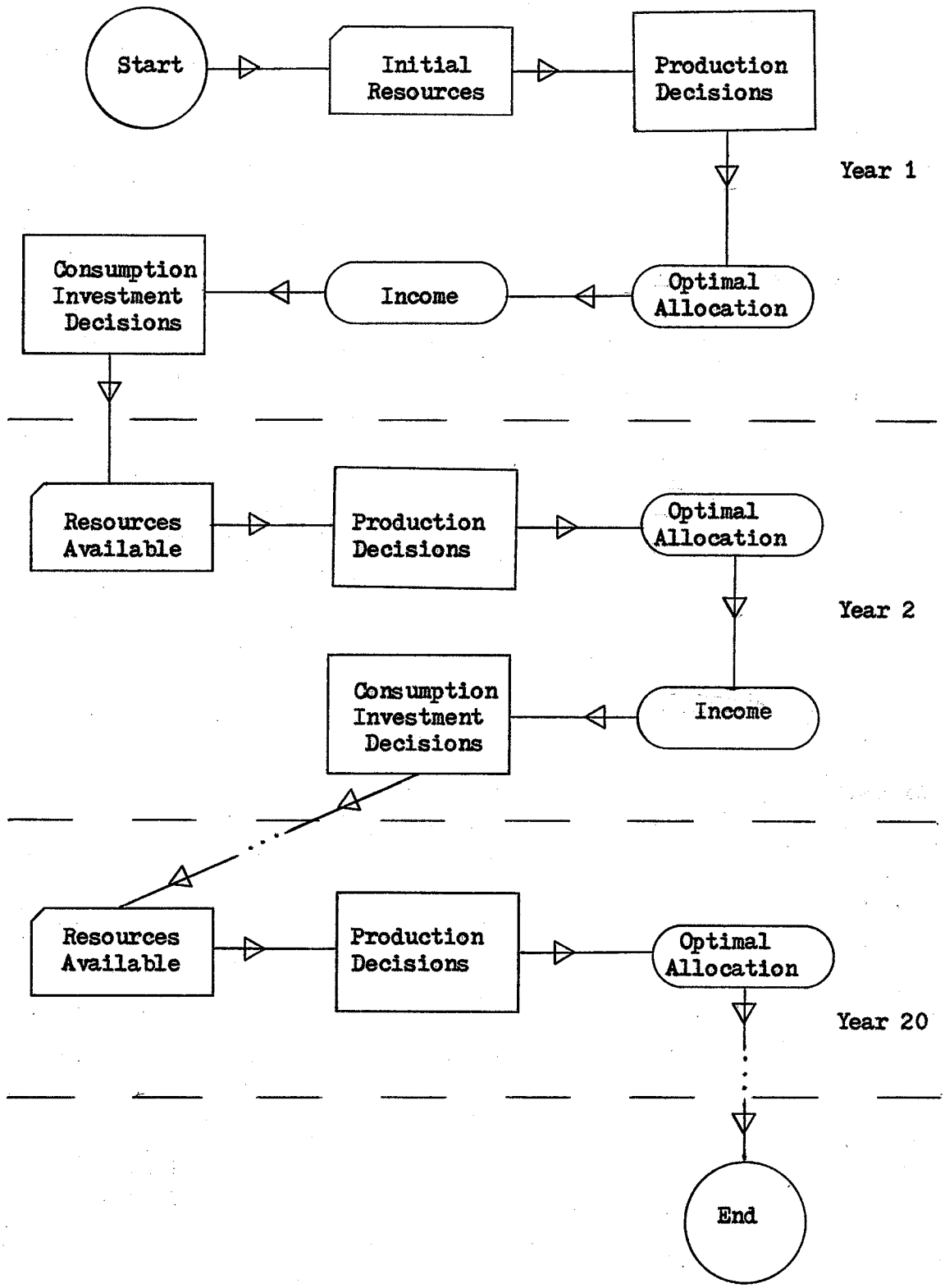

Figure 3. Outline of Farm Firm Growth Model.

Production Decision Environment

Adapting the model of Trebeck and Hardaker (73), the sequential decision environment for production at each year (or stage of the overall growth model) has been represented schematically in Figure 4.[7] The state variables or resources are available to the farmer in March-April, and in April-June he (or she) has to make the strategic decisions of what crops to grow, fertilizer rates and so on. Some of these decisions may in fact have to be made sometime in advance of April. Most strategic decisions may be made without knowledge of the effects of the ensuing state of nature.

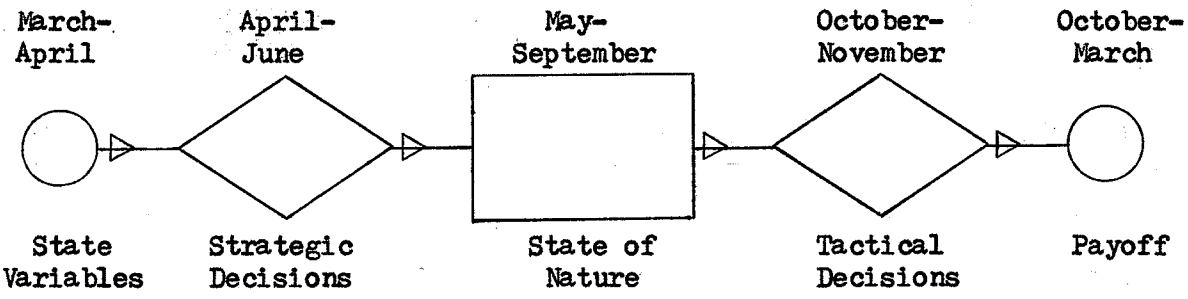

Figure 4. Sequential Production Decision Environment

Generally, there would be an opportunity for the decision maker to appraise the effects of the state of nature before subsequent decisions are made at the tactical decision stage. It is clear that an interdependent system is at work. As the production season progresses

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[7] For simplicity a purely annual crop farm will be considered throughout the analysis in this chapter, since this is sufficient to provide a test of hypothesis two.

however, the farmer would become locked into a particular production plan for that period. By September the full impact of the state of nature would be felt. At this stage, the farmer may have to make other tactical decisions, for example because of failure in some of his enterprises, he may have to alter his marketing plans to meet financial obligations. The interaction of his decisions and the state of nature gives his payoff or farm income.

The sequential decision problem given in Figure 4 has to be solved to determine how he should make his strategic decisions, and what these decisions should be. However to deal with this decision process with methodological efficiency, it is necessary to abstract from the interdependence (or overlap) of the various stages of the sequence, and to treat each stage as a separate entity. In this study the production decision problem is solved forwards, and the tactical decision stage is left out for methodological convenience. It is assumed that no severe loss of precision would result from the absence of a detailed consideration of tactical decisions.

The search procedure used to arrive at the optimal decisions in the production decision environment utilises analytical search procedures, in particular mixed integer linear programming. The state of nature was approximated by Monte Carlo simulation from normal distributions of price and precipitation variables. Details of these procedures are given in the next section.

Consumption-Investment Decision Environment

The schematic form of the sequential decision environment for consumption and investment in any year t is given in Figure 5. The

payoff from the production activities of the stage along with the financial resources transferred from the previous year (t-1) form the capital that is available for consumption and investment. Consumption represents a withdrawal from the model, but investment activities add to the capital stock of the farm firm, and thus enter the model as an addition to the state variables. Financial resources not consumed or invested remain as working capital available to the farm firm. Again, this environment has been cast into discrete stages only for methodological convenience. In fact, some investment may occur before consumption decisions.

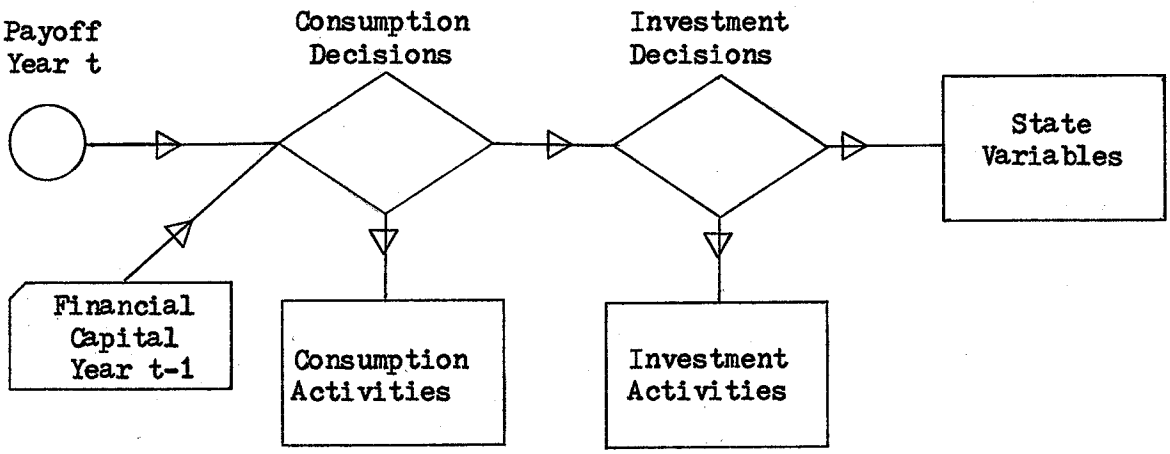

Figure 5. Consumption - Investment Decision Environment

The search procedures used to arrive at optimal decisions in the consumption-investment decision environment utilise exhaustive search procedures. Only one state variable, financial capital, is utilised here, and the number of alternative activities considered in the decision process is kept to a minimum. The decision environment is also assumed to be non-stochastic. The criteria used in the search procedures will

be described following the next section.

The Production Models

As stated in the overview of the test procedure, two farm firm growth models were developed in the study, one for a representative low income farmer, the other for a representative high income farmer. These models traced the growth of two hypothetical farm firms. This section sets out the production models that were used to determine the optimal decisions in the production environment at each stage of the planning horizon.

The structure of the production models is the same for both farmers, in keeping with the ceteris paribus conditions that have to be maintained for the test procedure. The only factors that differ are behavioral, notably goal orientations and the levels of aspiration. The two production models are hence dealt with together, and the differences in behavioral factors introduced are specifically noted. An outline of the production models used is given in Figure 6.

In Figure 6 the state variables represent the resources held by the farmer. Both the representative low income farmer and the representative high income farmer start with a typical low income farm resource base. This resource base is given in Table 22. The land resource of 306 acres is the average farm size of the low income farmers in the survey. Building, machinery, and working capital resource levels were obtained from the records of the Carman District Farm Business Association for 1970, and were adjusted to 1974 values by the use of Farm Input Price Indices for Western Canada reported in the 1974 Yearbook of Manitoba Agriculture (47: 103). The family labour supply was adapted

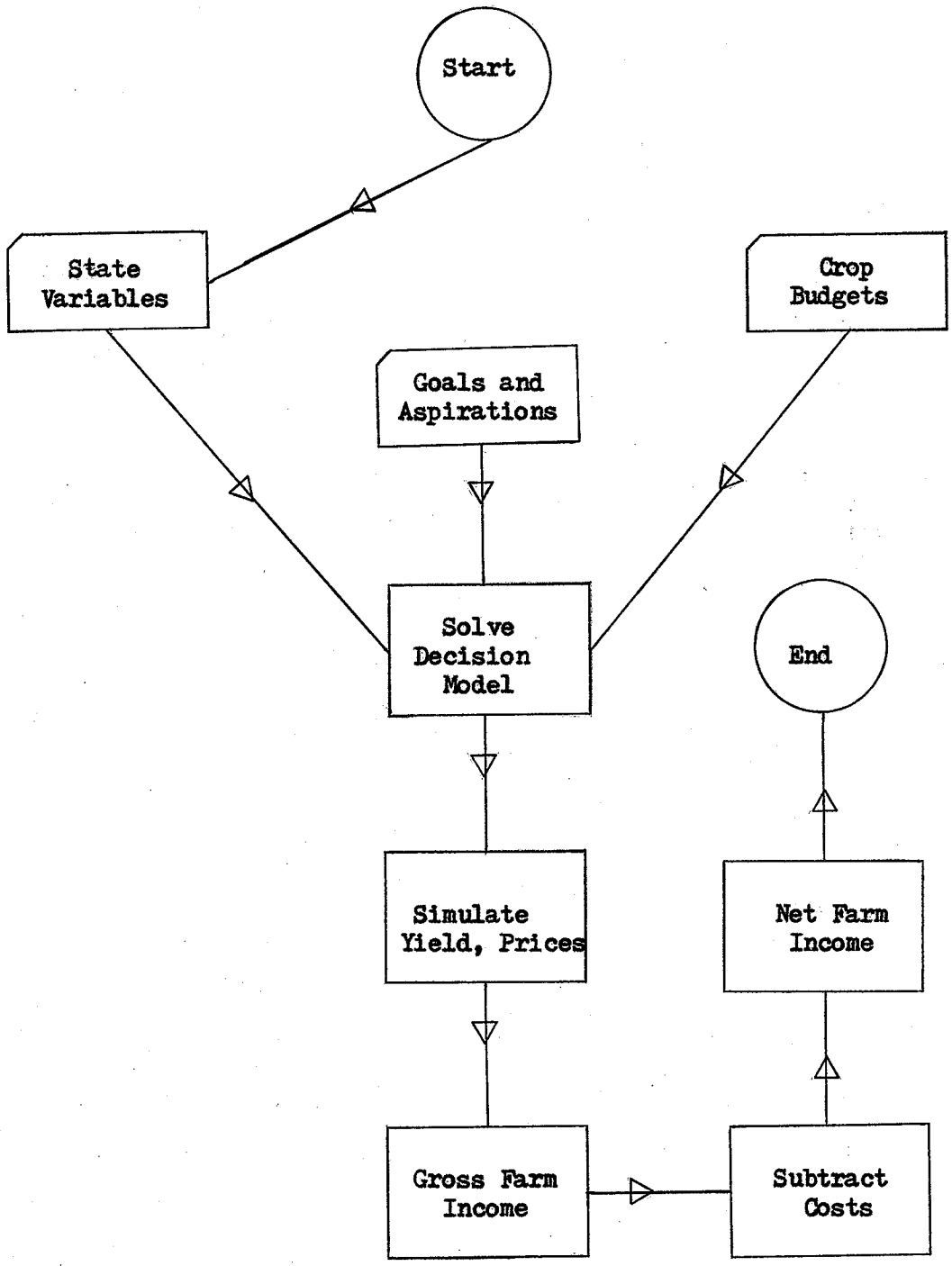

Figure 6. Outline of Production Models.

Table 22: Initial Resources of Farm Firms

Type of Asset	Unit	Total Amount
Machinery	$	12,694
Building	$	3,052
Short Term Capital	$	6,574
Land	acres	306
Labour	hours	1,403

from the work of Mitchell (51: 160), based on an analysis of records of farmers in Crop District 10 of Manitoba.

It was assumed that the hypothetical farms are purely crop farms with no livestock activities. Five crops were considered: wheat, barley, oats, rapeseed and flax, since these are the only crops grown by more than 14 (or 13.6 percent) of the farmers in the sample survey. An interesting point is that only one low income farmer grew rapeseed, compared to 12 high income farmers. This crop thus is not included in the low income production model. Each crop is given two budget activities - a small scale budget activity of approximately 80 acres, and a large scale budget activity of approximately 320 acres. All budget activity data except for labour, were obtained from the records of the Carman District Farm Business Association members for 1970. These data were adjusted to 1974 levels by the use of the Farm Input Price Indices for Western Canada (47: 103).

The labour requirements for the budget activities were calculated from data given by Mitchell (51: 173). These data originated from assumptions and computer programmes developed for the interregional

cereal production study of Craddock (19). The budget activities are given as columns of input-output production coefficients in the production decision models for the representative farm firms given in Appendix 3.

Production Decision Models

In Chapter 4, an analytical model of entrepreneurial decision making was developed based on the multiple goal theory. This decision model is utilised in the development of the two production decision models set out in this subsection. In the context of the overall sequential formulation given above, these models are the analytical search procedures of the production decision environment.

The general structure of the production decisions models used for the two representative farmers can be stated as:

Maximise:

$$Z = 0X_1 + \ldots + 0X_{10} + \lambda_1 g_1 + \ldots + \lambda_6 g_6 + 0L_1 + 0L_2 + \mu E_1 \qquad (1)$$

Subject to:

$$a_{11}X_1 + \ldots + a_{1\ 10}X_{10} + 0g_1 + \ldots + 0g_6 + 0L_1 + 0L_2 + 0E_1 \leq b_1 \qquad (2)$$

$$\vdots \qquad\qquad \vdots$$

$$a_{10\ 1}X_1 + \ldots + a_{10\ 10}X_{10} + 0g_1 + \ldots + 0g_6 + 0L_1 + 0L_2 + 0E_1 \leq b_{10} \qquad (11)$$

$$-r_{11}X_1 - \ldots - r_{1\ 10}X_{10} + 1g_1 + \ldots + 0g_6 + 0L_1 + 0L_2 + 0E_1 \leq 0 \qquad (12)$$

$$\vdots \qquad\qquad \vdots$$

$$-r_{61}X_1 - \ldots - r_{6\ 10}X_{10} + 0g_1 + \ldots + 1g_6 + 0L_1 + 0L_2 + 0E_1 \leq 0 \qquad (17)$$

$$P_1X_1 + \ldots + P_{10}X_{10} + 0g_1 + \ldots + 0g_6 + 0L_1 + 0L_2 - 1E_1 = 0 \qquad (18)$$

with:

$$c_k \leq g_k \leq d_k,\ c_k \text{ and } d_k \geqslant 0 \text{ for } k = 1, \ldots, 6, \qquad (19)$$

$$c_7 \leqq E_1 \leq d_7, \tag{20}$$

$$X_i \geqslant 0 \quad \text{and integer} \quad i = 1, \ldots, 10, \tag{21}$$

$$L_i \geqslant 0 \; i = 1, 2, \tag{22}$$

$$\sum_{k=1}^{6} \lambda_k = 1 \quad \text{and} \quad \lambda_k \geqslant 0 \quad k = 1, \ldots, 6. \tag{23}$$

where;

Z is the objective function,

X_i $i = 1, \ldots, 10$ are the budget activities for the five crops,

g_k $k = 1, \ldots, 6$ are the goals of the farmer,

L_1 is a labour hiring variable,

L_2 is a land rental variable,

E_1 is an economic means variable.

The coefficients will be described in the text.

The objective function, Z is a weighted function of the goals of the farmer, and the economic means variable E_1 which is described later. The goals and their weights (the λ_i's) are given in Table 23, and were based on the analysis of Cantril's method described in Chapter 5. The goals and percentages given in Table 23 are taken from Table 11 of Chapter 5.

The weightings are based on the percentage of farmers in each income group in the survey stating the particular goal. The percentages themselves could not be used for the following reason. Since each farmer could have stated more than one goal, the sum of the percentages is most likely greater than 100. For example for the high income farmers in Table 23 the sum of the percentages is 120.6. The model required that

Table 23: Goals and Their Weights for Production Decision Models

Goal	High Income Farmers		Low Income Farmers	
	% Farmers Stating Goals	[1]Weight in Objective Function	% Stating Goal	[2]Weight in Objective Function
g_1 Sound Economic Future	44.1	.37	10.0	.11
g_2 Own More	20.6	.17	20.0	.22
g_3 Have Enough to Earn Living	2.9	.02	20.0	.22
g_4 Good Health and Family Well Being	32.4	.27	20.0	.22
g_5 Retain Control of Farm	5.9	.05	16.7	.19
g_6 More Leisure	14.7	.12	3.3	.04

[1, 2]These are the weights in the objective function for the representative high income farmer (1), and the representative low income farmer (2).

Source: The Survey.

the sum of the weights of the goals in the objective function be equal to one. Hence a weighting scheme other than percentages had to be employed. The representative farmers are assumed to rank their goals in a manner identical to the weightings obtained for the group of farmers they represent.

The first ten constraints (Row (2) to Row (11)) are the ordinary production constraints of linear programming, where b_j $j = 1, \ldots, 10$ are the ten physical resource constraints on the levels of the budget activities. The labour hiring activity L_1 and the land rental activity L_2 allow additional quantities of labour and land to be available to the farm.

Rows (12) to (17) give the contribution of each budget activity to the goals that are maximised in the objective function. Row (12) accumulates the contribution to goal 1 (g_1), and transfers the total contribution to the objective function. Row (13) does the same thing for goal 2 (g_2) and so on to Row (17).

The contribution of each budget activity to the different goals (r_{ij} - contribution of budget j to goal i) was obtained from the results of the survey. The data obtained in the survey were classified by budget activities. For each farm size group, all farmers having the particular budget activity (that is, growing approximately the same acreage of the particular crop) were listed along with their orientation with respect to the various goals. The percentage of farmers stating the various goals was then computed for each budget activity, and the goals were weighted according to these percentages as described for the weightings in the objective function. These weights were then used as the contribution of the budget activity to the various goals for the

particular farm size group. Table 24 illustrates the calculation of the weights for the small scale rapeseed budget (60 acres) for high income farmers. The assumption made in deriving the weights in Table 24 is that the representative high income farmer in deciding to pursue the rapeseed budget activity would expect the relative contributions to his goals that are given by the weights. Again here the relative contributions obtained are identical with those that are obtained by the farmers as a group.

There are three further aspects to the model construction. The first involves the last row - Row 18. Referring to Table 24, it is suggested that the representative farmer would expect a relative contribution to goal 2 of .08, from each unit of the rapeseed activity. This contribution is not necessarily direct. The rapeseed activity would provide the farmer with income which he could then use to obtain additional goods (or own more). Income here provides the means to achieving the particular goal, and there is an interrelationship between budget activities, means and goals.

It was thought that the model as set out up to Row 16 may not fully capture the interrelationship involved, especially the means to achieving the goals. It was therefore decided to introduce explicitly into the model a means variable E_1, which would be maximised along with the goals in the objective function. Row 18 is introduced to provide an accounting and accumulation row for the means activity, and its accumulated value is transferred to the objective function. The contribution of each budget activity to the means activity (P_i i = 1, ..., 10) is its expected net return, calculated using Year 1 cost levels, mean prices and mean yields per acre of the crops for the planning

Table 24: Calculation of Relative Contribution to Goals of Rapeseed Budget*

Farm	Goals[1]						Acres Grown
	g_1	g_2	g_3	g_4	g_5	g_6	
1	1	0	0	0	1	1	45
2	0	1	0	0	0	1	50
3	0	0	0	0	0	0	40
4	0	0	0	1	0	1	40
5	1	0	0	0	0	0	70
6	1	0	0	1	1	0	107
7	0	0	0	0	1	0	110
TOTAL	3	1	0	2	3	3	
%[2]	42.9	14.3	0	28.6	42.9	42.9	
WEIGHTS	0.25	0.08	0.0	0.17	0.25	0.25	

*For a statement of the various goals see Table 23.

[1]If a farmer stated a goal, the number one is given in the table. If the goal is not stated the number zero is given.

[2]Percentage of farmers stating goals.

Source: The Survey.

horizon. The weight (μ) given to the means activity in the objective function, is the ratio of economic goals to the total number of responses by farmers for the particular farm size group. These responses refer to the question on wishes and hopes in Cantril's method.

The second aspect of the model involved the introduction of the levels of aspiration. This aspect is given in statements (19) and (20). For the goals g_k $k = 1, \ldots, 6$, and the means activity E_1, two goal levels are stated. The first levels are the low level goals which act as lower bounds on the values of the goals. These low level goals are given by c_m $m = 1, \ldots, k$. The second goal levels are the levels of aspiration, which act as upper bounds on the values of the goals. The levels of aspiration are given by d_m $m = 1, \ldots, k$. Further details on the way that levels of aspiration are introduced in a time perspective over the planning horizon are left to the section on the overall functioning of the growth models starting on page 141.

The final aspect of the production decision models involved their practicality. On the prairies, rapeseed is not grown on the same plots after broad-leafed crops like flax or rapeseed itself. This crop rotation practice prevents a build up of pests and diseases, and decreasing yields (57: 163). A constraint was therefore introduced in the model for the high income farmers, to limit the acreage of rapeseed and flax to less than one-third of the total acreage of the other crops grown the previous year.

Appendix 3 gives the two production decision models used for the representative high income and representative low income farmers. The models are for Year 1 of the planning horizon.

Branch and Bound Mixed Integer Programming

The production decision model stated above required that ten of the activities representing crop budgets take only integer values. The other activities were not constrained to be integer. The model therefore, had to be solved by a mixed integer programming code, which allows some but not necessarily all of the activities to have integer values. The computer code used was the Branch and Bound Mixed Integer Programming code (BBMIP) obtained from IBM, and developed by Shareshian (65).

In describing BBMIP, Shareshian states that the programme employs a branch and bound algorithm based on the Land and Doig Method[8] to solve mixed integer programming problems of limited size. All problems must be formulated as minimisation problems, and the linear programming minimisation problem is first solved without regard to integer constraints. From this point the program proceeds as if to enumerate the set of all possible mixed integer solutions by constraining each integer variable singly and in turn to an integer value within its range.

A dual simplex algorithm is used as a bound-establishing mechanism immediately after each integer variable is constrained. Large subsets of possible solutions, corresponding to continuations of partial sequences of integer-constrained integer variables, may be eliminated from consideration once it has been demonstrated that they must be inferior to the "best" feasible solution obtained to that point. When the total set has been exhausted, the best feasible solution is optimal.

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[8]Since detailed reviews of integer programming and the Land and Doig Method exist (e.g. Wagner (74: 295-315) and McMillan (44: 312-333) no extensive discussion will be given here. A review of integer programming computer codes is given in Loomba and Turban (40: 269-293).

The programme is written in Fortran IV, and the linear programming routine is double precision.

Simulation Subroutine

Once the production decision model is solved by BBMIP, the next step in the production model as seen in Figure 6 is the simulation of yield and prices. The results of the decision model are given in terms of integer values of the budget activities. For example, if in the optimal solution X_1 is equal to two, this means that the farmer grows 168 acres of wheat, since one unit of X_1 represents 84 acres of wheat. The simulation subroutine determines the gross income that results from 168 acres of wheat in the particular stage.

The simulation procedure was carried out as follows. Yield estimation equations for the five crops were obtained by regression analysis based on historical data. Then in each period, the values of certain stochastic variables in the regression equations were simulated. The values obtained were then substituted into the regression equations to obtain yield per acre estimates of the crops in bushels. At the next step, price per bushel values were simulated for the crops. For each crop, the product of the price per bushel, the yield (in bushels per acre) and the total acreage grown, gave its gross income value for the year. The sum of the gross income for all the crops gave the total farm gross income for the production period.

The yield estimation equations are dealt with first. The general form of the function used (with hypothesised signs of the elasticities given in brackets) is:

$$Y = F(P_1, P_2, P_3, P_4, P_5, P_6, N, P, K, SI) \quad (24)$$

where;

Y = Yield per acre in bushels,

P_1 = Number of days precipitation May, 15 - June, 15 (-),

P_2 = Number of days precipitation August, 15 - September, 15 (-),

P_3 = Inches precipitation October, 1 (Year t-1) - May, 31 (Year t) (+),

P_4 = Inches precipitation June (+),

P_5 = Inches precipitation July (+),

P_6 = Inches precipitation August and September (+),

N = Pounds of nitrogen fertilizer per acre (+),

P = Pounds of phosphorus fertilizer per acre (+),

K = Pounds of potassium fertilizer per acre (+), and

SI = Soil productivity index (+).

All precipitation data were obtained from tapes prepared by Environment Canada. Other data used for the estimation of the functions were obtained from the records of the Manitoba Crop Insurance Corporation (MCIC). These data were used in a study of benefit-cost analysis of agricultural drainage expenditures in the Department of Agricultural Economics at the University of Manitoba.[9]

The MCIC data are based on completed questionnaires returned by farmers to the MCIC on land use, crop yield and fertilizer use. The MCIC has an ordinal measurement of soil quality called the soil

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[9]This study has not yet been published. Further details can be obtained from the report of a pilot study done by Rigaux and Singh (60).

productivity index. This index rates all Manitoba soils by quarter section, as to their relative merits in the production of commercial crops, and is used as a determinant of premium and coverage rate schedules for farmers. The MCIC data were available from 1960 to 1972, and provided information for variables Y, N, P, K and SI, and whether the crop was grown on fallow or stubble land.

Precipitation and MCIC data were available for the survey area. The MCIC data chosen for use were for the following areas: Township 6 Range 5 Sections 1-36, Township 6 Range 6 Sections 1-36, Township 7 Range 5 Sections 1-36, and Township 7 Range 6 Sections 1-36, in the rural municipality of Dufferin, an area of radius approximately six miles from Graysville. The precipitation data were obtained for the meterological reporting station at Graysville, and were daily readings for the period 1925-1972. The two representative farms were thus assumed to be located within six miles of Graysville.

While the precipitation time series was adequate, the MCIC data only spanned 12 years. For most years however, a large number of cross-sectional observations were available for the variables Y, N, P, K and SI for each crop. It was therefore decided to use a combination of time series and cross-sectional regression analysis[10] to obtain the best estimation equations and also make the most efficient use of the data available.

The general function (given previously as (24)) can be written in linear form as:

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[10]This method was adapted from Klein (34: 70-74).

$$Y_{it} = \gamma + \beta_1 P_{1t} + \beta_2 P_{2t} + \ldots + \beta_6 P_{6t} + \alpha_1 N_{it} + \alpha_2 P_{it} + \alpha_3 K_{it} + \alpha_4 SI_{it} \quad \ldots(25)$$

$i = 1, \ldots, k$ denotes the number of cross-sectional observations for year t,

$t = 1, \ldots, n$ denotes the number of years of time series data.

If we take a cross-sectional sample at some time t_0 then:

$$Y_i t_0 = (\gamma + \beta_1 P_{1t_0} + \beta_2 P_{2t_0} + \ldots + \beta_6 P_{6t_0}) + \alpha_1 N_{it_0} + \alpha_2 P_{it_0} + \alpha_3 K_{it_0} + \alpha_4 SI_{it_0} \quad i = 1, \ldots, k \quad \ldots(26)$$

At any time point t_0 (when say the cross section sample is taken)

P_{jt_0} = constant for $j = 1, \ldots, 6$.

The only variable quantities are those that depend on the subscript i. Hence we can estimate (26) using the k cross-sectional observation to obtain estimates of:

$\alpha_1 \ldots, \alpha_4$ as $\hat{\alpha}_1, \ldots, \hat{\alpha}_4$. Equation (26) was thus estimated for the five crops using the MCIC cross-sectional data.

Summing equation (25) over i we get:

$$\sum_{i=1}^{k} Y_{it} = \gamma + \beta_1 P_{1t} + \beta_2 P_{2t} + \ldots + \beta_6 P_{6t} + \sum_{i=1}^{k} (\alpha_1 N_{it} + \alpha_2 P_{it} + \alpha_3 K_{it} + \alpha_4 SI_{it}) \quad t = 1, \ldots, n \quad \ldots(27)$$

Since we have estimates of $\alpha_1, \ldots, \alpha_4$, these can be submitted in (27), and we form a new variable Z_t as:

$$Z_t = \sum_{i=1}^{k} \left[Y_{it} - (\hat{\alpha}_1 N_{it} + \hat{\alpha}_2 P_{it} + \hat{\alpha}_3 K_{it} + \hat{\alpha}_4 SI_{it}) \right] \frac{1}{k} \quad \ldots(28)$$

Equation (27) becomes:

$$z_t = \gamma + \beta_1 P_{1t} + \beta_2 P_{2t} + \ldots + \beta_6 P_{6t} \quad t = 1, \ldots, n \qquad \ldots(29)$$

This equation was estimated using time series data to obtain values of the coefficients as $\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_6$.

The estimated equations, with t-values of the coefficients in brackets, are now given for the five crops:

WHEAT

$$Y = -3.836 + \underset{(2.564)}{.191}\, N + \underset{(0.653)}{0.086}\, P + \underset{(1.414)}{0.111}\, SI - \underset{(1.110)}{0.904}\, P_2 + \underset{(1.948)}{1.961}\, P_3 + \underset{(1.144)}{1.667}\, P_4 - \underset{(0.949)}{1.586}\, P_5 + \underset{(1.265)}{1.793}\, P_6 \qquad \ldots(30)$$

$R^2 = .500$ $\qquad$ $F = 1.422$

OATS

$$Y = -34.373 + \underset{(2.426)}{.469}\, N + \underset{(0.380)}{0.124}\, P + \underset{(3.266)}{0.621}\, SI - \underset{(0.430)}{0.588}\, P_2 + \underset{(1.594)}{2.693}\, P_3 + \underset{(0.808)}{1.975}\, P_4 + \underset{(0.872)}{2.447}\, P_5 + \underset{(0.593)}{1.410}\, P_6 \qquad \ldots(31)$$

$R^2 = .470$ $\qquad$ $F = 1.230$

FLAX

$$Y = -3.730 + \underset{(1.132)}{0.025}\, N + \underset{(2.764)}{0.096}\, SI + \underset{(1.094)}{0.243}\, P_2 + \underset{(1.830)}{0.502}\, P_3 - \underset{(0.829)}{0.329}\, P_4 + \underset{(1.152)}{0.524}\, P_5 + \underset{(0.818)}{0.316}\, P_6 \qquad \ldots(32)$$

$R^2 = .650$ $\qquad$ $F = 2.559$

BARLEY

$$Y = 1.626 + \underset{(0.689)}{0.069}\, N + \underset{(2.101)}{0.369}\, P + \underset{(3.101)}{0.282}\, SI + \underset{(0.971)}{2.911}\, P_1 - \underset{(0.650)}{1.615}\, P_2 + \underset{(0.302)}{1.105}\, P_3 - \underset{(0.401)}{1.285}\, P^*_7 \qquad \ldots(33)$$

$R^2 = .421$ $\qquad$ $F = 1.09$

* The variable P_7 is a composite of P_4 and P_5, and is the number of

inches precipitation in June and July.

RAPESEED

$$Y = 3.878 + \underset{(0.254)}{0.013}\ N + \underset{(0.640)}{0.075}\ P + \underset{(2.046)}{0.211}\ SI + \underset{(1.349)}{1.285}\ P_1 - \underset{(1.241)}{1.179}\ P_2 + \underset{(1.377)}{1.471}\ P_3 - \underset{(1.468)}{1.806}\ P_7 \quad \ldots(34)$$

$R^2 = .630$ $\quad$ $F = 2.129$

All equations were estimated with data from stubble fields. For all crops, the potassium variable K was highly insignificant, so it was left out. In general the nitrogen input (N), the productivity of the soil (SI), and the inches of precipitation the previous winter and the current spring (P_3) were the significant variables. Excess rainfall in June and or July appeared to have a depressing effect on yields of all crops except oats.

The next stage involved the simulation of the precipitation variables and prices. These variables were assumed to be stochastic, since they were the factors identified by farmers in the survey as the major contributors to uncertainty in farming.[11] Fertilizer inputs and the soil productivity index were assumed to be given deterministically. As stated previously, the precipitation data was for the meteorological reporting station at Graysville for the years 1925-1972.

It was felt that there would be little practicality in using historical price data prior to 1972 for the simulation, since the structure of the international and domestic grain economy has changed drastically since that year. It was therefore decided to use monthly

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[11] These results are given in Table 16 of Chapter 5.

price fluctuations from January 1st 1972 to July 31st 1975, as an indication of the annual price fluctuations which could be expected over the planning horizon of the growth model. These monthly data were obtained from Grain Statistics Weekly (a publication of the Canadian Grain Commission (11)), and the 1975 Canadian Agricultural Outlook Conference Report (58: 54-58).

The actual simulation was carried out by the Monte Carlo method. The precipitation data were assumed to be normally distributed with respect to time. Chi-square tests were performed (at the 95 percent significance level) to determine whether the distribution of prices of crops were normal. Of the five crops only flax prices did not pass this test of normality. It was decided to assume that the prices of all the crops were normally distributed.

Simulation of values of price and precipitation variables from their normal distribution with means and standard deviations known was accomplished by a Fortran IV programme, modified from Mize and Cox (52: 223-224). In this Monte Carlo method, a discrete approximation of the cumulative distribution function of the variable X is obtained from its known probability density function (normal distribution), by means of computer integration using Simpson's Rule. A random number generator is then used to obtain n numbers between zero and one. These generated values ($0 < F_i < 1 \quad i = 1, \ldots, n$) are taken to be values of the distribution function (probabilities), and the discrete approximation of the distribution function is then used to determine the values of X corresponding to the probabilities.[12]

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[12] Further details of the simulation are available from Mize and Cox (52: 76-93).

Table 25 gives the deterministic values used in the simulation subroutine. A soil productivity index of 50 was assumed throughout the analysis.

Table 25: Values of Deterministic Variables Used in Simulation Subroutine

Crop	Nitrogen Input lbs/acre	Phosphorus Input lbs/acre	Soil Productivity Index
Wheat	68.0	30.1	50
Oats	60.8	31.9	50
Flax	61.0	30.0	50
Rapeseed	63.0	28.4	50
Barley	58.4	30.1	50

Source: Fertilizer Data from Carman District Farm Business Association Records 1970.

The final aspect of the production model was obtaining the net farm income from total gross income by the removal of costs. The variable costs associated with the budget activities were the requirements of the budgets for working capital (given in Appendix 3). The fixed costs associated with the farm firms were obtained from the Carman District Farm Business Association records for 1970, and were updated to 1974 values by the use of Farm Input Price Indices (47: 103). Over the planning horizon, variable costs were increased by two percent per annum to include the effects of inflation. This figure represents a net inflation of costs over prices of commodities of two percent per annum, since commodity prices remained based on the price levels from January 1972 - July 1975, as described in the previous subsection.

Fixed or overhead costs were also increased by two percent per annum to reflect inflation. However, an additional adjustment factor was used. At the end of Year 10 and Year 15 the overhead costs were adjusted to reflect the increased capitalisation of the farms as growth took place. It was assumed that this capitalisation would require a larger overhead outlay. Land acreage owned was taken as the measure of capitalisation, and a fixed ratio of overhead costs to land owned (v_i) was used to adjust the overhead costs. This ratio was determined as:

$$v_i = \frac{\text{Overhead Costs Year 1}}{\text{Land Owned in Year 1}} \qquad \ldots(35)$$

Thus for Year 11, the overhead costs are:

$$OC_{11} = OC_{10} + v_i \ (\text{Land}_{10} - \text{Land 1}) \qquad \ldots(36)$$

where;

OC_t = Overhead cost in year t

Land_t = Land owned in year t

In Year 12 the overhead costs are:

$$OC_{12} = OC_{11} \ (1 + .02) \qquad \ldots(37)$$

The Consumption-Investment Models

It was indicated in Chapter 4 that the operator of the farm firm is influenced by his (or her) own goals and aspirations, and also those of other members of his family. It has been assumed that the goals of the farmer himself determine the production decisions of the farm firm, via the theory of entrepreneurial decision making. When dealing with investment-consumption decisions however, it is recognised that the goals of other members of his family have a major effect on decision

making. This study could not attempt a detailed analysis of family goals and aspirations, because of its limited scope and resources. Hence only rudimentary consumption-investment models are devised.

Again, the model for the representative high income farmer and the model for the representative low income farmer are basically the same, so they are described together. Any differences between the two models are specifically noted.

The Consumption Subroutine

The consumption subroutine gives the search procedures used to determine the optimal consumption decisions at each stage of the planning horizon. Exhaustive search procedures are used here based on criteria to be set out. Patrick and Eisgruber (55) have suggested that consumption expenditures of the farm family increase with income, and that family size, and the age of the operator are also important variables. They also suggest, these expenditures are likely to remain relatively constant, and to lag in adjustment to changes in farm income.

Using United States Department of Agriculture (USDA) data, Patrick and Eisgruber designed a consumption function based on their conclusions. This consumption function is:

$$C = -3277 + 0.5\ AFI + 1870\ FS + 84.5\ AGE - 183.4\ FS^2 - 1.1\ AGE^2 \quad \ldots(38)$$

where;

C is consumption expenditures,

AFI is the average farm income after taxes and debt payments (farm income in time period t is weighted by 0.2, t-1 by 0.5, and t-2 by 0.3; these weights introduce a lag or smoothing of consumption

expenditures),

FS is the size of the farm family ($FS \leq 5$), and

AGE is the age of the farm operator.

This consumption function is utilised in the models.

The age used in the function is the mean of age of all the farmers in the survey. This age was given in Table 19 of Chapter 5 as 47.47 years. Similarly, the size of farm family used is the mean family size of all the farmers in the survey. Table 19 of Chapter 5 gives the mean number of children of the farm operators as 2.97 children. Hence, the farm family size used in the consumption function was five. Substituting these figures into equation (38) yields a consumption function for the representative farmers as:

$$C = 3020 + 0.5\ AFI \qquad \ldots(39)$$

where C and AFI are defined as before.

A minimum level of family consumption was allowed in the model. This minimum was set at $6000 in Year 1, and increased by two percent per year over the planning horizon. This minimum level of consumption (Cm) was assumed to be sufficient to provide for the necessities of survival for the farm families, since it is just about the income stated by the revised Statistics Canada poverty line for a family of four in small urban areas (Table 1, Chapter 3).

The search procedure used to determine the consumption expenditures at each stage t is as follows: The level of consumption suggested by the consumption function (C_t^*) is first calculated. If this suggested consumption level is less than the disposable income for the year t, the consumption for year t, C_t is equal to the suggested consumption level (or $C_t = C_t^*$). If instead, the suggested consumption level

C_t^* is greater than the disposable income for the year t, the consumption level C_t is equal to the minimum consumption level for that year (or $C_t = Cm$).

The Investment Subroutine

The investment subroutine comprised the search procedures used to determine the optimal investment decisions for the farm at each stage of the planning horizon. An exhaustive search procedure is also used here. The search procedure is more complex than the one developed for the consumption decisions; it also contains a limited number of alternative strategies.

Two sources of funds are available to the representative farms at any time period t. First there is disposable income in excess of consumption requirements plus financial capital transferred from period (t-1). Second the farm can borrow funds. Two types of credit are allowed. Short term credit is available up to a maximum of $11,000, which has to be paid off entirely in the next period at seven percent interest. This credit is used solely for the provision of working capital. Intermediate term credit (referred to here as loans) is also available. The amount of capital available from this source - permissible loan borrowing - is determined by the difference between the borrowing capacity of the firm and outstanding loan debt.

Two of the major farm loan sources in Manitoba are the Farm Credit Corporation (FCC) and the Manitoba Agricultural Credit Corporation (MACC). These corporations allow a borrowing capacity of up to 75 percent and 80 percent respectively of the appraisal value of the security put up (57: 598-602). For the investment subroutine the

only collateral allowed on loans is the land owned. It was decided however to deflate the borrowing capacities of the two farmers to reflect their desire for capital rationing as reflected by the results of the survey (Table 17, Chapter 5). The deflation used was the percentage of farmers in each farm income group who stated capital rationing as a hedge against uncertainty. Hence for the representative low income farmer the borrowing capacity was 25 percent of the value of the land owned, and for the high income farmer the borrowing capacity was 50 percent of the value of land owned. Capital rationing was included to increase the practicality of the model, and also to indicate the more positive response to high income farmers to uncertainty as reflected by the results of the survey (Table 17, Chapter 5).

Several assumptions are needed to limit the number of alternatives considered in the optimal search procedures. The payback period on intermediate terms loans, is ten years and the interest rate and charges are assumed to amount to 15 percent of the value of the loan. Equal payments are made over the ten year payback period. Loans are used only for investment in machinery and buildings. Land is bought strictly from the first source of funds, disposable income in excess of consumption requirements plus financial capital transferred from the previous period. All land owned is thus available as collateral for loans. The farm firms are assumed to have no debts at the start of the planning horizon; also long term borrowing is not included in the model.

Investment is the primary source of growth on the farm firm. Hence to achieve maximum growth rates, investment should be kept at the highest possible levels. Some balance has to be kept however between the level of investment and the availability of working capital. This

is because, as discussed below, machinery and buildings are subject to depreciation over time, so that non-use of these capital assets represents a substantial withdrawal from the model.

The investment criteria used to arrive at optimal investment decisions are as follows: Land is bought (in multiples of 50 acres) only if working capital for year t+1 (including short term credit) was greater than the working capital of the year t. Investment in land and buildings (in multiples of $5000 and $2000 respectively) then proceeded. This investment was first used to replace depreciated capital assets, then to relieve any capital resource that was limiting in the year t. Loan borrowing for investment was limited by the borrowing capacity of the farm firm, and by the capacity of the farm to use additional capital assets productively. A key factor determining the productivity to which the capital assets could be put was the availability of working capital.

Machinery capital was depreciated at 15 percent per year for ten years, building capital at five percent per year for 20 years. The land price used was based on the work of Roehle (62). The price used was for land of soil productivity index 50 in Crop District 3 of Manitoba, adjusted to 1974. This price was $169 per acre in Year 1. The price of land was adjusted to $175 per acre from Year 7, $200 per acre from Year 12, and $225 per acre from Year 18.

Overall Functioning of Growth Models

As described previously, the two farm firm growth models for the representative low and high income farmers were solved forwards starting from Year 1. The details of the initial resources and the Year 1 production decision models have already been described and given in

Appendix 3. This section examines some other aspects of the overall functioning of the growth models. The first aspects dealt with are the levels of aspiration of the representative farmers.

Levels of Aspiration

As was seen in the subsection on the production decision models, the levels of aspiration were introduced into the analysis as upper bounds on the levels of the goal activities and the economic means activity. These activities were also limited by lower bounds representing low level goals. This subsection will examine how the levels of aspiration and low level goals were incorporated into the growth models in the time dimension.

The results of the survey given in Table 15 of Chapter 5 show that on average, the high income farmers stated a present life ladder level of 6.7, and a ladder level in five years of 7.3. The mean figures for the low income farmers were a present ladder level of 5.8, and a ladder level in five years of 6.1. These data can be expressed on the ordinal scale given by the ladder in Cantril's method as in Scale 1 of Figure 7.

The ladder level in five years is used as a generalised measure of the level of aspiration of respondents. The ordinal rankings of Cantril's method however, do not provide an operational scaling of levels of aspiration for the growth models. In common with all ordinal scales, the actual numbers used in the index to measure the levels of aspiration are not as important as the ranking the scale provides. It was decided therefore to devise another ordinal index of the levels of aspiration. This scale is presented as Scale 2 in Figure 7.

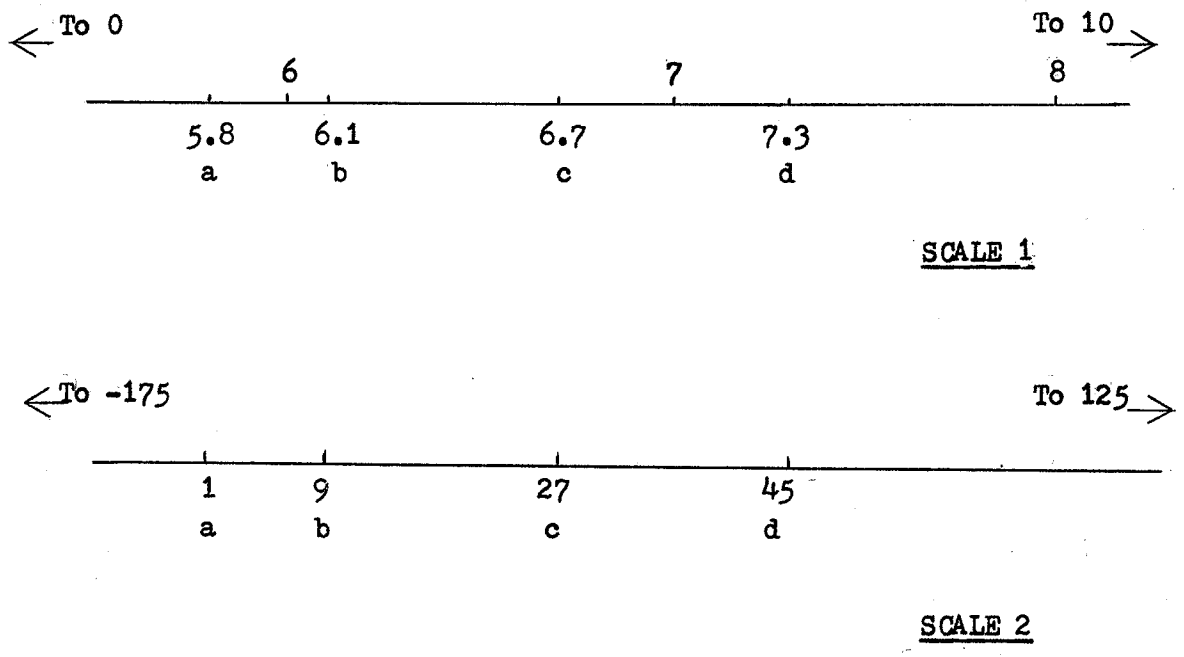

Figure 7. Level of Aspiration Scales.

The present level of life of low income farmers is given as 5.8 on Cantril's scale (Scale 1), and 1.0 on Scale 2. From 5.8 in both negative and positive directions, every one tenth unit on Cantril's scale is represented by three units on Scale 2. The best possible life on Scale 2 is thus represented by 125 (10 on Cantril's scale, Scale 1), and the worst possible life is represented by -175 on Scale 2 (0 on Cantril's scale, Scale 1). Scale 2 suggests that if low income farmers are presented with a scale where -175 represents the worst possible life, and 125 the best possible life, then on average, these farmers should state a present life level of 1.0 and a level of 9.0 in five years. Scale 1 is an ordinal index. As such, it is unique up to a monotonic transformation. The transformation given in Scale 2 is a monotonic

transformation of Scale 1,[13] so that it also is an ordinal index.

The reason for adopting Scale 2 is now examined. This scale was designed to provide an operational framework for the introduction of levels of aspiration into farm firm growth models. The key consideration is to set these levels of aspiration to enable the representative low income farmer to survive in farming over the planning horizon.

The levels of aspiration are used as upper bounds on the levels of achievement of goal activities and the economic means activity. It is therefore important that these bounds be such that realistic rates of growth can be obtained by the farm firms. One of the necessities in constructing growth models is that the models must allow the farmer to stay in business over the planning horizon (72). In the survey, many of the lower income farmers stated that they had been farming for over 30 years. A model purporting to represent low income farmers, should allow a representative low income farmer to remain farming for 20 years.

In line with the use of Cantril's measure as a generalised measure of the level of aspiration, it was assumed that the representative low income farmer would aspire to a goal of a growth rate of the levels of their goal activities and economic means activity of nine percent. Similarly the representative high income farmer is assumed to aspire to a goal of a growth rate of the levels of goal activities and economic means activity of 45 percent. For the representative low income farmer therefore, the possibility exists that a growth rate of

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[13] A function $f(X)$ is a monotonic transformation of X if $f(X_1) > f(X_2)$ whenever $X_1 > X_2$. Further details on measurement are given in Baumol (3: 537-542).

nine percent per annum can be realised. This rate is assumed to be sufficient to keep the farmer in business, since the net inflation rate of costs in the growth model is two percent per annum.

The choice of Scale 2 was arbitrary. Analysis was therefore carried out to determine the appropriateness of Scale 2, with particular regard to determining whether the choice of scale affects the testing of hypothesis two.

Attention will now be given to the actual procedure used with respect to levels of aspiration in the growth models. The two growth models are solved in Year 1, without regard to aspiration constraints. The levels of goal and economic means activities achieved at Year 1 are then used as the lower bounds or lower level goals of the goal and means activities for the other 19 years of the planning horizon. Thus in terms of the model developed as (1) to (23), the lower bounds on goal and means activities become

$$c_k = g_{k1} \qquad \text{for } k = 1, \ldots, 7 \qquad \ldots(40)$$

where, c_k is the lower bound on goal activity g_k, and

g_{k1} is the value of goal activity g_k in Year 1.

The values of the goal and means activities in Year 1 are incremented by nine percent for the representative low income farmer, and by 45 percent for the representative high income farmer. These incremented values form the upper bounds on the activities for Year 2.

If for any subsequent year t in the planning horizon for the two representative farmers, the level achieved for any goal or economic means is greater than the previous incremental value of the upper bound, in the next year (t+1), the upper bound on the goal or means activity is incremented. This increment on the goal or means activity

is nine percent for the low income farmer, and 45 percent for the high income farmer. The process can be represented mathematically as follows: If for the representative low income farmer:

$$(d_{kt} - .09\ d_{kt}) < g_{kt} < d_{kt} \qquad \ldots(41)$$

then $$d_{kt+1} = d_{kt} + .09\ d_{kt} \quad \text{for} \quad k = 1, \ldots, 7 \qquad \ldots(42)$$

where: d_{kt} is the upper bound on goal activity g_k in year t, and

g_{kt} is the value of goal activity g_k in year t.

For the representative high income farmer the process is similar except that .45 is substituted for .09 in statements (41) and (42).

The incremental increase in the level of aspiration is consistent with the theory of the level of aspiration given in Chapter 4, which suggested that successful performance at a goal generally leads to an increase in the level of aspiration associated with it. The incremental process ensured that the level of aspiration was always above the level of goal achievement as is also suggested by the theory.

Additional Functional Features

For every year (t) from total gross income, variable costs and overhead costs are subtracted to yield net farm income. Overhead costs include loan payments and credit. Net farm income plus off farm income yields total income. Off farm income is assumed to be $3000 in Year 1 increasing by two percent per annum over the planning horizon. The total income received is then subject to income tax according to the income tax schedule of Revenue Canada for 1974. Only basic federal and provincial taxes were levied. A basic deduction of $6000 was taken from total income to arrive at taxable income in Year 1. This basic deduction was increased by two percent per annum.

Total income with taxes deducted yields disposable income. From disposable income, consumption expenditures are deducted. The remaining disposable income (after consumption) plus the financial capital transferred from the previous year yield available capital. Available capital is used as working capital in the next period or to buy land.

The machinery and building capital available for the next year (t+1) after depreciation is then calculated, as well as the permissible loan borrowing for the period. Machinery and building investment is then made in accordance with the criteria previously set out. The new capital resources are added to those in existence and passed to the next period (t+1).

At the next period (t+1), the new cost structure is put into the production decision model, and the transferred resources became the new production resource limits. Then the production models for (t+1) are solved and the process continued as above. The growth model proceeded in this way for the 20 periods for the two representative farmers.

The Results

The farm growth models developed thus far in this chapter were designed to provide a test of the second hypothesis set for the study. This section sets out the results of the testing procedures carried out for the representative high income and the representative low income farmer utilising the test procedure outlined above.

Tests of the hypothesis were carried out with various assumptions for parameters and procedures included in the two growth models. This was done to provide evidence of the reliability of the test procedure under the various conditions that could exist in the agricultural

environment. Assessing the impact on analytical procedures of changes in parameters included in their structure is usually referred to as sensitivity analysis. Before the results are discussed, a brief digression on sensitivity analysis is made with special reference to sensitivity analysis in dynamic programming.

Sensitivity Analysis

Sensitivity analysis is basically a tool to improve the quality of decision making. In the normative analysis associated with operations research and mathematical programming, results are obtained based on the assumptions thought appropriate to the problem, and the different mathematical algorithms applied. At the completion of these analyses it is desirable to know the extent to which the results obtained are meaningful, and whether they provide a good basis for decision making. Sensitivity analysis is a tool that assists in this evaluative process.

It is clear that sensitivity analysis is concerned with the same general area discussed in Chapter 4 under the section - Practical Decision Models. The idea of devising practical decision models is to give the models used the highest degree of realism possible, so that the decisions they provide do not depart unrealistically from those that would be made by farmers under similar environmental conditions. Sensitivity analysis is concerned with another aspect of this area. Here an examination is made of the effect on the final solution obtained, of changes in the various parameters of the model providing the results.

The empirical analysis described in this chapter was designed to provide a test of the second hypothesis set for the study, that differences in goal orientation and levels of aspiration associated with

high income farmers compared to low income farmers lead to significantly higher levels of economic attainment for high income farmers. What is required in sensitivity analysis then, is to determine how sensitive the significance test results on economic attainment are to changes in the parameters included in the two growth models.

Two parameters are important in connection with the sensitivity analysis of farm firm growth models, (1) the length of the planning horizon, and (2) the level of resources (or state variables) at the beginning of the planning horizon. Sensitivity analyses of these two factors were attempted in the study.

Other procedures included in the growth models were examined to determine their effect on the results of the significance testing. The procedures examined and the manner of the examinations are described in the next subsection.

Tests Carried Out

This subsection will describe the tests of hypothesis two that were carried out. As described previously, these tests involve running the two farm firm growth models over the planning horizon chosen, and comparing the economic achievement of the two representative farmers at the end of the planning horizon. The individual tests will be referred to as runs.

The first test of the hypothesis carried out (Run 1) followed exactly the test procedures described in the preceding sections of this chapter. This test was done for a 20 year planning horizon. These are the primary results of the tests of the second hypothesis, so they are reported in detail.

The second test of the hypothesis (Run 2) involved performing a sensitivity analysis on the length of the planning horizon. Here the economic achievement of the two representative farmers is compared after 15 years, to determine whether significant differences in economic achievement occur.

The third test of the hypothesis (Run 3) involves determining the sensitivity of the results obtained to changes in the levels of aspiration. This run also tests the effect of the adoption of Scale 2 as an operational measurement scale of the level of aspiration. The test was carried out by running the low income farm firm growth model over a 15 year planning horizon without level of aspiration constraints. The economic performance of the low income farmer is then compared to his performance with level of aspiration constraints, and also with the performance of the high income farmer with level of aspiration constraints.

If the levels of aspiration are a limiting factor to income attainment on low income farms, there should be significant differences in the levels of income obtained for the low income farmer in Run 2 and Run 3. If the high income farmer with level of aspiration constraints still obtains a higher level of income over the planning horizon than the low income farmer without such constraints (Run 3), this would imply that goal orientations of the low income farmer alone (that is without level of aspiration constraints) are a significant limitation to economic achievement.

The fourth test of the hypothesis (Run 4) involves determining the impact of the level of consumption expenditures on the hypothesis testing. In this test the two growth models were run over a 20 year

planning horizon. Consumption expenditures were kept at the minimum consumption level (of $6000 in Year 1 increasing by two percent per year over the 20 years), described above. Also both farmers were not constrained by levels of aspiration, so that there were no upper (or lower) bounds on the levels of goal and economic means activities. The mean levels of income attainment of the two representative farmers are then compared.

A comparison is also made of the level of income attainment of the low income farmer in Run 4, with his attainment in Run 3. This comparison provides an assessment of the impact of consumption investment on the growth rate of the farmer, since ceteris paribus conditions are maintained for all factors except consumption expenditures. It is expected that in Run 4 with minimal consumption expenditures, the low income farmer will realise a higher level of income.

The final tests of the hypothesis (Runs 5 and 6), involve determining the sensitivity of the results obtained to the level of resources on the farms at the start of the planning horizon, and an examination of the impact of changes in the borrowing capacity of the low income farmer. These tests will be discussed briefly.

Results of Run 1

The results of Run 1 are given in Tables 26 and 27. In Table 26, it can be seen that the representative low income farmer achieved a net farm income of $13,319 in Year 1 on 306 acres of land. By Year 20, he owned 656 acres of land, and was making a net farm income of $39,276.

For five of the 20 years, the representative low income farmer only attained the minimal consumption level (Years 3, 4, 8, 11 and 14).

Table 26: Results of Farm Firm Growth Model for Representative Low Income Farmer - Run 1

Year	Gross Farm Income	Net Farm Income	Disposable Income	Consumption	Land Owned
1	23403	13319	13123	9751	306
2	27022	11970	12357	9494	306
3	20272	- 3068	- 453	6242	356
4	30538	8703	10751	6367	356
5	24532	7686	9740	6672	356
6	45061	21570	18070	11709	406
7	39238	11232	12314	11584	456
8	26099	819	4265	6892	456
9	36147	14704	14688	7393	456
10	36792	13643	14133	8416	456
11	34350	4742	232	7314	456
12	42081	11959	13259	8498	456
13	51096	22771	19410	9491	506
14	37860	5164	8749	7762	506
15	62163	25589	21053	10424	506
16	59544	16896	16697	11120	556
17	52682	4674	8918	8337	606
18	82005	39869	28074	10552	606
19	87758	40913	28593	14226	606
20	88165	39276	27505	17120	656

Table 26 (continued)

Year	Machinery Capital	Building Capital	New Loan Borrowing	Acres Wheat	Acres Barley	Acres Oats	Acres Flax
1	12694	3052	12000	84	0	0	78
2	20789	4874	2000	0	0	83	156
3	17671	6630	0	84	0	83	0
4	15020	6299	5000	0	0	166	78
5	17767	5984	5000	0	103	83	78
6	20102	5684	7000	0	206	0	78
7	19087	7406	5000	0	0	166	156
8	16224	7036	5000	84	0	166	0
9	18790	6684	2000	168	0	0	78
10	15972	8350	5000	168	0	83	0
11	18576	7933	5000	84	0	249	0
12	20790	7536	5000	84	103	0	234
13	22672	7158	0	168	103	83	0
14	19271	6800	7000	168	0	166	78
15	21380	8460	7000	168	0	83	234
16	23171	10037	7000	168	0	83	312
17	24695	11535	7000	252	0	0	312
18	25991	12958	5000	336	0	166	0
19	27092	12310	12000	336	0	166	78
20	33028	13695	-	420	0	166	0

For three other years (5, 9 and 17), the consumption level was within $300 of the minimal level. For eight of the 20 years of the planning horizon therefore, the low income farmer was forced to subsist at a level where his family obtained just about enough to take of the necessities of life.

Wheat was the major crop grown by the low income farmer. For five years only, wheat was not grown. Oats was also grown for fifteen years, but only in four years was its acreage greater than the wheat acreage. Flax was grown for 13 years, and barley for four years. As noted previously, rapeseed activities were not included in the low income farm firm growth model.

Loan borrowing for the low income farmer reached a maximum of $12,000 in Year 1 and Year 19. This loan borrowing provided for investment in machinery and building capital. Building capital rose from $3052 in Year 1 to $13,695 in Year 20, while machinery capital rose from $12,694 in Year 1 to $33,028 in Year 20. Short term credit was used for five years. In Year 2 this credit was $10,000; in the other four years it was $5000.

Table 27 presents the results for the representative high income farmer. This farmer received a net farm income of $18,435 in Year 1 on 306 acres of land. By Year 20, he was receiving $178,556 net income from 1956 acres of land. This higher level of net income of the high income farmer enabled his family to always achieve a level of consumption well above the subsistence level.

Wheat was the main crop grown by the high income farmer. This crop was grown in every year of the planning horizon. Rapeseed was grown for 16 years, and its acreage reached a maximum of 367 acres in

Table 27: Results of Farm Firm Growth Model for Representative High Income Farmer - Run 1

Year	Gross Farm Income	Net Farm Income	Disposable Income	Consumption	Land Owned
1	28748	18435	16030	11025	306
2	35115	18659	15607	10982	306
3	50807	14304	13897	10706	356
4	72422	32028	22933	11118	406
5	76931	26893	20548	12883	506
6	148928	97534	47508	16338	606
7	162465	97567	47519	22721	706
8	138766	60115	34958	25512	806
9	157918	86597	44235	23601	956
10	183985	111843	52690	24582	1056
11	158485	66269	37681	26586	1156
12	170774	90635	45928	24927	1256
13	248033	156636	67849	26129	1256
14	190770	64658	37420	30604	1356
15	208727	105644	51671	26005	1456
16	235627	110657	53053	25824	1556
17	204141	64333	37677	27792	1656
18	346536	198564	82413	28629	1756
19	328359	192826	80602	37325	1856
20	329675	178556	76033	43126	1956

Table 27 (continued)

Year	Machinery Capital	Building Capital	New Loan Borrowing	Acres Wheat	Acres Oats	Acres Flax	Acres Rapeseed
1	12694	3052	12000	168	0	0	0
2	20789	4874	12000	84	83	0	120
3	27671	6630	7000	84	166	0	180
4	28521	8299	12000	412	0	0	0
5	34243	9884	12000	580	0	0	120
6	39107	11390	12000	580	0	0	120
7	43241	12821	15000	992	0	0	60
8	51755	12180	12000	908	0	0	367
9	53992	13571	0	748	0	0	307
10	45893	12893	12000	824	0	0	307
11	49009	14248	5000	1236	0	78	60
12	45658	13536	12000	1152	0	0	60
13	48809	14859	24000	1236	0	78	60
14	61488	18116	0	1724	83	0	0
15	52265	17210	17000	1312	166	78	0
16	59425	18350	20000	1448	0	234	60
17	65511	22433	12000	1724	83	78	60
18	65684	23311	12000	1724	83	0	120
19	65831	24146	20000	1724	83	0	120
20	70956	27939	-	1640	166	0	307

Year 8. Oats was grown for eight years, flax for five years, while barley was only grown in Year 4.

Loan borrowing for the high income farmer reached a maximum of $24,000 in Year 13. For ten of the 20 years, loan borrowing was $12,000. Again, these loans provided for machinery and building investment. Machinery capital rose from $12,694 in Year 1 to $70,956 in Year 20. Building capital rose from $3052 in Year 1 to $27,939 in Year 20. Short term credit of $10,000 (per year) was used by the high income farmer for six years.

Table 28 provides a comparison of the economic performance of the two farmers over the 20 year planning horizon. The results show that the high income farmer received a significantly higher mean annual net farm income than the low income farmer. Since net farm income is the primary measure of economic attainment, this result provides support for hypothesis two. The secondary measures of economic attainment give similar results. The mean annual disposable income and the mean annual gross farm income of the high income farmer are significantly higher than the respective means for the low income farmer. It can be concluded that the results clearly support the second hypothesis of the study.

Table 28 also illustrates the difference in consumption levels between the two farmers. The low income farmer maintained a mean consumption level of $9459, while the high income farmer maintained a mean level of $23,321. Mean consumption comprised .672 of the mean disposable income of the low income farmer, and .526 of the mean income of the high income farmer.

The final row of Table 28 shows the mean annual percentage growth rate of the representative high income farm was 16.19 percent, while the

mean for the representative low income farm was 11.10 percent. There was substantial variability in the growth rates of the two farms due to the effects of uncertainty on the operation of the farm firms. The low income farm suffered negative growth rates in eight years, while the same experience occurred to the high income farm in five years.

Table 28: Comparison of Economic Attainment and Growth of Representative High Income and Low Income Farms - Run 1

Category	Low Income	High Income
	.....mean annual value $.....	
Gross Farm Income	45341	173861[a]
Net Farm Income	15622	89637[a]
Disposable Income	14074	44313[a]
Consumption	9459	23321[a]
Growth Rate[1]	11.10 (32.63)	16.19 (29.71)

[a]Significantly higher than representative low income value at 95% significance level.

[1]Mean annual percentage growth rate of gross farm income, standard deviations given in brackets.

This subsection closes with a closer analysis of the growth rates obtained for the two farmers. The growth rates attained may appear high, but it should be made clear that they are based on the assumptions made in the development of the models. An examination is now made of some of the factors that may tend to limit the realised growth rates of the farmers.

The first factor is labour availability. The models assume

labour can be hired in unlimited quantities via the labour hiring activity (L_1 in the model set out as (1) to (23)). By Year 10, the high income farmer was hiring 1195 hours of labour, and by Year 20, 2345 hours. The corresponding figures for labour hiring for the low income farmer are 287 hours in Year 10 and 700 hours in Year 20. By Year 20, the high income farmer would require two men working approximately 25 days a month for the six months of the growing season to provide the necessary labour. This labour may also have to be supplemented during the busy sowing and harvesting periods. Lack of access to this labour supply may limit the growth rates of the farms.

There is another aspect to labour availability. All labour was assumed to be available at a wage rate of $1.92 per hour in the first year, increasing by two percent per annum over the planning horizon. To obtain the services of two men full time over six months however, it may be necessary to provide substantial fringe benefits, and also to make statutory employment payments, in addition to the flat wage rate. Any additional wage payments will again limit the growth rate of the farms.

The second factor is managerial expertise. The assumption is made in the farm firm growth models that the farmers have the expertise to manage the larger farm acreages with the same degree of efficiency as the smaller acreages with which they started. Negative deviations from this level of efficiency associated with managerial expertise would severely limit the growth of the farms. The question of managerial efficiency is also related to land availability. The high income farm increased in size over fivefold in the 20 years. If this additional acreage is only available at some distance from his original holdings, some loss of managerial efficiency may ensue as the farmer attempts to

coordinate his spatially diverse operations. If additional land is not available to the farmers at the times suggested by the growth model, this would again limit the growth of the farms.

The final factors identified here that could limit the rate of farm growth are commodity prices and input costs. As stated earlier in the chapter, the commodity prices used in the models were based on the period January 1st 1972 to July 31st 1975. This interval represents perhaps, the start of a period of buoyant prices. It is assumed that these prices are representative of those that could be expected in the foreseeable future. The level of costs are assumed to rise at a rate of two percent per annum. These costs include the costs of labour. To the extent that commodity prices fall over the planning horizon, or costs rise faster than two percent per annum, this would reduce the rate of growth of the farm firms.

Results of Run 2

Run 2 is designed to test the sensitivity of the significance testing associated with the two growth models to changes in the length of the planning horizon. In farm firm growth studies, two planning periods are usually chosen - 15 years and 20 years. A planning period of 20 years was used in the original test procedure (Run 1). It was therefore decided to examine the results obtained by the models for a 15 year planning horizon. These results are given in Table 29.

In Table 29 it is seen that after 15 years, the mean annual net farm income of the representative high income farmer was significantly higher than that received by the representative low income farmer. Also, for the secondary measures of economic attainment, disposable income and

Table 29: Comparison of Economic Attainment and Growth of Representative High Income and Low Income Farmers - Run 2[1] with Run 3

Category	Low Income Run 3[2]	Low Income Run 2	High Income Run 2
	.....mean annual value.....		
Gross Farm Income	67303[a]	35777[b, a]	135525[b]
Net Farm Income	33224[a]	11387[b, a]	69854[b]
Disposable Income	23726[a]	11446[b, a]	37098[b]
Consumption	14217[a]	8521[b, a]	20248[b]
Growth Rate[3]	15.52 (35.82)	11.64 (29.62)	17.30 (35.21)

[1]Run 2 utilises a 15 year planning horizon.

[2]Run 3 utilises a 15 year planning horizon and no levels of aspiration constraints.

[3]Mean annual percentage rate of growth of gross farm income, standard deviations given in brackets.

[a]Significantly different from representative high income mean value in Run 2 at 95% significance level.

[b]Significantly different from mean value obtained for representative low income farmer in Run 3 at 95% significance level.

gross farm income, the means obtained for the high farmer were significantly higher than those obtained for the low income farmer. The results of the significance testing were thus identical with those obtained after 20 years. The mean growth rates were higher over the first 15 years, while the mean levels of consumption were lower.

The results of this sensitivity test indicate that the choice of a 20 year planning horizon is appropriate, since by Year 15, the significant differences in economic attainment could be observed. Also, little precision would be lost by using a 15 year planning horizon. It can be concluded that the procedures used to test hypothesis two are not sensitive to the length of the planning horizon.

Results of Run 3

Run 3 was designed to test the impact of levels of aspiration on the economic attainment of the low income farmer, and also to examine the impact of the adoption of Scale 2 as an index of levels of aspiration. The test was carried out by running the low income farm firm growth model over 15 years without level of aspiration constraints, and comparing the results obtained with those of the low income with levels of aspiration constraints (Run 2) and with the high income farmer with level of aspiration constraints (Run 2). These comparisons are given in Table 29.

In Table 29 it is seen that when the levels of aspiration constraints are removed from the low income farmer in Run 3, he achieves a significantly higher level of economic attainment. The means of all the economic measures and consumption for the low income farmer for Run 3 without aspiration constraints are significantly higher than the means obtained for Run 2 with level of aspiration constraints. The growth

rate in Run 3 is also 3.88 percent higher for the low income farm, than in Run 2. These results indicate that levels of aspiration limit the economic achievement of low income farmers. In other words, low income farmers could achieve higher levels of economic attainment if they aspire to these levels, and engage in instrumental activity to achieve these higher levels.

Table 29 shows however that the mean levels of economic attainment by the low income farmers in Run 3 are still significantly lower than the mean levels obtained by the high income farmers with levels of aspiration constraints. This means that even without levels of aspiration limitations, the other aspects of the behavioral structure of low income farmers, in particular goal orientations, still limit the level of economic achievement of low income farmers.

The results obtained for Runs 2 and 3 show that Scale 2 provides an operational index of the levels of aspirations for the growth models. When the levels of aspiration constraints are removed in Run 3, the economic performance of the low income farmer improves to the point where it is atypical of the general performance of these farmers. Utilising Scale 2 in Run 2, the low income farmer survived over the planning horizon, and was able to achieve a growth rate of 11.64 percent per annum. The results with respect to consumption expenditures reported for Run 1, also show that in general the economic performance of the low income farmer constrained by levels of aspiration utilising Scale 2, is in accordance with what could be practically expected for that income group.

Results of Run 4

Run 4 was designed to examine the impact on the test of hypothesis two of changes in the consumption pattern for the two models. This was done by running the models without aspiration constraints, and with consumption expenditures at the minimal or subsistence level. A comparison is also made of the economic performances of the low income farmer in Run 4 and in Run 3 to assess the impact of the level of consumption expenditures. The results associated with Run 4 are given in Table 30.

Table 30: Comparison of Economic Performance and Growth Rates of Representative High and Low Income Farmers - Run 4 with Run 3[1]

Category	High Income Run 4	Low Income Run 4	Low Income Run 3
	.....mean annual value.....		
Gross Farm Income	296090[a]	130920	67303[a]
Net Farm Income	181426[a]	75623	33224[a]
Disposable Income	74946[a]	41750	23726[a]
Consumption	6917	6917	14217[a]
Growth Rate	33.47	36.43	15.52

[1]Run 4 utilises a 15 year planning horizon, no levels of aspiration constraints, and minimal consumption expenditures. Run 3 as in Table 29.

[a]Significantly different from the mean value for representative low income farmer in Run 4.

Table 30 shows that very high rates of growth are attained when the farmers are forced to maintain a minimal consumption level and to reinvest in the farm all their funds in excess of consumption requirements. The growth rate of the low income farmer jumped from 15.52 percent per annum in Run 3, to 36.43 percent per annum in Run 4, where minimal consumption levels are maintained. In Run 4 also, the low income farmer obtained significantly higher mean levels of all economic variables than were obtained in Run 3. These results demonstrate the impact of consumption expenditures on farm firm growth.

Even under the extreme conditions of Run 4 however, the results still support hypothesis two. Table 30 shows the high income obtained significantly higher mean levels of all economic measures than the low income farmer.

Results of Final Tests

The fifth test of hypothesis two involves determining the sensitivity of the significance test results to changes in the level of resources on the farm firms at the beginning of the planning horizon. The sixth test involves an examination of the impact of changes in the borrowing capacity of the low income farmer on his economic performance. The results of these tests are similar to those already reported for the four previous tests so they are just briefly summarised.

In test five, the resource levels of the farms at the beginning of the planning horizon are representative of a large scale farm organisation. For the five other tests, the resource levels at Year 1 were representative of a small scale farm organisation. For example in Year 1 in Run 5, the land acreage owned was 821 acres, and the machinery

capital $37931, compared to Year 1 figures of 306 acres and $12694 for Runs 1 to 4.

The results obtained over a 20 year planning horizon showed that for all economic indicators, the mean annual values for the representative high income farmer were significantly higher than the means for the representative low income farmer. Again, the results support hypothesis two, and demonstrate the insensitivity of the hypothesis test procedure to the level of resources at the beginning of the planning horizon.

The final test, Run 6, involved the borrowing capacity of the representative farmer. It was assumed in the growth models that the representative high income farmer had a borrowing capacity of 50 per cent of the value of land owned, and that the low income farmer had a borrowing capacity of 25 percent of the value of land owned. The lower value for the low income farmer resulted from a greater degree of capital rationing as a reaction against uncertainty. The sensitivity of the results to these assumptions was carried out by developing the low income farm model over 15 years using a borrowing capacity of 50 percent of the value of land owned. All other conditions were identical to those reported for the representative farmers in Run 4.

With the higher borrowing capacity, the low income farmer achieved a growth rate of 37.58 percent per annum, compared with the 36.43 percent per annum figure obtained in Run 4. The mean annual values of all economic variables for Run 6 were not significantly higher than the mean values for the low income farmer in Run 4.

Even with the higher borrowing capacity, the mean annual economic attainment of the low income farmer in Run 6 was significantly lower

than that of the high income farmer in Run 4. These results again demonstrate the insensitivity of the test procedures to the assumptions underlying the models, in this case the borrowing capacity of the low income farmer.

Conclusions

The results reported in this section support the second hypothesis set for the study. The differences in behavioral characteristics between high and low income farmers in the sample area are sufficient to account for significant differences in their economic achievement. The two major behavioral factors--goal orientations and levels of aspiration--are both shown to limit the economic attainment of the low income farmers, each factor being significant in its effect.

The procedures used to test the hypothesis were examined under a wide variety of conditions. The major conditions examined were the length of the planning horizon, the levels of aspiration, and changes in consumption patterns. Sensitivity analyses were also carried out to determine the effect on the significance testing, of variations in the level of resources at the beginning of the planning horizon, and variations in the level of the borrowing capacity of low income farmers.

All the sensitivity analyses carried out provided the same general results, which supported hypothesis two. The testing procedures were thus shown to be insensitive to the various assumptions utilised in the construction of the models. The results obtained can thus be accepted as being reliable.

The results of this chapter also support the entrepreneurial theory of decision making developed in Chapter 4. As described in

detail earlier, this theory provided the analytical model used to introduce goal orientations and levels of aspiration into the production models. The successful testing obtained shows the theory furnished good representations of entrepreneurial decision making on farm firms.

Chapter 7

SUMMARY AND CONCLUSIONS

This chapter provides a review of the study reported in this thesis, then the implications of the results obtained for the low income farm problem are examined. It should be stated at the outset that the policy conclusions made in this chapter are based solely on the interpretations of the results of the analysis presented in this thesis. As such these conclusions are based only on the opinions of farmers in the sample area. The opinions may not be atypical of farmers in Canada, but support for the generality of the statements would require further research. The thesis ends with a discussion of further research areas arising from the study.

Review of Study

This study was concerned with low incomes which exist on some farm firms in Canada. This problem has persisted through the decades, despite efforts by governmental agencies to eliminate it. Three distinct types of low income problems were identified in Chapter 1: (a) a physical asset problem, (b) a resource adjustment problem, and (c) a preference problem. The preference problem is concerned with those farmers who may freely choose to derive lower monetary returns from their resources, since they are not sufficiently motivated to strive after high monetary incomes. A survey of governmental programmes suggested that little attention had been given to the

existence of a preference problem; therefore it was decided to investigate this area as the specific problem for the study. Two aspects of the preference problem were considered: (a) the extent to which it exists in Canadian agriculture, and (b) whether this problem is a significant limitation to economic achievement on low income farms. The second aspect of the preference problem may not have been investigated previously. Hence the findings of the study with respect to this aspect is one of the major contributions of this research.

The hypotheses tested in the study were based on a review of literature concerning the relationship between motivational attributes and economic achievement. These studies suggested higher income farmers are more oriented to monetary goals and economic success than low income farmers. On the other hand low income farmers seem to be more oriented to economic and physical survival. One study also suggested high income farmers have higher levels of aspiration than low income farmers.

Hypothesis one was: High income farmers are motivated more towards monetary goals, and have higher levels of aspiration; while low income farmers are oriented towards non-monetary goals, and have lower levels of aspiration. Hypothesis two was: Ceteris paribus, the differences in motivational characteristics between the low income and the high income farmers are significant determinants of the differences in economic attainment between the two farm income groups. The first objective of the study was to provide tests of the two hypotheses.

Preference is an element of behaviour, so to study the preference problem it was decided to examine the motivational factors which can cause an individual to prefer low monetary returns. A review of psychological theory in Chapter 4, showed that much of human behaviour

is goal oriented. Levels of aspiration were also shown to be a major determinant of the achievement levels reached with respect to the goals sought by individuals. It was concluded that economic behaviour, in common with other goal oriented behaviour, is governed by a complexity of factors that cannot be simply described as "preference structure". A more apt name the "motivational problem" was therefore designated for the problem under study.

Another objective of the study was achieved in Chapter 4. Here a theory of entrepreneurial decision making on the farm firm was developed. This theory states that the entrepreneur may desire to attain several goals. By assigning relative weights to each goal, he incorporates them into a single goal (or "utility") function. The entrepreneur sets for each goal two levels, a level of aspiration and a low level goal. The level of aspiration becomes the objective of goal attainment, while the low level goal represents some perceived minimal level of goal achievement.

The farmer views his production activities as discrete investment alternatives or budget activities, and evaluates the contribution of each activity to his goals. The decision as to which activities he pursues is made by maximising his goal function. This leads to the selection of those activities which give the greatest contribution to the goals he hopes will be attained.

Chapter 4 ended with an analytical formulation of the entrepreneurial decision theory. This formulation was used in the farm firm production decision model, which formed an essential element of the farm firm growth models developed in Chapter 6.

To test the first hypothesis, data were required on the goal

orientations and levels of aspiration of high and low income farmers, so that these characteristics could be compared. These data were obtained from a survey of farmers carried out in the Carman-Morden-Manitou area of Manitoba. Two sets of interviewing were done. The first was a personal interview of 103 respondents carried out in the spring of 1975. The respondents consisted of 30 low income, 39 medium income, and 34 high income farmers. In the fall of 1975, telephone interviewing of the original 103 respondents was done to obtain additional information. Seventy-two farmers responded to the second interview.

Analyses of the goal orientations and levels of aspiration obtained in the survey showed that significant differences do exist between the motivational patterns of high and low income farmers in the sample area. High income farmers have significantly higher levels of aspiration, and they are more significantly oriented towards monetary goals than low income farmers. The results supported the first hypothesis set for the study.

The survey results also showed high income farmers in the sample area get greater satisfaction from farming and place a higher value on the achievement aspects of their occupation than low income farmers. Low income farmers showed a greater orientation to affiliative values such as making friends. Both groups place a very high value on influence aspects of farming particularly, the independence achieved by being their own bosses.

Reliability tests indicated that there is no reason to believe the results obtained from the survey are unreliable. The measures used were found to be consistent in themselves, and also when compared to

others included in the survey. Precision estimates of the results were presented for the sample area. However other validity tests showed that the results cannot be extended to the entire survey area, or the province of Manitoba, without the support of further research.

To test the second hypothesis, representative patterns of goal orientations and levels of aspiration of the low income and high income farmers were incorporated into two production decision models using the analytical form of the multiple goal decision theory. One model was for a representative low income farmer, and the other model was for a representative high income farmer. The production decision models were then introduced into two farm firm growth models, which were used to trace the development of two hypothetical farm firms over a 20 year planning horizon. Ceteris paribus conditions were maintained for all factors except those related to goal orientations and levels of aspiration.

The second hypothesis was tested under various conditions, to test the sensitivity of the results. All tests indicated the mean economic attainment of the high income farmer was significantly higher than the mean annual economic attainment of the low income farmer. These tests therefore support the second hypothesis, and demonstrate that, ceteris paribus, motivational characteristics of farmers in the sample area do have a significant effect on their level of economic attainment. This is a major conclusion of this study.

Another major contribution of the study was to demonstrate the value of utilising techniques and theoretical constructs of psychology and other social sciences, in the methodology of agricultural economic research. The survey procedures made extensive use of measurement

techniques from social psychology. Psychological theory also provided the basis for the theoretical developments in Chapter 4.

Policy Conclusions of Study

This section discusses the policy conclusions which are derived from an examination of the results of the study. The implications for the low income farm problem will be looked at first.

Implications for Low Income Farm Problem

The results of the study demonstrate that a motivational problem exists on farms in the region of Manitoba surveyed, since some farmers in the sample area are not motivated to seek the highest monetary incomes. It was noted in Chapter 1, that national income is usually taken as an index of social welfare. Therefore, those individuals who prefer non-monetary to monetary returns, are frequently accused of using their resources inefficiently. In this way the motivational problem becomes a matter for public policy.

For the low income farmers, there is little evidence to believe that the choice of low monetary returns is due to a positive choice to use their resources in the pursuit of non-economic goals, like leisure, religious or political commitments. Rather, the choice seems to be an orientation of economic goals towards non-monetary or

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[1] There was no evidence, for example, of farmers not seeking higher incomes to prevent their additional tax dollars going to support "welfare bums" etc.

non-maximising ends - seeking not the highest possible but a satisfactory or lower level of monetary achievement. The reasons for this choice may lie in some sort of frustration reaction on the part of low income farmers.[2] To illustrate the ideas included here a brief discussion of frustration will be given.

Cofer and Appley (18: 415) state that there are two necessary preconditions to frustration: (1) the presence of a previously aroused and unrequited desire or motive, and (2) some form of interference with or thwarting of its means of gratification. The initial reaction to these two conditions is usually instrumental or coping behaviour, and if this initial behaviour fails to attain the desired goal, frustration comes into play. Frustration is an emotional state, and many patterns of resolution may be adopted by the afflicted subject. These include aggression, repression, fixation and regression. The evidence available would seem to indicate a frustration - regression reaction on the part of low income farmers, so only this aspect of regression will be dealt with here.[3]

According to the regression hypothesis of Barker, Dembo and Lewin, strong frustration causes tension and leads to emotionality and dedifferentiation of the personality (18: 424-425). In Lewin's theory (37, 18: 375-364), the total personality of the individual constitutes

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[2]It must be realised that this is an assertion based on the author's understanding of the results obtained. Providing a verification of this assertion would require detailed research on individual low income farmers.

[3]Further details on the other resolutions of frustration can be obtained in Cofer and Appley (18: 414-429).

his Life Space. As development takes place in the individual, differentiation of the personality takes place, by the separation of the cognitive structure of the Life Space into regions. Regions connote such things as specific activities, events and objects or even roles and statuses as they are perceived by the person. Different regions become integrated into systems which may correspond to a chain of activities associated with some bodily or psychological function. Region systems allow certain behaviour patterns to proceed with great facility, and allow clear paths to exist for achieving goals. In addition to differentiation, as development takes place, regions become more ordered in terms of centrality, with a hierarchy of goals (and also roles) being established. The individual seeks to direct his efforts towards the most central (or most favoured) goals.

If regression becomes established in the individual, the developmental process is reversed, and the ordered structure of the Life Space breaks down. Two consequences of regression are (a) goal achievement becomes impaired as the structural paths become disorganised, and (b) the established centrality or hierarchy of goals becomes changed. Simon (67) has traced the development of a frustration-regression reaction in terms of the behavioral constructs of goals and level of aspiration. He states that if performance of an act repeatedly falls well short of the level of aspiration of the individual, search behaviour is induced especially for alternative means of achieving the particular goal. At the same time, the level of aspiration begins to adjust itself downwards, until the goals set by the individual reach more realistic levels. If the search behaviour and aspiration adjustment operate too slowly to adapt aspirations to performance, a frustration reaction will

begin to occur. This could lead to regression as mentioned previously, which Simon describes as apathy.

A regression reaction to frustration may underlie the motivational problem of low income farmers. These farmers may have had progressive goals like "securing a sound economic future" at some stage of their development such as when they started farming.[4] However abnormal environmental factors may have prevented a realisation of their goals, or their goals may have been out of reach of the normal environmental factors (or resources) at their disposal. In other words, ordinarily adequate capacities may have been insufficient in an environment that had insufficient resources, or one which required extraordinary capacities; or the individuals may have demanded more than their normal environment could have provided.

Non-gratification of their goals for high monetary returns would first have led to a search for alternative avenues, or coping behaviour; then if this coping behaviour failed to satisfy the goals, a pattern of regression set in. Analysis of data obtained in the survey suggests a three stage regression pattern for low income farmers.[5]

At the first stage, there is a change of goal structure from one based on high monetary returns and a maximisation orientation, to a less monetary orientation stressing only a commitment to survival - "just enough to make a living". In the low income sample obtained,

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[4]The development referred to here is the development of the economic cognitive structure of the personality, as distinct from overall physiological or psychological development.

[5]Three of the low income farmers could not be easily accommodated under the regression trichotomy.

four farmers showed a high monetary orientation, while six were oriented towards a lower level of monetary attainment.

The next stage of the regression seems to be a movement away from a commitment to achieve any particular income level, to only a concern for economic variables such as low commodity prices, general inflation and strikes, which would affect income. A concern for these variables would indicate that the economic cognitive structure is still highly developed, but the individuals have moved away from setting income goals. At this stage also, a strong desire was evident for a maintenance of the farming way of life. As one farmer put it:"If I could stay on the farm as long as possible - that's what I want that would make me happy". Twelve of the low income farmers were probably at this secondary stage.

There was also evidence of a third stage of regression, where the economic cognitive structure has become severely dedifferentiated to the point where economic variables may have little concern to the individual. This is illustrated in Table 31. This table examines the goal and aspiration orientations of five low income farmers. In answer to the question on wishes and hopes for the future (Question 8 on the questionnaire), none mentioned any economic goal. One farmer commented: "(I am as) contented as a little pig - money nice but can do without (it)." All of these farmers gave only one response to the question, and as seen in Table 31, none of their answers is indicative of any strong preference for non-economic goals that could compete with monetary goals in resource use. Also revealing was the fact that none of the farmers had any worries or fears for the future (in response to Question 9).

Table 31: Goal and Aspiration Orientations of Five Low Income Farmers

Farm No.	Wishes and Hopes	Present Ladder Level	Ladder Level in 5 Years	Occupational Ladder Level
1	Good Health	5	5	9
2	Maybe a new Home	5	5	5
3	Just Health	7	7	9
4	Happy With Way Life Is	8	8	10
5	Continue Farming	7	5	8

Source: The Survey.

As seen in Table 31, none of the five farmers could see any improvement in the level of their life in the next five years, and one even saw his life level falling. With reference to farm gross income, two of the farmers reported that their 1974 income was very much worse than 1973, two that it was worse and one that it was about the same. Yet despite all the negative factors, the farmers gave relatively high scores for occupational satisfaction via the occupational ladder level. The common goal orientation of these five farmers seems to be the maintenance of health and happiness.

Given a motivational problem and its probable cause by a regression reaction to frustration, the question remains as to how these behavioral patterns could be changed to make the farmers adopt more progressive monetarily oriented goals. Bishop (5: 195-196) reports that two major types of action can be taken to combat a motivational problem. First given the individual behaviour patterns, the problem can be reconciled

by arbitration or by law. That is some arbitrary or policy making body must restrict the choices of individuals in the uses of their resources, for example as in drafting into the armed forces or collectivisation. Such policies would undoubtedly be unpopular in Canadian society.

The second type of action is to change the behavioral patterns of individuals. Bishop states that this action can be accomplished through education - by providing information about alternative uses of resources - and through subjecting individuals to new experiences. He argues however that this second type of action may challenge the very foundation of democracy, since it asserts that certain sets of values are superior, and that particular environments are consistent with the acquisition of these superior values. He concedes that such views may deny the sovereignty of the individual. Nonetheless, McClelland and Winter (43) have described an attempt at changing the motivational patterns of businessmen in India, in a project sponsored by the United States Agency for International Development (AID). They reported that no spectacular successes were evident from the programme, and it was discontinued after the first trial.

Changing the behavioral patterns of individuals may be consistent with individual sovereignty, if they desire change and would welcome the resultant benefits. This may be the case for the majority of the low income farmers. Only 20 percent of the farmers could be identified as possibly being in the third stage of the regression reaction. The other farmers did show more positive concern for economic matters as indicated earlier.

Reversing the pattern of regression reaction to frustration may be achieved by providing the environment for the farmers to exceed their

expectations of economic attainment. As was seen in Chapter 4, improved performance of a task leads to a raising of the level of aspiration associated with it, and this process if continued could lead to new learning situations and a reconstruction and differentiation of the cognitive structures. This may lead to the adoption of more monetarily oriented goal patterns for low income farmers.

The problems of frustration and regression may be present in fields of human endeavour, and just to show that reversal can never be ruled out, an illustration will be taken from Marrow (49: 44-45). Marrow claims that the factors that determine the level of aspiration provided new insights into the reasons for social apathy in the face of pressing political and international problems. He quotes Morton Deutsch as saying that people are not likely to attempt to seek even highly valued objectives when they see no way of attaining them. Hence he adds an understanding of levels of aspiration

> . . . sheds some light upon why social revolution tends to occur only after there has been a slight improvement in the situation of the oppressed groups: the improvement raises their level of aspiration making goals which were once viewed as unattainable now perceived as realistic possibilities.

Implications for Governmental Policy

The final policy items to be considered are the policies and programmes that governmental authorities could implement to aid the low income farmers. Again it must be stressed that these conclusions are based on the analysis of responses of farmers in the sample area. Generality of these statements would be dependent on further research.

The conclusion of the preceding subsection was that the farmers' expectations of income attainment had to be exceeded before

their aspiration levels could be raised, snapping them out of the regression reaction, and back on the development path of monetarily oriented goal patterns. Hence what is needed is a Farm Income Improvement Programme. The results of the study suggest one important feature of any such programme. This is that the farmers would not wish direct governmental intervention into the agricultural sector at the farm level. Schemes like land leasing, contractual arrangements and income supplements may not have great appeal to farmers, who value highly the influence aspect of their occupation, including their independence of action and their authority over the farmstead. Governmental action thus should not directly interfere with production decisions on the farm.

Where the farmers would seem to wish the most governmental action is in the question of marketing, and the orderliness of the marketing institutions, both for commodities and farm inputs. Where governmental action could be favourably aimed, is at widening the margin of returns (gross income minus total cost) received by the farmers. On the input side, policies could be implemented to control the price inflation of inputs. This could possibly be done by the setting up of agencies to seek the cheapest farm inputs domestically and overseas, especially for fertilizer and machinery. Also the cost of machinery services could be controlled, especially gasoline and lubrication services. Another policy on the input side could possibly be the maintenance of a steady supply of labour at reasonable rates.

With respect to commodity marketing, it would seem that the low income farmers sampled are no stalwarts of the private enterprise free

market system.[6] Rather they seem interested only that orderly systems of marketing could be set up, which would also be seen to be orderly. Farmers did not see the free market system as being "free"--they thought that meat packers and grain companies profited from it, and that it led to too much price instability. The Canadian Wheat Board was frequently mentioned as a model of orderly marketing. Policy considerations should therefore be directed to marketing institutions, and the effect of these institutions in increasing the price and income uncertainty associated with farmers' decision making.

Areas for Further Research

The thesis closes with a discussion of areas where further research can be done with a view to extending the work included in this study. The first area concerns the expansion of this study to all regions of Manitoba, and also Canadian agriculture as a whole. This thesis presents what could be considered a pilot study. Many aspects of the study could therefore be useful in further research in this area.

The study has demonstrated methodological procedures which show facility and accuracy in analysing behavioral problems which may exist on farms. Referring specifically to the survey, some knowledge is now available on the type of responses that could be expected from surveys related to motivational characteristics of farmers. Prior classification and coding can be arranged for subsequent studies, which would lead to greater efficiency. Precision estimates of variables in the

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[6] Only 30 percent of the low income farmers believed the free market system worked.

study could also be used in future surveys, to determine the sample sizes necessary for acceptable statistical precision of the results of these surveys.

Another area for further research is the impact of firm household interrelationships on the allocation of resources on farms in Canada. Analysis in Chapter 6 showed the level of consumption expenditures may have a significant effect on the economic achievement of farmers. High consumption levels may leave little financial capital for use in farm firm investment, the major source of farm firm growth. Conceivably, a conflict between the requirements for household consumption, and the requirements for farm firm investment could also be a contributor to the low income problem on farms in Canada. This study did not attempt a firm-household interrelationships or family goal patterns. The theoretical developments in Chapter 4 could however be utilised in an analysis of this related problem area.

Another area for further research involves further tests of the frustration regression reaction as a probable cause of the preference problem on farms in the sample area. These tests would require more elaborate psychological testing on an individual basis. However, this is not to suggest that such studies must necessarily be carried out outside of the field of Agricultural Economics. As suggested earlier in the thesis, agricultural economists, in their position of dealing with the problems of agriculture, should incorporate as much as is necessary of other disciplines in their work, since only a detailed knowledge of the agricultural sector and farming as possessed by agricultural economists would enable these inputs of other

disciplines to be put to effective use.

The final area for further research identified here concerns the entrepreneurial theory of farm firm decision making developed in Chapter 4. This theory can be subjected to more testing involving different environmental situations. In particular, the theory shows great promise in dealing with problems associated with small farming in developing economies. Here new ideas like the adoption of improved practices (such as fertilizer, insecticides, etc.), new cropping patterns, and progressive managerial techniques, have proven to be particularly difficult for small farmers to assimilate and implement. In the midst of great technological developments then, these farmers remain in a peasant oriented agricultural environment. An analysis of their particular behavioral patterns especially their goals, may provide policy makers with more rational avenues for helping the development of this small farm sector.

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APPENDIX 1

SURVEY QUESTIONNAIRE

Section 1

1. What is the total acreage of land you own?

2. How many acres of land do you rent from others in your area?

3. How many acres of land do you rent out to others in your area?

4. What types of farm enterprises in order of importance make up the greatest portion of your farm?

5. Could you state how many acres of your total farm, including rentals, were used for your various crops in 1974.

6. Which category on this card comes closest to the total value of gross sales on your farm for the year 1974?

7. How does the total value of gross sales on your farm for the year 1974 compare to the total value of gross sales for the year 1973?

Section 2

8. All of us want certain things out of life. What are your wishes and hopes for the future if you are to be happy? (Anything else)

9. Now taking the other side of the picture, what are your fears and worries about the future? (Anything else)

10. Here is a picture of a ladder. Suppose we say that the top of the ladder represents the best possible life for you, and the bottom represents the worst possible life for you.
    a. Where on the ladder do you feel your life is at the present time?
    b. Where on the ladder do you think your life will be five years from now?

Section 3

Part 1

Turning now to your occupation in farming, could you indicate how you feel about the following statements. You must rate the statements between the number 9 (nine) if you strongly disagree, and the number 1 (one) if you strongly agree with the statement. In other words, the answers must be a number between 1 and 9.

11. To be really successful in life, you have to care about making money.

12. I would like my family to have most of the things my friends and neighbours have.

13. I am in farming to make as much money as possible.

14. Success in farming is mainly a matter of luck.

15. After you are making enough money to get along, then making more money in farming is not very important.

16. I aim to make a certain minimum level of income each year.

17. Farming is most satisfying when there are hard problems to solve.

18. Success in farming is mainly a matter of hard work.

19. To me, it is important in farming to get to the top.

20. A person should constantly try to succeed in farming, even if it interferes with other things in life.

21. To me, it is important to have the kind of work that gives me a chance to develop my own special abilities.

22. To me, a very important part of farming is the opportunity to make friends.

23. The main satisfaction a person can get out of farming is helping other people.

24. It is satisfying to supervise the work of others.

25. To me, it is important in farming for a person to be able to carry out his own ideas without interference.

26. To me, gaining the increased respect of family and friends is one of the most important rewards of farming.

27. It is important that farming should be fun.

28. Work is a way of being of service to God.

29. Farming is a good builder of character.

30. To me, almost the only thing that matters about farming is the chance to do work that is worthwhile for society.

Part 2

31. Here is another picture of a ladder. Suppose this time that the top of the ladder represents the best possible occupation for you, and the bottom the worst occupation for you.
    a. Where on the ladder do you feel that your occupation of farming stands at the present time.

32. What specific factors about farming prevented you from giving it a lower rating? (Anything else)

33. Do you think farming is a risky occupation?

34. What are the risky features of farming that you have encountered? (Anything else)

35. How do you attempt to deal with these risky features of farming? (Anything else)

36. Would you say that you understand the private enterprise-free market system?

37. Do you think that the private enterprise-free market system works?

DOCUMENT 1

INTERVIEW NUMBER		

SAMPLE NUMBER		

Record of Visits to Household Address:

	1	2	3
DATE			
TIME OF DAY			
OUTCOME			
INTERVIEW COMPLETE			
APPOINTMENT SET FOR			
RESPONDENT ABSENT			
NO ONE AT HOME			
REFUSED			
NON-SAMPLE			

Time Began _____

Time Ended _____

Non-sample (Check if appropriate) ---------- House Vacant

Refusals: Give respondent's reason and/or interviewer's comments:

ANSWER SHEET

SECTION 1

1. Total Acreage

2. Rented In

3. Rented Out

4. (Hand the respondent Chart A, with enterprises, and rate the enterprises in order of importance: 1, most important; then 2, next important, etc; i.e., only numbers must be recorded.)

Grain	Dairy
Poultry	Hogs
Special Crops	Beef Feed Lot
Cow Calf Enterprise	Beef Stocker Enterprise
Forage Crops	Other

5. (Hand the respondent Chart B, and list the crops in acres.)

Wheat	Barley
Sugarbeet	Oats
Rye	Sunflower
Buckwheat	Corn
Forage	Flax
Potatoes	Rapeseed
Summerfallow	Native Pasture
	Other (Specify)

6. (Hand the respondent Chart C, and note the number called.) _____

7. (Check one.)

Large Improvement	_____	Small Improvement	_____
About the Same	_____	Worse	_____
Very Much Worse	_____		

SECTION 2

8. (If the respondent falters at first, add the following: "In other words, if you imagine your future in the best possible way, what would your life look like." Take down the answer as the respondent says it.)

Anything else:

9. (If the respondent falters, add the following: "In other words, if you imagine your future in the worst possible way, what would your life look like then?")

Anything else:

10. (Hand the respondent the picture ladder Chart D, and point to the top and bottom of ladder. As parts (a) and (b) are asked, move finger rapidly up and down ladder.)
(a) Present Step Number _____
(b) In 5 Years Step Number _____

SECTION 3

(Hand the respondent Chart E, and explain this is a new section. You may need to explain the instruction, and stress that 9 represents strong disagreement and 1 strong agreement and answers must be numbers between 1 and 9, 5 for example being no strong feeling either way about the statement. Some care may be needed in writing in the numbers for the respective questions.)

11.	_____	12.	_____	13.	_____	14.	_____	15.	_____	16.	_____
17.	_____	18.	_____	19.	_____	20.	_____	21.	_____	22.	_____
23.	_____	24.	_____	25.	_____	26.	_____	27.	_____	28.	_____
29.	_____	30.	_____								

31. (Hand the respondent Chart F, point to the top and bottom of the ladder, and as the question is asked at (a), move finger rapidly up and down ladder. Note number called.)
Step Number _____

32. (Report verbatim.)

Anything else:

33. (For the next five questions, be careful not to prompt the respondent. If he/she cannot answer the question, repeat it, and if he/she still cannot answer, report: "No answer." Check the appropriate answer.)
Yes _____ No _____

34. (Report verbatim.)

Anything else:

35. (Report verbatim.)

Anything else:

36. Yes _____ No _____

37. Yes _____ No _____

(This is the end of the formal part of the interview. Thank the respondent for his cooperation. The following information should be completed by the <u>interviewer</u> immediately after the interview is complete. Check the appropriate answer).

38. Sex of the respondent: Male _____ Female _____

39. Was there anyone else besides yourself and the respondent present during the interview?
Yes, there was someone present during most of the interview _____
Yes, there was someone present during some of the interview _____
No, there was not anyone else present _____

40. Consider such things as the attitude of the respondent toward the survey and the circumstances under which the interview was conducted: do you feel the information obtained during this interview is sufficiently valid to be included in the study?
Yes, this interview seemed highly valid _____
Yes, although some sources of error may be present _____
(Please describe below.)

No, this interview is probably invalid _____
(Please describe below.)

Comment on the interview:

Signed

_____
Interviewer's Name

GRAIN

DAIRY

POULTRY

HOGS

SPECIAL CROPS

BEEF FEED LOT

COW CALF ENTERPRISE

BEEF STOCKER ENTERPRISE

FORAGE CROPS

OTHERS (SPECIFY)

A

WHEAT

BARLEY

SUGAR BEET

OATS

RYE

SUNFLOWER

BUCK WHEAT

CORN

FORAGE

FLAX

POTATOES

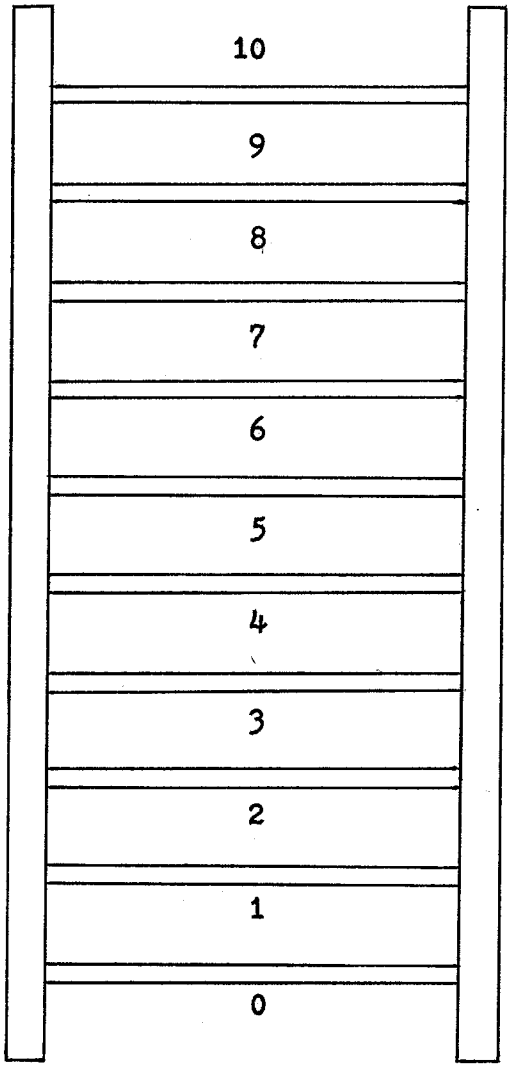
RAPESEED

SUMMER FALLOW

NATIVE PASTURE

OTHERS (SPECIFY)

	CATEGORY
$50-249	1
$250-1,249	2
$1,250-2,499	3
$2,500-3,749	4
$3,750-4,999	5
$5,000-7,499	6
$7,500-9,999	7
$10,000-14,999	8
$15,000-24,999	9
$25,000-34,999	10
$35,000-44,999	11
$45,000-54,999	12
$55,000-64,999	13
$65,000-74,999	14
$75,000 + over	15



The best possible life.

The worse possible life.

D

1 STRONG AGREEMENT

2 FAIRLY STRONG AGREEMENT

3 MODERATE AGREEMENT

4 MILD AGREEMENT

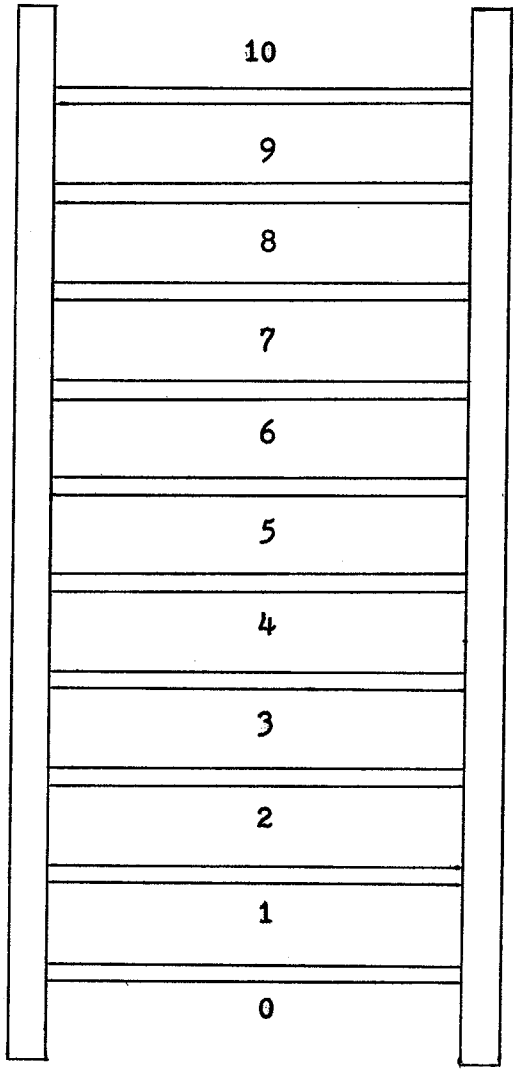
5 NO STRONG FEELINGS EITHER WAY

6 MILD DISAGREEMENT

7 MODERATE DISAGREEMENT

8 FAIRLY STRONG DISAGREEMENT

9 STRONG DISAGREEMENT



The best possible occupation.

The worse possible occupation.

F

APPENDIX 2

INTERVIEWER'S GUIDE[1]

Nature of the Research Project

The objective of this research is to examine the behavioral factors that may be important in the farming community in Manitoba. The research is particularly interested in the value that farmers attach to their occupation in farming, and whether these values vary with the income level of the farmers. To accomplish this objective, a survey of farms in Manitoba is being done. This survey will provide the basic data that will be used in subsequent analysis.

Before the Interview Starts

The first step is to fill out Document 1 attached to each answer sheet. Assign an interview number to the respondent. This number is to be assigned in the order interviewed. The sample number is obtained from the sample list of farmers, and should be entered in Document 1. Since this is the only identification for each answer sheet, it is essential that the correct sample number is listed. Care should be taken that the list of farmers is never seen by the respondent (perhaps it should not be taken to the respondent's home if possible). As Document 1 indicates, only two recalls must be paid to each respondent.

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[1]General details about the conduct of interviews can be found in: Michigan University Survey Research Center, Interviewer's Manual, Revised, Ann Arbor Michigan Institute for Social Research, University of Michigan, 1972.

If the respondent cannot be contacted on the third visit, he is to be classified as a non-respondent, and the reason for the non-response listed in Document 1. Ask the respondent for his/her postal address. If it is given report it on Document 1. Also report the time the interview started and ended.

The second step is to have the questionnaire and the charts ready. The charts are to be arranged in the order in which they are to be presented, i.e., A, B, C, D, E, F. The respondent should only see the charts, not the questionnaire or the answer sheet. Only if it is absolutely necessary must the questionnaire be shown to the respondent, and even so, it is only to be shown as a last resort to make the interview possible.

A letter of introduction is provided in case this is needed for assurance to the respondent. A letter will also have been sent previously to the respondent, by the Department of Agricultural Economics University of Manitoba, advising him/her of the survey, and you could possibly remind him/her of this. The names of the respondents were obtained from the telephone book, and the sample carefully selected from this frame. This information may prove reassuring to some respondents.

Asking the Question

The interview should be taken in a standardised yet relaxed atmosphere. Ask every question in the questionnaire. The instructions to the interviewer about the questions (such as handling the charts) are listed in the answer sheet, so that this sheet should be consulted before each question is asked.

Ask every question in the order presented in the questionnaire. The sequence is arranged so that early answers do not have a harmful effect on the respondent's answers to later questions. Also the questions and the order asked need to be standardised from respondent to respondent, if the interviews are to be comparable. In this connection, it is very important that every question is asked exactly as worded in the questionnaire.

What if the respondent doesn't understand a question: If the respondent misunderstands a question or asks what a particular phrase may mean, you can simply repeat the question. If at the second try the respondent still fails to understand the question, and asks the meaning of phrases, have the respondent use his own definitions. Only as a last resort should you attempt to define anything, and on no account should you define anything pertaining to questions 33-37, as instructed on the answer sheet. The instructions given on the answer sheet may help to clear up doubts for the respondent. If you do assist the respondent in any definition of phrases, please note this on the questionnaire immediately.

Recording the Interview:

The respondent's replies should be recorded in the very words of the respondent. No attempt should be made to summarise or paraphrase the respondent's answers to open-ended questions. Instead the answer should be taken using the phrases, grammatical usage and peculiarities of each respondent, so that the interview will reflect something of his/her individual personality. If during the interview, a respondent talks at length about subjects not included in the study questionnaire,

these may be omitted. The answer sheet also gives specific guides as to how certain questions should be recorded. Questions 38-40 must be completed by the interviewer at the end of the interview.

APPENDIX 3

This appendix sets out the production decision models used in the farm firm growth models of Chapter 6. The model for the representative low income farmer is set out first, then the model for the representative high income farmer. Both models are for Year 1 of the planning horizon.

Table 32 provides a description of the activities used in the models. As noted in this table, rapeseed activities were not included in the low income model. Table 33 describes the constraints included in the model.

Table 34 sets out the low income production decision model. The objective function is given in the last row of the table. As described in Chapter 6, the decision models were mixed integer linear programming models, which were solved by the computer code BBMIP. This code requires all programmes to be formulated as minimisation problems. The other rows in Table 34 give the model constraints. Row 1 to Row 10 are the regular production constraints of linear programming. Rows 11 to 16 give the contribution of the budget activities to the goals (activities 11 to 16). Row 17 is the accumulation and accounting row for the economic means activity (activity 19, Table 32).

The nature of the inequality or equality of each row is given in the second column of Table 34. Column 3 provides the right hand side of each row. Columns 4 to 11 give the input output coefficients for the budget activities associated with the crops included in the production models. For example Column 4 gives the wheat activity 1.

This activity is seen to require $4141 of machinery capital, $1172 of building capital, 84 acres of land, and so on. Row 11 shows wheat activity 1 makes a relative contribution of .06 to goal 1. The expected net return of wheat activity 1 or its expected contribution to the economic means variable is $9705. Column 5 to Column 11 are interpreted similarly.

The high income production model is given in Table 35. This model is set out in identical fashion to the low income model of Table 34. The high income model contains rapeseed activities, and an additional row - Row 18. Row 18 is designed to limit the number of acres of rapeseed and flax, for reasons given previously. (These reasons are given on page 125 of Chapter 6).

Table 32: Description of Activities Used in Production Decision Models for Representative Farmers

Activity Number	Description of Activity	Unit
1	84 acres of wheat	-
2	328 acres of wheat	-
3	83 acres of oats	-
4	360 acres of oats	-
5	60 acres of rapeseed[a]	-
6	307 acres of rapeseed[a]	-
7	78 acres of flax	-
8	384 acres of flax	-
9	103 acres of barley	-
10	380 acres of barley	-
11	Goal 1 Sound Economic Future	-
12	Goal 2 Own More	-
13	Goal 3 Have Enough to Earn a Living	-
14	Goal 4 Good Health and Family Well Being	-
15	Goal 5 Retain Control of Farm	-
16	Goal 6 More Leisure	-
17	Labour Hiring	hours
18	Land Rental	acres
19	Economic Means	$

[a]Rapeseed activities were not included in low income production decision model.

Table 33: Description of Constraints Used in Production Decision Models

Constraint Number	Description of Constraint	Unit
1	Machinery Capital	$
2	Building Capital	$
3	Short Term Capital	$
4	Land	acres
5	Labour Available Sept. 16-Oct. 30	hours
6	Labour Available April 10-May 15	hours
7	Labour Available May 16-June 15	hours
8	Labour Available June 16-August 15	hours
9	Labour Available August 16-Sept. 15	hours
10	Hired Labour	hours
11	Contribution to Goal 1	-
12	Contribution to Goal 2	-
13	Contribution to Goal 3	-
14	Contribution to Goal 4	-
15	Contribution to Goal 5	-
16	Contribution to Goal 6	-
17	Contribution to Economic Means	$'00[a]
18 (High)[b]	Rapeseed Level Constraint	acres

[a]Unit is one hundred dollars.

[b]Constraint only appears in representative high income model. For further information see page 125.

Table 34: Year 1 Input-Output Coefficients Used in Representative Low Income Production Decision Model

Constraint Number	Type	Right Hand Side	Activity Number 1	2	3	4
1	≦	12694	4141	10295	4060	12363
2	≦	3052	1172	1997	1136	1551
3	≦	6574	3163	11444	3548	10343
4	≦	306	84	328	83	300
5	≦	423	31	75	30	69
6	≦	397	21	53	17	48
7	≦	292	31	98	31	90
8	≦	630	5	16	3	15
9	≦	324	43	207	52	246
10	≦	0	96	384	95	351
11	≦	0	-.06	0	-0.11	0
12	≦	0	-.18	0	-.17	0
13	≦	0	-.30	0	-.33	0
14	≦	0	-.18	0	-.17	0
15	≦	0	-.24	0	-.11	0
16	≦	0	-.06	0	-.11	0
17	=	0	97.054	388.06	60.71	244.23
Objective Function	Minimise		0	0	0	0

Table 34 (continued)

Constraint Number	Activity Number 7	8	9	10	11	12	13
1	2321	12229	5219	14348	0	0	0
2	1510	2700	810	1432	0	0	0
3	2934	13273	3460	12271	0	0	0
4	78	384	103	380	0	0	0
5	19	77	27	87	0	0	0
6	20	54	14	61	0	0	0
7	25	119	34	114	0	0	0
8	4	19	6	19	0	0	0
9	49	223	78	274	0	0	0
10	42	244	94	334	0	0	0
11	-.07	0	-.11	0	1	0	0
12	-.14	0	-.22	0	0	1	0
13	-.29	0	-.33	0	0	0	1
14	-.21	0	-.11	0	0	0	0
15	-.21	0	-.11	0	0	0	0
16	-.07	0	-.11	0	0	0	0
17	43.204	224.410	75.036	281.770	0	0	0
Objective Function	0	0	0	0	-.11	-.22	-.22

Table 34 (continued)

Constraint Number	Activity Number 14	15	16	17	18	19
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	25	0
4	0	0	0	0	-1	0
5	0	0	0	-.1	0	0
6	0	0	0	-.05	0	0
7	0	0	0	-.35	0	0
8	0	0	0	0	0	0
9	0	0	0	-.5	0	0
10	0	0	0	-1	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	1	0	0	0	0	0
15	0	1	0	0	0	0
16	0	0	1	0	0	0
17	0	0	0	0	0	-1
Objective Function	-.22	-.19	-.04	0	0	-.333

Table 35: Year 1 Input-Output Coefficients Used in Representative High Income Production Decision Model

Constraint Number	Type	Right Hand Side	Activity Number 1	2	3	4
1	≤	12694	4141	10295	4060	12363
2	≤	3052	1172	1997	1136	1551
3	≤	6574	3163	11444	3548	10343
4	≤	306	84	328	83	300
5	≤	423	31	75	30	69
6	≤	397	21	53	17	48
7	≤	292	31	98	31	90
8	≤	630	5	16	3	15
9	≤	324	43	207	52	246
10	≤	0	96	384	95	351
11	≤	0	-.44	-.35	-.36	-.33
12	≤	0	-.06	-.20	-.14	-.33
13	≤	0	-.06	0	-.07	0
14	≤	0	-.19	-.20	-.21	0
15	≤	0	-.13	-.05	-.21	0
16	≤	0	-.13	-.20	0	-.33
17	=	0	97.054	388.057	60.706	244.23
18	≤	100	0	0	0	0
Objective Function	Minimise		0	0	0	0

Table 35 (continued)

Constraint Number	Activity Number 5	6	7	8	9	10	11
1	2990	10501	2321	12229	5219	14348	0
2	646	1268	1510	2700	810	1432	0
3	2041	8736	2934	13273	3460	12271	0
4	60	307	78	384	103	380	0
5	14	44	19	77	27	87	0
6	7	68	20	54	14	61	0
7	20	89	25	119	34	114	0
8	2	9	4	19	6	19	0
9	40	184	49	223	78	274	0
10	46	235	42	244	94	334	0
11	-.25	-.5	-.38	-.4	-.38	-.5	1
12	-.08	-.25	-.06	-.20	-.08	-.25	0
13	0	0	0	-.10	-.04	0	0
14	-.17	-.25	-.19	-.20	-.21	0	0
15	-.25	0	-.19	-.10	-.13	0	0
16	-.25	0	-.19	0	-.17	-.25	0
17	60.126	324.714	43.204	224.41	75.036	281.77	0
18	60	307	78	384	0	0	0
Objective Function	0	0	0	0	0	0	-.37

Table 35 (continued)

Constraint Number	Activity Number 12	13	14	15	16	17	18	19
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	25	0
4	0	0	0	0	0	0	-1	0
5	0	0	0	0	0	-.1	0	0
6	0	0	0	0	0	-.05	0	0
7	0	0	0	0	0	-.35	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	-.5	0	0
10	0	0	0	0	0	-1	0	0
11	0	0	0	0	0	0	0	0
12	1	0	0	0	0	0	0	0
13	0	1	0	0	0	0	0	0
14	0	0	1	0	0	0	0	0
15	0	0	0	1	0	0	0	0
16	0	0	0	0	1	0	0	0
17	0	0	0	0	0	0	0	-1
18	0	0	0	0	0	0	-1	0
Objective Function	-.17	-.02	-.27	-.05	-.12	0	0	-.354

APPENDIX 4

This appendix presents the precision estimates for the sample results. These estimates are the standard errors of the percentages and means given in the tables, and are given in brackets below the sample results. All the data are from the survey carried out in the study.

Table 11A: Goal Orientations of Farmers: Wishes and Hopes*

Response	Low Income N = 30	Medium Income N = 39	High Income N = 34
	.....percent.....		
A. ECONOMIC			
1. Sound Economic Future	10 (5.5)	25.6 (7.0)	44.1 (8.5)
2. Own More (Money, Land, etc.)	20 (7.3)	20.5 (6.5)	20.6 (6.9)
3. Better Commodity Prices	16.7 (6.8)	10.3 (4.9)	17.7 (6.6)
4. Have Enough to Earn Living	20 (7.3)	12.8 (5.4)	2.9 (2.9)
5. Other Economic	20 (7.3)	20.5 (6.5)	32.4 (8.0)
6. Total Economic	66.7 (8.6)	69.2 (7.4)	79.4 (6.9)
B. NON ECONOMIC			
7. Good Health and Family Well Being	20 (7.3)	25.6 (7.0)	32.4 (8.0)
8. Retain Control of Farm	16.7 (6.8)	20.5 (6.5)	5.9 (4.0)
9. More Leisure	3.3 (3.3)	7.7 (4.3)	14.7 (6.1)
10. Other	23.3 (7.7)	25.6 (7.0)	20.6 (6.9)

*Percentage of Farmers giving the particular response.

TAble 12A: Goal Orientations of Farmers: Fears and Worries*

Response	Low Income	Medium Income	High Income
	.....percent.....		
A. ECONOMIC			
1. Cost Price Squeeze	3.3 (3.3)	23.1 (6.8)	29.4 (7.8)
2. General Economic Conditions	30 (8.4)	23.1 (6.8)	32.4 (8.0)
3. Losing Farm Business	26.7 (8.1)	15.4 (5.8)	11.8 (5.5)
4. Other Economic	20 (7.3)	23.1 (6.8)	17.7 (6.6)
B. NON ECONOMIC			
5. Government Control of Agriculture	16.7 (6.8)	5.1 (3.5)	29.4 (7.8)
6. None	23.3 (7.7)	15.4 (5.8)	8.8 (4.9)
7. Other	13.3 (6.2)	30.8 (7.4)	32.4 (8.0)

*Percentage of Farmers giving the particular response.

Table 13A: Occupational Values of Farmers*

Description	Low Income	Medium Income	High Income
	.....Average Scale Rating[1].....		
A. EXTRINSIC			
1. Economic Monetary (11,12,13)	4.1 (0.49)	4.2 (0.54)	3.9 (0.62)
2. Economic non-Monetary (15,16)	3.6 (0.29)	3.8 (0.61)	4.9 (0.77)
3. Economic Overall (11,12,13,15,16)	3.9 (0.31)	4.0 (0.26)	4.3 (0.38)
4. Effect of Luck (14)	5.8 (1.06)	5.8 (1.12)	6.8 (0.96)
B. INTRINSIC			
5. Achievement (17,18,19,20,21)	4.0 (0.24)	4.0 (0.64)	3.7 (0.36)
6. Affiliation (22,23)	3.2 (0.53)	4.1 (0.34)	4.1 (0.72)
7. Influence (24,25,26)	3.5 (0.24)	3.4 (0.18)	3.5 (0.46)
8. General (27,28,29,30)	3.1 (0.31)	3.0 (0.21)	3.1 (0.36)

*Based on disagree-agree scaling of statements 11 to 30 on questionnaire. Statements have been arranged in categories to derive meaningful measures of occupational values: brackets give the statements aggregated to form the category.

[1]Scale had 9 points--from 1, strong agreement, to 9, strong disagreement.

Table 14A: Occupational Values: Factors that Prevented Lower Occupational Rating*

Factor	Low Income	Medium Income	High Income
	.....per cent.....		
A. Extrinsic			
1. Income and love of outdoors	20 (7.3)	20.5 (6.5)	20.6 (6.9)
B. Intrinsic			
2. Achievement derived	20 (7.3)	12.8 (5.4)	52.9 (8.6)
3. Influence (own boss)	53.3 (9.1)	51.3 (8.0)	61.8 (8.3)
C. General			
4. Personal Liking	13.3 (6.2)	20.5 (6.5)	32.4 (8.0)
5. Good way of (family) life	13.3 (6.2)	20.5 (6.5)	8.8 (4.9)
6. Other	23.3 (7.7)	30.8 (7.4)	29.4 (7.8)

*Based on answer to Question 32, per cent of farmers giving response.

Table 15A: Aspiration and Satisfaction Scores for Farmers

Description	Low Income	Medium Income	High Income
	.....Mean Ladder Level.....		
ASPIRATION			
1. Present Life Level	5.8 (0.84)	6.4 (0.53)	6.7 (0.55)
2. Life Level in Five Years	6.1 (0.71)	6.6 (0.96)	7.3 (0.88)
OCCUPATIONAL SATISFACTION			
3. Present Level	7.4 (1.10)	8.0 (0.72)	8.6 (0.41)

1. Based on ladder levels 10--the best possible life (or occupation) to 0--the worst possible life (or occupation), given in Questions 10 to 31 of questionnaire.

Table 16A: Percentage of Farmers Stating Different Uncertainty Factors*

Factor	Low Income	Medium Income	High Income
	.....percent.....		
1. Weather	50 (9.1)	74.4 (7.0)	82.4 (6.5)
2. Commodity Price Fluctuations	50 (9.1)	48.7 (8.0)	52.9 (8.6)
3. Investment and debt	26.7 (8.1)	18.0 (6.2)	20.6 (6.9)
4. Diseases of Livestock	13.3 (6.2)	28.2 (7.2)	8.8 (4.9)
5. Physical Injury and Health	10 (5.5)	18.0 (6.2)	8.8 (4.9)
6. Other	26.7 (8.1)	23.1 (6.8)	44.1 (8.5)

*Answers to Question 34 of questionnaire.

Table 17A: Percentage of Farmers Giving Different Responses to Uncertainty*

Response	Low Income	Medium Income	High Income
	.....percent.....		
1. Capital Rationing	2.0 (2.6)	12.8 (5.4)	11.8 (5.5)
2. Good Farm Management	13.3 (6.2)	12.8 (5.4)	29.4 (7.8)
3. Insurance	3.3 (3.3)	25.6 (7.0)	23.5 (7.3)
4. Planning and Diversification	10.0 (5.5)	28.2 (7.2)	20.6 (6.9)
5. No Economic Action	60.0 (8.9)	38.5 (7.8)	32.4 (8.0)

*Answers to Question 35 of questionnaire.

Table 18A: Farmers' Opinions of Decision Environment*

Description	Low Income	Medium Income	High Income
	.....percent.....		
1. Farmers Stating Farming Risky	86.7 (6.2)	87.2 (5.4)	88.2 (5.5)
2. Farmers Staing They Understood the Free Market System	40.0 (8.9)	25.6 (7.0)	52.9 (8.6)
3. Farmers Staing Free Market System Works	30.0 (8.4)	43.6 (7.9)	52.9 (8.6)

*Row 1 from Question 33, Row 2 from Question 36 and Row 3 from Question 37.

Table 19A: Age and Number of Children of Farmers[1]

Description	Number of Respondents	Mean Age of Children	Mean Number of Children
Low Income	24	51.58 (2.82)	2.48 (0.37)
Medium Income	27	44.44 (2.14)	3.62 (0.38)
High Income	21	46.67 (2.60)	2.68 (0.35)
All Farmers	72	47.47 (1.47)	2.97 (0.22)

[1]Based on a telephone interview of 72 of the respondents.

GLOSSARY OF PSYCHOLOGICAL TERMS

The following is a glossary of psychological and social psychological terms used in the thesis. At the end of the glossary references are given to some of the literature dealing with the meaning of terms used in the social sciences.

affect. A broad class of mental processes, including feeling, emotion, moods and temperament.

affiliation. A state of legal, formal or cooperative relationship between two or more organised social groups; or the process of establishing same.

aggression. A hostile act intended to harm a person or object, often the result of frustration, or the desire or tendency to perform hostile acts.

attitude. An orientation toward certain objects or situations that is emotionally toned and relatively persistent. It may be regarded as a specific expression of a value or belief.

differentiation. The change in the psychological field from homogeneity to heterogenity. (Lewin) The organisation of the psychological field into regions such as the past, the present and the future, and into levels of reality and unreality. There is also the application of intelligence to one's learning experience. Dedifferentiation takes place when the disparate parts return to a condition of balance and homogeneity.

emotion. A complex reaction involving a high level of activation and visceral changes, and accompanied by strong feelings, or affective states.

fixation. A persistent mode of behaviour which has outlived its usefulness or has become inappropriate.

frustration. An unpleasant state of tension, anxiety and heightened sympathetic activity resulting from blockage or thwarting of goal directed behaviour.

goals. The end result towards which the organization is striving. (Adler) An objective such as success, towards which the individual strives and which determines his life style.

goal-directed behaviour. Behaviour which is interpretable only in terms of the organism's seeking a goal.

goal orientation. The condition of being directed toward a goal.

gratification. The pleasant state immediately following drive reduction or the achievement of a desire.

influence. A characteristic of persons in power who utilise their position in order to gain favours for themselves or others, or to change the course of events.

instrumental. Pertaining to a form of behaviour in which the subject's response is a means to an end.

level of aspiration. The maximum goal, either general or specific, that a person strives to attain at any given time. For example, a student with a motivation for only average achievement may be satisfied with a "C" average, whereas another "C" average student, whose level of aspiration is to obtain an "A" may very well be miserable.

life space. The totality of the individual existing in his perceived environment (both psychological and physical) at any given time.

motivation. A variable which is used to account for factors within an organism which arouse, maintain and channel behaviour toward a goal.

personality. The distinctively different characteristic or sum total of a person including his behaviour, character traits (honesty, loyalty, etc.), physical appearance, and individual and social modes of adjustment.

regression. A reversion to less mature or less realistic modes of response in attempting to escape from responsibility, stress and anxiety and to allow for self indulgence.

repression. The forceful ejection from consciousness of impulses, memories or experiences that are painful or shameful and generate a high level of anxiety.

tension. The experience of anxiety, discomfort and restlessness and the bodily and emotional changes that occur concomitantly. (Lewin) The distance between a motive and its goal.

Thematic Apperception Test (TAT). A semi-projective test developed by Murray in 1943, consisting of a set of ambiguous black and white picture cards, providing two series of ten each for boys, girls, men and women, to which the subject responds by creating a story. The story themes are considered as expressions of deeply hidden personality needs and reveal to the trained interpreter some of the dominant drives, emotions and personality conflicts on a somewhat conscious level. Scoring is complicated.

values. An individual or collective conception of that which is desirable. This conception usually has both emotional and symbolic components. Values may range from those that are subjectively

meaningful to a given individual to those that are shared cultural norms. They influence the selection of means and ends of action, and they serve as criteria by which objects or actions are evaluated.

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