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To the Graduate Council:

I am submitting herewith a thesis written by Kashayya Channayya Hiremath entitled "A Study of Adjustment of Farm Organization to the Family Life Cycle." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirement for the degree of Master of Science, with a major in Agricultural Economics.

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A STUDY OF ADJUSTMENT OF FARM ORGANIZATION TO THE FAMILY LIFE CYCLE

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Kashayya Channayya Hiremath

August 1960

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K. C. H.

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CHAPTER I

INTRODUCTION

A. THE FARM FAMILY

The family is a universal human grouping found in every known society.[1] Although the family is the smallest of social institutions, it forms the basic economic unit on most of the farms in the United States. This is particularly true with regard to the farm family because it is a working unit as well as a living unit. The farm forms a complete economic unit by itself. "In no other industry is the interdependence between the household and firm so strong as in agriculture."[2] A unique interrelationship exists between the family and the farm. "In the family type of farming," say Long and Parsons, "the entire farm economy is adjusted to the purposes, the capacity and the limitations of farm families."[3]

Families are not static, but they are dynamic. From its formation until its dissolution a family runs through a series of stages that are subject to demographic changes.[4]

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[1]G. P. Murdock, Social Structure (New York: Macmillan Company, 1949), p. 79.

[2]Earl O. Heady, Economics of Agricultural Production and Resource Use (Englewood Cliffs: Prentice Hall Inc., 1960), p. 417.

[3]E. J. Long and K. H. Parsons, How Family Labor Affects Wisconsin Farming, Agricultural Experiment Station, Research Bulletin 167 (Madison: University of Wisconsin, May, 1950), p. 3.

[4]Paul C. Glick, "The Family Cycle," American Sociological Review, XII (April, 1947), 164.

Following marriage, the family starts as a small unit, gradually increases in size and complexity and then declines as children leave home and finally comes to an end with the death of parents. Thus a family moves through a characteristic life cycle.

B. THE PROBLEM

The change from one phase of a life cycle to another affects the effective organization of a farm, as there is a close relationship between the farm family and its occupation. Farm organization problems change with different stages of the life cycle and involve needs for frequent adjustments. So the problem facing the farm family is the determination of a succession of optimum farm plans, which take into consideration future changes in the family life cycle. This problem is one of incorporating a certain measure of flexibility into the farm plans to provide for continuing adjustments as the family advances in age, so that the family can be successful throughout its career.

C. IMPORTANCE OF THIS STUDY

The close relationship between the family and its farm enterprise makes the life cycle significant from the farm organization point of view. On most farms in the United States the family cycle causes considerable irregularity in family labor supply and affects the problem of farm organization and labor accomplishments.[5] The family life cycle imposes

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[5] W. P. Ranney, The Labor Force on Tennessee Farms, Agricultural Experiment Station Bulletin 304 (Knoxville: University of Tennessee, October, 1959), p. 28.

serious limitations on farm organization.

If the farm planning and farm organizations are to be realistic, the stage of the life cycle of the family must be taken into consideration before making the plans. This necessitates the importance of planning a flexible farm organization that will help an operator to adjust to changes in his family cycle, especially if the family labor force increases and decreases markedly.[6]

The family gains in size with the birth of each child. But the birth of each child adds to the financial and social responsibilities and a period of years must lapse before they are of any material help on the farm. A special problem arises later when the children approach the age at which they can do some farm work. Long and Parsons[7] point out that:

> . . . the process of family dynamics, by which the father's labor is replaced by the son's, is not automatically and naturally integrated in such a way as to provide a stable labor force. The son's labor contribution rises from zero to full man equivalent in 10 years; it takes 40 to 50 years for the father's labor capacity to decline correspondingly. The problem of integrating the son's labor into an economic farming unit poses one of the most difficult decisions farm operators have to make. But the consequences of failing, for whatever reasons, to make a place for the son may pose problems even more difficult for the farmer to solve.

As the farm family forms the basis of an integrated productive enterprise, it is imperative that the enterprise must be adjusted to family resources, and the size of the business must be adequate to meet current living expenses, to provide some savings and to utilize the family labor force. Planning, saving, borrowing and investment are all tied up with the

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[6] Ibid., p. 30

[7] Long and Parsons, op. cit., pp. 8-9.

life cycle. If the children do not receive any help from their parents at the beginning of their career, they have to struggle hard to establish themselves.

The departure of children from home is an event of economic significance. It marks the breakup of old, and formation of new family units. It may result in a labor shortage on the farm from which the son departs. On the other hand, if too many sons stay at home there may result an oversupply of labor and low income per worker. Another alternative is the breakup of the original farm into several units, each of which may be too small economically.

Census data show quite clearly that there are many undersized commercial farms in United States, that there is a surplus of farm labor in some areas, and that there is a dearth of young farm operators. These phenomena may have been caused in part by failures of families to make timely adjustments to the family life cycle.

D. REVIEW OF LITERATURE

Relative to the tremendous amount of literature on the family, little attention has been given to the family life cycle, yet some observations in this field have been made.[8] Most of these studies deal largely with social aspects of the family life cycle. Only a few studies[9] consider

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[8] C. P. Loomis, "The Study of the Life Cycle of Families," Rural Sociology, I (1936), 180.

[9] The following are the more important studies of the life cycle of farm families in the United States:

(i) C. E. Lively, The Growth Cycle of Farm Family, Mimeographed

the economic significance of the changes associated with the family life cycle. From the standpoint of farm organization much less attention has been paid to the family life cycle.

H. C. Taylor, J. D. Black, L. C. Gray and other Agricultural Economists have described the theoretical economic implications of the life cycle and family size as a factor in agricultural economics.[10]

Interest of American students in the family life cycle was stimulated by the publication of A Systematic Source Book in Rural Sociology

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Bulletin 51 (Wooster: Ohio Agricultural Experiment Station, 1932).

(ii) C. P. Loomis, The Growth of the Farm Family in Relation to Its Activities, Agricultural Experiment Station, Bulletin 298 (Raleigh: North Carolina State College of Agriculture, June, 1934).

(iii) E. L. Kirkpatrick, Rosalind Tough and May L. Cowles, The Life Cycle of Farm Family, Agricultural Experiment Station, Research Bulletin 121 (Madison: University of Wisconsin, September, 1934).

(iv) Long and Parsons, op. cit.

(v) E. O. Heady, W. B. Back and G. A. Peterson, Interdependence Between the Farm Business and the Farm Household with Implications on Economic Efficiency, Agricultural Experiment Station, Research Bulletin 398 (Ames: Iowa State College, June, 1953).

[10](i) H. C. Taylor, Outlines of Agricultural Economics (New York: The Macmillan Company, 1925), pp. 173-175.

(ii) J. D. Black, Agricultural Reforms in the United States (New York: The McGraw-Hill Book Company, Inc., 1929), p. 368.

(iii) L. C. Gray, Introduction to Agricultural Economics (New York: The Macmillan Company, 1927), p. 102.

(iv) P. A. Sorokin, C. C. Zimmerman, and C. J. Galpin, A Systematic Source Book in Rural Sociology, Vol. II (Minneapolis: University of Minnesota Press, 1931), p. 114.

(v) George F. Warren, Farm Management (New York: The Macmillan Company, 1924), pp. 239-243.

by Sorokin, Zimmerman, and Galpin in 1931.[11] A number of investigators have shown that there is a definite life cycle of the family and particularly of the unbroken rural family.

The family cycle has been delineated into various stages from its formation to its dissolution. The cycle has been mainly described in two ways - in terms of the school periods of children and in what the children can contribute towards the farm work.[12]

Sorokin, Zimmerman and Galpin postulated four stages in the life cycle of a farm family with respect to the composition of the family in its relationship to the agricultural operations and material well-being of the family group.[13] The delineations by them are shown along with those of other investigators in Table I.

Loomis[14] using a similar empirical mode of procedure for analyzing the life cycle of white farmers' families in North Carolina also distinguished four stages based upon the age of the oldest child.

O. D. Duncan in his study of farm families in Oklahoma, using the age of the oldest child as a measure of the duration of family life, also listed four stages in the family life cycle.[15]

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[11] Lowry Nelson, Rural Sociology (Second Edition; New York: American Book Company, 1955), pp. 307-308.

[12] Robert C. Ross, An Introduction to Agricultural Economics (New York: McGraw Hill Book Company, Inc., 1951), p. 366.

[13] Sorokin and others, op. cit., pp. 30-33.

[14] Loomis, 1934, op. cit., pp. 15-18.

[15] Analysis of Farm Family Organization in Oklahoma, unpublished Ph. D. thesis, cited by Lowry Nelson, op. cit., p. 308.

TABLE I

STAGES IN THE FAMILY CYCLE AS DESCRIBED BY VARIOUS INVESTIGATORS

Family Cycle Phase	Sorokin, Galpin, Zimmerman	Loomis	Kirkpatrick, Tough, Cowles	Duncan
I	Married couple just starting independent existence	Childless couples of child-bearing age	Children under 6 years of age	Married couple - no children
II	Couples with one or more children	Oldest child not over 14 years of age	Children 6 to 13 years of age	Constant increase in number of children at home
III	Couple with one or more adult self-supporting children	Oldest child over 14 but not over 35 (No broken families included in this stage)	Children 14 to 18 years of age	Children leaving home (a) as fast as others born; (b) faster than birth
IV	Couples becoming old; some children marry, separate from the family and start as an independent couple (enter stage I)	Families over 35 years of age as calculated from the birth of the oldest child, and broken families with husband, if living, over fifty, and wife, if living over 40 years of age	All adult, children 19 years or older	Begins when number of children at home had declined to about same level as beginning of stage II. (Approx. 35 years after birth of first child.) Continues until complete disintegration of parental household. (Approx. 50 years for tenants and 55 years for owners after birth of first child)

Source: Lowry Nelson, Rural Sociology (Second Edition; New York: American Book Company, 1955), p. 309.

Kirkpatrick[16] and his associates, although basing their classification of life cycle on the school ages of children, the variability in character and type of goods consumed, the ability of families to provide at different stages, and the extent to which the parents consider these factors in planning for future, arrive at four stages much similar to those indicated by Sorokin and his associates, Loomis and Duncan. They delineate the stages as pre-school, grade school, high school and all adult. These four classifications have been summarized by Nelson as shown in Table I.

There is a good deal of similarity among the corresponding stages described by Sorokin and his associates, Loomis and Duncan, although they have used different criteria for classification. Loomis and Duncan seem to have patterned their schemes of classification after the general frame work presented by Sorokin and his associates. Kirkpatrick's first and third stages differ from those of the other investigators. He does not differentiate between the pre-child period and the post-child period as long as the children are under 6 years of age. He includes these two periods into the first phase of life cycle. His third stage is limited to the period when children are between 14 and 18 years of age. Duncan while reviewing the contemporary sociological research in farm family living, comments that Kirkpatrick does not employ 'stage' concept but breaks families into duration period.[17] He further states that Kirkpatrick does not identify the structural and functional changes which occur with the

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[16]Kirkpatrick and others, op. cit. pp. 28-32.

[17]O. D. Duncan, "Contemporary Sociological Research in Farm Family Living," Rural Sociology, VI (1941), 308.

aging of the family unit as definitely as is done by Loomis and Duncan.[18]

None of these classifications can accommodate a joint family system. "The cycle includes," states Loomis, "parents and children and does not refer to the life cycle of a family made up of many generations carrying the same or different name."[19] Each investigator defines a family differently. Most of the studies of the life cycle of the family have failed to define satisfactorily the terms employed.[20] These different classifications emphasize the particular aspect of the family which the investigators wanted to study. Duncan himself is of the opinion that the family cycle studies of Sorokin, Loomis, Lively, Kirkpatrick and his own should be regarded as a beginning since none of them have advanced very far beyond the pioneer stages.[21]

Paul Glick,[22] in his analysis of United States Census data of 1890 and 1940, divided the average family cycle into: (1) marriage; (2) child bearing; (3) children leaving home; and (4) dissolution of the family, but he made no attempt to distinguish between urban and rural or farm family cycle. In their attempt to suggest a method of bringing a number of census materials together in order to describe rural, rural-non farm and urban differences in the life cycle stages, Beegle and Loomis,[23] delimit the

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[18] Ibid.

[19] Loomis, 1936, op. cit., p. 193.

[20] Ibid., p. 192.

[21] O. D. Duncan, op. cit., p. 308.

[22] Paul C. Glick, op. cit., pp. 174-194.

[23] Allen Beegle and C. P. Loomis, "Life Cycle of Farm, Rural-Non Farm and Urban Families in the United States as Derived from Census Material," Rural Sociology, XIII (March, 1948), 70-74.

family cycle into seven stages based on age of mother. They indicate the stages as: (1) marriage; (2) birth of the first child; (3) birth of the last child; (4) marriage, or the migration of the first child from the parental household; (5) marriage or the migration of the last child from the parental household; (6) death of the father; and (7) death of the mother. All these classifications are designed for normal families.

Long and Parsons[24] in their study of Wisconsin farming treated the family life cycle from a different angle. They describe the family cycle of an individual in terms of the farm labor force which is measured in terms of man equivalents. They examine the life cycle of labor capacity of Wisconsin farm males, since it is the farm men and boys whose labor forms the basic structure of the family labor force. The individual's changing capacity for farm work over a life time is taken as a criterion for the family cycle.

Loomis is of the opinion that it is immaterial which of the various scales such as adult-equivalent-scale, adult male-equivalent-scale are employed but they are all designed to give a common measure of size of the family.[25]

Heady and his associates[26] have taken into account the operator's age for classifying them into different stages of life cycle on the assumption that the operator's age is highly correlated with the family life cycle. They divide the sample into five age groups: (a) 30 years

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[24]Long and Parsons, op. cit., p. 9.

[25]Loomis, 1934, op. cit., p. 3.

[26]E. O. Heady and others, op. cit., pp. 398-399.

and under, (b) 31 to 40 years, (c) 41 to 50 years, (d) 51 to 60 years, and (e) over 60 years. This grouping is practically similar to that of Loomis as well as that of Duncan's stages of life cycle, because: (i) Age group I of operators under 30 years included very few children of working age, the children drew from the household as consumers but contributed no production (ii) Age group II included as many "consumer" children as those contributing to production, while group III included mainly boys and girls who contributed to the labor resources of the farm business (iii) Age group IV representing operators 60 years or older, included mostly children old enough to contribute to productive activities and majority of the families in the older age included children who had left home and were providing their own support. Although different investigators have used different criteria for classifying the life cycle of farm families into different stages, the result seems to be quite similar.

Several studies have shown that these stages have a distinct influence upon certain structural and behavioral characteristics of families. During the life cycle many important changes occur not only in its composition but also in many other measurable aspects. Lowry Nelson appropriately comments that "as it waxes and wanes, the family must make many adjustments, and especially important are those of economic nature."[27]

A phenomenon associated with the family life cycle from its origin to the time of its dissolution, is expansion and contraction of the family size. Typically a family starts as a small unit, grows to be a larger one and finally in the process of breaking up and decay, again becomes small.[28]

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[27]Lowry Nelson, op. cit., p. 311.

[28]Loomis, 1936, op. cit., p. 183.

The major changes in size occur due to the birth of children and their departure from home. One of the recent studies found that the number of persons in the household increased regularly to a peak at the twentieth year of marriage and then gradually declined during the succeeding decades.[29] The family remains stable in size, from the time when the last child is born until the first child leaves home.[30] In general, the quantitative membership of the family unit follows a parabolic cycle during its life history.[31]

The composition and size of the family has a direct bearing on the family labor force. To bring the varying man-power into balance with other factors of production will lead to several problems. The size of the farm enterprise is conditioned by the size of the working force. The economic productiveness of older children materially increases the labor force of the family for farming and supplementary employment.[32]

The variations in the size of the farm enterprise clearly reflects the economic impact of the family life cycle. According to Heady "the farm firm goes through phases of a life cycle in much the same manner as the household."[33] Loomis, in his study of North Carolina farm families

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[29]May L. Cowles, "Changes in Family Personnel, Occupational Status and Housing Occurring Over the Farm Family's Life Cycle," Rural Sociology, XVIII (1953), 37-38.

[30]Paul C. Glick, op. cit., p. 164.

[31]Loomis, 1936, op. cit., p. 183.

[32]G. W. Blackwell, "Correlates of State of Family Development Among the Farm Families on Relief," Rural Sociology, VII (1942), 168.

[33]Heady, op. cit., p. 431.

observed that farm acreage changed according to the stage of the life cycle. The acreage was smallest in the first stage when the couple has no children, increases during the second stage when the family is burdened by the children under 14 years of age, reaches its maximum size in the third stage when the family has the greatest working force, and then declines in the last stage when most children have left home.[34] A similar trend was found by Lively at Ohio.[35] Loomis further concludes that the whole farm will be larger in the fourth stage if the farmers are owners but most of it will be rented out, while in case of tenants less land is rented. The comprehensive Wisconsin study conducted by Long and Parsons shows the relationship of dairy herd size to the biological life cycle of farm operators. It also points out that farmers with sons 16 years old or older worked more area than farmers with small children.[36] Heady and his associates have also found that farmers near the middle of the family cycle managed more land than those in the early and later stages of the family cycle.[37] Several studies have shown that the more working units there are in the family the more land it is likely to farm. The size of the farm, therefore, fluctuates with the life cycle of the family.

Loomis found that the average total cash income per adult unit fluctuates during five year intervals in the life of the family. It decreased from stage I, until the oldest child was between 20 and 24 years

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[34]Loomis, 1934, op. cit., pp. 21-22.

[35]Lively, op. cit., p. 21.

[36]Long and K. H. Parsons, op. cit., p. 22.

[37]Heady and others, op. cit., p. 401.

of age. Then there was a slight increase and fell to its lowest level of all in stage IV.[38] A similar relationship was indicated by Blackwell, even among the relief families.[39] Kirkpatrick and his associates have shown that Wisconsin farm families during all adult stage (third stage) is the most favorable period for cash income and the cash farm operating receipts constitute between 91.1 and 93.7 percent of all the cash coming to family.[40] The fluctuations in the cash income of the family is a clear reflection of the impact of the dynamics of the farm family.

Blackwell[41] showed that young married couples without children have a significantly larger average amount of wealth than do the families just entering the second stage with the oldest child under 5 years of age. In succeeding stages the net wealth steadily increased to the end of the third stage and leveled off in the fourth stage. Those in the later stages have accumulated more net wealth.

Regarding capital investment Heady[42] and his associates have found that little capital is used during both the beginning and closing phases of the farm family cycle, because of different types of uncertainty and values of farm families. Beginning operators possess small amount of capital relative to the quantity of labor available. The families in the final stage are reluctant to invest more capital, either in land or in

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[38] Loomis, 1934, op. cit., pp. 22-24.

[39] Blackwell, op. cit., p. 168.

[40] Kirkpatrick and others, op. cit., pp. 16-17 and 30.

[41] Blackwell, op. cit., pp. 166-167.

[42] E. O. Heady and others, op. cit., p. 384.

machinery, as they place high values on liquidity and security. Heady's[43] study clearly shows that the interdependence of the farm business and farm household creates a cycle where the quantity of capital employed parallels the cycle of the farm family. The entire structure of the capital assets differs in the various phases of the life cycle.

Long and Parsons[44] enumerate a variety of adjustments of farm operations ordinarily made by the Wisconsin farmers during the course of the family cycle. Heady[45] and his associates listing a number of theoretical adjustments, stress the need for examining a scheme of alternatives for adjusting the farm organization to the family cycle.

A few studies[46] have been made at Iowa to provide guidance to beginning farmers in their planning. Optimum plans were prepared for beginning operators who had different amounts of capital and labor, and/or who operated under different restrictions in respect to cropping systems, leasing arrangements or ability to withstand risk and uncertainty. But no serious attempts seem to have been made to study how farm organization must be adjusted from one phase of a cycle to another and to evolve a

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[43] Ibid.

[44] Long and Parsons, op.cit., pp. 33-34.

[45] Heady and others, op. cit., pp. 427-428.

[46] (i) E. O. Heady, et al., Optimum Farm Plans for Beginning Farmers on Tama-Muscatine Soils, Agricultural Experiment Station, Research Bulletin 440 (Ames: Iowa State College, May, 1956).

(ii) Arthur B. Mackie, E. O. Heady and H. B. Howell, Optimum Farm Plans for Beginning Tenant Farmers on Clarion-Webster Soils, Agricultural Experiment Station, Research Bulletin 449 (Ames: Iowa State College, April, 1957).

flexible plan of farm organizations which will help an operator to adjust to changes in his family cycle and the consequent variations in the resource and management situations.

E. USE OF FARM PLANNING TO SOLVE THE PROBLEM

Farming is becoming more and more complex and competitive. "Agriculture," state Boss and Pond, "is a dynamic industry and change is the rule rather than the exception."[47] It, therefore, requires careful planning and adjustments for successful operation.

In defining planning as a process of decision making, Brown points out that "planning differs from other processes of decision making in that it involves developing and evaluating alternative courses of future action designed to reach predetermined goals. Usually the pre-determined goals can be classified as maximizing income or satisfaction."[48]

A well-knit plan will help in fitting enterprises and farming methods together into a more profitable unit.[49] Planning is particularly indispensable where major adjustments of a long range nature are involved. The kind of plan depends upon the stage of the family and the resources at its disposal. Generally a beginning family has little or no capital of its own. Probably it has to start with borrowed capital, and can not afford

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[47] Andrew Boss and G. A. Pond, Modern Farm Management (Saint Paul: The Webb Publishing Company, 1951), p. 225.

[48] D. D. Brown, "Problems of a Farm and Home Planning Program," Journal of Farm Economics, XXXVI (1954), 187.

[49] E. O. Heady and H. R. Jensen, Farm Management Economics (Englewood Cliffs; Prentice-Hall, Inc., 1957), p. 91.

to take much risk. The operator may be ambitious to increase his income but often he is limited by insufficient productive assets.

Later, when there are several children under 12 years of age, he is burdened with expenditures for a growing family that has not reached the stage of providing help with the farm work. By this time the operator has gained considerable experience, and he may desire to expand his operations in preparation for an expanding family labor force. When some of the children are between 12 and 19 years of age, they will be of some help in farming operations. Thus during this period the family labor supply will be gradually increasing and the plan will have to be adjusted to absorb the additional family labor effectively.

In the next stage when the older children are over 19 years of age, each child can contribute one-man-equivalent of labor. During this period the one-man farm may become a two-man farm. The farmer by now feels more confident in his judgment and he may desire to take more risk. Moreover as one son after another may help in farming, the farm business needs to be expanded as rapidly as possible. The entire farm business may have to be reorganized in view of the increased labor supply and ability to borrow more capital.

In the final stage when the operator is more than 55 years of age and he wants to continue farming, the farm plan needs to be remodeled to suit his physical ability with declining age. He places high value on liquidity and security and attempts to pay off all mortgages. He cannot afford to take much risk and invest more capital as it will be too late for him to expect to recover many types of fixed investments. The plan should therefore include enterprises requiring less strenuous operations,

less fixed capital and less risk.

A father-son partnership presents a different problem. In this case the labor supply usually increases more rapidly than other resources.

Thus each stage of the life cycle presents different problems in farm management. Careful farm planning coupled with foresight is very useful for adjusting the farm organization to the changing conditions of the family as it moves from one stage of the life cycle to another.

F. OBJECTIVES OF THIS STUDY

Factors determining systems of farming on individual farms and type-of-farming areas have been classified under the following headings: physical, economic, biological, and personal.[50] The personal group includes race, age, skill, training, experience and preference of the farm operator.

The basic assumptions made in this study are the following:

1. That, in addition to the factors listed above, the farm organizations to be found in a community are related to the present stages of the family life cycle on the respective farms; and

2. That on some farms the present farm organizations are related to the extent that timely adjustments had been made to fit changes in the family life cycle in recent decades on these respective farms.

The objectives of this study are the following:

1. To present information available about the family situations and farm organizational structures on a group of selected farms.

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[50] B. H. Luebke, et al., Types of Farming in Tennessee, Agricultural Experiment Station, Bulletin 169 (Knoxville: University of Tennessee, 1939).

2. To arrive at optimum net income possibilities for two selected farms, within the limitations set up by the farm families on these farms at the present time, and with due consideration being given to flexibility for future needs.

G. PROCEDURE USED

A case study of selected farms is used as a basis for substantiating the assumptions made above. It cannot be asserted that the farms were selected at random, or that a definite inference can be made to the universe of all farms. In fact, the average size of the farms selected is above that for all farms in the County and the state in which they are located.

Since most of these farms have been used by the Department of Agricultural Economics, University of Tennessee, for research and instructional purposes, much historical information was available, and is presented herewith to fulfill the first objective.

The procedure includes two parts:

1. Presenting information available for the farms selected for this study, and selecting two farms for a more detailed case study in regard to historical changes, and for carrying through formation of current plans to fit the present and probable future stages in their respective family life cycles.

2. Presenting the actual preparation of optimum net-income plans for the two farms selected for detailed analysis, using linear programming as the working tool.[51]

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[51] A short discussion of linear programming and other tools used in farm planning is presented in Appendix A.

CHAPTER II

CASE STUDY OF SELECTED FARMS

A. THE FAMILY SITUATIONS ON THE FARMS STUDIED

To illustrate the divergence of family life cycle situations among farms the following report is made of a group of farms in one community about 20 miles West of Knoxville. The delineation of the farm boundaries of these farms is shown in Figure 1.

Farm I

It has 300 acres of land. The age of the operator is about 60 years. Several sons have passed through college. The father and one son are working together. They have established a large Grade-A dairy and have kept several thousand laying hens. Since the margin of profit in the latter has declined, they are going out of the poultry business. More land has been purchased very recently to replace the large poultry enterprise being discarded. There are several growing children in the son's family.

Farm II

The operator is an ex-salesman. He bought the farm 23 years ago. It is 133 acres in size. He raised a few beef calves, and tobacco and grain as cash crops. Twenty years ago this farm was used as a laboratory farm for a short course for Vocational Agricultural teachers, taught jointly by a committee from all agricultural subject matter departments of the State University. A number of systems were budgeted and one with

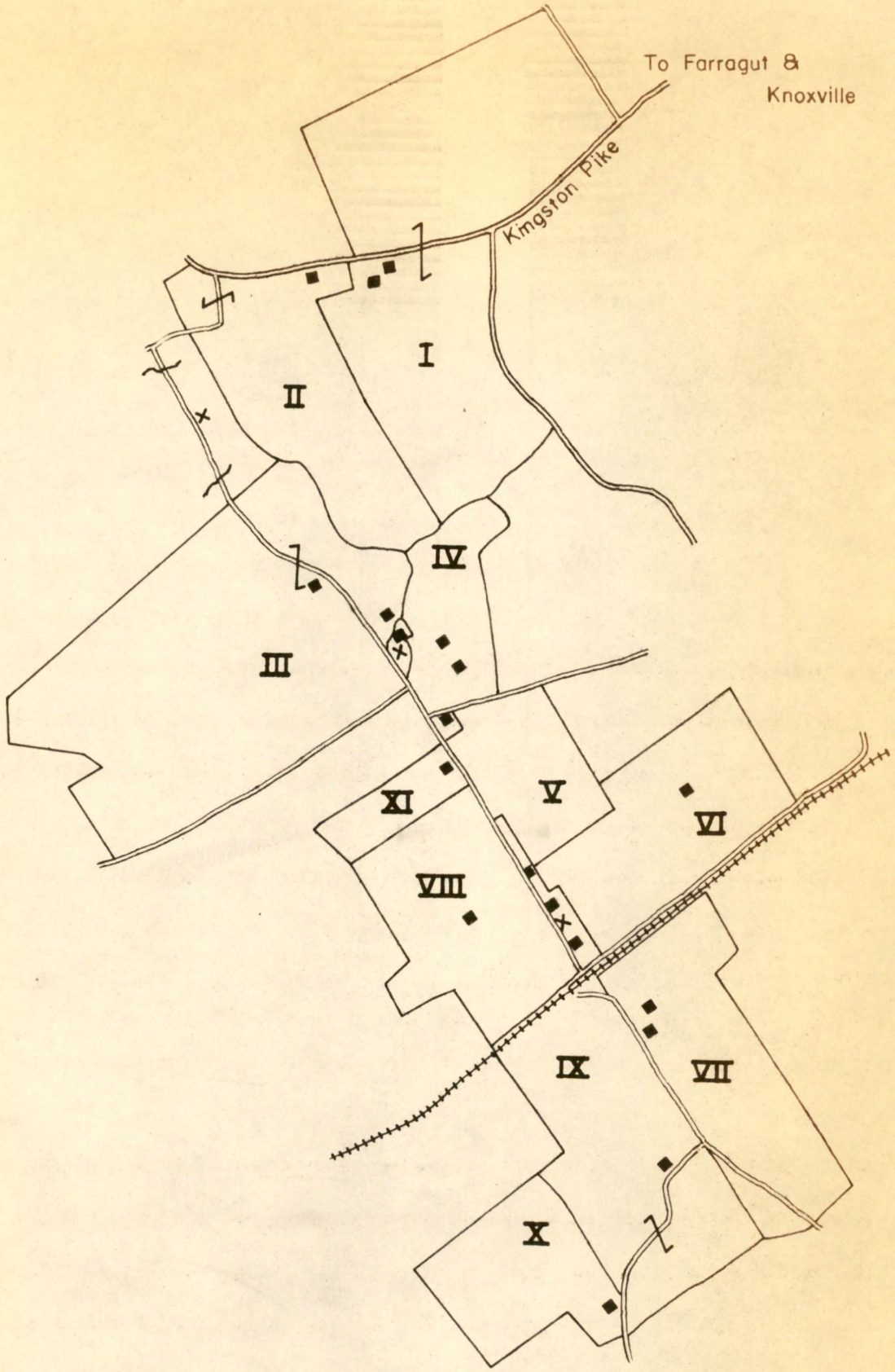

Figure 1. Delineation of boundaries of farms included in case study of family life cycle.

Grade-A dairy as the major enterprise resulted in highest net income.

About twelve years later he built a milking parlor and started operating a Grade-A dairy. He used his share-cropper to help with the milking. Although a milking machine was used, he experienced difficulties in keeping croppers for this work. The last one left two years ago and he could not find a suitable replacement. Several months later he decided to drop the dairy enterprise and go back to raising beef calves and selling crops.

He is open for suggestions to enable him to increase net income. He has two children, both daughters, one of whom is still in the University. Hence he needs to continue earning a living as long as his health permits. Because of his age, he is not interested in expansion that would entail much additional capital investment.

Farm III

It consists of 325 acres of owned land and 38 acres rented land (1.1 acre from Farm XI, and the remainder from Farm V). Several sons have gone through the University. One son is in partnership with the father in the farm business. The father works away, so the son is the principal operator. The son manages the farm with two full time hired men. They have a large beef herd consisting of cows and calves, in addition to several thousand turkeys. He is interested in any proposition that will increase net income. He has several small children, who will be available for help when they become older.

Farm IV

It is a small farm of 62 acres. The operator is about 60 years old.

He has had a small Grade-A dairy most of the time since he started operating. The son that went through college is in religious work. Another son, who did not go to college, is in partnership with his father on the farm. They have two good homes and small children are coming into the picture in the son's home. They need more business. They have rented 5 acres of alfalfa land from Farm XI and 11 acres from his son's father-in-law, about 6 miles away. They also rent 34.5 acres from Farm V. They welcome suggestions for increasing net income.

Farm V

It is 72 acres in area. The operator was a retired school teacher, who, because of health and age, had reduced his farming operations to a low ebb. He died a few years ago. The farm is now rented by operators on Farm III and IV.

Farm VI

It has 130 acres. The operator is an agricultural college graduate, and his wife is well educated and has helped in managing the farm. They have had no children. The farm was bought in 1930, and built up into a very good Grade-A dairy. They used hired help. As they experienced a good deal of difficulty in getting hired help they sold the dairy herd 3 years ago, and started buying young heifers and selling bred dairy heifers.

They are continuing to feel the need of improving their net income. They have now hired a young man who wants to go into dairy on a 50:50 livestock share basis, but they are rather dubious about the advisability of such a move in view of their ages and health.

Farm VII

It consists of 140 acres. The operator is 50 years old. He has no sons. The farm was bought with credit obtained from the Farm Home Administration. He has built a home for his daughter and son-in-law on the farm. The son-in-law has a full time off-farm job. He, however, helps his father-in-law in summer in crop emergencies. There is a Grade-A dairy operation on this farm. The operator is interested in improving the efficiency of operations but not with any appreciable additional capital investments.

Farm VIII

This farm is 142 acres in size. It is operated as a Grade-A dairy, with father-and-son partnership setup.

Farm IX

This farm has 180 acres of land, a considerable part of which is of low quality. The large brick mansion was undoubtedly quite pretentious a century ago, but is in rather poor condition now. Probably more so than any of the other of these 11 farms, the family on Farm IX illustrates the approach to its dissolution as a farm family. The aged mother lives in the big house, and parts of the house are rented out to people engaged in pursuits in nearby cities. The farm land is rented out to neighbors.

Farm X

The situation is somewhat similar to Farm IX, but the land resource is of better quality, and the home is in good condition. An unmarried son operated the farm as a Grade-A dairy for a period. He is now married with a growing family, but has discontinued farming and is working at a job off

the farm. The land is rented out to neighbors.

Farm XI

This is a small farm of about 30 acres. The owner purchased it about a decade ago and built a home on it. But the home is now rented out, as the owner's off-farm work has taken him some distance away. Small tracts of the best land are rented to the operators on Farms III and IV.

B. THE PROBLEMS ARISING OUT OF THE FAMILY CYCLE SITUATIONS ON THE FARMS STUDIED

The situations on the farms described above reflect the general nature of the impact of the dynamics of the farm family upon the farm organizations. The cyclical increase and decrease in family labor force has adversely affected the effective organization on some of the farms. Each farm presents a different problem.

Since all of the farms under the study are family farms, the family labor supply plays a decisive role in their organization. In these days when farming has become an increasingly complex and competitive industry, it is extremely important that the family labor be kept in proper balance with other productive factors such as land and capital.

Some of the families have experienced difficulty in providing gainful employment for their surplus family labor resulting from a change in the family life cycle. Although some farmers or their heirs have discontinued farming operations and rented land out, there has not been sufficient rental land available for the other families to keep all growing sons gainfully employed until the time when they could find employment else-

where, or for an adequate father-son operating unit.

This poses the problem of integrating the son's labor into an economic unit. It involves the weaving of two generations into a continuously going concern. This is one of the critical problems often faced by the farm families, in their endeavor to keep the farm in the family.

Several of these farmers are facing the problem of a scarcity of family labor either because the sons have left the parental home or they have no sons to assist and to take over the farm. The waning strength of the aged couple has impaired the effective organization of the farms. The aging parents are faced with the problem of what to do with the farm and how to retire. The farms have become unwieldy for the old operators to manage efficiently.

Most of the farm families are interested in maximizing profits and are in need of feasible farm plans. The alternatives at the disposal of the families for working out long range programs differ from family to family.

C. SELECTION OF FARMS FOR DETAILED ANALYSIS

The situations on the above case study farms, may be classified into three general groups:

1. A stage has been reached in which all of the farm land is rented out.
2. Operators have reached or are nearing the stage in which it is desired to curtail the labor intensity of the farm operations with the least possible curtailment of net income. Farm II was selected as an example of this situation.

3. A father-son partnership is now in effect and there is need for increased size of business and net income for two families. Farm IV was selected as an example of this situation.

CHAPTER III

DEVELOPMENT OF A CURRENT FARM PLAN FOR FARM II

Past and Present Situation

A brief description of the situation on this farm is presented in Chapter II. This family is composed of the operator, wife and two daughters. The wife teaches school. One daughter has graduated from a University and is working at a distant city. The other daughter has had one year at a University in another state. In as much as the parents are in their sixties they are approaching the usual retirement age or fourth stage of the life cycle, yet needing to earn a good income to finish the education of the second daughter and to prepare for themselves an adequate retirement income.

This farmer had originally been a salesman. Twenty years ago, or three years after the farm was purchased and farming operations started, a class of University students prepared several alternative plans for this farm. The plan that included a Grade-A dairy enterprise showed the highest net income, considerably higher than the income from the low-pressure crop and beef cow-calf system that he was following. The operator did not get around to starting the dairy enterprise until 12 years later. If a new budget had been prepared at this later date it should have reflected a considerably higher rate of depreciation for the investment in a milking parlor and dairy equipment than had been figured twelve years previously, because of the more advanced age of the operator. The rate of depreciation would depend on the plans of the operator for use or disposal of the farm

when he reached retirement age, and on any probable effect that a milking parlor would have on the sale value of the farm, if he planned to sell it. Such a change in the costs allotted for depreciation in budgets prepared eight years ago might have altered the ranking of a dairy enterprise in net income among alternative enterprises that could have been considered at that time.

The operator of this farm found it difficult to keep hired help for a dairy enterprise. He has passed the age at which he could expect to carry on all of the dairy work himself. He has reverted to the beef cow-calf and cash crop system. The drop in income concerns him. He is open for suggestions for ways to increase the net income, with the use of some hired help for raising crops, but without entailing a large amount of additional investment of a permanent nature such as he had made for a masonry milking parlor and floor area between the parlor and loafing barn.

Hence, as a part of this study, an analysis has been made to determine the system of farming that will satisfy his preferences and life cycle expectations now, and yield the highest possible net income with expected future average prices and costs.

Tool Used for Current Planning

In order to arrive at the most precise optimum net income that could be obtained from possible combinations of alternative enterprises to be considered, with specified restrictions, linear programming, as stated in Chapter I and explained in Appendix A, was chosen as the tool to use in preparing a current farm plan.

Alternative Enterprise Budgets Selected for Consideration

The farmer's own preferences were given heavy weight in setting up the analysis for arriving at an optimum plan. He was willing to consider two different systems of handling the beef enterprise, two for handling the hog enterprise, raising burley tobacco, raising corn silage and pasture for feed, and raising corn, and alfalfa hay for feed or sale as cash crops, and buying corn or hay for feed. Raising of small grain was omitted because most of the research data available indicated that it would not compare favorably with corn or alfalfa in a situation as that existing on this farm. Results of research studies also indicate that at prospective prices the raising of weanling pigs for sale is more profitable than feeding out market hogs in this area.

Pasture was considered as a land use for all of the land in the farm (excluding the farmstead). Corn and alfalfa were considered only for land best suited for these crops. The land area was divided into three classes on the basis of suitability for these crops and for pasture (see figure 2). The expected yields for crops and pasturage are those designated in the County Survey Report[1] to be expected with good management practices. Prices were selected in consultation with farm management research specialists at the State University. They are presented in Appendix B. Amounts of inputs, such as feed, seed, fertilizer, and tractor fuel and expected outputs of beef and pigs were determined also, on consultation with the University farm management specialists. The alternatives (called

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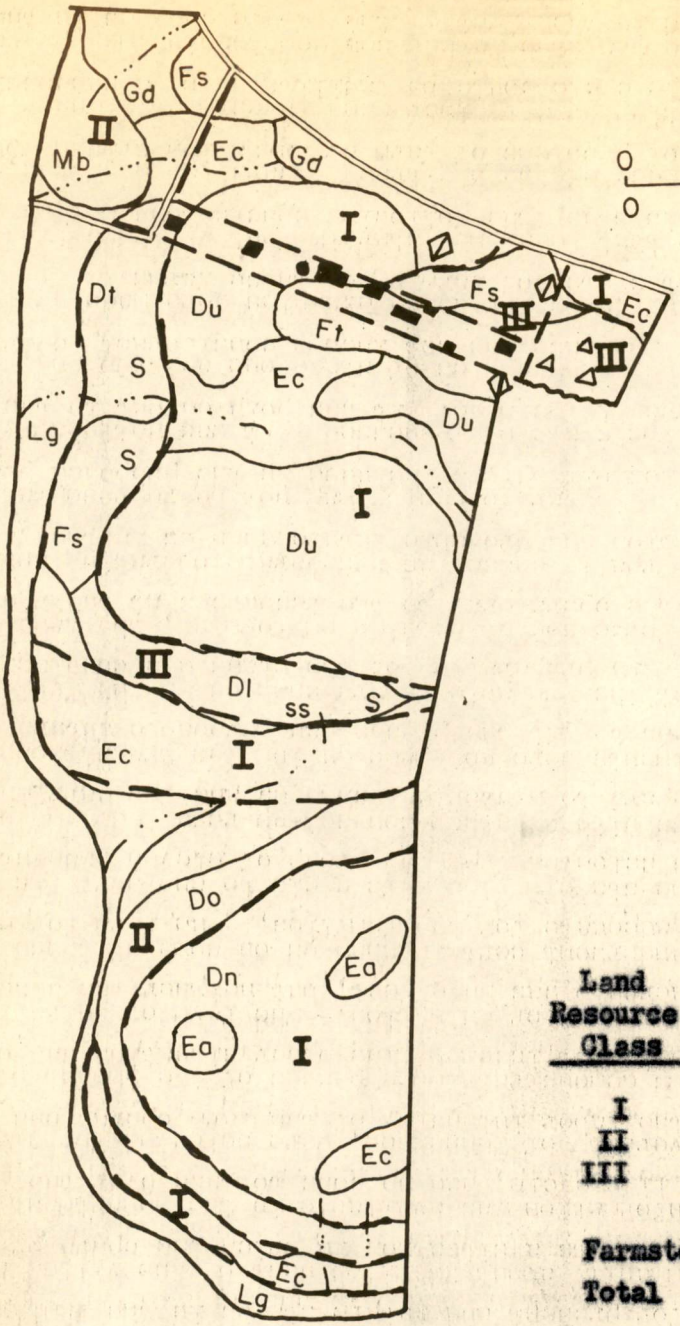
[1] Wallace Roberts, et al., Soil Survey: Knox County, Tennessee (Washington: United States Department of Agriculture in Cooperation with Tennessee Agricultural Experiment Station and the Tennessee Valley Authority, 1955), pp. 184-191.



Scale

0	1"	2"
0	660'	1320'

Land Resource Class	Acres
I	78.75
II	35.00
III	17.00
	130.75
Farmstead	2.25
Total	133.00

Figure 2. Map of Farm II showing soil areas delineated into three land resource classes.

activities or processes in linear programming vernacular), considered in the analysis with expected net revenues, or costs for purchasing or raising intermediate products, are presented in Table II.

The operator is unwilling to take a chance of losing his burley tobacco allotment of 0.75 acre. Hence this enterprise was omitted from the linear programming analysis. The land and labor for the tobacco enterprise were subtracted from the total supplies of these resources. The net revenue expected from the tobacco was included in the final computation of earnings.

Resource Restrictions

The operator of this farm has access to sufficient machinery to raise the corn, silage, hay and pasture to be considered in the analysis. He has sufficient storage space and shelter for the feed and cattle that could conceivably be included in the optimum set-up, because of the limitations of land resources for raising these products. He is not limited on operating capital.

He is willing to hire one man to help with the crop work. The May-June months constitute the most crucial period for demands for labor. He set the labor restriction for these two months at 860 hours (10 hours per day per man for 20 days each month, plus 3 hours per day for himself for chores for 10 additional days each month). Allowing 80 hours for work on the tobacco leaves 780 hours available for other activities.

The operator figures that the milking parlor and dairy loafing barn can be used as farrowing quarters with some additional investment for second hand lumber for partitions, fencing material for yards and pasture, and

TABLE II

ACTIVITIES AND NET REVENUES OR COSTS USED IN ANALYSIS FOR OPTIMUM FARM PLAN FOR FARM II

	Activities	Unit	Net revenue[a] or cost (dollars)
1.	Beef cattle - cow and 9 month calf	Cow	94.60
2.	Beef cattle - cow and 18 month calf	Cow	182.60
3.	Weanling pigs - sow and 15 pigs (2 litters)	Sow	136.00
4.	Selling hay	Ton	30.00
5.	Selling corn	Barrel[b]	5.00
6.	Buying hay	Ton	- 35.00[c]
7.	Buying corn	Barrel	- 6.00
8.	Alfalfa on Soil I	Ton	- 8.11
9.	Pasture on Soil I	30-cow-days	- 2.30
10.	Pasture on Soil II	30-cow-days	- 2.39
11.	Pasture on Soil III	30-cow-days	- 3.59
12.	Corn on Soil I	Barrel	- 2.02
13.	Corn silage on Soil I	Ton	- 2.95

[a]For enterprise budgets, see Appendix C.

[b]One barrel is equivalent to 5 bushels.

[c]The costs for intermediate products that may be used as feed, whether purchased or raised, are shown as minus revenues.

miscellaneous equipment such as feeders and waterers. An additional investment requirement of seventy-five dollars was estimated per sow. An additional investment of ten dollars for hay drying facilities per ton of alfalfa hay produced was estimated to be necessary in order to assure high quality hay for sale. The operator placed a ceiling of $5,000 as a total that he was willing to allow for additional investment.

The limited resources and the requirements for these resources by the proposed activities used in the linear programming analysis are shown in Table III.

Results of the Analysis

The results of the analysis are shown in Table IV. The final solution included a substantial fraction over 22 sows and a small fraction under 15 beef cows. These were rounded out to whole numbers: 22 sows and 15 beef cows. This rounding out process did not cause the use of restricted resources to exceed the supply and lessened the net revenue by only fourteen dollars.

In addition to the .75 acres for tobacco on Soil I would be used as follows: 73.5 acres for alfalfa and 4.5 acres for corn silage. The alfalfa would be utilized as cattle feed (22.5 tons) and for sale (308.3 tons). The cattle and hogs would require 31.8 acres of Soil II for pasture.

The unused land would include 3.2 acres of Soil II and all 17 acres of Soil III. This is hilly land and could bring in some additional income if placed in some government program, in woodland, or in pasture for purchased steers, if utilized at times of the year when competition for labor was not critical.

TABLE III

RESOURCE RESTRICTIONS AND REQUIREMENTS FOR ACTIVITIES USED IN ANALYSIS FOR OPTIMUM FARM PLAN FOR FARM II[a]

Limited resources		Soil I	Soil II	Soil III	May-June labor	Additional investment	Corn supply	Hay supply	Silage supply	Pasture supply
Unit		acres	acres	acres	hours	dollars	barrel	tons	tons	30-cow-days
Resource Restrictions		78	35	17	780	5000	0	0	0	0
Activities	Unit	Requirements								
9-mo. beef calf	Cow				.8375			1.0	3.0	8.3333
18-mo. beef calf	Cow				.9422		4.0	1.5	4.5	10.6667
Weanling pigs	Sow				2.0140	75.	15.0			1.4000
Selling hay	Ton							1.0		
Selling corn	Barrel						1.0			
Buying hay	Ton							-1.0		
Buying Corn	Barrel						-1.0			
Alfalfa, Soil I	Ton	.2222			2.0667	10.		-1.0		
Pasture, Soil I	30-cow-days	.1613			.1290					-1.0000
Pasture, Soil II	30-cow-days		.1667		.1333					-1.0000
Pasture, Soil III	30-cow-days			.2500	.2000					-1.0000
Corn, Soil I	Barrel	.0667			.1667		-1.0			
Silage, Soil I	Ton	.0667			.1667				-1.0	

[a]The negative figures add the respective units of feed to the supply of feed, an intermediate product.

TABLE IV

RESULTS OF ANALYSIS FOR OPTIMUM FARM PLAN FOR FARM II

Activity	Supply	Requirements: Soil I acres	Soil II acres	May June labor hours	Corn barrels	Corn silage tons	Hay tons	Pasture 30-cow-days	Additional investment	Net Revenue or Cost
Weanling pigs	22 sows			44.3	330.0				$1,650.	$2,992.00
18 month calves	15 cows			14.1	60.0		22.5	30.8		2,739.00
sell hay	308.3 tons					67.5	308.3	160.0		9,249.00
buy corn	390 barrels									- 2,340.00
corn - silage	67.5 tons	4.5		11.3						- 199.13
alfalfa hay	330.8 tons	73.5		683.7					3,308.	- 2,682.79
pasture	190.8 30-cow-days		31.8	25.4						- 456.01
Total of analysis		78.0	31.8	778.8	390.	67.5	330.8	190.8	4,958.	$9,302.07
tobacco		.75		80.0						819.15
Total for farm		78.75	31.8	858.8	390.	67.5	330.8	190.8	4,958.	$10,121.22
Less wages for full time hired labor										2,400.00
Net revenue for operator and for interest, depreciation, upkeep and taxes on real estate and machinery										$ 7,721.22

The limited supply of labor for the months of May and June was entirely utilized in the optimum program. In two other months, August and September, two full-time workers would be kept fairly busy. Approximately 3000 hours of labor would be required for the entire year for this optimum plan.

The operator has a house on the farm available for hired help. With this situation it is usually easier to hire a full-time man for the year than to hire occasional help by the month, week or day. Allowance is made in Table IV for a wage of $200 per month for a hired laborer. In addition the laborer would have free house rental and the use of a garden.

After deducting the wage for the laborer there remains $7,721.22 for the operator, and for interest, depreciation, upkeep and taxes on real estate and machinery. In Table V deductions are made for these items, most of which constitute non-cash charges. If an allowance is made for house rental and garden produce for the operator, and the above deductions are made, there remains about $2,200 for operator's earnings.

Because of the age of the operator fairly high depreciation rates are used. If he has no liabilities his net income is really $5,500.

At present the operator is carrying on with a small grain, corn, tobacco and beef cow-calf system, using occasional hired help when needed for crop work. A rough estimate of his returns under this system indicates that there is very little, if any, net income above all expenses including charges for depreciation and interest. Also, he is working considerably more than he would have to with the proposed optimum plan with a full-time hired laborer available. With the proposed plan he would have considerable time for management duties and for the ever-increasing leisure that a man

TABLE V

SUMMARY OF FARM INVESTMENT AND OPERATOR'S EARNINGS
FOR OPTIMUM PLAN FOR FARM II

FARM INVESTMENT AND SPECIFIC CHARGES

Items	Estimated value	Depreciation and repairs, and interest	
		Rate	Amount
Land	$20,000.00		
Buildings & Fences	20,000.00	8%	$1,600.00
Machinery	10,000.00	16%	1,600.00
Cows	3,000.00		
Sows	880.00		
Feed on hand	1,120.00		
Total	$55,000.00		
Interest		6%	3,300.00
Real estate tax			150.00
Total			$6,650.00
Net revenue from Table IV	$ 7,721.22		
Rental value of dwelling	1,000.00		
Estimate of garden produce	130.00		
Total	$ 8,851.22		
Operator's Earnings			$2,201.22

desires as he approaches the age of 70. His program would be less vulnerable in busy seasons if he became completely incapacitated. There would be a hired man to assist the operator's wife direct the completion of the year's operations.

Under the proposed plan there would be very little additional investment of a highly fixed nature. The brood sows would be readily marketable. The farrowing partitions could be sold as scrap lumber. A hay crimper could be sold in the second-hand machinery market. If the hay drying equipment consisted mainly of movable equipment it could undoubtedly be sold at depreciated values.

The proposed plan would be quite flexible, in that the livestock numbers and crop acreages could be reduced gradually, and some land rented to neighbors.

CHAPTER IV

DEVELOPMENT OF A CURRENT FARM PLAN FOR FARM IV

Past and Present Situation

This farm is an example of a situation where the labor forces of two generations were to be integrated into a going concern. A short description of this farm is already given in Chapter II. The operator is in the fourth stage of the life cycle and the son in the first stage. The age of the operator is 60 and that of the son is 30. Though the two families live in two different houses on the farm, they work the farm together. The size of the owned farm is too small to provide adequate employment for both of the families.

A small Grade-A dairy has been operated for the past several decades. The first son in this family sought an off-farm job and left home early for a University education. Therefore, the problem of expansion of the farm did not arise critically until the second son grew up.

The increased use of fertilizers and other improved practices resulted in higher crop and pasture yields and permitted some expansion in the size of the dairy herd. Two years ago the operator rented in 16 acres of alfalfa land and the last year he was able to rent in 34.5 acres from Farm V, the operator of which died a few years back. He is selling some alfalfa hay. However, the present size of the farm business is not adequate to provide full employment for two men. The operator has had considerable experience in dairying and was mostly interested in expansion of his dairy enterprise. He was willing to consider the alternatives of buying or raising cow replacements, and the possibility of adding a

feeder-pig-raising enterprise.

In view of the preferences of the operator and the probable changes in the life cycle in both of the families, an analysis has been made to determine the system of farming that will fully utilize their labor, satisfy their preferences and at the same time yield the highest possible net income with expected future average prices and costs.

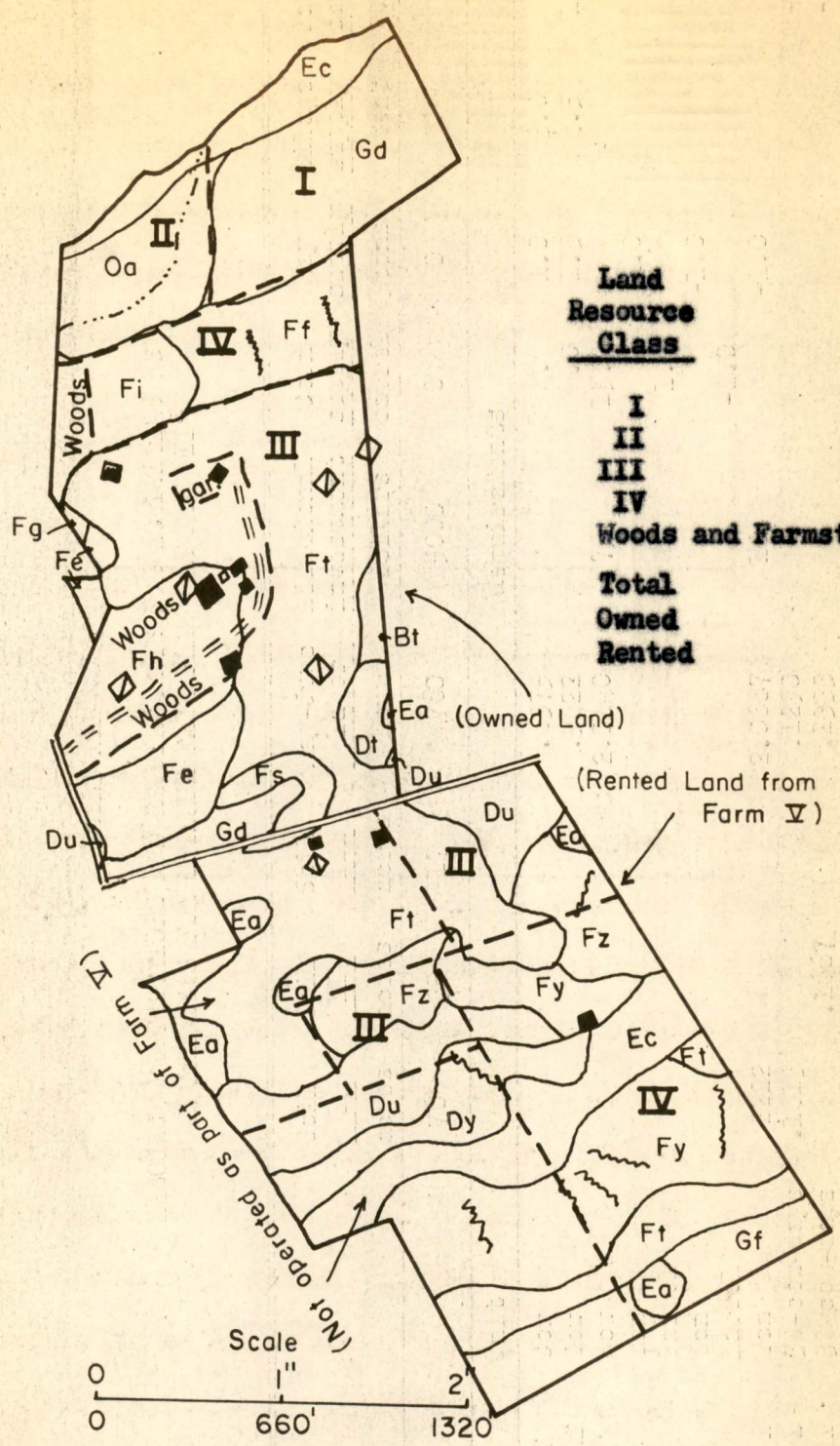
Tool Used for Current Planning

The same simplex method of linear programming technique that was used for Farm II was employed for determining the optimum plan for Farm IV.

Alternative Enterprise Budgets Selected for Consideration

In selecting the enterprises, due consideration was given to the preferences of the operator, his experience and his managerial ability. Two different methods of handling dairy cows, one for handling the hog enterprise, raising burley tobacco, raising corn silage and pasture for feed, raising corn and alfalfa hay for feed or sale as cash crops, and buying corn or hay for feed, were selected as potential enterprises. Raising of small grain was not included as the research data available shows that it would not compare favorably with corn or alfalfa in the situation existing on this farm. Raising weanling pigs for sale was selected because research results indicate that at prospective prices it is more profitable than feeding out market hogs.

Pasture was considered as land use for all land in the farm (excluding the farmstead). Corn and alfalfa were considered for the land best suited for these crops. The land area was divided into four classes on the basis of suitability for these crops and for pasture (see Figure 3).



Land Resource Class	Acres
I	12.3
II	6.5
III	42.97
IV	29.8
Woods and Farmstead	4.93
Total	96.50
Owned	62.00
Rented	34.50

Figure 3. Map of Farm IV showing soil areas delineated into four land resource classes.

The rented alfalfa land had to be considered for alfalfa only, inasmuch as the owners of this land specified that alfalfa was to be established thereon. The expected yields for crops and pasturage were determined in the same manner as stated for Farm II. In order that livestock numbers could be extended to increase the size of the total farm business, provision was made for purchase of corn and hay. Prices were selected in consultation with the farm management specialists at the State University. A distinction was made between selling and buying prices, as the farmer may not get the same price for their produce as the price at which they purchase the feeds. The quantities of inputs such as seed, feed, fertilizer and the like, and expected outputs of milk and pigs were also determined in consultation with the farm management specialists. The alternatives included in the analysis are presented in Table VI along with their units and expected net revenues or costs per unit of each activity.

It was the personal desire of the operator to retain his tobacco allotment of .67 acre. Hence this enterprise was not included while programming. The land and the labor resources required for the tobacco enterprise were first substracted from the total supplies of these resources. The net revenue expected from tobacco was included in the final computation of earnings.

Enterprise budgets were made for each of the various livestock and crop activities to obtain choice indicators that could be used to determine the optimum combination of enterprises. The results of this budgeting are presented in Table VI.

TABLE VI

ACTIVITIES AND NET REVENUES OR COSTS USED IN ANALYSIS FOR OPTIMUM FARM PLAN FOR FARM IV

Activities	Unit	Net returns[a] or cost Dollars
Dairy, raising replacements	Cow	386.50
Dairy, buying replacements	Cow	308.00
Raising feeder pigs (sow + 2 litters)	Sow	136.00
Selling hay	Ton	30.00
Selling corn	Barrel[b]	5.00
Buying hay	Ton	- 35.00
Raising alfalfa on Soil I	Ton	- 7.96
Raising alfalfa on Soil III	Ton	- 9.38
Raising alfalfa on rented land	Ton	- 7.50
Production of corn silage on Soil I	Ton	- 3.57
Production of corn silage on Soil II	Ton	- 3.33
Production of corn silage on Soil III	Ton	- 4.02
Buying corn	Barrel	- 6.00
Raising corn on Soil I	Barrel	- 2.21
Raising corn on Soil II	Barrel	- 2.05
Raising corn on Soil III	Barrel	- 2.75
Raising pasture on Soil I	30-cow-days	- 2.45
Raising pasture on Soil II	30-cow-days	- 2.48
Raising pasture on Soil III	30-cow-days	- 3.47
Raising pasture on Soil IV	30-cow-days	- 4.96

[a]The costs for intermediate products that may be used as feed, whether purchased or raised, are shown as minus revenues.

[b]One barrel is equivalent to 5 bushels.

Resource Restrictions

The operator has a full complement of machinery to raise the corn, silage, hay and pasture to be considered in the analysis. He has sufficient storage facilities for grains, silage and hay. The space for cows and pigs is limited but the operator is willing to erect some sheds as he has a good woodlot from which lumber may be obtained.

The operator has sufficient amount of home labor. He can hire some labor if need be. Thus there is no limit on labor supply.

There is no restriction on the operating capital but the additional investment capital is limited to $5,100. An additional investment of $75 per sow would be needed to provide the brood sow and shelter, fencing and equipment for her and the pigs. An additional investment of $10 in hay drying equipment, per ton of alfalfa hay produced, was estimated to be necessary in order to assure high quality hay for sale.

The limited resources and the requirements for these resources by the proposed activities included in the programming are presented in Table VII.

Results of the Analysis

The results of the analysis for Farm IV are presented in Table VIII. The final solution included 36.3 cows in the dairy enterprise where the replacements were to be raised, and 59.4 sows. These were rounded to whole numbers: 36 cows and 59 sows. The rounding out process did not exceed the resource limits, it only lessened the net revenue by about $160.

All resources would be completely utilized in the optimum plan. The entire area in soil groups I and IV would be used for pasture. Out of the

TABLE VII

RESOURCE RESTRICTIONS AND REQUIREMENTS FOR ACTIVITIES USED IN ANALYSIS FOR OPTIMUM FARM PLAN FOR FARM IV[a]

Limited Resources		Soil I	Soil II	Soil III	Soil IV	Rented land (Alfalfa)	Alfalfa supply	Corn supply	Corn silage supply	Pasture supply	Additional investment capital
Unit		acres	acres	acres	acres	acres	tons	barrels	tons	30-cow-days	dollars
Resource Restrictions		12.3	6.5	42.3	29.8	16.0	0.0	0.0	0.0	0.0	5,100
Activities	Unit	Requirements									
Dairy, raise repl.	Cow						1.9	6.8	4.5	8.0	
Dairy, buy repl.	Cow						1.25	6.0	4.5	7.0	
Feeder pigs	Sow							12.0		1.4	75.0
Selling hay	Ton						1.0				
Selling corn	Barrel							1.0			
Buying hay	Ton						-1.0				
Alfalfa, Soil I	Ton						-1.0				10.0
Alfalfa, Soil III	Ton						-1.0				10.0
Alfalfa, rented land	Ton					.2500	-1.0				10.0
Silage, Soil I	Ton	0.0714							-1.0		
Silage, Soil II	Ton		0.0667						-1.0		
Silage, Soil III	Ton			0.0909					-1.0		
Buying corn	Barrel							-1.0			
Corn, Soil I	Barrel	0.0714						-1.0			
Corn, Soil II	Barrel		.0667					-1.0			
Corn, Soil III	Barrel			0.0909				-1.0			
Pasture, Soil I	30-c-days	0.1408								-1.0	
Pasture, Soil II	30-c-days		.1429							-1.0	
Pasture, Soil III	30-c-days			0.2000						-1.0	
Pasture, Soil IV	30-c-days				0.2857					-1.0	

[a]The negative figures add the respective units of feed to the supply of the feed which is an intermediate product.

TABLE VIII

RESULTS OF ANALYSIS FOR OPTIMUM FARM PLAN FOR FARM IV

Activities	Supply	Requirements: Soil I (acres)	Soil II (acres)	Soil III (acres)	Soil IV (acres)	Rented land (Alfalfa) (acres)	Alfalfa (tons)	Corn (barrels)	Corn silage (tons)	Pasture (30-cow-days)	Additional invest. (dollars)	Net revenue or cost (dollars)
Dairy raise repl.	36 cows						68.4	244.8	162.0	288		$13,914.00
Feeder pigs	59 sows							708.0		82.6	$4,425.00	8,024.00
Buying corn	954 barrels											-5,724.00
Buying hay	5 tons											- 175.00
Alfalfa	63.7 tons					16.0					637.00	- 477.75
Silage	163.63 tons			14.9								- 657.79
Pasture	374.2 30-cow-days	12.3	6.5	27.4	29.8							-1,319.79
Total of analysis		12.3	6.5	42.3	29.8	16.0	68.4	952.8	162.0	370.6	$5,062.00	$13,583.67
Tobacco			.67									731.77
Total for farm		12.3	7.17	42.3	29.8	16.0	68.4	952.8	162.0	370.6	$5,062.00	$14,315.44[a]

[a]Net revenue for operator and for interest, depreciation, upkeep and taxes on real estate and machinery.

7.17 acres in soil group II, .67 acres would be utilized for tobacco and 6.5 acres for pasture. In soil group III, 27.4 acres would be used for pasture and the remaining 14.9 acres for production of corn silage. Sixteen acres of rented alfalfa land would also be completely utilized. In addition to the production of 63.7 tons of hay, 163.63 tons of silage, and 374.2 30-cow-days of pasture, the operator would have to purchase 954 barrels of corn and 5 tons of hay for feeding the cows and sows. The limited supply of capital would be used for purchasing sows, and shelter and equipment for the sows and pigs, and hay-drying equipment.

The capacity of the present cow barn is limited to 25 cows and 9 heifers. Since there is plenty of timber on the farm to supply the needed lumber, the present shed can be easily extended to accommodate the additional cows. Shelter and equipment for each sow and her pigs ($35 per sow) and the value of the sow ($40 per sow) are included in the restrictions of additional capital per sow ($75). The optimum plan including the tobacco enterprise would require 5,274.5 hours of labor per year. Each man would have to put in about 2,637 hours in a year. Thus the plan would provide full employment for most months for both the persons. A sum of $14,315.44 would remain for the operator, and for interest, depreciation, upkeep and taxes on real estate and machinery as shown in Table VIII.

A summary of farm investment and operator's earnings for the optimum plan for this farm is presented in Table IX. As it is a going concern, somewhat lower depreciation rates are used for this farm than for Farm II. If an allowance is made for house rental and garden produce for both of the operators and the appropriate deductions for interest, depreciation, upkeep and taxes on real estate and machinery are made, there

TABLE IX

SUMMARY OF FARM INVESTMENT AND OPERATOR'S EARNINGS
FOR OPTIMUM PLAN FOR FARM IV

FARM INVESTMENT AND SPECIFIC CHARGES

Items	Estimated value	Depreciation and repairs, and interest	
		Rate	Amount
Land	$ 3,600.00		
Building and Fences	15,000.00	6%	$ 900.00
Machinery	8,000.00	12%	960.00
Dairy equipment	3,000.00	15%	450.00
Hog shelter and equipment	2,000.00	15%	300.00
Cows	10,800.00		
Sows	2,360.00		
Feed on hand	3,240.00		
Total	$48,000.00		
Interest		6%	2,880.00
Real estate tax			80.00
Rent on rented land			505.00
Total			$6,075.00
Net revenue from Table VIII	$14,315.44		
Rental value of both dwellings	1,200.00		
Estimate of garden produce	260.00		
Total	$15,775.44		
Operator's earnings (for two operators)			$9,700.44

would be $4,850.22 for operator's earnings for each operator.

If we assume that there are no liabilities there would be an income, including perquisites, to both families of $12,580. The interest on investment is of course income to the father and son proportionately as they share in the ownership of the assets.

At present, the operator is carrying on with small grain, corn, and sale of alfalfa, tobacco and milk from 25 dairy cows. A rough estimate of operator's earnings for each operator amounts to about $3,300. Moreover, the present plan does not provide them full employment. With the proposed plan, the operator's earnings per operator would be increased nearly 50%. It will also provide full employment for both father and son most of the year, with a maximum of 282 hours per man in August.

The proposed plan would have sufficient flexibility for the family life cycle. As the father's physical ability declines, the children in the son's family would be reaching the age at which they could gradually replace the father's labor. Thus at least some of the growing labor force could be absorbed, and the setting up of another father-son partnership facilitated. The full amount of the fixed investments could be expected to be used in as much as the business will very likely be a continuing concern.

CHAPTER V

SUMMARY AND CONCLUSIONS

One of the objectives of this study was to investigate the influence of the family life cycle on farm organization and to show that the farm organization is somewhat related to the stages of the family life cycle. Eleven farms in one community about 20 miles west of Knoxville, about which some historical information was available in the Department of Agricultural Economics, University of Tennessee, were selected for study. The situations on these farms demonstrate some phases of the impact of the family life cycle upon the farm organization. The farm organization and the systems of farming underwent certain changes on some of these farms when the family moved from one stage of the life cycle to another. In some cases an expanded farm business with a father-son set-up resulted. On other farms when timely adjustments were not made during the transitional stages of the life cycle to meet the probable future changes in the family labor force, the entire labor force sought outside employment, the land was rented out, and the farm really ceased as a separate operating unit.

Variations in a particular community may not be representative of the conditions all over the state of Tennessee. It was noticeable that the case study did not include examples of stage one and two and, therefore, no detailed examination of farms for these examples were made.

It is conceivable that young men starting out by themselves will be fewer in the future, because of the big trend toward larger farms, increased mechanization, and resulting greatly increased investment. Under these conditions it is probable that the father-son combination may prevail to a greater extent in the future, thus enhancing continuity in the organi-

zation on family farms and decreasing the extent of disruption so often caused by advancing age of the farm operator.

As a part of this study two situations were selected for detailed analysis to determine adjustments that would provide optimum net income with due consideration for present and future stages in the family life cycle. One of these represents a situation in which the operator was in the fourth stage of the life cycle, had no sons to take over the farm, and who decided to curtail the labor intensity of the farm operations with the least possible reduction in net income. The other situation was one in which a father-son partnership was in effect, but neither the size of the farm nor the income was adequate for two families. One farm for each of these two situations was selected from the group of eleven case-study farms for detailed study in regard to historical changes and for carrying through formation of current plans to fit the present and probable future stages in the respective families. In preparation of the plans due consideration was given to preferences of the operators, to the resources at their disposal, and to the present situation and probable future changes in the family life cycle. A good deal of flexibility was included in the proposed plans so that adjustments could readily be made. It was pointed out in the study that the proposed plans would increase the net income considerably over that obtained from the present system of farming on these farms.

As a result of this study the following conclusions may be drawn:

1. The solution of problems of farm organization arising out of the changes in the family life cycle could be facilitated by a succession of optimum farm plans worked in the light of the future changes in the life cycle of the family. Careful selection of enterprises and introduction of

a certain measure of flexibility into the farm plans to provide for continuing adjustments as the family changes in nature and in ages of its various members, would tend to help the family solve its farm organization problems and to become successful throughout its career.

2. Linear programming would be a very useful tool to use in preparing the farm plans for the various stages of the life cycle, mainly because of the precision involved in this method of analysis. When there are a number of restrictions in available resources, and a considerable number of alternative income-producing activities to choose from, the simplex method of analysis greatly facilitates precise determination of an optimum net income plan, with a minimum of time involved in necessary computations. Also, it should be pointed out that changes in the nature of these restrictions and alternatives from time to time are caused to a large extent by the changes in the family life cycle.

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APPENDICES

APPENDIX A

APPENDIX A

TOOLS OF FARM PLANNING

The basic objective in farm planning is to efficiently utilize farm resources that are available or potentially available and to eliminate maladjustments, thereby maximizing income and satisfaction. Returns to a particular farm can be maximized only if enterprises are selected in such a way that resource requirements are matched against the resource availabilities.

In planning a farm the following tools are generally used:

1. Partial Budgeting
2. Complete Budgeting
3. Linear Programming

Partial Budgeting

In this system of farm planning some phases of the farm operations are examined to make minor shifts without reconsidering the total farm set-up. It refers to estimating the outcome or returns for a small part of the business.[1] The results will not indicate the complete earnings or returns that may be expected from the adoption of any one of the plans.[2] It suggests only the difference that the adjustment will make in the total farm earnings. Only additional changes in the quantity of resources need

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[1]E. O. Heady and H. R. Jensen, Farm Management Economics (Englewood Cliffs: Prentice-Hall, Inc., 1957), p. 92.

[2]Andrew Boss and George A. Pond, Modern Farm Management (Saint Paul: The Webb Publishing Company, 1951), p. 214.

to be examined under partial budgeting. When using this method care should be taken to be certain that all phases of the business that are affected are analyzed.

Complete Budgeting

"Complete budgeting" state Heady and Jensen, "refers to making out a plan for the whole farm or for all decisions of one enterprise."[3] It involves bringing about desirable changes in the organization and operation of the entire plan, the comparison of expected expenditures for the enterprises to be introduced with their expected returns and formulation of schemes for carrying them out during a future period of time. It is useful as a method of estimating the financial gains of using one organization of the farm as compared to another organization. The farm budget, in addition to considering the farm as a unit, takes into account the complementary, supplementary and competitive relationships among enterprises. But budgeting proceeds peacemeal by considering in sequence each part of the farm business, and simultaneous consideration of the specified available resources and alternative products is not possible.[4] In budgeting, a person cannot be certain that he has discovered the optimum combination of enterprises. Budgeting can compare only the results of the budgets developed and there is a possibility of failure to even consider the most profitable combination of enterprises.

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[3]Heady and Jensen, op. cit., p. 92.

[4]Earl A. Swanson, "Integrating Crop and Livestock Activities in Farm Management Activity Analysis," Journal of Farm Economics, XXXVII (December, 1955), 1249.

Linear Programming

"Linear Programming," defines Dorfman,[5] "is the analysis of problems in which linear functions of a number of variables are subject to a number of restraints in the form of linear inequalities."

It is a recent empirical tool introduced in agricultural economics. Linear programming is used either for profit maximization or for cost minimization subject to linear inequalities. A linear programming problem includes three quantitative components: (1) an objective (2) alternative processes or resource use and (3) resource restrictions.[6]

In linear programming the optimum combination of enterprises can be discovered only if all possible alternatives are included in the analysis. If all of these possibilities are included, linear programming has an advantage over the conventional comparison of budgets in that the optimum combination of the enterprises can readily be ascertained precisely.

Linear programming is a mathematical technique permitting simultaneous consideration of many possible productive enterprises, practices, input-output coefficients, and prices. It determines the most profitable plan with due consideration for capital, land, labor and other restrictions on the farm.

The assumptions used in linear programming include: additivity, linearity, divisibility, finiteness, and single value expectations. These

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[5]Robert Dorfman, P. A. Samuelson and R. M. Solow, Linear Programming and Economic Analysis (New York: McGraw-Hill Book Company, Inc., 1958), p. 8.

[6]Earl O. Heady and Wilfred Candler, Linear Programming Methods (Ames: Iowa State College Press, 1958), p. 2.

are explained in numerous publications. One excellent explanation is in Heady and Candler.[7]

[7]Heady and Candler, op. cit., pp. 17-18.

APPENDIX B

APPENDIX B

PRICES OF FARM PRODUCTS USED IN THE ENTERPRISE BUDGETS

Item	Unit	Price
Hay purchasing	Ton	$ 35.00
Hay selling	Ton	30.00
Corn purchasing	Barrel	6.00
Corn selling	Barrel	5.00
Weanling pig	Each	8.00
Old sows	Each	40.00
Beef calves 9 months old	Cwt.	20.00
Beef calves 18 months old	Cwt.	22.00
Cull beef cows	Each	150.00
Cull dairy cows	Each	120.00
Replacement dairy heifers	Each	250.00
Dairy calves	Each	20.00
Grade-A milk	Cwt.	4.75

APPENDIX C

APPENDIX C

ENTERPRISE BUDGETS

1. DAIRY

Description	Farm IV	
	Dairy, raise replacement	Dairy, buy replacement
Selected items of expenses		
Milk hauling	$ 18.00	$ 18.00
Breeding fee	7.00	7.00
Veterinary	5.00	5.00
Protein feed	24.00	24.00
Bedding	3.00	3.00
Calf feed	9.00	
Salt and Misc.	20.00	20.00
1/4 replacement heifer		62.50
Total	$ 86.00	$139.50
Revenue		
Milk, 900 lbs.	$427.50	$427.50
3/4 calf	15.00	
calf		20.00
1/4 cull cow	30.00	
Total	$472.50	$447.50
Net revenue over the above expenses per cow	$386.50	$308.00

APPENDIX C (continued)

2. BEEF CATTLE AND HOGS

Description	Farm II		Farms II and IV
	Beef cow 9-month 500# calf	Beef cow 18-month 1000# calf	Sow 16 weanling pigs
Selected items of expenses			
Marketing expenses	$ 2.80	$ 4.00	$ 11.50
Veterinary and Misc.	1.35	1.35	4.20
Mineral and salt	.85	1.10	.30
Supplement		5.00	2.00
Bedding	2.40	2.75	5.50
Depreciation on sire	2.00	2.00	.50
Total	$ 9.40	$16.20	$24.00
Revenue			
Sale of calf or 15 pigs	$100.00	$220.00	$120.00
79% of calf a/	79.00	173.80	
1/6 of old sow or old cow b/	25.00	25.00	40.00
	$104.00	$198.80	$160.00
Net revenue over the above expenses per cow or per sow	$ 94.60	$182.60	$136.00

a/95% calf crop is assumed and 16% replacement of brood cows.

b/2 litters of 8 pigs each saved; one gilt kept to replace old sow.

APPENDIX C (continued)

3. PASTURE FARM II

Description	Soil I	Soil II	Soil III
Establishment			
Seed and inoculation	$ 7.95	$ 7.95	$ 7.95
Fertilizer	21.30	21.30	21.30
Lime	6.60	6.60	6.60
Tractor operation	2.40	2.40	2.40
Total	$38.25	$38.25	$38.25
one-tenth	$ 3.83	$ 3.83	$ 3.83
Maintenance			
Fertilizer	$ 9.15	$ 9.15	$ 9.15
Tractor operation	1.38	1.38	1.38
Total	$10.53	$10.53	$10.53
Maintenance and establishment	$14.36	$14.36	$14.36
Yields per acre, 30-cow-days	6.2	6.0	4.0
The above costs per 30-cow-days	$ 2.30	$ 2.39	$ 3.59

APPENDIX C (continued)

4. PASTURE FARM IV

Description	Soil I	Soil II	Soil III	Soil IV
Maint. and one-tenth estab.	$14.36	$14.36	$14.36	$14.36
Putting up 1st crop as grass silage	3.00	3.00	3.00	3.00
Total	$17.36	$17.36	$17.36	$17.36
Yields per acre, 30-cow-days	7.10	7.00	5.00	3.50
The above costs per 30-cow-days	$ 2.45	$ 2.48	$ 3.47	$ 4.96

APPENDIX C (continued)

5. ALFALFA

Description	Farm II	Farm IV		
	Soil I	Soil I	Soil III	Rented land
Selected items of expenses				
Fertilizer	$15.00	$11.00	$12.50	$10.00
Estab. (1/5)	5.50	5.50	5.50	5.50
Tractor operation	7.50	6.25	6.25	6.25
Tractor operation for estab. (1/5)	.75	.75	.75	.75
Bailing twine	3.25	2.50	2.00	2.50
Hauling and storing	4.50	4.00	3.00	5.00
Total	$36.50	$30.00	$30.00	$30.00
Yields per acre, tons	4.50	3.9	3.2	4.0
The above costs per ton	$ 8.11	$ 7.69	$ 9.38	$ 7.50

APPENDIX C (continued)

6. CORN SILAGE

Description	Farm II	Farm IV		
	Soil I	Soil I	Soil II	Soil III
Selected items of expenses				
Seed	$ 2.50	$ 2.50	$ 2.50	$ 2.50
Fertilizer	16.80	16.80	16.80	16.80
Ammonia nitrate	11.70	11.70	11.70	11.70
Tractor operation	13.28	13.28	13.28	13.28
Extra hauling	____	5.74	5.74	____
Total	$44.28	$50.02	$50.02	$44.28
Yields per acre, tons	15.0	14.0	15.0	11.0
The above costs per ton	$ 2.95	$ 3.57	$ 3.33	$ 4.02

APPENDIX C (continued)

7. CORN

Description	Farm II	Farm IV		
	Soil I	Soil I	Soil II	Soil III
Selected items of expenses				
Seed	$ 1.80	$ 1.80	$ 1.80	$ 1.80
Fertilizer	12.00	12.00	12.00	12.00
Ammonia nitrate	11.30	11.30	11.30	11.30
Tractor operation	5.28	5.28	5.28	5.28
Extra hauling	____	.62	.42	____
Total	$30.38	$31.00	$30.80	$30.30
Yields per acre, barrels	15.0	14.0	15.0	11.0
The above costs per barrel	$ 2.02	$ 2.21	$ 2.05	$ 2.75