SMALL FARMS IN MICHIGAN:

A Proposal for Research

by James Chapman

Plan B Masters Thesis

TABLE OF CONTENTS

PART I

Introduction

The operators of small farms play an important role in determining Michigan's agricultural production. Approximately one third of the State's gross farm sales originate from small farms. Yet small farms are relatively less efficient and less productive than commercial farms. Crop yields are lower and a smaller percentage of cropland results in harvested crops. If greater land productivity and larger agricultural output are desirable from Michigan farms, they could come from small farms provided that physical production inputs are available to the operators in sufficient quantities at reasonable prices, and that small farmers can learn and use good managerial techniques in order to achieve greater productivity.

Thompson and Hepp (1976) define a small farm as over 10 acres of farmland grossing between $50 and $20,000 per year from sales of agricultural products and services (1969 prices). Of the approximately 66,000 small farms, 57% are operated by people who have full-time, off-farm employment and whose farms are a secondary source of income. Farmers over 64 years of age or on social security whose farming activities have declined, own 17% of Michigan small farms. The remaining 26% of small farms are controlled by full-time farmers who have less than 100 days off-farm employment per year.

It would be wrong to assume that the only matter needing attention with regard to small farms is that of increasing agricultural production. Small family farms are held in high regard in our society, as witnessed by the current abundance of testimony and legislation purporting to help save the small family-owned-and-operated farm (U.S. House of Representatives, 1972, 1976; U.S. Senate, 1975-1976). The terms "small farm" and

"family farm" are not synonymous, although there is certainly a great deal of overlap. The issues raised are: (1) size of operation and (2) land tenancy. Both of these issues can and should be treated simultaneously. The small family farm corresponds closely to the image that people have of what has been traditionally called a family farm.

The high value and commitment to this type of farm organization is not based largely or exclusively on tradition or emotion. The commitment to "small" family farms was made in the earliest days of our nation, and was a conscious political and ideological (and practical) decision based on what was considered to be the best economic and social organization of agriculture. Reflected in this position was a desire to minimize class differences and the concentration of wealth and power.

Problem Setting

The "small farm problem" is part of the outcome of changes that have taken place in U.S. agriculture mainly in the last four decades. Agricultural research and extension have been oriented towards increasing productivity, which has led to mechanization and the pursuit of economies of size. Technological changes and their pursuant effects on cost and price structure have led to increases in the minimum size of an economically viable farm unit. Farmers who have not increased the size of their farms, mechanized their operations, or otherwise updated their farming practices became noncompetitive and eventually dropped out of the main stream of farming, i.e., became small farmers. The structure of U.S. farms has changed from a large number of small farms, relatively equal in resources and output, to a concentration of production on a minority of the largest farms.

Agricultural economists have tended to focus on the monetary aspects of small family farm organizations, conceptualizing the problems that

small farmers face in terms of income and enterprise organization.
Recommendations have generally been along the lines of seeking higher-
paying occupations outside of agriculture, or expansion in agriculture
(Schultz, 1953; Brewster, 1945).

Defining the Small Farm

What is a small farm? What do people identify with when the term
is used? The great diversity of types of farms that could possibly
fit into a small farm category prevent the use of a simple definition.
Also, there is a high degree of overlap among small farms, family farms
and part-time farms which tend to confuse popular notions as to the
nature of small farms.

There are a number of dimensions pertaining to farms which can be
examined to aid in formulating operational definitions. Such dimen-
sions include family income levels, total family wealth, total value
of farm assets, physical size of the farm, gross farm sales, percen-
tage of labor effort allocated to farm activities, and others. For
example, part of a relevant definition of a small farm population could
specify the inclusion of only those families with total incomes below
a poverty level, with most or all of their income derived from farm
activities. There could also be physical size limitations appropriate
to the enterprises being undertaken.

Small farms are most commonly defined in terms of gross sales.
Thompson and Hepp (1976) placed a $20,000 gross sales limit in their
1974 Michigan study, while a U.S. Senate Report (1976) also included a
$5,000 minimum gross farm sales level. The $5,000 minimum effectively
eliminates many part-time and hobby farms from consideration, but may
also exclude some of the poorest farm families that should benefit from
any small farm programs that may be undertaken.

It is necessary to point out that any definition of a small farm should not be static. If dollar limits on gross sales are used in the definition, they should be in terms of real dollars.* Furthermore, since farm income may be a major dimension of small farm problems, perhaps the most relevant figure would be minimum net income, measured in terms of goods and services rather than dollars due to regional price differentials.

Small farms have often been identified as being "nonviable" in the long run because they do not provide many families with satisfactory incomes. This notion would seem to indicate that the incidence of small farms is a temporary phenomenon. For many farmers this is probably true, and studies of part-time farmers have identified a group of formerly full-time farmers who take non-farm jobs as the first step in the exit from farming process. However, small farms now seem to be persisting beyond the time needed for adjustment out of agriculture. Hottel and Reinsel (1976) suggested several reasons for the continuance of small farms with negative or low returns to labor and capital:

(1) Non-farm income is relatively more important than farm income (see Figure 1). The small farm is not just a producer of goods, but also of services such as custom work as well as off-farm labor.

(2) Farm land and housing are mainly consumption items for those in non-farm activities. Studies of part-time farmers have revealed a significant group who are primarily non-farm workers, but who live on farms (Bertrand, 1967).

---

*For continued discussion on this point, see section on problems in determining numbers of small farms.

(3) The potential for gains in land due to value appreciation may outweigh the importance of returns to labor and capital.

(4) Non-monetary factors may be so important that some farmers are prepared to accept lower returns to capital, labor and management than could be earned if resources were allocated to some other career alternative.

It should be remembered that the above reasons given for the permanence of small farms probably refer to the different "types" of small farms. One might question as to whether land being held mainly for speculation purposes would really qualify in the "spirit" of the small farm definition.

The Target Population

Reasons for studying small farms and farm families will be given in another section of this paper. There are needs on both individual and societal levels which must be given consideration when choosing the most appropriate target group or groups to investigate. Resources for small farm research are limited, and should be allocated where the possibility exists of attaining the greatest social benefit. Measuring social benefit is extremely difficult due to the "some gain, others lose" nature of changes which take place in the real world.

Researchers cannot escape making value judgements about the institution, human and technological organization of society. For purposes of this study, decisions will be made as to the limits of what will be called a "small farm" according to those dimensions that the author believes to be most important.

Figure 1. Distribution of Income per Farm Operator Family and of Number and Percent of Farms by Value of Sales Classes, United States, 1975

INCOME ($), Off-farm income Realized net farm income								
Number of farms (000)	729	485	254	326	565	339	110	2808
Percent of farms	25.9	17.3	9.1	11.6	20.1	12.1	3.9	100
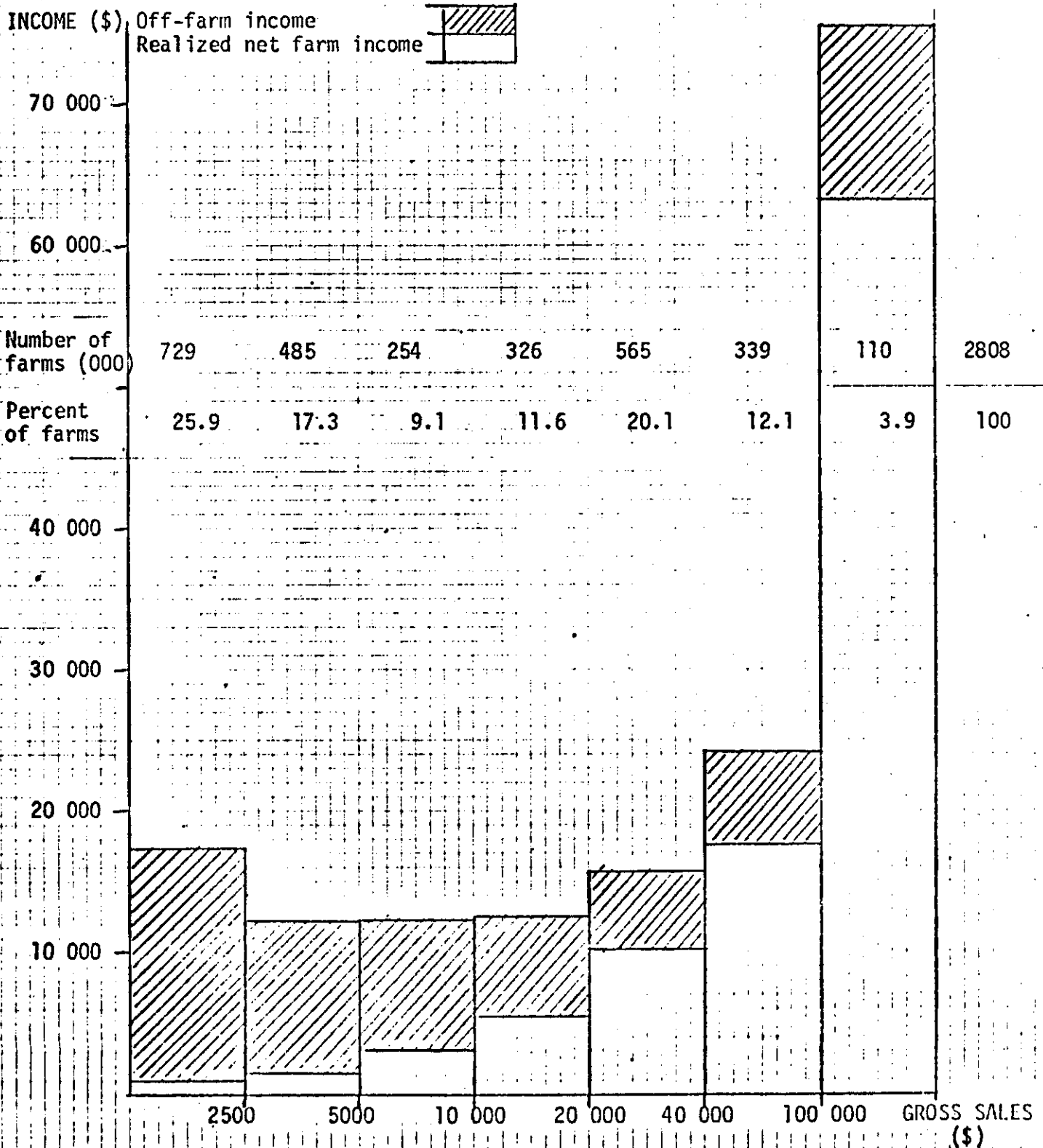
SOURCE: U.S. Department of Agriculture (1976 :58-59).

The target population shall be defined as those farms:

1. whose families receive a total net income from all sources of less than $20,000. A special effort will be made to encounter farm families living with incomes at or below regional poverty levels.

2. whose enterprise levels (numbers of livestock, acres in crops) are low in comparison to other farms in the same region. They should be in the lower 1/3 of farms categorized by size of operation.

3. whose families earn their livelihood principally from farming. At least 80 percent of farm labor should be performed by family members, and off-farm income should not exceed more than 1/2 of total family income.

The farms satisfying the requirements stated above shall be called "small, full-time family farms." This does not mean that the head of the family is necessarily a farmer. The emphasis is a family labor. There are also no requirements with respect to tenancy -- small farms may be rented as well as owned. There is no minimum farm income requirement, though the researcher will seek to work with families who are committed to farming both as a lifestyle and as a source of income. There are no minimum or maximum age requirements, though the researcher will seek families with a "future" in farming (not wanting to disinvest within 10 years).

Reasons for Studying Small Farms

Before embarking on small farm research, one should ask if there is any need for doing so. Is there something about small farmers that sets them apart from the rest of society? Do they have special problems that need to be dealt with in unusual ways? What will be the returns to society on resources spent on small farm research?

The possible benefits of the solution or alleviation of small farm problems will accrue to different groups.

To Society: Changing conditions in U.S. and world agricultural production in recent years have caused changes in the ways in which policy makers look at problems relating to agriculture. While world and U.S. stockpiles of food have diminished, world demand for U.S. food has increased. This increased demand has led to higher food prices on world markets and in the U.S. while the supply of food has remained relatively constant. Meteorlogists are predicting a decade of "bad" weather for agriculture. These situations have led to new pressures for changes in U.S. agricultural policy toward fomenting increases in food and fiber production. While the desired supply response can come partly from increasing the land area in production, greater emphasis must also be placed on increasing the productivity of land currently under cultivation. It has been documented by Thompson (1975) and others that yields are substandard on many small farms. Policies, educational programs and the design of appropriate technology may encourage greater productivity on small farms and hence increase the efficiency with which our natural and human resources are being utilized.

Many people are concerned about the structure and control of agriculture as it relates to the overall performance of the U.S. food and fiber system. The basic question is whether a dispersed production and marketing system will prevail in the U.S., or whether production and marketing will be concentrated in a relatively small number of larger firms (North Central Public Policy Committee, 1972). The criteria for choice concern the value and goals of all affected people, not just small farmers. The decision as to the structure of agriculture must

be made by the public. A decision to "leave it to the market" is in fact, a vote for concentration due to the already existing inequities in the distribution of economic power. Should society decide to adopt policies to preserve the small family farm, institutions should also be developed to ensure equal bargaining power with input suppliers and marketers, whose industrial structure is very concentrated.

Paul Barkley (1976) stated still another reason for preserving small family farms that this author finds a bit distasteful but true. The reason is that family farms are flexible, can (and do) accept extremely low returns to their capital and labor, and provide a "shock absorber" for society in times of adversity. Due to the biological nature of agricultural production, the specialized nature of farm productive resources (i.e., corn picker, hay rake) and the low opportunity value of specialized resources off the farm or in other enterprises, production of food and fiber continues even as output prices become severely depressed. After harvest, the payment of some fixed costs of production, return on investment and even family labor costs are subject to deferral. Corporate and large commercial farms generally operate high volume, low profit margin enterprises with hired management and labor costs not subject to deferral. These organizations would soon expire in times of sub- stantial adversity.

Stability in the food supply can be better maintained with an agricultural structure consisting mainly of small units. However, the small family farm has found itself in an extremely exploitable position. It has been asserted that the small family farm is really a trap - coercing people to perform great amounts of labor at extremely low returns (Johnson, 1976a). The problem with this assertion, though it is true to a certain extent, is that it defines small farm problems strictly in terms of monetary returns to labor, capital and management.

There are other perhaps more important dimensions of the small farm situation which need to be examined.

Barkley believes that the small family farm should survive and prosper because the negative social consequences of not having an exploitable food-producing class are too great. His argument, then, rests on non-economic as well as economic grounds. He suggests that perhaps society should pay a subsidy to farmers in order to distribute the costs of food production more equitably.

To Rural Areas: It has been well documented that tremendous changes are taking place in rural communities, in part due to changes that have taken place in agriculture (e.g. Clawson, 1975; Shover, 1976). Population decreases come about due to decreases in farm numbers (and hence farm population) and to further decreased employment opportunities as rural residents shop and seek services in larger and more distant towns, bypassing the smaller and more local towns. Incentives to community participation by individuals are being lost. Little research has been done on the effects on rural communities of a small farm versus large farm regional agricultural structure. Goldschmidt's study (1946) is a notable exception, and offers evidence that the permanence of a significant number of small farms in rural communities contributes very favorably to the social and economic viability of those communities.

To Small Farm Families: This last category includes the target population for the research. Research that contributes to the solution and/or alleviation of properly identified small farm problems will benefit this group a great deal in terms of providing opportunities for earning adequate family incomes while pursuing other non-monetary goals.

The preceding list of reasons for embarking on small farm research is certainly not all inclusive nor complete. Some basis, however, has been established to justify the use of public resources in studying the problems prevalent on small farms.

Conceptual Problems and Informational Needs*

Many problems arise at the outset of conducting research on small farms. Questions as to the basic nature and definition of the target population must first be answered. In this section, some questions will be raised, the answers to which are critical in guiding small farm research.

1. What is a "small" farm?

In order to be able to look at solutions designed to alleviate the problems of small farmers and their families, an operational definition of the word "small" needs to be presented. The answer to this question will have an impact upon the number of small farms identified; their social and economic characteristics; the types and magnitudes of their problems, the social consequences flowing from alleviation or non-alleviation of their problems; and the amounts of resources necessary to solve their problems.

2. What are the major "types" of small farms?

Numerous adjectives are used to modify the word "farm" in reference to "small" farms. Some of these include part-time, low-income, limited resource, subsistence, retirement, rural resident, hobby, senior citizen, supplemental income and full-time [e.g. Thompson and Hepp, 1975]. The classification of small farms and farmers into different categories is an essential pre-condition to small

---

*Much of this section is based on information contained in Rodefeld (1977).

farm research, as problems, magnitudes of problems, causes of problems, programs and policies aimed at alleviating problems and consequences of alleviating or not alleviating problems may differ among small farm types. Different programs may have to be designed for different types of small farms.

3. How many small farms are there, and what are their major characteristics?

Significant work has been done by Thompson and Hepp (1975) in Michigan which provides some of the basic descriptive information needed. Some types of information about small farmers need to be presented in greater detail - what are small farm family goals, aspirations, needs and problems, causes of problems, implications of problems, and the fundamental ways that small farmers differ from larger farmers.

4. What kinds and magnitudes of problems do small farm families face?

The "small farm problem" has been referred to in conversation and in the literature. One may be led to believe that the small farm _is_ the problem, and that the best way to alleviate it is to get rid of small farms via transfer of small farm families out of agriculture and into non-farm occupations or help them to increase the size of their operation. It can be hypothesized that due to severe capital limitations on many small farms, the second option is not usually a viable one.

Assuming that the small farm itself is not the problem, and there is good reason for doing so, then there is a need to investigate the problems that small farmers and their families face in order to ascertain the extent to which supportive programs are needed. Thus far, very little research has been carried out on small farm problems as perceived by small farmers and their families.

It is quite possible that public perception of small farm problems does not coincide with the perceptions held by small farm families. It has become increasingly evident that the ideas and values of the target population must be given consideration when dealing in an interactive dynamic development process.

5. What are the major causes of problems encountered by small farm families?

If small farm problems are to be effectively dealt with, information must be made available as to which are the major causal factors behind the problems. Since any problem will contain multiple causal roots, attempts should be made to determine the most important causes and to allocate the greatest amount of resources to attack them. If the deep-seated causes are not confronted, or are confronted incorrectly, alleviation of small farm problems is unlikely to take place.

6. What will be the consequences to society and to small farm families of solving (not solving) small farm problems?

What is needed here is determination of the benefits and costs of taking or not taking action to eliminate the causes of specific small farm problems. It is likely that resources will not be available to address the problems of all types of small farms simultaneously and with the same vigor. Decisions will have to be made on the allocation of scarce resources. Problems of the greatest magnitude and those with the most far-reaching consequences should receive the highest priority. Implications exist also with regard to the levels of resources that should be allocated to small farm research versus other types of research. Investigations in this area may demonstrate the magnitude of small farm problems to be much greater and have far greater negative consequences for society than is presently supposed.

7. What programs and/or policies can be designed and implemented to

    alleviate or solve small farm problems?

    The answer to this question will provide the basis for guiding

    future small farm research. However, it is difficult or impossible

    to shed much light here until most or all of the previously stated

    questions have been answered. We need information on the institu-

    tions, behavior and performance of the small farm system, and to

    understand interactions and motivations, before programs and policies

    can be devised and their validity tested. It is suggested that the

    information gathered in answering the previous questions be used

    to build a research "laboratory" - in this case a system model -

    to be used to test the effectiveness of different public programs

    and policies in alleviating small farm problems as well as give

    indications as to ways in which small farmers and their families

    can organize to alleviate some of their own problems and to main-

    tain or improve their viability in agriculture.

Characteristics of Michigan Small Farm Families

In this section, an attempt will be made to summarize some charac-

teristics of Michigan small farms as presented in research report by

Thompson and Hepp (1976).

Types of small farms

There are numerous types of small farms, which Thompson and

Hepp classified as follows:

Rural residents - Person under 65 years of age, working more
than 100 days/year in non-farm employment, with annual farm
sales less than $2,500.

Supplemental income farmers - Person under 65 years of age,
working more than 100 days/year in non-farm employment, with
annual farm sales between $2,500 and $20,000.

Senior citizen farmers - Persons receiving Social Security or
over 64 years of age with annual farm sales of less than $20,000.

Full-time small farm operators - Person under 65 years of age, working less than 100 days/year in non-farm employment, with annual farm sales of less than $20,000.

Small farmers in the "rural resident" category accounted for 22% of all farmers in Michigan in 1969, the largest percentage of any type of farm including large commercial farms. Full-time small farmers, on the other hand, controlled more crop-land than any other type of small farm and had the highest average net worth in the small farm category (see Tables 1, 2, 3). Full-time farm families also reported the lowest average net income per farm family (Table 4).

Family Incomes

Almost 1/2 of the full-time farm families and 1/3 of the senior citizen families reported incomes from all sources below $5,000 in 1973. It would be fair to say that poverty does exist on some Michigan small farms, primarily restricted to the previously mentioned categories. More detailed studies are necessary to determine whether farm families in a poverty situation are located mainly in certain geographical areas, or if the lowest-income farms are spread fairly evenly through-out the state's agricultural areas.

Reasons for living in a rural area

When asked why they were living in a rural area, the majority of all types of small farmers expressed the appreciation of rural life as a primary motive. Unfortunately, the farmers were not asked why they chose farming as an occupation ver-sus some other non-farm vocation. With the dispersion of industry, especially in lower Michigan, it is not uncommon to find people living in rural areas while earning 100% of

Table 1. Number and Percent of Michigan Farms by Operator
Characteristics, 1969

Farm Size	Operator Characteristics	Number of Farms	Percent of Total Farms
Commercial	Full Time Farmers	11434	15
Small			
	Senior Citizens	11439	15
	Full Time Farmers	17077	22
	Supplemental Income	15341	20
	Rural Residents	22637	29
	Total	77928	100

Source: 1969 Michigan Census of Agriculture.

Table 2. Percent of Cropland Use By Operator Characteristics,
Michigan 1969.

Farm Size	Operator Characteristics	Percent of All Cropland
Commercial	Full Time Farmers	35
Small		
	Senior Citizens	10
	Full Time Farmers	22
	Supplemental Income	20
	Rural Residents	13
Total		100

Table 3. Farm Assets, Debts and Net Worth For Families on Small Farms, 1974 Survey

	Rural Resident	Supplemental Income	Senior Citizen	Full Time	Total Small Farm
Land and Farm Buildings	$40,970	$61,020	$50,410	$63,660	$53,723
Machinery	3,760	10,890	5,000	14,810	8,488
Livestock	1,230	5,530	3,570	10,700	4,913
Total Assets	$45,960	$77,440	$58,980	$89,170	$67,124
Farm Debt	7,280	6,380	950	5,410	5,352
Farm Net Worth	$38,680	$71,060	$58,030	$83,760	$61,772
Consumer Debt	1,890	1,000	310	590	939
	------------ Percent Distribution Farm Net Worth ------------				
$ 0-$ 20,000	21	1	9	4	9
$20,001-$ 40,000	39	21	22	19	26
$40,001-$ 70,000	24	38	42	21	31
$70,001-$100,000	16	19	22	17	18
$100,000-over	--	21	4	38	15

Table 4. Average Income per Farm Family, 1974 Survey

	Rural Resident	Supplemental Income	Senior Citizen	Full Time	Total Small Farm
Net Cash Farm	$ 50	$ 3,080	$ 1,930	$4,750	$ 2,299
Transfer Payments	144	1	2,933	249	594
Investments	394	155	1,373	176	444
Other Income Pensions	--	12	771	216	181
Wages	10,878	8,861	1,353	1,166	6,631
Net Family Income	$11,466	$12,109	$ 8,360	$6,557	$10,149
Per Capita	2,874	2,667	3,981	1,946	2,721
		---- Percent Reporting Income Between ----			
$ 0-2,500	1	3	12	17	7
2,501-5,000	4	3	19	30	11
5,001-7,500	16	11	19	15	15
7,501-10,000	17	15	16	19	17
≥ 10,000	61	68	35	19	50

their income from non-farm labor sources. Only 2% of all
full-time small farmers listed employment as a primary con-
sideration in their decision to live in rural areas. This
statistic leads one to the conclusion that small farmers are
trading monetary income for the amenities of rural life at a
rate that many researchers cannot comprehend. With the value
of land increasing as fast as it has been, many small farmers
are into the position of receiving returns on their assets
so low that they would be better off (from a monetary income
viewpoint) selling the farm, putting the proceeds in a bank,
and drawing the interest. The values that small farmers and
their families hold need to be explored thoroughly, to get an
idea as to what is keeping these people in agriculture and as
to what kinds of policies and programs can be implemented to
help them achieve a higher income (if they desire it).

Permanence of Michigan small farms

The 1974 survey provided some useful information as to the
short-run permanence of small farms by inquiring as to plans
for expansion of operations, maintenance of enterprises at
current levels, or exit from farming altogether (Table 5).
Nearly 1/2 of all types of small farm families anticipated
no changes in their farming operations. Approximately 1/3
of the sample group indicated they planned to expand produc-
tion, the senior citizen category being the notable exception.
On average over all types of farms, 90% of those interviewed
planned to continue in farming in the short-run. Information
regarding longer-run plans needs to be obtained to determine
whether or not a significant clientele group will exist once
programs for small farmers can be implemented.

Table 5. Anticipated Changes in Farm Operations in Next Two Years, 1974 Survey

	Rural Resident	Supplemental Income	Senior Citizen	Full Time	Total Small Farm
			Percent		
No Changes	52	46	60	50	51
Do Less Farming	6	4	17	9	8
Expand Farming Operation	34	43	3	30	31
Retire From Farming	2	4	14	5	5
Other	6	3	6	7	5
Changes Anticipated by Those Anticipating Expansion					
Don't Know	9	3	50	7	7
Increase Livestock Numbers	48	30	50	20	26
Increase Crop Yields	--	3	--	13	4
Increase Acres Farmed	13	30	--	47	27
Increase Livestock Production	--	3	--	--	1
Other	30	30	--	13	26

Small farm problems

One of the major small farm problems perceived by researchers was the incidence of low crop yields when compared to those obtained on larger commercial farms. Small farmers anticipating expansion did not indicate that increasing crop yields was a feasible means for furthering their goals. A number of hypotheses can be drawn from this fact. First, it may be possible that small farmers do not consider low yields a significant problem. Second, small farmers may be aware of the problem and desire to do something about it, but perhaps the needed information regarding cultural practices and/or other types of appropriate technologies may not be readily available or existent. Third, small farmers who stated that they planned no changes in their operations may in fact plan to try to increase yields using available technology, though they did not indicate this due to possible misunderstanding of the survey question, i.e. they did not consider an attempt to increase yields as expansion, per se. Fourth, perhaps there are institutional considerations, such as credit restrictions, that prevent small farmers from obtaining the necessary inputs to achieve higher yields.

Age distribution of small farmers

The average age of the male head of a small farm family ranges between 45 and 54. Female heads of families tended to be somewhat younger in all small farm types. The rural resident and supplemental income categories included more younger people (under 35) than did the others (Table 6).

Table 6. Age of Male and Female Heads of Families Living On Small Farms, 1974 Survey

Age	Rural Resident		Supplemental Income		Senior Citizen		Full Time		Total Small Farms	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	---------------------------------- Percent ----------------------------------									
Not present	3	3	--	3	2	7	2	11	2	5
Under 25	3	6	1	3	--	--	--	--	1	3
25-34	20	21	18	24	--	--	11	13	14	17
35-44	21	28	30	36	--	--	22	24	20	25
45-54	37	32	35	21	--	.2	28	24	28	22
55-64	17	10	16	13	11	55	37	27	19	22
65 or over	--	--	--	1	87	36	--	--	16	7

Much has been written about the exodus of young people from rural areas. The skewness of the age distribution favoring the higher age groups indicates that many young people are not remaining in farming (Clawson, 1975). However, it is difficult to get an idea as to the current patterns of age composition of small farmers in Michigan with a cross-sectional survey. Is the median age of the full-time small farmer increasing or decreasing? What about part-time farmers? Table 5 indicates that a greater percentage of part-time farmers (rural resident and supplemental income) plan to expand their operations than do full-time farm operators. It can be hypothesized that part-time farming is for many younger people an "entry point" into full-time farming, either on a small scale or a larger scale. On the other hand, full-time farming on a smaller scale may not be an important entry point into large commercial farming. Greater knowledge of these items can give us guidance in formulating the most appropriate policies for each of the different types of small farms.

Level of formal education

An important variable that the survey measured is level of formal education. Are small farmers less educated than the rest of the population? Tables 7 and 8 show that all types of small farmers, with the exception of the senior citizen group, have greater levels of educational achievement (measured in terms of number of years in school) than does the general Michigan population. Small farmer educational achievement equals or exceeds the state average except in percentage

Table 7. Level of Formal Education and Emphasis of High School Program, 1974 Survey

	Rural Resident		Supplemental Income		Senior Citizen		Full Time		Total Small Farms	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	----------------------------------- Percent -----------------------------------									
8 years or less	17	3	11	5	43	38	26	7	22	11
9-11 years	26	19	18	18	34	43	17	22	23	24
High School Degree	33	63	55	68	16	10	39	59	39	54
Some College or Technical	17	13	15	7	7	5	13	10	14	9
College Graduate	6	2	1	1	--	5	4	2	3	3

Table 8. Level of Formal Education of Persons 25 yrs. or Older in Michigan by Sex. April, 1970.

	Male	Female
8 years or less	27	23
9-11 years	22	22
High School Degree	30	38
Some College or Technical	10	10
College Graduate	11	7

Computed from: Michigan Statistical Abstract, 1976

of college graduates, assuming that graduation from high school is considered a favorable level of attainment, while less than that is unfavorable.

On the basis of this information, the hypothesis that small farmers remain in farming on a small scale because they do not have the education necessary to command greater incomes is implausible. This information lends support to the hypothesis that small farm families are sacrificing higher income opportunities in the pursuit of goals they find more important.

Family goals

An attempt was made in the survey to learn about family goals by asking what net farm income small farmers desired. The mean response was more than double the actual income earned (Table 9). This information would tend to lead one to believe that income was a severe problem on all types of small farms. However, subsequent information obtained in the survey indicated that most of the families living on small farms considered their incomes (from both farm and non-farm sources) more than adequate (Figure 3). In fact, only in the full-time category did farmers report that their income was less than that needed to provide them with a comfortable living. Minimum needed income was, however, achieved by full-time small farm families, though the margin is a bit slim. Contrary to popular belief, low income is probably not a major problem facing small farm families in their estimation, even though their monetary earnings may be substantially less than their urban neighbors.
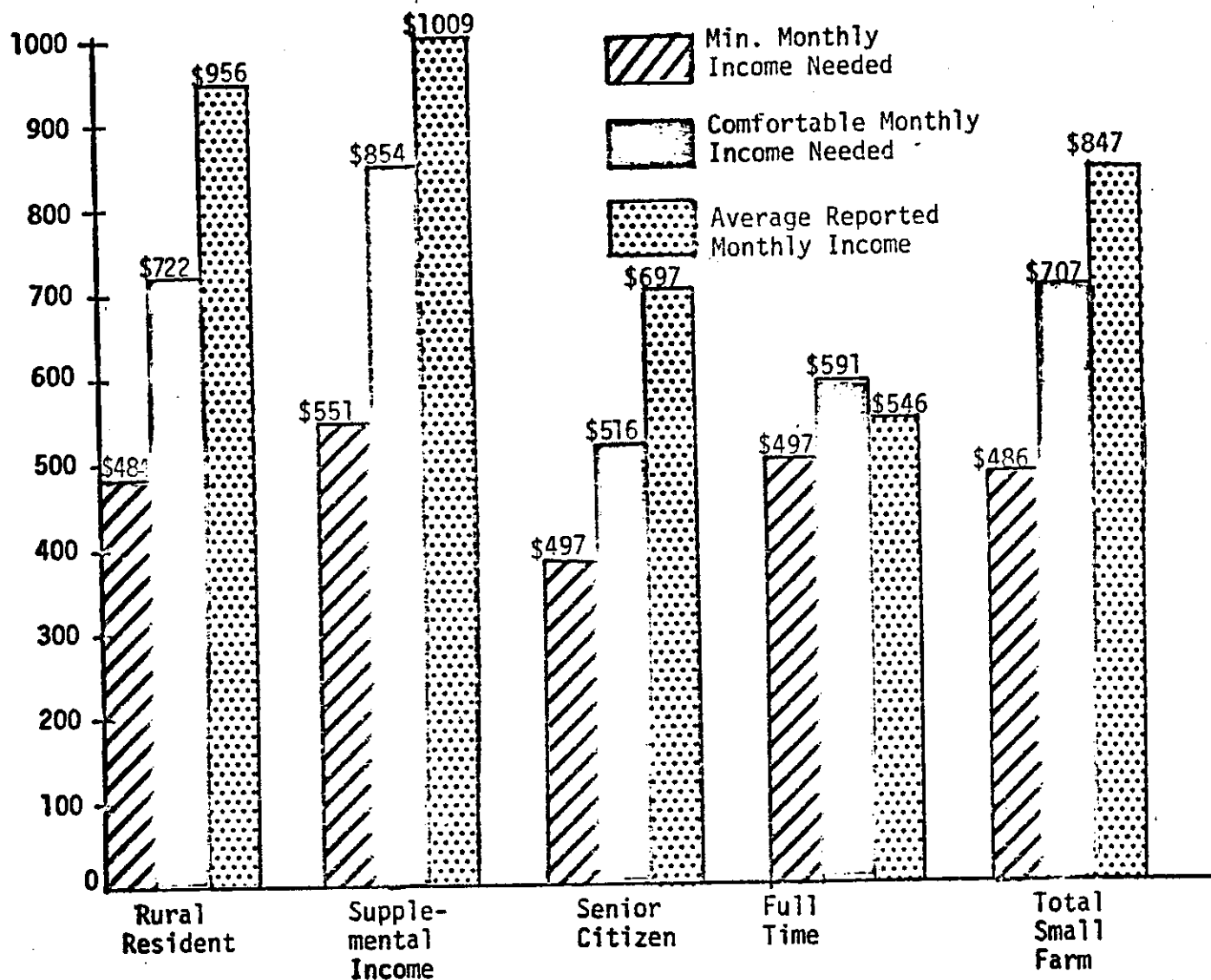
Figure 3. Minimum, Comfortable, Average Monthly Income, 1974 Survey

Table 9. Desired and Actual Net Cash Farm Income, 1974 Survey

	Rural Resident	Supple-mental Income	Senior Citizen	Full Time	Total Small Farm
Desired Net Cash Farm Income	$3,009	$6,278	$5,348	$9,054	$5,721
Actual Net Cash Farm Income In 1973	$ 50	$3,080	$1,930	$4,750	$2,299

Michigan Small Farm Problems

This section will basically review the current state of knowledge of the problems which face Michigan small farm families, from both the perspective of the applied economist and, to a limited extent, from the perspective of the small farm family members themselves.

Problems Perceived by Applied Economists

1. There is a disproportionate amount of land in a "non-productive" use. Only 4 out of 10 acres on small farms were planted to harvested crops in 1969 versus 6 out of 10 acres being in harvested crops for larger commercial farms.

2. Crop yields per acre on small farms were significantly lower (12 to 15%) than yields on larger farms. In addition, on the average of about 40% less dollar value of fertilizer per acre was used by small farmers planting corn. Unfortunately, Thompson's questionnaire did not contain questions that would possibly elicit the explanation from small farmers as to why yields were lower and less fertilizer was used. One may hypothesize that low yields and low fertilizer use may have been due to poor soil quality and/or difficulties in obtaining credit to purchase optimal amounts of inputs, rather than necessarily due to poor management practices. More information is needed with regard to the biological and institutional constraints faced by Michigan small farmers so that a more complete analysis of these types of problems can be made.

3. It has been noted that extensive amounts of land on small farms were planted to low-value crops in 1969.

4. Small farm livestock enterprises were significantly less productive than those on large commercial farms.

Problems Perceived by Michigan Small Farm Families

This information was obtained through open-ended questions, which provided small farmers an opportunity to voice their biggest problems, as they saw them.

The responses given can be divided into 3 general categories. The first type of response consisted of complaints about high taxes, inflation and the current economic situation in general. The second type of response reflected "anti-government" sentiments. Some small farmers felt that the government should not subsidize farming, that the universities and the extension service were not responsive to their needs, and that too much red tape was involved in administering government programs. The third type of response expressed the belief that income from small farm agriculture was insufficient to provide an adequate standard of living, which made the retention of employment off the farm essential. Most small farmers presenting this type of response were most concerned with economic conditions that would threaten their off-farm employment.

No indication was made in Thompson and Hepp's report as to which type of farmer had made which remarks, but one may speculate as to the farmer's situation by what he said. This kind of information can be extremely helpful in classifying types of farms and helping to understand the kinds of problems that are plaguing each type.

For example, one would guess that many of the people most worried about general economic conditions are mainly rural residents. Their farm represents a consumption item in the main, rather than a source of livelihood. They are not in a poverty situation, and their concerns are mainly non-agricultural. It is doubtful that programs designed to stimulate increased production levels on small farms would have much effect on this group.

It is likely that the second type of response was given by full-time and retired small farmers whose interest in agriculture, both as a source of income and as a vocation, is keen. They are disillusioned with government programs which provide the vast majority of the benefits to large farmers even though they were originally designed to support incomes of farmers who needed the support to stay in farming. They are also disillusioned with the land grant college and extension system which has followed a "progressive farmer" strategy (Hightower, 1973) by concentrating efforts on a small number of more innovative, wealthier, larger, better educated and more receptive farmers with the hope that the information and attitudinal change would spread to the "laggards" in the countryside (Rogers and Shoemaker, 1975: Ch. 5). Furthermore, the shortage of funds for extension work and the chronic over-abundance of agricultural supply provided the rationale for not attempting to educate all the farmers.

Part-time farmers obviously comprise the majority of people giving the third type of response. They may be on the way in to farming, on the way out of farming, or in a fairly stable position. The stable part-time farm family enjoys living in a rural setting and doing some farming as a necessary supplement to family income from sources off the farm. In Thompson's 1974 survey, members of this group were more concerned with economic conditions that could affect their outside employment than they were about conditions within agriculture.

As is obvious from the preceding, we have 3 very different groups of people with some problems in common, but also with exceedingly important problems (from their perspectives) which are different from the problems perceived by agricultural research and extension people.

Small and part-time farmers should have greater input into the process

deciding what types of programs would achieve the most favorable results.

Problems in Determining Small Farm Numbers

Intra-Census Comparisons: For purposes of agricultural censuses

over the past 18 years, a small farm has been defined as over 10 acres

of land with gross farm sales between $50 and $20,000. Any unit with

sales over $250, regardless of size, has also been included in the

definition. Each census year, farms are grouped by economic classes[1]

in current dollars. In time of general inflation and/or rising agricul-

tural prices, farms near the upper margins in each class change positions,

even though no changes in the farm operation may have been made or no

gains enjoyed in terms of real income.

What we come to in the 1974 Census of Agriculture is a rather severe

problem of interpreting what has happened to small farms. Small farm

numbers, using the current definition, appear to have been declining

---

[1]Class 1............$40,000 or more of farm product sales
Class 2............$20,000 to $39,999 of farm product sales
Class 3............$10,000 to $19,999 of farm product sales
Class 4............$5,000 to $9,999 of farm product sales
Class 5............$2,500 to $4,999 of farm product sales or having a
                   value of products sold of less than $2,500 provided
                   they had the acreage or livestock operations which
                   normally would have had sales in excess of $2,500.
Class 6............$50 to $2,499 of farm product sales and a farm
                   operator who is under 65 years of age and did not
                   work off the farm 100 days or more in the census year.
Part Time.........$50 to $2,499 of farm product sales and a farm
                   operator who is under 65 years of age and worked
                   off the farm 100 days or more in the census year.
Part Retirement....$50 to $2,499 of farm product sales and a farm
                   operator who is 65 years old or over.

fairly drastically from census to census (Figures 4 and 5). Of course, some farmers are exiting from agriculture altogether and searching for employment in urban areas, while others are expanding their operations. Unfortunately, the census does not provide us with a way of determining the shifts in farm numbers nor the direction of those shifts. Is the decrease in small farm numbers due mainly to movement out of agriculture, or is the main problem that the class limits need to be revised so that small farms are not excluded from the count or counted in other classes?

Knowledge of these problems is important in gaining an understanding of the limitations on the small farm numbers published, especially when considering these numbers in the context of trends over time.

Accuracy of the Census: Probably the most serious drawback to relying on the Agricultural Census figures on numbers of small farmers is the gross incompleteness of the census. The census has a record of continually underestimating the number of farms which satisfy stated farm definitions. Nowhere is this problem more acute than in the small farm categories. The reasons for this are many. As the Bureau of Commerce has turned to a sampling procedure rather than a complete enumeration, many small farmers have been left out because they were not on ASCS or other lists being used as sampling frames. Other small farmers included in the sample do not in fact consider themselves farmers and hence do not participate in the process. This is especially true in Michigan, where nearly 1/2 of all farmers counted listed their principal occupation as something other than farming (U.S. Department of Commerce, 1976). Several other logistical problems also exist (Ingram and Prochaska, 1976).
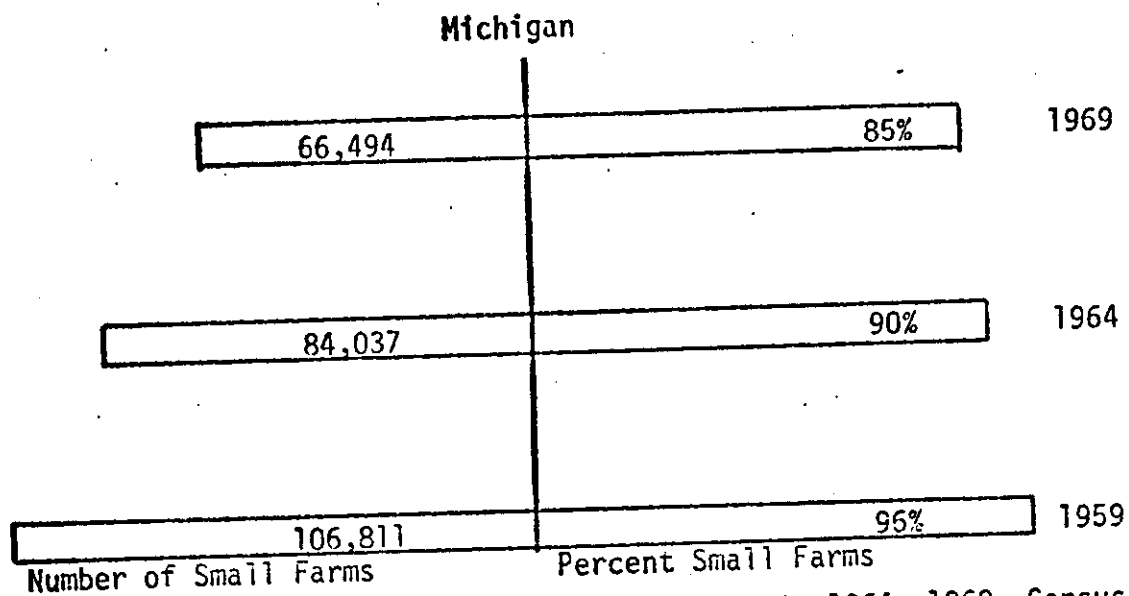
Michigan

66,494	85%	1969
84,037	90%	1964
106,811	96%	1959

Number of Small Farms   Percent Small Farms

Figure 4. Number and percent small farms in Michigan, 1959, 1964, 1969, Census of Agriculture.

United States

2,175,475	80%	1969
2,753,897	87%	1964
2,820,127	90%	1959

Number of Small Farms   Percent Small Farms
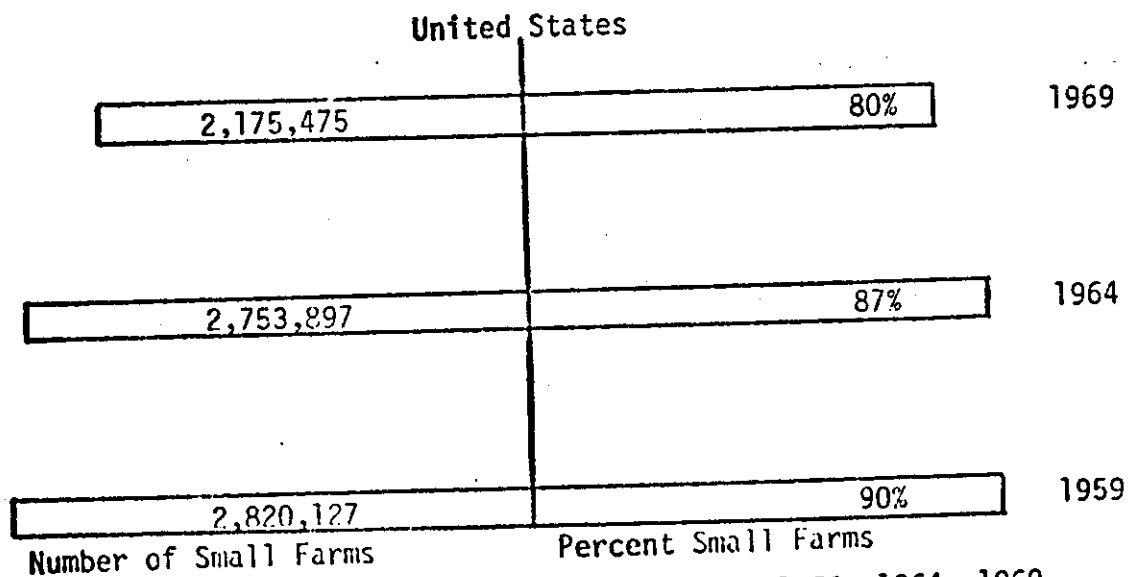
Figure 5. Number and percent small farms, United States, 1959, 1964, 1969, Census of Agriculture.

The U.S. Bureau of the Census evaluates the completeness of the coverage of each census of agriculture, usually about 3 to 4 years after the census is completed. The estimates of completeness for 1959, 1964 and 1969 for the conterminous U.S. are presented in Table 10. One *how?* is shocked to learn that between 35 and 40 percent of all small farms (census definition) were not counted in 1969. Furthermore, the margin of error (undercount) has increased greatly since 1959, perhaps as much as 25 percent. This is especially relevant to the importance of study of small farms in Michigan, since such a large percentage of farms are included in the small farm categories. The accuracy with which larger farms are counted (or overcounted as in 1969) is much greater, signifying a definite downward bias on the lower end of the farm sales distribution.

In conclusion, there is the suspicion that our conventional wisdom as to trends in farm sizes and numbers may be wrong. Most everyone accepts the assertion that small farm numbers have been declining at a fairly rapid pace. There is now good reason to doubt this.

Table 10

Estimates of Census Completeness for 1969, 1964, and 1959 by Economic Class of Farm for Conterminous United States

Census Year and Economic Class	Estimated percent Farms covered by the Census	Estimated percent net undercount
1969 (Preliminary)		
All Farms	86.4	13.6
Classes 1-5 ($2500+)	97.1	2.9
Classes 1, 2 and 3 ($10,000+)	100.6	(0.6)
Classes 4 and 5 ($2500-$9999)	93.3	7.7
Class 6 and others (<$2500)	71.1	28.9
1964		
All Farms	88.7	11.3
Classes 1-5 ($2500+)	95.7	4.3
Classes 1, 2 and 3 ($10,000+)	96.9	3.1
Classes 4 and 5 ($2500-$9999)	94.6	5.4
Class 6 and others (<$2500)	80.7	19.3
1959		
All Farms	91.6	8.4
Classes 1-5 ($2500+)	96.2	3.8
Classes 1, 2 and 3 ($10,000+)	97.2	2.8
Classes 4 and 5 ($2500-$9999)	95.6	4.4
Class 6 and others (<$2500)	86.3	13.7

Source: Ingram and Prochaska (1972)

PART II - A PROPOSAL FOR RESEARCH

Conceptual Framework

To be investigated and/or understood and/or modeled are the main features of the decision-making processes that take place on small farms, with special reference to the allocation of human and capital resources. Since one of the desired outcomes of this study is a somewhat "generalizable" model, aggregates must be defined for which goals and decision rules can be assumed to be similar.

Family farms are unique in that there is a strong interdependence exhibited between production-related firm decisions and consumption-related family decisions. Farm-household decisions are concerned with allocating income between consumption and saving, with savings available to the farm-firm for use in productive investment. The family also allocates its labor capacity among farm and non-farm work, leisure, and other activities. Given the farm-household allocation of income and labor, and considering available physical fixed assets such as land and machinery, potential alternative factor uses can be considered and decisions made. This process comprises the decision framework of the farm-firm.

The decisions made in both the farm-firm and farm-household follow decision rules that are determined by the farm family according to their monetary and non-monetary values and goals, subject to human, technological and institutional constraints. For example, decisions are made under conditions of risk and uncertainty, and the farm family may want to take into consideration insurance schemes according to the size of possible gains and their relative preference for risk versus security.

Once the factor allocation decisions are made for a given production period, production and consumption are then assumed to be influenced

only by random disturbances such as weather, job layoffs, sickness or price changes. Of course, the farm family has no control over these disturbances, but may make changes as a result of them.

Resources of the small farm and of the farm family may appear to be combined in an "inefficient" manner, or that opportunities to increase farm productivity are being ignored. Families view their farms as much more than just a productive resource, and perhaps decide to forego some income-producing opportunities in order to attain other non-monetary goals. When non-monetary values are taken into consideration, one is no longer able to judge the efficiency with which a farm is being operated. Unfortunately, we do not have an interpersonally valid common denominator between monetary and non-monetary values, rendering inappropriate the use of maximizing calculus to produce behavioral prescriptions.

Statement of Objectives

The main objective of the proposed study is to devise an instrument that can be used to predict farm outcomes (resource allocation, income, yields) according to the decision rules specified by small farm families. The instrument must not only be predictive, but also possibly prescriptive in the sense that it can use positive and normative information gathered by the researcher through observation, question and experience to help small farmers select, if necessary, more appropriate plans than those they are currently following. The prescribed plan, however, must not conflict with the goals and values of the family being studied. More specifically, the objective can be stated as follows:

1. To develop a conceptual framework of small farm family decision-making processes.

    1a. To ascertain the goals of small farm families and to rank their relative importance.

2. To test the validity of the relationships hypothesized in the conceptual framework. An attempt will be made to derive decision rules stemming from the ranking (and possibly weighting) of family goals. The decision rules will then be used as the control mechanism of a simulation model.

3. If possible, to develop a means for accounting for changing goals (and decision rules) over time so that more accurate predictions can be made for the longer run. In this case, the model becomes dynamic and is concerned with firm growth (or lack of growth, reduction).

4. To use the simulation model as a "laboratory" to test the effectiveness of a number of public program and policy alternatives in helping to solve or alleviate small farm problems.

5. As a more immediate short run benefit to participating farmers - use information on land and land capabilities, labor supply, management ability, livestock, machinery, equipment, supplies, credit availability, etc., to formulate alternative farm plans, evaluate them via simulation and present the results for use at the farmers' discretion.

Decision-Making Models

There are a number of models which have been developed by operations research experts which purport to describe rational, economic behavior. The algorithms that have been developed hinge on the assumption that man has knowledge of the relevant aspects of his environment, a well-organized and fairly stable system of preferences, and a skill in computation that enables him to calculate, for alternative courses of action that are available to him, which alternative will permit him to

reach the highest attainable point on his preference scale (Simon, 1969). From traditional economic theory arises "economic man." Man, however, does not possess the qualities described above. Probability computations and analysis of all feasible alternatives do not seem to be part of our cognitive processes.

It follows that the types of models alluded to above will not be useful in many types of decision situations. Decisions are not usually well-structured and the more important ones tend not to present a repetitive probabilistic profile (Mack, 1971). The more unstructured a situation is, the more difficult it is to describe ends, the larger the number of possible alternatives, the more difficult it is to foresee the consequences of actions, and the more difficult is the estimation of probabilities of specified occurrences.

What is needed is modelling which represents a kind of rational behavior that is compatible with the access to information and computational capacities that are actually possessed by man in the kinds of environments in which he exists (Simon, 1969).

In light of the preceding comments, some alternative approaches to modelling small farm system behavior will be explored, with the goal of choosing the appropriate model for each decision situation.

Maximization of a Single Objective

The use of single-objective maximization techniques to predict or prescribe managerial behavior is widespread and (hopefully) well understood. The pros and cons of the techniques and the assumptions lying behind them have been discussed in numerous articles and papers and will be discussed only briefly here.

The most common types of optimizing procedures used by agricultural economists include mathematical programming (usually linear programming) and maximizing calculus applied to an econometrically derived multi-variable functions. Y. C. Lee did a theoretical and empirical comparison of linear programming and production function analysis (1975).

One of the points in favor of single-objective maximization is that the procedures for carrying out the analysis and arriving at a conclusion are relatively well developed. For example, if one can obtain enough data about the firm and can estimate structural parameters, then the setup and running of a linear program is relatively straight-forward. The output is a set of recommendations as to how the firm should be organized in order to maximize profits. The output will almost never be completely correct due to variations in the firm environment which are not directly influenced by managerial action. The results do, however, give the manager a "ball park" idea of how to organize his firm in order to maximize profit. Functional analysis accomplishes somewhat the same thing, though the results are somewhat more restricted in scope and detail.

When one examines the statistics regarding net income and total value of assets of Michigan small farms, the question arises as to whether small farm managers are, in fact, profit maximizers. With extremely low returns to capital assets and labor, the small farmer would be better off from a "profit" standpoint by selling out and placing the proceeds in a bank to earn interest of five percent or more. This fact suggests that small farmers may have motives for staying in business which alone or in combination outweigh or modify the profit motive. This notion may help to explain the small farm asset-income paradox.

In doing the kind of behavioral research suggested in this paper, clearly the single objective maximization models are inadequate.

Toward Greater Realism: Multiple Criteria Decision Theory

Single-objective maximization models have already been discussed and their deficiencies noted. There is general agreement among economists and psychologists that all people have a multiplicity of goals or objectives that they would like to maximize, but maximization of all goals is not usually possible due to the fact that many of the goals will be in conflict, and human and natural resources are limited. Therefore, in order to be more effective in helping small farmers or other groups of people deal with their problems, economists need to recognize some of the inaccuracies of their assumptions and strive to resolve some of the more difficult theoretical problems within the discipline. One such problem is that of devising a computational method of handling multiple goals.

It is encouraging to note that work has begun in this area. Part of this work, namely that concerned with the applicability of multi-dimensional utility theory to a certain class of micro-economic problems, will be discussed in this section of the paper. The basis for the first part of the discussion will be an article by Ferguson (1965). Later on, some of the problems connected with this approach will be explored and hopefully some insight obtained.

A better understanding of multi-dimensional utility analysis requires a brief explanation of the theory of multi-dimensional vector ordering, more commonly called lexicographic ordering. Lexicographic ordering in the utility context, as Ferguson explains it, has the following meaning. Consider two alternatives, which may be bundles of goods, characteristics of farm machinery, or what have you: $x^0 = (x_1^0, x_2^0 \ldots x_n^0)$

and $x^1 = (x_1^1, x_2^1 \ldots, x_n^1)$. One could say that x^0 has the characteristics $x_1^0, \ldots, x_n^0$, or x^0 is composed of $x_1^0 \ldots x_n^0$. Let U be a preference index function. A non-lexicographic ordering of preference or utility between the two alternatives ranks $U(x^0) > U(x^1)$, which implies that x^0 has a higher utility than x^1, if and only if $x_i^0 \geq x_i^1$ for all i and the strict inequality holds for at least one component or characteristic.

In a lexicographic ordering, however, a hierarchy of wants is recognized; the components of any vector x^i are not usually regarded as equally important. For example, in the vector x^0, assume that $x_1^0 > x_2^0 > x_3^0 > \ldots > x_n^0$, where $>$ is to be read "is more important than." The result here is that $U(x^0) > U(x^1)$ if $x_1^0 > x_1^1$, irrespective of the relationships between x_i^0 and x_i^1 ($i = 2, 3, \ldots, n$). If both x_1^0 and x_1^1 attain a predetermined "satisficing" level, then comparison is then based upon the second component or characteristic. Thus $U(x^0) > U(x^1)$ if $x_2^0 > x_2^1$, and so on. Proceeding in this manner, vector components which are lower in the hierarchy are considered only after the higher order wants are satisfied.

The argument for profit maximization as a single goal (characteristic) is relevant in this context if one assumes that it is the dominating component of a vector goal-set. The validity of this argument remains to be tested.

Some examples may help make the theory just described more comprehensible. The vectors x^i could represent various farm organization schemes, with the components of each vector representing the various desired characteristics that the farmer wants in his farm. The x^i could also represent a quality of life index, with the components representing the goal set of the farm family. These are just two examples where further research using the lexicographic approach may be fruitful.

Consideration will be given to some serious questions about the theories that have been left unaddressed by Ferguson. Consider a set of vectors x^i each with two components, x_1^i and x_2^i.
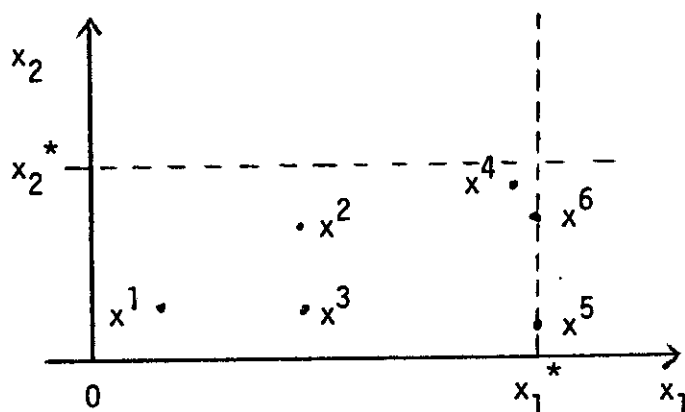

Figure 6

The satisficing levels of x_1 and x_2, represented by x_1^* and x_2^*, are delineated by the dotted lines on the graph (Figure 6). The dominant component is x_1, so x_2 is not a criterion unless two or more alternatives provide the same quantity of the dominant characteristic. For example, alternatives x^2 and x^3 are preferred to x^1 since both have greater levels of x_1. However, x^2 and x^3 have equal amounts of x_1, but $U(x^2) > U(x^3)$ because x^2 contains a greater level of x_2 than does x^3. Continuing on, $U(x^4) > U(x^1)$, $U(x^2)$, or $U(x^3)$ because each successive alternative contains a greater level of the dominant characteristic. For reasons already specified, $U(x^6) > U(x^5) > U(x^4)$. Consider for a moment Alternative x^4. Its composition is such that it contains very near the satisficing level of the dominant characteristic x_1 and also has a great deal of the characteristic x_2. In comparing x^4 and x^5, for example, one could ask whether the utility satisficing farmer is prepared to give up just a little x_1 in return for a much larger amount of x_2. There would, in this case, seem to be a relevant "trade-off" area where the answer to the previously posed question would be "yes." This is a difficult matter to deal with, for it seems that some kind of cardinal utility measurements need

to be made in order to find out exactly how "dominating" the dominating characteristic is.

Amos Tversky (1972), in his work on choice theory, has shed further light on the matter. His model, called the elimination-by-aspects (EBA) model, differs from the lexicographic model in that there is no fixed prior ordering of aspects (characteristics) assumed, and the choice process is inherently probabilistic.

It is perhaps easiest to explain Tversky's criticism of the lexicographic model via an example. Suppose a farmer is in the market for a tractor, and he must decide between a John Deere (JD) and a Massey Ferguson (MF). Assume that the tractors cost the same and that cost is the dominating characteristic. Suppose further that the John Deere dealer offers the farmer a $1.00 rebate on a JD. According to the lexicographic model, the farmer would then buy the John Deere tractor solely because it is cheaper without bothering to consider any of the other characteristics of either tractor. The probability of selecting a John Deere with the rebate when faced with a choice between the JD + $1.00 (JD+) and the MF is equal to one. Here again, a clearer explanation of Tversky's comment can be made using a figure. Let $U(JD) = U(MF) = B$, and $U(+) = A$. Also, as a notation convention, let $P(x;y)$ mean "the probability that x is chosen when the choice set includes x and y." The alternative set, then, is (JD,JD+,MF), as described in the figure. Using the notation convention described above, it is possible to calculate choice probabilities as follows.
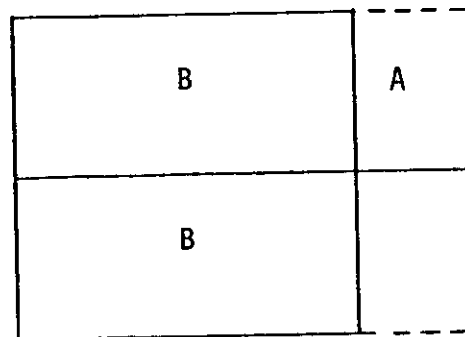
JD+

JD

Figure 7

MF

1. $P(JD;MF) = \dfrac{B}{2B} = \dfrac{1}{2};$

2. $P(JD+;JD) = \dfrac{A+B}{A+B} = 1;$ and

3. $P(JD+;MF) = \dfrac{A+B}{A+2B}.$

The right-hand side of the third equation, representing the probability that the farmer selects a John Deere with the $1.00 rebate over the Massey Ferguson, can take any value between 1/2 and 1 depending on the relative weight of A. Therefore, unless there is a fairly wide difference between the dominant aspects of the alternatives, there should be no reason to suspect that other aspects will not be considered.

The preceding has been an analysis pointing out the problems that can occur when choosing among alternatives following strictly the lexicographic ordering model. The first criticism brought out the difficulty in deciding between alternatives when a question of tradeoff potential exists between the characteristics of each alternative. Should the dominant characteristic rule absolutely? The second criticism, that of Tversky, brought out the problem of accepting the alternative when only

slight differences between the dominant characteristics exist. The question is basically the same as in the first case, but the attack is coming from a slightly different angle.

In all cases, cardinal utility measurements are called for in order to derive the rankings or probabilities. This fact, in itself, is another problem that must be dealt with.

Still another question can be posed: Are the problems with multi-dimensional utility analysis discussed so far even relevant? There seems to be an implicit assumption that decision makers are able to look at all the alternatives, measure them according to their ability to satisfice the required goals or characteristics, and only then choose the best alternative. It is highly unlikely that this is an adequate statement of reality, so some of the problems related to the lexico-graphic theory may be irrelevant or unimportant. Whether or not there is in fact a dominating goal or set of goals is another interesting question. Perhaps similar goals or goals with relatively equal strengths can be grouped together in some meaningful way in order to simplify, but not weaken, the analysis. There also exist problems in determining what the satisficing levels of the goals are. Are people even able to articulate their goals clearly enough so that they can be understood or classified?

Multiple goal analysis is a new idea that is just beginning to be explored by economists and others. It seems that some or all of the questions and problems posed in this section cannot begin to be answered, at least in the context of Michigan small farmer behavior, until further research is undertaken to determine what small farmers' goals are and how they make their decisions.

The Systems Approach

System Simulation

The words "system" and "simulation" are general enough so that employing them when describing a model does not necessarily limit the characteristics of the model to any particular type or category. The optimizing models referred to in previous sections could be called system simulation models to the extent that they represent what is happening in a real world system.

In general, simulation models differ from other types of models in that they permit a wide range of knowledge to be incorporated. According to Johnson (1974), "simulation exploits the strengths and potential contributions of any relevant discipline, source and kind of information, or technique; hence, it is an approach rather than a technique." With simulation, one is limited in depth only by his understanding of the real world situation (including all relevant variables) and his capacity to handle the data management problems that arise when he attempts to model reality closely.

One can simulate systems which are assumed to be "static," though simulation is most often employed to represent systems moving through sequential time. One of the most common techniques used in dealing with sequential time by system scientists is the incorporation of recursively-linked differential or difference equations, especially when dealing with stimulus-response time delays (Manetsch and Park, 1974).

Probably the most important characteristic of the system simulation approach is its flexibility. The object of simulation is to develop a model that will conform to reality as closely as is feasible. When attempting to build a simulation model, one can include as much information as is deemed necessary to fulfill the requirements of the designer

and his client. It is possible to describe the most important parts
of the system in great detail while de-emphasizing other components by
allowing them to be modeled less precisely.

In designing a simulation model, other factors are also taken into
consideration. For example, the amount of resources available for a
simulation project will influence greatly the detail in which the sys-
tem can be modeled. Because system simulation modelling is very expen-
sive when carried out in great detail, attempts should be made to build
"generalizable" models that can be used in or adapted to other situa-
tions. An example of a generalizable model will be presented in another
section of this paper.

The General Agricultural Firm Simulator

The General Agricultural Firm Simulator is a product of some research
carried out at The Pennsylvania State University by R. F. Hutton and
H. R. Hinman (1969). The simulation is designed to represent a farm
in its most general aspects.

The Simulator was chosen as a tool in carrying out the research
proposed in this paper because of its flexibility. It consists basically
of a set of subroutines which represent the events which take place in
one production season. The design is such that logical modifications
can be made in one or more of the subroutines fairly easily without
disrupting the whole program. The most desirable feature is the pro-
vision for the addition of user-specified subroutines, in this case
to represent decision rules and other behavioral aspects of the small
farm. This allows one to reduce the amount of "accounting simulation"
that must be done and to concentrate on the part of the model which is
the heart of the research.

Model Features

The Simulator is designed primarily for use in modeling farm opera-
tions. It may, however, be useful in other applications where the
characteristics of the firms and markets are similar to those in farming.
There are limitations intrinsic to the model that may limit its more
generalized applicability, namely the lack of treatment of between-
firm interaction and imperfections in the product market. It should
be noted here that the structure of the model is such that user modifi-
cation to accommodate alternative specifications is relatively uncom-
plicated. The following is a listing of the major features of the model.

1) Physical resources controlled by the firm are described in
   terms of the type of input service they render, their quan-
   tity, and, if depreciable, their age.

2) Physical resources can be bought, sold, depreciated, used as
   security for debt, and their services can be used in the firm
   or sold directly. Capital goods may be available in discrete
   or continuous amounts and at constant costs that are a function
   of quantity purchased or costs subject to change over simulated
   time.

3) Financial capital may be used to purchase physical capital,
   retire debts, pay expenses, and provide management income.
   It can be increased by sale of physical capital, borrowing,
   sale of products, and investment by the owner. Terms of credit
   may be a function of the type of security offered.

4) Production opportunities are described in terms of input services
   required and outputs produced. Output of each product may be
   treated as a probability event and subject to modification to
   reflect alternative rates of efficiency.

5) Input services may be provided by physical capital controlled by the firm, by direct purchase, or by products currently produced. "Lumpiness" of inputs and variance in their price as a function of quantity purchased or as a function of time may be represented.

6) Products may be sold at prices that are subject to trend over simulated time and the prices may be probabilistic. Products may be inventoried for sale or use in later time periods.

7) Property taxes, insurance, and maintenance costs may be specifically levied on each capital asset class. Income and social security tax may be levied against the firm's net returns.

8) Results of the simulation may be reported each period. Any number of periods may be run with automatic updating of prices, costs, inventory, and capital accounts. There is, however, no summary analysis of results across periods.

9) All numeric coefficients and all activity, product and input service identifications can be entered as data. Modifications can be made within a series of runs to reflect changes in organization or in the simulated environment.

Methodological Considerations

Johnson (1976) presented a useful diagram which aids in the classification of different types of information (Figure 8). Needed information includes that which deals with values (normative) and that which does not deal with values (positive). It should be pointed out that there is some ambiguity between these two types since what one experiences in a positive sense often affects one's normative beliefs, and vice versa. Information is also required regarding technology, institutions and people. There is also a time dimension present; information about the

Figure 8.
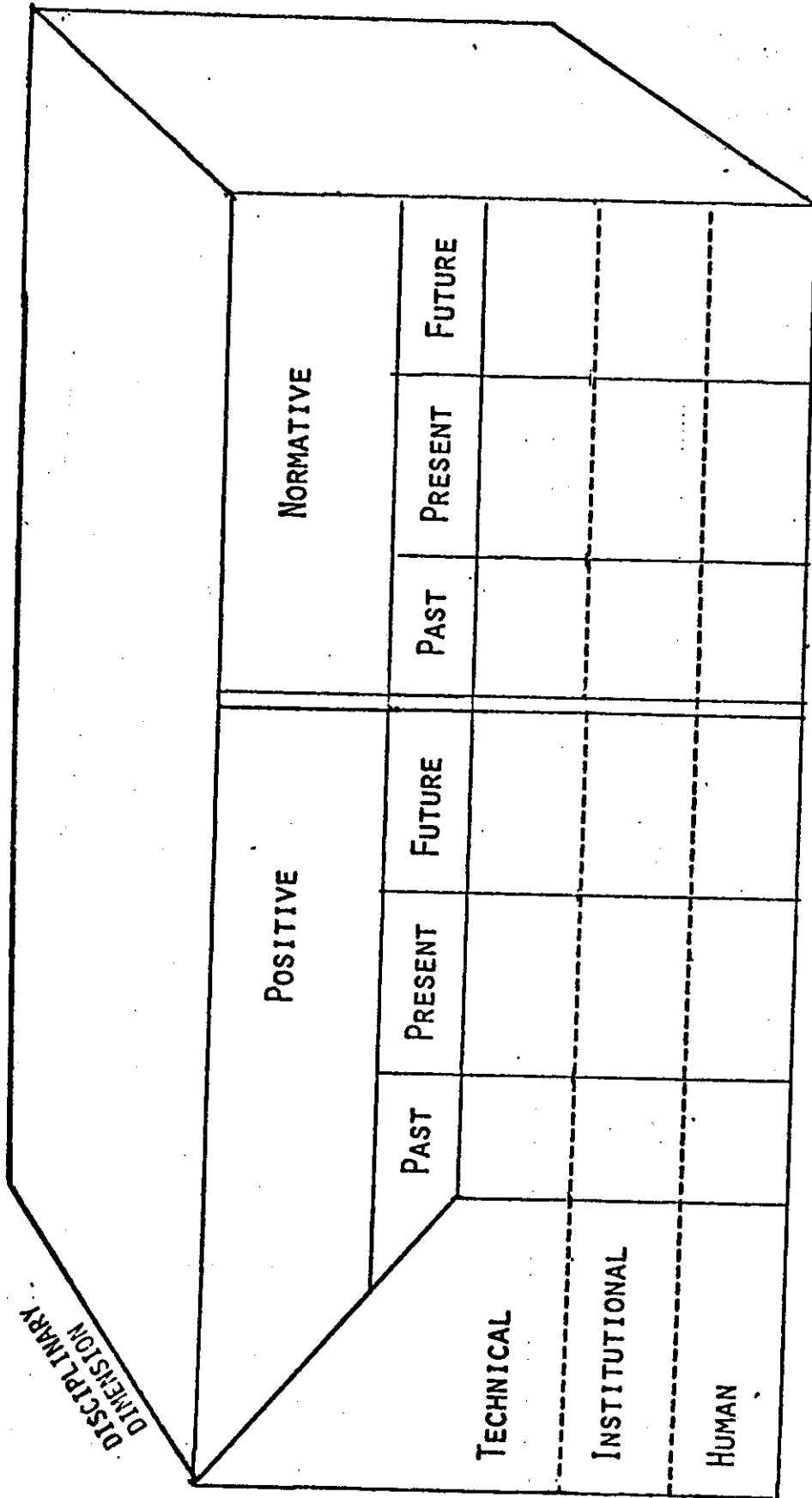
Source: Johnson (1976b)

past and present needs to be obtained in order to form expectations about the future. There is also a disciplinary dimension. Knowledge from several disciplines is generally required to get a complete picture of a system or problem. Each relevant discipline may contribute any or all of the types of information discussed previously. It is unlikely, however, that any one discipline could completely fill any cell, though many may contribute to all the cells. A difficult question arises when decisions are made as to which disciplines are most relevant and which types of information are most important to obtain. A great deal of emphasis has been placed upon information contributed from the discipline of economics, as economics contributes something to many of the information cells. Perhaps economics receives the attention it does because its appropriate theories are relatively better developed and in more quantifiable forms than theories relating to other disciplines. However, economists and others are becoming increasingly aware of the shortcomings of some of the economic theories because many of them do not describe, to a sufficiently accurate degree, human and institutional behavior. In an increasingly complex and interdependent world, prescription based on overly simplified and unrealistic theories which do not include a greater range and depth of information of all kinds, will lead decision makers to either ignore the prescriptions or to make incorrect decisions.

What is called for, then, is a multi-disciplinary approach to research. Research teams should be composed of disciplinarians according to their perceived relevance in treating the subject matter or problem at hand. This type of research organization is difficult to institute due to the inabilities of research team members to understand problems

in sufficient depth and breadth, to accept that their own discipline cannot provide all the answers and to subvert their individual paradigm for greater collective understanding. Herein lie some of the disadvantages to professional specialization.

Individual research, however, is still the rule, and some time will pass before many changes are made. Therefore, a graduate student trained in the discipline of agricultural economics must familiarize himself to the extent possible with the ideas emerging from other disciplines in order to achieve a satisfactory awareness of the dimensions of a subject or problem area. The value of extra knowledge required and opportunity costs (time and resources) help determine the satisfactory amounts of each of the different kinds of information, in all or part of its dimensions, to acquire.

Alternative Research Procedures

After giving careful attention to the amounts and kinds of information that would be useful in investigating small farm problems, a decision needs to be made as to the proper means of acquiring the appropriate information. There are two basic methodological approaches that should be considered.

1. _Survey approach_. A broad study can be made by choosing at random a large sample of each of the various types of Michigan small farms, farmers and their families. An area sample would perhaps be better than sampling from a list frame, due to the fact that some types of small farmers may not likely be on any list. The entire farm population in each selected area should be sampled in order to determine differences or similarities between small farms and large farms and to enable some type of comparative analysis. Thompson (1975) used basically

the approach described above. Much valuable information was obtained from that survey, and it should be used as a benchmark for further work of that type.

2. Case-Study Approach. This approach has been applied mainly in anthropological research, though it is now receiving more attention from economists trying to understand decision-making processes in an environment of risk and uncertainty. In-depth studies can be made concentrating on just a few farms of perhaps one type in one geographical area. Such an approach would allow the researcher to obtain the kind of knowledge that would not likely be uncovered in a survey with most of the questions predetermined. Statistical significance would be sacrificed, hopefully trading off for the attainment of a better understanding of small family farm systems, including increased insight into how decisions are made.

There also exists the possibility of using a mix of the two approaches mentioned above, though it would be difficult for a single researcher to undertake both simultaneously. Decisions need to be made regarding how resources should be expended so that sufficient amounts of information of each type will be collected and available for use in analysis. The farm family unit is the relevant decision-making unit at the micro level. It seems reasonable that farm family input into deciding what is good or bad or possible should be incorporated into any realistic behavioral model.

For purposes of the research being suggested in this paper, the case-study approach seems most appropriate. The General Agricultural Firm Simulator provides a structural framework for viewing the farm production system, enabling the researcher to concentrate on the decision-making unit in hopes of discovering behavioral patterns which

will provide for the specification of decision rules or criteria. The set of decision rules would then provide "control" to the system model, and allow testing of the model to monitor the reactions of the system to changes in the environment. The environmental changes would consist of alternative programs or policies designed to solve or alleviate some of the problems facing small farm families.

Conclusion

In trying to conceptualize the small family farm, there is a strong tendency to focus in on the farm production aspects and ignore or disregard the fact that one is dealing with a production-consumption household unit. Farm family resources must be allocated not only to production but also to consumption. There is a competition for scarce resources, the returns to which cannot always be measured in terms of expected profits. Quantitative techniques which employ profit maximization as a decision rule become limited in their relevance due to the lack of a normative common denominator which would allow the quantification of utilities of consumption to combine with expected profits to achieve an overall maximum.

The goals of the small farm operator are strongly influenced by family conditions and desires. More research needs to be done in the area of family consumption needs and patterns on small farms. There is a fairly large body of theory on labor allocation and consumption economics, as there is in the disciplines of sociology and anthropology. The assertion here is that both economic (monetary and non-monetary) and non-economic information needs to be collected in order to begin to achieve a full understanding of the complete small farm family system and its environment.

As we have seen in the analysis of some of the information collected by Thompson, problems on small farms are not limited to economics, though researchers sometimes tend to view them in that respect. Perhaps studying the symptoms of problems, such as poverty, low yields and inefficient resource use, leads one to believe that the symptoms are in fact the problems. It is necessary to explore the causes of problems, be they economic or not.

Without a better understanding of the small farm unit, the production of prescriptions to solve perceived problems by agricultural economists using only partial information may turn out to be fruitless. On the surface, resources of the small farm family may be combined in a seemingly inefficient manner. However, the existing resource combination may produce greater returns to the family than some others, due to the importance of non-monetary goals and values and external constraints.

Bibliography

Barkley, Paul W.
1976 "A Contemporary Political Economy of Family"
      American Journal of Agricultural Economics 58(5): 812-819.

Bertrand, Alvin L.
1967 "Research on Part-time Farming in the United States"
      Sociologia Ruralis 7(3): 295-306.

Brewster, J.M.
1945 "Farm Opportunities: Output and Population Growth"
      Land Policy Review 8(4): 8-11.

Clawson, Marion
1975 "Restoration of the Quality of Life in Rural America"
      in Heady and Whiting, Ch. 9.

Ferguson, C.E.
1965 "The Theory of Multi-Dimensional Utility Analysis in Relation
      to Multiple-Goal Business Behavior: A Synthesis"
      Southern Economic Journal 32: 169-175.

General Accounting Office
1975 "Some Problems Impeding Economic Improvement of Small Farm
      Operations: What the Department of Agriculture Could Do"
      Report to Congress by the Comptroller General.

Goldschmidt, Walter
1946 Small Business and the Community: A Study in Central Valley of
      California on Effects of Scale of Farm Operations
      Senate Committee Print No. 13, Report of the Special Committee
      to Study Problems of American Small Business, U.S. Senate, 79th
      Congress, 2nd Session.

Heady, E.O. and Whiting, L.R. (eds.)
1975 Externalities in the Transformation of Agriculture:
      Distribution of Benefits and Costs from Development
      Iowa State University Press.

Hightower, Jim
1973 Hard Tomatoes, Hard Times
      Schenkman Publishing Company.

Hottel, B.J. and Reinsel, Robert D.
1976 Returns to Equity Capital by Economic Class of Farm
      Washington, D.C.: USDA, ERS, Agricultural Economics
      Report 347.

Hutton, R.F. and H.R. Hinman
1969 A General Agricultural Firm Simulator
      Pennsylvania State University, Agricultural Experiment
      Station, Agricultural Economics and Rural Sociology #72,
      Revised Edition.

Bibliography (continued)

Ingram, J. Jack and Prochaska, D. Dean
1972 "Measuring Completeness of Coverage in the 1969
        Census of Agriculture"
        American Statistical Association Business and Economics
        Section Proceedings, pp. 199-205

Johnson, Glenn L.
1976 Comment made in production economics lecture.
        Michigan State University.

Johnson, Glenn L.
1974 "The Roles of the Economist in Studying Problems
        Involving Energy and Food"
        Michigan State University Agricultural Economics
        Staff Paper.

Johnson, Glenn L.
1976 "Contributions of Economists to a Rational Decision-
        Making Process in the Field of Agricultural Policy"
        Michigan Agricultural Experiment Station Journal Article #7640.

Lee, Y.E.
1975 "Adjustment in the Utilization of Agricultural Land in South
        Central Michigan with Special Emphasis on Cash-Grain Farms"
        Unpublished Ph.D. Dissertation, Michigan State University.

Mack, Ruth
1971 Planning on Uncertainty
        New York, Wiley-Interscience.

Manetsch, T.J. and Park, G.L.
1974 System Analysis and Simulation with Applications to
        Economic and Social Systems
        Department of Electrical Engineering and Systems Science
        Michigan State University, Second Preliminary Edition.

Michigan Statistical Abstract
1976 Graduate School of Business Administration
        Michigan State University, Eleventh Edition.

North Central Public Policy Committee
1972 Who Will Control U.S. Agriculture?
        North Central Regional Extension Publication 32
        University of Illinois, Cooperative Extension Service,
        Spec. Publication 27.

Rodefeld, Richard D.
1977 "Proposal for Possible Small Farm Research"
        Memo to Joan S. Thompson, Pennsylvania State University.

Bibliography (continued-3)

Rogers, E.V. and F. Floyd Shoemaker
1971 Communication of Innovations: A Cross Cultural Approach
      The Free Press, New York.

Schultz, T.W.
1953 The Economic Organization of Agriculture
      pp. 152-171, McGraw-Hill, New York.

Shover, John L.
1976 First Majority - Last Minority
      The Transformation of Rural Life in America
      Northern Illinois University Press.

Simon, Herbert A.
1969 "A Behavioral Model of Rational Choice"
      Quarterly Journal of Economics 69: 99-118.

Thompson, Ronald L.
1975 Description and Analysis of Limited Resource Farmers
      in Michigan
      Unpublished Ph.D. Dissertation
      Michigan State University.

Thompson, Ronald L. and Ralph E. Hepp
1976 Description and Analysis of Michigan Small Farms
      Michigan State University, Agricultural Experiment
      Station, Research Report 296.

Tversky, Amos
1972 "Elimination by Aspects: A Theory of Choice"
      Psychological Review; Volume 79, No. 4.

U.S. Department of Agriculture
1976 Farm Income Statistics
      Economic Research Service; Statistical Bulletin 557
      Washington, D.C.

U.S. Department of Commerce
1976 1974 Census of Agriculture: Preliminary Report, Michigan
      Bureau of the Census.

U.S. House of Representatives
1976 Upgrade Small Farmer Operations
      Committee on the Judiciary, Subcommittee on Family Farms
      and Rural Development, Hearings, 94th Congress.

U.S. House of Representatives
1972 Family Farm Act
      Committee on the Judiciary, Antitrust Subcommittee, Hearings,
      92nd Congress.

Bibliography (continued-4)

U.S. Senate
1976 "Assistance to Small Farmers in Upgrading Their Farming Operations"
      Report No. 94-1234.

U.S. Senate
1975 Will the Family Farm Survive in America?
      Committee on Small Business
      Joint Hearings, 94th Congress.