A construct of social action for small farmer agricultural development

Kerry Joseph Byrnes

Iowa State University

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A construct of social action for small farmer agricultural development

by

Kerry Joseph Byrnes

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of The Requirements for the Degree of DOCTOR OF PHILOSOPHY

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Major: Sociology

Approved:

Signature was redacted for privacy.

In Charge of Major Work

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For the Major Department

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For the Graduate College

Iowa State University
Ames, Iowa

1975

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<th>Complete Name</th>
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<td>CIAT</td>
<td>Centro Internacional de Agricultura Tropical</td>
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</tr>
<tr>
<td>CIMMYT</td>
<td>Centro Internacional de Mejoramiento de Maíz y Trigo</td>
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<td>CPC</td>
<td>Commodity Production Cycle</td>
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<td>CPF</td>
<td>Commodity Processing Facility</td>
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</tr>
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<td>CPS</td>
<td>Commodity Process System</td>
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<td>CSA-SFD</td>
<td>Construct of Social Action for Small Farmer Agricultural Development</td>
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<tr>
<td>IARC</td>
<td>International Agricultural Research Center</td>
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<td>IRRI</td>
<td>International Rice Research Institute</td>
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<td>LDC</td>
<td>Less Developed Country</td>
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<td>Multi-Commodity Process System</td>
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<td>NAREO</td>
<td>National Agricultural Research/Extension Organization</td>
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<td>SFT</td>
<td>Small Farmer Technology</td>
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<td>SSEM</td>
<td>Social System Elements Model</td>
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1A more complete definition of each acronym will be found on the designated page.
CHAPTER I. THE PROBLEM AND THE OBJECTIVE

The Problematic Context

The agricultural sector in most of the less developed countries (LDCs) of Latin America and to a lesser extent in Asia and Africa is composed of two subsectors: (1) the highly commercialized or "output subsector" and (2) the predominantly subsistence or "employment subsector." The contrast between these two subsectors is summarized by Biggs (1974a:12) as follows:

The output subsector is characterized by relatively large farming units utilizing modern production techniques for the purpose of raising marketable surpluses for export or domestic consumption. The employment subsector is composed of small farming units whose output is just sufficient to support the immediate family's consumption needs.

The demarcation between these two subsectors is more concretely reflected in Table 1.1 which provides the world distribution of agricultural holdings. Approximately two-thirds of all the agricultural holdings in the world are five hectares\(^1\) or less in size. It may also be noted that while this group accounts for only about 6% of the total agricultural area, this area encompasses more than one-fifth (over 20%) of the total cropland. The intensive crop production on small holdings to meet food requirements, in contrast to the larger units which are comprised of land that is either unusable for crops, held idle, or is used for grazing livestock, accounts for the disproportionately large cropland area in the subsistence sector (Biggs, 1974a:13)

While the commercialized or output subsector should not be neglected in development planning (Schutjer and Coward, 1971; Mosher, 1972), there

\(^1\text{One hectare (ha) is equivalent to 2.47 acres.}\)
Table 1.1. World distribution of agricultural holdings, total area, and total cropland by size of holding (percent) (FAO, 1971:35)

<table>
<thead>
<tr>
<th>Number of holdings</th>
<th>Total area</th>
<th>Total cropland</th>
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<tr>
<td>1 ha and under 2</td>
<td>31.4</td>
<td>1.7</td>
</tr>
<tr>
<td>2 ha and under 5</td>
<td>34.0</td>
<td>4.1</td>
</tr>
<tr>
<td>5 ha and under 10</td>
<td>15.7</td>
<td>4.2</td>
</tr>
<tr>
<td>10 ha and under 20</td>
<td>8.6</td>
<td>4.4</td>
</tr>
<tr>
<td>20 ha and under 50</td>
<td>5.2</td>
<td>5.8</td>
</tr>
<tr>
<td>50 ha and under 100</td>
<td>2.3</td>
<td>5.8</td>
</tr>
<tr>
<td>100 ha and under 200</td>
<td>1.4</td>
<td>6.7</td>
</tr>
<tr>
<td>200 ha and under 500</td>
<td>0.8</td>
<td>8.7</td>
</tr>
<tr>
<td>500 ha and under 1000</td>
<td>0.3</td>
<td>6.6</td>
</tr>
<tr>
<td>1000 ha and over</td>
<td>0.3</td>
<td>52.0</td>
</tr>
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</table>

^Includes those holdings less than 1 hectare.

has been increasing recognition that "greater assistance and resources should be devoted to raising the productive capacity of the employment [or subsistence] subsector" (Biggs, 1974a:12). McNamara (1973) has emphasized in this regard that there is "no viable alternative to increasing the productivity of small-scale agriculture if any significant advance is to be made in solving the problems of absolute poverty in the rural areas...or of achieving long-term stable economic growth." Thus, as Owen (1974:30) has stressed, "The subsistence farming sector needs to be viewed as a separate and critical development planning environment in its own right." When viewed as a planning environment in its own right, the agricultural development of the subsistence farming sector entails three basic concerns: productivity, income, and employment.
Productivity

For any particular developing country, "subsistence farmers may support as much as two-thirds of the entire population" (Biggs, 1974a:8). "Since the combined output of the small individual units constitutes an important and in some cases dominant position in total production, marginal productivity gains would have a marked impact on the aggregate" available for feeding the dependent rural and urban populations (Biggs, 1974a:14). In short, since subsistence holdings "provide the food needs for the bulk of the world's population," increased productivity on these holdings would constitute "a remarkable impact on global food supplies" (Biggs, 1974a:13). These considerations take on even greater importance in light of (1) alarming rates of population growth in the LDCs (Borgstrom, 1967) and (2) widespread human suffering from malnutrition (McIntosh, 1975).¹

Income

The importance of increasing productivity in the subsistence subsector lies not only in the need for increased food supplies but also in the simple fact that "the subsistence farmer...constitutes by far the majority of the rural poor in developing countries" (Biggs, 1974a:12). By increasing productivity on subsistence holdings, the currently low per capita income of the subsistence farmer can be increased either (1) through consumption

¹The author recognizes the import of Engels' law "that the higher the per capita income, the lower the proportion of income spent on food" (Mellor, 1966:18). The implication of Engels' law in the context of agricultural and economic development is that there is a point beyond which a developing economy will not further develop solely through increased output of food supplies. Development in the long run also requires the expansion of output in nonagricultural goods and services and/or the exportation of food in exchange for the importation of foreign-produced industrial and consumption goods.
of larger quantities of the agricultural commodities which are produced
and/or (2) through exchange of larger quantities of produce in local or
regional markets for cash, other goods, and/or services. Increased produc-
tivity on each of the relatively large number of small holdings will not
only increase income among small farmers but also will thereby help (1) to
achieve a more equitable distribution of income, (2) to increase effec-
tive demand for consumer goods, and (3) to provide a sufficiently absorbent
market for industrial investment (Biggs, 1974a:14).

Employment

With lowered mortality rates and continuing high birth rates in the
LDCs, the estimated annual average growth rate of the labor force between
1950-65 and 1965-80 rose from 1.7% to 2.2% (Thorbecke, 1970:26). With lim-
ited effective demand for consumer goods and consequent limited industrial
investment, the expansion of industrial employment has not been sufficient
to absorb the estimated increases in the work force. The employment prob-
lem is further complicated by the considerable migration of people from
rural to urban areas in a largely futile search for jobs which do not
exist.

Mahbub Ul Haq (1971:62), Senior Adviser in the Economics Department of
the International Bank for Reconstruction and Development, recently observed
that employment in the national plans of the developing countries is
often a secondary, not a primary, objective of planning. And yet while
LDCs seek higher economic growth rates, it is somehow forgotten "that a
high growth rate has been, and is, no guarantee against worsening poverty
and economic explosions" (Haq, 1971:63). As a result of these and other
interrelated trends, the problems of malnutrition, maldistribution of income, and other forms of poverty are compounded by massive unemployment and underemployment (underutilization of total available man-hours).

Implications for Agricultural Development Planning

Those who have analyzed these complexly interrelated trends have increasingly come to the conclusion "that in almost all of the developing countries there will continue to be a rapid increase for many years in the number of people who must find their livelihood in agriculture" (Abercrombie, 1971:1). In support of this conclusion, FAO (1969:22-23) has estimated that the developing world's agricultural population, while declining as a proportion of the total population from 67 to 55%, is likely to increase by almost 50% in absolute terms between 1962 and 1985. "This would mean that nearly half of the additions to the population during this period would need to be absorbed in the agricultural sector" (Abercrombie, 1971:1).

In connection with the realization that the agricultural sector in the LDCs must absorb increasingly greater quantities of labor, Haq's (1971:65-67) thesis merits quoting here at length:

We have a number of case studies by now which show how illusory it was to hope that the fruits of growth could be redistributed without reorganizing the pattern of production and investment first. . . . I am afraid that the evidence is unmistakable; divorce between production and distribution policies is false and dangerous. The distribution policies must be built into the very pattern and organization of production. . . . We were taught to take care of our GNP as this will take care of poverty. Let us reverse this and take care of poverty as this will take care of the GNP. . . . ...the concerns for more production and better distribution should be brought together in defining the pattern of development; both must be generated at the same time; the present divorce between the two concerns must end. If the pattern of
production...is geared to satisfying minimum consumption requirements and to employing the entire labour force, higher production will itself lead to better distribution. ...employment should become a primary objective of planning and no longer be treated as only a secondary objective. Let a society regard its entire labour force as allocable; over this force its limited capital resources must be spread. Let us reverse the present thinking that, since there is only a fixed amount of capital to be allocated at a particular time, it can employ only a certain part of the labour force, leaving the rest unemployed, to subsist on others as hangers-on or as beggers, without any personal income, often suffering from the worst forms of malnutrition and squalor. Instead let us treat the pool of labour as given; at any particular time it must be combined with the existing capital stock....

A careful consideration of the close interrelationship between the positions set forth by Abercrombie (1971) and Haq (1971) leads one to the conclusion that national governments throughout the LDCs, as well as international development assistance agencies, "should explore the extent to which...techniques requiring more labor in the production process can be applied in agriculture" (Thorbecke, 1970:27).

This conclusion is not only implicit in the Haq thesis but also reechoed by various other students of development (Oshima, 1970; Schumacher, 1973; Lund, 1974; Merrill, 1974). In view of the increasingly larger populations which must be absorbed by the agricultural sector, development planners must now seek ways to more effectively utilize this available labor supply. Since the subsistence farmer not only comprises a large percentage of the population in the agricultural sector (Pearse, 1969; Shanin, 1972) but also has access to land, is currently engaged in the production process, and has management skills (Schultz, 1964; Wilken, 1974), "a strategy aimed specifically at the subsistence farmer has a high probability of success" (Biggs, 1974a:12). While one may find Biggs' optimism encouraging, one's enthusiasm must be realistically tempered by a
recognizing the vast numbers of small farmers who somehow must be assisted (cf. Bradfield, 1974a, 1974b; Rao, 1974; Nash, 1975; World Bank, 1975).

Identifying ways in which the large numbers of subsistence farmers can begin to participate in a more productive agriculture has been a focus of several international conferences and seminars (Wharton, 1969; CIMMYT, 1970b; Adams and Coward, 1972; Biggs and Tinnermeier, 1974; Harrison and Shwedel, 1974). A recurrent theme in these discussions has been the recognition of a need for improved (more productive) agricultural technology that can be profitably utilized by and rapidly diffused to the subsistence farmer. This theme has also been echoed in one way or another in a number of recent documents (CIMMYT, 1969; CIAT, 1973, 1974a; McRobie and Hodgkinson, 1974; Franklin and Scobie, 1974). As Tinnermeier (1974:97) observes: "Technological innovations for increasing productivity on small scale farms are accepted now by most developmental specialists."

Despite the increasing recognition that the small farmer needs more productive technology, there has been no parallel emergence of a systematically-articulated strategy to develop such improved technology and to diffuse that technology to an LDC's small farmers. As Tinnermeier (1974:97) recently noted, "the most appropriate procedure for introducing new technology to the small farmer is not always evident." Why?

Reporting on a recent Workshop on Research Resource Allocation, Pintrup-Anderson and Byrnes (1975:6) note:

The lack of adequate delivery systems and supporting institutions and public policy are generally considered the principal limitations to the adoption of new technology. But discussions on means of accelerating the rate of adoption of new technology suggested the possibility that inadequacy of the technology to solve
farm level problems in a way acceptable to the farmer might well be the most important adoption limitation. This limitation might be reduced or eliminated through efforts to provide the research manager with more and better information on actual farm level problems and technology preferences.

The workshop suggested that agricultural and social scientist work together to help assure that 1) research is relevant to the farm level problems and farmer preferences and 2) adequate technology is rapidly and extensively adopted.

The emphasis on the inadequacy for the small farmer of previously developed technology is also reflected in a recent sector policy paper on rural development published by the World Bank (1975:32): "Inappropriate research programs and the inadequacies of adaptive research and extension have in many cases been major factors limiting the benefits reaching poor farmers."

The World Bank (1975:32) also notes as an emerging common problem "the failure to treat the subsistence farm as a system of cultivation, requiring a comprehensive approach to on-farm technological improvement."

The observations of the World Bank (1975) and the Workshop on Research Resource Allocation (Pinstrup-Anderson and Byrnes, 1975) highlight the urgent need for research on (1) the subsistence farm as a system and (2) the specific processes that would be involved in developing improved technology that is appropriate to the small farm situation and diffusing this technology to the small farmer. The research possibilities are numerous. Reporting on a Seminar on Small Farmer Development Strategies held in September, 1971, at The Ohio State University, Adams and Coward (1972:22) suggest that: "More detailed, well-documented case studies of SFD programs are needed." They also propose that: "More work is needed on an

---

1"SFD" is used as an acronym by Adams and Coward (1972) to stand for Small Farmer Development.
analytic framework for analyzing SFD programs. This should include identifying additional essential variables, adjusting the critical variables already identified, and further specifying the relationships among the variables" (Adams and Coward, 1972:23).

In relation to developing such an analytic framework, Adams and Coward (1972:22) also urge "that more SFD programs should include a systematic evaluation component. Much of the knowledge currently available on SFD stems from such evaluation." Another dimension that merits investigation is

...more integrative research which looks across several SFD programs.... This integrative research should be classified by societal contexts within which SFD is carried out, and by complexity of the package of development techniques applied. A clear picture of success and failure patterns should emerge once this matrix is more adequately filled with such studies (Adams and Coward, 1972:22).

The urgency of the need to tackle these many research areas cannot be overemphasized during a time when the developing countries are increasingly attempting to bring about rapid social change through various developmental policies, programs, projects, and practices. These components of development strategy and tactics, however, cannot be effectively implemented with any meaningful developmental impact without a modicum of planning. As Röling (1974:22) recently noted: "Most countries are increasingly faced with problems which can only be solved through planned social change." The information which such research as proposed by Adams and Coward (1972:22-23) would provide is essential not only for agricultural development planning and policy making at the national level but also for more effective program and project implementation in the area of developing more productive agricultural technology that employs larger amounts of presently
underutilized labor (both small farmers and landless laborers) in the rural areas of an LDC.

Tinnermeier's observation, however, in regard to an uncertainty as to the most appropriate procedure for introducing new technology to the small farmer, reflects an even more general uncertainty given the current state of social science knowledge as to the most effective strategies for introducing change (e.g., new technology) in an LDC. In this regard, Röling (1974:22) argues:

It is...shameful for social science research that change agencies in developing countries each work with its own rule-of-thumb approaches to rural development, simply because there is no set of proved strategies which can be replicated. In short, we can safely say that most social science research has not yet been able to provide us with...prototype strategies for social change.

Röling (1974:22-23) cites several reasons why social science has not yet provided replicatable strategies for instigating planned social change in the LDCs. First, "social scientists have usually aimed at reaching conclusions about society instead of at methods for changing society." Second, "most regular social science research is...not experimental. That is, it usually stops at the quantitative survey stage and can thus only draw conclusions about 'current practice' and never about what would happen if one tried to change current practice." Third, "ordinary social science research...tackles problems which derive from the theories, models and paradigms of other social scientists and not from pressing social problems." Finally, in "deriving problems from theory...the researcher usually takes a monodisciplinary view while real problems usually require a multidisciplinary approach."
As an alternative to "regular social science research," Röling (1974:23) advocates what he calls problem-solving research or decision-oriented research which:

...aims at solving social problems, at developing prototype solutions which can be replicated by the practitioner. That is, the goal of problem-solving research is...to gain knowledge which can improve the outcome of a project, i.e., knowledge about effective means to reach a desired state or objective. Where regular social science research aims at conclusions, problem-solving research aims at decisions, at formulas for action.

In order to develop knowledge about effective means to reach a desired end, Röling (1974:23) argues that the social scientist's analysis must go beyond simply analyzing current practice.

Small-scale experimentation with alternative approaches to solve a problem are needed to end up with a replicable prototype for policy makers. "Experimentation" here does not refer to the rigorously controlled experiments in a laboratory, where the effect of one action (experimental treatment) on the environment is assessed. What we are after is to test the comparative effectiveness of packages of experimental treatment (programmes, projects or strategies) which have the desired effect as a package. Perhaps it is better to speak of "prototype development and testing" than of "experimentation".

Röling (1974:23) cautions that while the problem-solving or decision-oriented approach does have the disadvantage "that the contribution of each treatment in the package or strategy (say, a combination of farmer training, credit and input provision) is unknown, ...the advantage is that one ends up with a strategy or package which works, i.e., which can be used to achieve a policy objective."

The dissertation problem

It may be concluded from the preceding discussion that: (1) there is a "real world" need for effective strategies to develop improved agricultural technology for the small farmer and to diffuse this technology to the
small farmer and (2) that social science needs to develop models or prototype strategies for introducing social change that would be of practical utility to those national and international development assistance agencies responsible for planning and implementing programs or projects of planned or instigated social change. Obviously, within the context of the research topics proposed by Adams and Coward and the perspective on social science research advocated by Röling, a prototype strategy or model of the steps that are involved in developing and diffusing improved agricultural technology to small farmers in an LDC is one research problem which merits urgent attention. As Wellhausen (1970:7) has emphasized:

...it is urgent that ways be found whereby the new science-based technology can be more rapidly extended to the large number of non- or semi-commercial farmers whose primary concern is producing enough for themselves and their families to eat. How to do this is the number one problem confronting the developing world today.

This problem is addressed by this dissertation from a predominantly sociological as contrasted to a purely economic, agronomic, or other relevant disciplinary perspective.

The dissertation objective

The overall purpose or general objective of the dissertation is to devise a strategy that would be of practical utility in designing action programs to improve the level of living of small farmers in the LDCs through the development of improved agricultural technology and the diffusion of this technology to small farmers.

At a more specific level, the objective of this dissertation is to approach the problem of developing and diffusing improved agricultural technology to small farmers in the LDCs from a sociological viewpoint. In
other words, while the dissertation does not deny or in any way intend to
belittle the appropriate application of certain economic, agronomic, or
other disciplinary approaches to agricultural development, the dissertation
does take the position that there is also a sociological approach which is
an essential input to the design and implementation of action programs to
reach specific target populations or groups within a larger population.
While the point of view elaborated in this dissertation is not the only
sociological approach to the problem of agricultural development insofar as
the small farmer is concerned (cf. Rogers, 1969; Smith, 1972), the author
does take the position that the approach is perhaps the most operationally
feasible.

At the most specific level, the objective of the dissertation is to
specify a strategy (1) to develop Small Farmer Technology (SFT), i.e.,
technology that is workable and beneficial within the context of the pre­
dominantly subsistence-oriented or small farm agricultural operation in an
LDC, and (2) to diffuse such SFT to an LDC's small farmers. At this spe­
cific level, the dissertation is addressed to the problem of specifying the
relevant social processes that are involved in developing and diffusing SFT
to small farmers in an LDC. Given this particularly sociological concep­
tualization of the problem, the dissertation accordingly will not explic­
itly address the many immediately pertinent considerations that would be
addressed by an economist, agronomist, or other scientist who focuses on
the problem of developing improved technology for small farmers. However,
the author does take the position that this dissertation's sociological
approach is sufficiently general to allow incorporation of other disciplin­
ary approaches to specific aspects of the more general problem of the development and diffusion of SFT in an LDC.

**How dissertation's objective will be met**

This dissertation's objective will be met through a series of four interrelated chapters. Chapter 2 outlines a social action perspective at a general conceptual level and then applies this perspective to the problematic area of small farmer agricultural development in the LDCs. The specific output of Chapter 2 consists of a conceptual framework for taking a social action approach to the problem of specifying a strategy to develop SFT and diffuse such technology to small farmers in an LDC.

Chapter 3 addresses the methodological considerations relating to the procedure utilized by the author in specifying a model of a strategy of social action for small farmer agricultural development, i.e., a strategy to develop and diffuse SFT to an LDC's small farmers. The specific output of this chapter is the idea of developing a middle-range prototype model of social action for small farmer agricultural development through a synthesis of the general "Construct of Social Action" (Beal et al., 1966) and the specific strategy utilized in the Puebla Project (CIMMT, 1969) to develop and diffuse SFT to small farmers in Mexico. The product of such a synthesis is identified as a "Construct of Social Action for Small Farmer Agricultural Development."

Chapter 4 presents the outline of the author's efforts to specify, according to the conceptual framework outlined in Chapter 2 and the methodology discussed in Chapter 3, a "Construct of Social Action for Small Farmer Agricultural Development." The specific output of this chapter is
the presentation and discussion of a series of interrelated action steps that would, if followed by an action agency, such as a national agricultural research and extension organization, provide a vehicle or prototype strategy for developing SFT and diffusing this technology to the small farmers in the LDC in which that organization operates.

Chapter 5 then briefly discusses some of the considerations of application that would be involved in actually putting the "Construct of Social Action for Small Farmer Agricultural Development" to an empirical test and suggests several problems in measurement and theory that merit further research.

Finally, Chapter 6 provides a summary overview of the dissertation.
This chapter's objective is to articulate a social action perspective for approaching the problem of developing a model of a strategy for developing improved technology for small farm agriculture in the LDCs and diffusing this technology to an LDC's small farmers. The objective will be met in two steps. First, a general social action perspective will be developed. Second, this perspective will be applied to the context of small farm agriculture in the LDCs.

A Social Action Perspective

The social action perspective articulated in the first part of this chapter presupposes several concepts which must first be defined: social system, social change, and social development.

Social system

The concept of social system, defined below, presupposes the concepts of social interaction and social organization which must first be defined. Once the social system concept is defined, three additional concepts will be discussed: subsystem, social system maintenance, and social system element. In relation to the idea of a social system element, nine specific social system elements will be defined and a Social System Elements Model (SSEM) elaborated.

Social interaction The concept of social interaction is defined as "the reciprocal influencing of the acts of persons or groups, usually mediated through communication" (Gould and Kolb, 1964:657). Loomis (1960:2) lists four characteristics of interaction as important:
1. Interaction requires a plurality of two or more actors.

2. Interaction is directed toward objectives (or goals) which are subjectively held by actors.

3. Interaction is carried out through the actors' communication with one another by means of symbols.

4. Interaction takes place within a time dimension possessing a past, present, and future.

While other characteristics of interaction could be mentioned (cf. discussion below in regard to "social system elements"), it should be emphasized that a social system (as defined further below) is not the actual interaction of actors but rather a simplified representation or model of selected elements (e.g., the actors' objectives) of that interaction.

**Social organization** The concept of social organization is used here to convey the image of a special type of actor: "an organized network of social interaction" (Bertrand, 1972:3). This image is elaborated by Bertrand (1972:3) as follows:

...when used in a generic sense, social organization refers to the totality of activity within a greater society, such as a nation. When used in a specific sense, this term relates to the interactional patterns found in one or another of the various subunits, such as families, corporations or communities, that constitute a total society.

Thus, used in a specific sense, a social organization is a concrete unit or component of society.

**Social system** The concept of social system is defined as a unity or set of actors (either social organizations or individual persons) who interact with one another through communication and material interchanges across the boundaries which define the actors as concretely distinct entities or units. This definition of a social system corresponds to Berrien's
(1968:14-15) definition of a system as "a set of components interacting with each other and a boundary which possess the property of filtering both the kind and rate of flow of inputs and outputs to and from the system." While the social system concept is "applicable to many levels of generality, identification or labelling of the units depends on the level of generality of the system under discussion" (Rushton and Shaudys, 1967:54). With this consideration in mind, either a generic social organization (e.g., a greater society or nation such as the United States of America) or a specific social organization (e.g., the Jones family, an agricultural research institute, etc.) may be analyzed (and referred to) as a social system.

Subsystem Any specific actor (whether a specific organization or an individual person) or set of two or more actors may be designated as a subsystem of some wider social system; at the same time, any specified subsystem can be analyzed as a relatively independent social system. Beal and Hobbs (1969:1), for example, note that "a community, while being termed a social system, is composed of many different systems or sub-systems." The component subsystems of any social system may vary considerably in the specific contributions they have not only in meeting the needs and aspirations of individual actors who are members of that social system but also in maintaining the performance capability of the overall social system.

Social system maintenance A number of sociologists (Parsons et al., 1961; Black, 1961) have hypothesized that if a social system is to survive, it must solve four problems:

...(1) latency (pattern maintenance and tension management)--the primary concern is with values; (2) integration--the primary concern is with the mutual adjustment of units within the system;
(3) adaptation—the emphasis is on means or facilities; (4) goal attainment—the emphasis is on ends (Rushton and Shaudys, 1967: 54-55).

Rushton and Shaudys (1967:55) note that social interaction directed toward "the solution of each of these problems takes different forms, and each structured behavior pattern may be viewed as a subsystem of the larger system." This idea is represented in Figure 2.1.

![Diagram of the four functional subsystems of a social system](image)

**Figure 2.1.** The four functional subsystems of a social system, the primary concern of each subsystem, and specification of the action cycle within a social system

When generic or specific social organizations are viewed as dynamic social systems, action may be conceptualized as occurring

...in a recurring cycle, beginning with the latency subsystem and ending with the solution of the goal attainment problem. In terms of action, latency and integration (stages 1 and 2 of the cycle) are in an area of expressive activity, with integration as the prime goal. Adaptation and goal attainment (stages 3 and 4 of the cycle) fall in an area of instrumental activity, with adaptation as the prime goal (Rushton and Shaudys, 1967:55).

The action cycle within a social system is also illustrated in Figure 2.1.

Put somewhat more simply, a social system has two basic problems:

(1) integrating its various subsystems and (2) adapting to external systems.
Social system element In analyzing any social system, there are a number of attributes or elements which may be identified. Bertrand (1967:25) observes that the term "element" is:

...normally used to designate some basic part of a larger whole. Chemical elements...represent varieties of matter which singly or in combination make up all material things. Likewise, the elements of social systems are units of social interaction. The elements make up the structure of the social system--they are the parts of the system which hold it together.

Thus, a social system element is not the actual interaction between and among actors but rather an "analytical aspect...of interaction" (Bertrand, 1967:25). Nine such elements may be identified in any social system. Each of these elements is defined below. Their relevance to small farmer agricultural development will be illustrated later in the chapter.

Sentiment A sentiment (or attitude) is a feeling which an actor has about a thing, an event, or a place. Numerous qualifiers may be imposed on this definition of a sentiment, particularly in regard to the question of whether and in what way sentiments are the same as or different from beliefs (defined below). The conceptual and definitional problems involved in this issue will not be further pursued here. For purposes of this dissertation, the distinction between knowing something (beliefs) and feeling something (sentiments) is accepted as a meaningful and useful distinction.

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1 The author notes here Charles P. Loomis' (1959:12-42) earlier articulation of the nine social system elements at a general theoretical level. The many references in regard to the social system elements which are cited in this dissertation reflect the work of later sociologists to utilize the social system elements in an empirical research context.
Belief  A belief (or knowledge) is a proposition about the universe which is accepted by an actor in a social system as true or right. It is not necessary that the actor's beliefs be in fact true. As Bertrand (1967:27) notes: "Beliefs are an important element of social system because people behave in terms of what they know, and they know that certain explanations and evaluations propounded in their systems are true, right, and good." Knowledge may be defined as a special type of belief: knowledge consists of those beliefs which are obtained through some process of validation, the process being "some method of testing which is considered adequate by members of a social system to sustain a belief" (Bertrand, 1967:27). This process of validation applies as well to the formulation and modification of beliefs.

Norm  A norm is a rule which prescribes what is acceptable or unacceptable in a particular situation. Among many sociologists, Bertrand (1967:28) observes, a norm is considered as "the most critical element in the understanding and prediction of action in social systems. Norms represent the rules of the game; in other words they provide standards for judging behavior and for behaving." Three types of norms may be identified in any social system: "(1) folkways or commonly accepted rules of conduct which do not have a compulsive or 'must' status; (2) mores or 'must' behaviors, which are strictly enforced; (3) laws that codify and reinforce the mores and control behavior outside the scope of the mores" (Bertrand, 1967:28).

Status-role  A status-role is defined here as the normatively defined behavior expected from an incumbent of a social position. Any social system, by virtue of the fact that a social system involves two or
more actors, is characterized by different status-roles. Bertrand (1967: 29) defines a **status** as "a position in a social system independent of given actors, whereas a **role** can be described as a part of a status position consisting of a more or less integrated subset of social norms." For example, in the case of the family as a social system, there are four basic status positions: husband (father), wife (mother), son (brother), and daughter (sister). Each status position a person occupies in a given social system imposes on that person a normatively defined social role, i.e., a set of duties (responsibilities and obligations) and rights that the person is expected to fulfill. Bertrand (1967:29) further notes that it is "a general rule that social roles fit together in such a way as to be **reciprocal** in terms duties, rights, and obligations." Thus, for example, in each society the status position of husband defines a specific role which he is expected to play in relation to his wife in her status-role. Bertrand (1967:29) emphasizes that:

...status positions must not be thought of as synonymous with the individual who, at the moment, occupies the given place in a group structure to which it is attached. It is simply the established collection of responsibilities, obligations, and rights associated with a certain position that is recognized and understood in a given society.

In short, "social roles are prescribed for every status position and social interaction is predictable to the extent that individuals behave in accordance with the acceptable patterns for their roles" (Bertrand, 1967:29).

The duties and rights that enter into the pattern of expected behavior normatively defined by an actor's status-role determine in part the actor's place, value, or worth in relation to other actors in the social system in question. When such criteria are considered, we are concerned with the way
in which social subsystems (individual actors: persons or groups) may be ranked either by individual actors within the overall social system or by an outsider (e.g., the sociologist) as superior or inferior according to one or more criteria. Whether rank is defined by actors within a social system or by an outsider, such rank comprises what may be referred to as the stratificational subsystem of the broader social system. A stratificational system may arise in a social system through one or more of several different processes: (1) increasing specialization and differentiation of status-roles; (2) ranking of actors; and/or (3) controlling or distribution of natural (e.g., gold, salt) or socially-produced (e.g., food) wealth (Lenski, 1966; McIntosh, 1975). These latter two processes, i.e., ranking and controlling, underlie the next two elements that will be defined: rank and power.

**Rank**

A rank may be defined as the value an actor has for the system in which the rank is accorded. This definition is elaborated by Bertrand (1967:3):

> Each actor in a social system is constantly evaluating the other actors in the system to determine their rank relative to his own. . . . After evaluation by...fellow actors, a given individual is ...ranked...according to the appraisal of his [or her] worth by [fellow actors]. Appraisal of actors may be done in terms of skills, experience, schooling, or any other criterion important or trivial. However, performance is usually the key to movement up or down the system.

It may be further noted that the efficacy of performance as a means of enhancing one's mobility upward in a social system's stratificational subsystem and relatedly, thereby, the rank that is likely to be accorded to oneself, will be impeded in the extent to which: (1) certain statuses to which the individual aspires can be entered only through ascription and not
achievement, (2) the actor who aspires to a higher rank is at a disadvantage in terms of the distribution of power in the social system in which he (she) is a member; (3) the actor pursues as relevant objectives which can be realistically achieved; (4) the actor optimally utilizes available facilities (resources) in the pursuit of objectives which the actor has defined as relevant; and (5) the actor does not incur any negative sanction to penalize, slow down, or terminate his upward progress. These latter four social system elements, namely power, objectives, facilities, and sanctions, will now be discussed.

**Power**

Power may be defined as "the capacity to control others." An actor's power over others resides in the control which the individual actor exercises over the things which other actors value—regardless of what these other things might be (Emerson, 1962:31-32). Bertrand (1967:30) notes that power is exercised in either or both of two types of control: authoritative or nonauthoritative (influence or coercion). "Established or authoritative power always rests in a status position while nonauthoritative power such as coercion and the capacity to influence others, is not implicit in status positions" (Bertrand, 1967:30). Power is operationalized through decision-making and the initiation of action. An actor who is at a disadvantage in terms of the distribution of power in a given social system can compensate or overcome this disadvantage in the extent to which that actor pursues his or her objectives through a more optimal use of available facilities. Each of these two elements will now be discussed.

**Objective**

An objective or end is defined as the change which a social system's individual actors expect to accomplish through interac-
tion within the system in general and, specifically, through the actor's decision-making with respect to and utilization of available facilities (resources). Bertrand (1967:28) notes that "when persons interact it is to achieve some purpose" and that such purposes or "goals" are most clearly seen as functions of the system." Sometimes, however, "functions (or ends) are achieved which are not perceived, at least at first, by the actors in a system" (Bertrand, 1967:28). Although certain consequences may not be manifest (intended) in the purposes of actors, their behavior and interaction can nevertheless bring about such consequences (Merton, 1957).

**Facility**  
A facility is defined "broadly as any means which may be used to attain ends within the system. . . . The use of the facility, rather than its nature, determines its significance to social systems" (Bertrand, 1967:31).

One type of facility particularly important in any social system is that of technology. The concept of technology may be defined as a highly specific combination of facilities utilized by an actor to attain one or more specific objectives valued by the actor.

**Sanction**  
A sanction is a reward (positive sanction) or penalty (negative sanction) which motivates an actor's conformity to the objectives (ends), facilities (means), and norms of the system. Whether any particular social object would be defined as a positive or negative sanction would depend on the particular social system in which the sanction is applied. In other words, whether any particular object would be utilized or, in effect, operate as a sanction--positive or negative--will depend not only on the particular object in question but also on the vari-
ous elements (e.g., norms, objectives, facilities) that comprise the social system in which the sanction is applied.

The Social System Elements Model (SSEM) To counter whatever tendency there might be to view each of the nine social system elements as at best only an analytically distinct aspect of social interaction, it is helpful to provide a figurative representation of a social system in terms of its nine social system elements. Such a representation is provided in Figure 2.2. This representation of a social system in terms of the nine social system elements will hereafter be referred to as the Social System Elements Model (SSEM).

The reader should note three particular features of the SSEM represented in Figure 2.2. First, facilities may be analytically divided into those which are internally available and manipulable within a given social system and those which are or must be obtained from sources outside the social system. Second, since the concept of technology has been defined as analytically distinct from the concept of facility, the two concepts are each represented in Figure 2.2 by a separate circle, with technology being a function of the specific combination of facilities utilized by an actor to achieve his or her objectives. It must be emphasized, however, that the appropriateness of a technology depends not only on the specific combination of facilities actors utilize to achieve their objectives but also on the appropriateness of the technology's specific combination of facilities in the context of, i.e., in relation to, each of the other social system elements. Third, and finally, sanctions are figuratively represented as highly interrelated with each of the other social system elements.
SOCIAL SYSTEM REFERENCE POINTS

SOCIAL
PSYCHOLOGICAL

SOCIAL
ECONOMIC

SOCIAL
ORGANIZATIONAL

OBJECTIVE

NORM

STATUS-ROLE

SANCTION

BELIEF

RANK

SENTIMENT

POWER

FACILITY

TECHNOLOGY

Figure 2.2. The Social System Elements Model (SSEM): A representation of a social system in terms of the nine social system elements
There are, of course, an infinite number of possible interrelationships among the nine social system elements. For example, if an actor in a superordinate position of authority uses inappropriate means to pursue valued ends, he may fear that punishment will be applied by the proper authorities. This example clearly illustrates all nine of the social system elements in the SSEM: power, rank, and status-role (re "superordinate position of authority"); norms (re "inappropriate"); facilities (re "means"); beliefs and objectives (re "valued ends"); sentiments (re "fear"); and sanctions (re "punishment").

As another example: if an actor wishes to pursue a new objective, the technology currently utilized by that actor may be inappropriate either in the sense that the existing technology ineffectively achieves the newly defined objective or is normatively judged in some negative way (e.g., the technology lowers soil fertility and thus should not be used). At the same time, if a technology is developed which will effectively accomplish the newly specified objective, the actor in his or her specific-status-role may not have the necessary skills (knowledge or beliefs) that are required in order to properly utilize the new technology or the technology itself may be judged inappropriate in light of some religious belief or the individual actor's inability, given his (her) low rank in the system, to marshal the necessary facilities required for proper utilization of the new technology.

**Social system reference points** As the reader will observe in Figure 2.2, the author has proposed three analytically distinct social system reference points within the SSEM: the social organizational reference point, the social psychological reference point, and the social economic reference point. It will also be noted that the social system elements of
power, rank, and status-role are situated in the right column of the figure and are collectively referred to as the social organizational elements. In the left column, the social system elements of norm, belief, and sentiment are collectively referred to as the social psychological elements. Finally, in the middle column, the social system elements of objective, sanction, and facility are collectively referred to as the social economic elements. These collective references and their corresponding social system elements are also presented in Figure 2.3 to reemphasize the idea of the social organizational, social psychological, and social economic reference points.

<table>
<thead>
<tr>
<th>Social Psychological</th>
<th>Social Economic</th>
<th>Social Organizational</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norm</td>
<td>Objective</td>
<td>Power</td>
</tr>
<tr>
<td>Belief</td>
<td>Sanction</td>
<td>Rank</td>
</tr>
<tr>
<td>Sentiment</td>
<td>Facility</td>
<td>Status-Role</td>
</tr>
</tbody>
</table>

Figure 2.3. Specification of each of the nine social system elements in terms of a social system reference point

Reference points and functional subsystems While Figure 2.2 demonstrates one approach to the representation of the interrelationships among the nine social system elements, there is also another means whereby such interrelationships can be figuratively represented. First, recall from the initial discussion of the idea of social system maintenance that if a social system is to survive, each of its four functional subsystems
must solve a specific problem relating to a specific concern or emphasis:
(1) latency (values), (2) integration (mutual adjustment of units within the system), (3) adaptation (means), and (4) goals (ends). Second, recall that the interrelationships among these four subsystems were represented in Figure 2.1. Third, within this general functional perspective, each of the social system elements can be analytically associated with one of the four functional subsystems as illustrated in Figure 2.4.

Figure 2.4. Specification of interrelationship of the social system elements and the functional subsystems of a social system

The reader will observe in Figure 2.4 that the social psychological elements (norm, belief, sentiment) are analytically associated with the latency subsystem's primary concern with values. The social organizational elements (power, rank, status-role) are associated with the integration subsystem's primary concern with the mutual adjustment of units within the system. The social economic elements of facility (technology) and objective are associated with the adaptation subsystem's primary concern with means and the goal attainment subsystem's primary concern with ends,
respectively. Finally, while the social system element of sanction is classified in Figure 2.3 as a social economic element, its interrelationship with each of the other social systemic elements and, relatedly, with each of the four functional subsystems is represented as a circle at the intersection of the four subsystems in Figure 2.4.

Having discussed the concept of a social system and, relatedly, introduced the Social System Elements Model (SSEM), we may now turn to the definition of the concepts of social change, social development, and social action. As each of these concepts is defined, the author will introduce an additional relational dimension not previously considered in defining the preceding concept. These dimensions are, respectively: (1) in defining social change, the idea of social system element X as an independent variable and social system element Y as a dependent variable; (2) in defining social development, the idea of the purposive initiation (or instigation) of action with respect to a particular social system element X and the planned alteration of social system element Y; and (3) in defining social action, the idea of a first social system or subsystem A (designated as the change agent system) that seeks to achieve changes in a second social system B (designated as the target system).

**Social change**

*Social change* is defined herein as the unplanned alteration in one or more social system elements (Y) in social system A which occurs as the result of a change in another social system element (X) within the same social system A. This definition is represented in the upper third of Figure 2.5 and introduces the idea that a change which occurs in a particular
Social Change: Change in element X in social system A leads to: Unplanned alteration in element Y in social system A

Social Development: Purposive instigation of change in element X in social system A leads to: Planned alteration in element Y in social system A

Social Action: Social system A (change agent system) purposively instigates change in element X in social system B (target system) leads to: Planned alteration in element Y in social system B (target system)

Figure 2.5. A representation of the concepts of social change, social development, and social action
element X (the independent variable) leads to unplanned alteration in one or more social system elements Y (the dependent variable).

**Social development**

*Social development* is defined as the purposive instigation of a change in social system element (X) in social system A with the objective of achieving some planned alteration in one or more social system elements (Y) in social system A. This definition is figuratively represented in the middle third of Figure 2.5 and introduces the idea that actors in a given social system can purposively instigate change in an element (X) with the objective of achieving some planned alteration in some other element (Y) in that same social system.

**Social action**

*Social action* is defined herein as a special type of social development or instigated social change in which a first social system or subsystem A (designated as change agent system) purposively instigates a change in element X in a second social system or subsystem B (designated as target system) with the planned objective of altering one or more elements Y in the target system. This definition is figuratively represented in the lower third of Figure 2.5 and introduces the idea of change in an element Y of one social system or subsystem B (designated as the target system) as being achieved through the purposive action of another social system or subsystem A (change agent system) to instigate change in some element X of social system or subsystem B (target system).

A final consideration in discussing social action is the possibility of multiple change agent systems and multiple target systems. First, in an
overall social system, certain subsystems may be designated as primary target systems and others as secondary target systems. The import of this distinction lies in the recognition that it may not be possible to achieve certain alterations in the systemic elements of one social system without simultaneously or previously achieving certain alterations in the systemic elements of another social system. Thus, the first social system would be designated a primary target system and the second a secondary target system.

Second, for a particular social system, there may be a change agent system which is internal to that system as well as a change agent system which is external to the social system in question. For purposes of exposition, a change agent system internal to the overall social system is referred to as a primary change agent system; a change agent system external to the overall social system is referred to as a secondary change agent system.

Thus, we have four types of social systems which may be specified: (1) a primary target system, (2) a secondary target system; (3) a primary change agent system, and (4) a secondary change agent system. These four types of social systems in social action are represented in Figure 2.6.

<table>
<thead>
<tr>
<th>Target System</th>
<th>Change Agent System</th>
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</thead>
<tbody>
<tr>
<td>Primary</td>
<td></td>
</tr>
<tr>
<td>(1) Primary Target System</td>
<td>(3) Primary Change Agent System</td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
</tr>
<tr>
<td>(2) Secondary Target System</td>
<td>(4) Secondary Change Agent System</td>
</tr>
</tbody>
</table>

Figure 2.6. Specification of relevant social systems in social action
Application of Social Action Perspective to Small Farmer Agricultural Development

In the first half of this chapter, a social action perspective was developed. This perspective will now be applied to small farm agriculture as a specific social system in the LDCs. Once small farm agriculture has been conceptualized in terms of a social systems approach, the concepts of "small farmer agricultural development" and "social action for small farmer agricultural development" will be defined, thereby articulating the dissertation's social action perspective on small farmer agricultural development. This perspective will then be utilized as a basis for taking a social action approach to the problem of specifying a strategy to develop improved technology for small farmers and to diffuse such technology to an LDC's small farmers. This problem will be specifically addressed in Chapter 3 wherein the author discusses the methodology utilized to develop a model of social action for small farmer agricultural development.

Introduction

The importance of studying small farm agriculture in the LDCs is emphasized by the considerable debate among economic anthropologists between the substantivists (cf. Polanyi, 1947; Dalton, 1961; Foster, 1973) and formalists (cf. Burling, 1962; LeClair, 1962; Cook, 1966; Beishaw, 1965; Nash, 1966) over whether peasant agriculturalists respond to economic opportunities in the same fashion as modern farmers in the more developed nations. Somewhere between the substantivist and formalist arguments debated by the economic anthropologists, there has also been a somewhat parallel debate between sociologists (cf. Rogers, 1969; Smith, 1972; Frank, 1967) and economists (cf. Schultz, 1964; Wharton, 1969; Byrnes, 1966) over
which variables best explain or predict the behavior of small farmers in adopting purportedly improved technology.

Toward resolving the various issues involved in these related debates, John L. Schultz (1974:61) has argued: (1) that most scholars will tend to agree that...peasant economies reflect cultural peculiarities which require considerable, theoretical modifications to allow for maximum understanding and predictability" and (2) that change agents should be aware of such cultural peculiarities "in order to design strategies which will optimize the possibility of the acceptance of change."

Useful generalizations about small farm agriculture in the LDCs have been difficult to formulate in view of not only the aforementioned problem of "cultural peculiarities" but also the tendency of researchers across the various relevant academic disciplines to approach the phenomenon of "small farm agriculture" from a highly unidisciplinary perspective. The possibility of developing generalizations about small farm agriculture is further complicated in the extent to which such agriculture is interrelated not only with the varying peculiarieties of the natural environment but also with the "cultural peculiarities" of a broader social system beyond the small farm. Accordingly, while attempting in the following to focus primarily on small farm agriculture as a relatively independent social system, the discussion will consider at various points social system elements which are interrelated with either the natural and/or the broader social system environment.
The small farm system as a social system

No single criterion adequately suffices to define the nature of small farm agriculture in the LDCs. Harrison and Shwedel (1974:2) observe in this regard that the trend in defining "small farm agriculture" is to employ a multi-dimensional criterion. As will be demonstrated below, the social system and social system element concepts provide heuristic tools for purposes of taking into account the diverse aspects of small farm agriculture.

Basic concepts The "small farm system" concept defined further below presupposes a number of concepts which will first be defined.

Production input factor A production input factor is any process or input to that process utilized in producing a particular agricultural commodity.

Commodity disposition factor A commodity disposition factor is any process or input to that process that is utilized in disposing of a produced agricultural commodity.

Commodity Processing Facility (CPF) A Commodity Processing Facility (CPF) is defined as any process or input to that process that is utilized in producing and/or disposing of an agricultural commodity.

Commodity Process System (CPS) A Commodity Process System (CPS) is defined as the sequence of activities involved in producing (growing and/or raising) a particular agricultural commodity and disposing of that commodity. Within a CPS, one may refer to the production phase as distinct from the disposition phase.
Commodity Production Cycle (CPC) The period of time required to produce a particular commodity is referred to as a Commodity Production Cycle (CPC).

Multi-Commodity Process System (Multi-CPS) If two or more plants (e.g., corn and beans) are involved or, similarly, two or more animals (e.g., pigs and chickens), we may speak of a Multi-Commodity Process System (Multi-CPS).

Mixed-Commodity Process System (Mixed-CPS) If at least one plant and one animal are involved, we may speak of a Mixed-Commodity Process System.

Resource Allocation System (RAS) A Resource Allocation System (RAS) is defined as the social organizational unit which is responsible for decision-making with respect to and operation of a CPS.

CPS and RAS as social systems

CPS as the farm firm The idea of a CPS is used here in much the same sense as the idea of a farm firm. Rushton and Shaudys (1967:55) have defined a farm firm as

...a social system in which the physical factors of agricultural production—land, labor, and capital—are combined, through the management process, to achieve a specific set of both integrative and adaptive goals. The units of a farm firm...are the relevant social statuses of the individuals involved in the farm decision making complex--operator, landlord, and others in decision-making positions (emphasis added).

The integrative goal or function is that of solving three problems:

First, there is the problem of integrating the physical factors of production into a smoothly working unit. Second, there is the goal of integrating the human elements of the farm firm--the needs, desires, attitudes, and values of the managerial complex. Third, there is the integrative problem of relating the physical and human elements of the farm firm. For example, the problem of matching labor and management skills available to the farm firm
to the kind of farm operation and size of farm is an integrative one (Rushton and Shaudys, 1967:55).

Rushton and Shaudys (1967:55) proceed to emphasize that social systems "do not exist in a vacuum" in that they are interrelated with other systems. And the adaptive problem of the farm firm (or CPS) is precisely that of relating to other systems.

There are several systems which have relevance to the farm firm. Among these are the economic system, the community system, the political system, the family system and, in the case of a tenant, the landlord-owner system. Each of these systems, here called external systems, has certain goals, values, and expectations which may influence the operation of the farm firm. For example, the farm firm must meet its mortgage payments, conform relatively closely to community norms on production practices and appearance, pay taxes, and submit to political controls on production and marketing. A tenant must comply with his landlord's wishes and with the contractual arrangements agreed upon. The farm firm is adapted to the extent it can meet these external demands (Rushton and Shaudys, 1967:55-56).

The farm firm as defined by Rushton and Shaudys may be represented as in Figure 2.7 which indicates the four functional subsystems of the farm firm as a social system; the function, process, and output of each; and input-output interchanges between the subsystems and between the farm firm and external systems (e.g., the farm family).

RAS as the farm family The social organizational unit of focal interest here is the farm family as a unique organizational type of RAS, i.e., it is different from the farm corporation organizational type of RAS that can be found in some areas of the United States. When we speak of small farm agriculture in the LDCs, however, the assumption can be fairly safely made "that in most farm situations where alternatives exist, decisions will be made in terms of family considerations, either short or long run" (Rushton and Shaudys, 1967:56). The farm family as a social system
Adaptation Subsystem (3)

**Function:** Allocation of means to farm goals.

**Process:** Management of the farm firm; efficient use of resources to produce an optimum return.

**Output:** A farm plan.

Goal Attainment Subsystem (4)

**Function:** Farm task performance.

**Process:** Activities directed toward carrying out the farm management.

**Output:** Farm income and other, noneconomic, returns to the adaptive subsystem of the family.

Latency Subsystem (1)

**Function:** Creation, maintenance, and restoration of energies, motives and values of individuals who enter into the management process.

**Process:** This is a stage of resting up for the next goal attainment cycle with the exception that some activities which are considered goal oriented by the family may be leisure to the farm firm.

**Output:** Available energy and motivation.

Integration Subsystem (2)

**Function:** Definition of farm goals.

**Process:** Taking into account the needs of the farm, the family, norms of the community, etc., and problem recognition ability.

**Output:** A hierarchy of farm goals.

Figure 2.7. The farm firm as a social system: Arrows indicate the input and output interchanges between functional subsystems and between the farm firm and other social systems (e.g., the farm family). Numbers indicate stages in the action cycle (Rushton and Shaudys, 1967:58)
may also be represented as a social system comprised of four functional subsystems (Figure 2.8).

CPS as subsystem of RAS There are a number of ways in which the relationship between the farm firm and the farm family can be visualized. The image of greatest relevance to the definition of a "small farm system" is that of the farm firm as subordinate to or embedded within the farm family, "with the effects of external systems on the farm firm screened through the family system. This does not mean that external systems do not directly affect the farm firm. It does imply, as suggested above, that where alternatives exist, decisions are made in terms of family considerations" (Rushton and Shaudys, 1967:56). The image of the farm firm as subordinate to the farm family is illustrated in Figure 2.9.

The interchange between the farm family and the farm firm may be stated as follows:

At the most general level, the farm family has a particular value-orientation [norms] which affects action at more specific levels. The family translates this value-orientation into a hierarchy of goals [objectives] about which family members arrive at a consensus. Resources or means [facilities] are then allocated [through a technology] for the attainment of the family goals, and the tasks [specific activities of the CPS] are carried out. It is at the adaptation or allocation stage in the action cycle that an interchange between the family and farm firm takes place (Rushton and Shaudys, 1967:56-57; elements in brackets included by the author).

In effect, the farm family requests the farm firm to provide the outputs which the family requires in order to attain its goals. To obtain these outputs, however, the farm family must transfer some of its resources from other goal-attainment functions to the farm firm. On the other hand, the farm firm requests resources from the farm family and provides material
Adaptation Subsystem (3)

Function: Allocation of means to family goals.

Process: Decision making regarding the goals of the family and the available resources (time, money, energy, health, etc.). (A satisficing model.)

Output: A plan of work

Goal Attainment Subsystem (4)

Function: Task performance.

Process: Activities directed toward carrying out the decisions of the adaptive stage.

Output: Satisfaction, happiness, achievement, etc. or lack of it.

Latency Subsystem (1)

Function: Creation, maintenance, and restoration of energies, motives, and values of family members. (Pattern maintenance and tension management.)

Process: This is a stage of resting up for the next goal attainment cycle. Leisure time activities fall in this stage.

Output: Available energy and motivation.

Integration Subsystem (2)

Function: Creation of unity of purpose and solidarity. Goal definition and consensus.

Process: The process of arriving at goals, given the various value and normative orientations of the individuals involved.

Output: A hierarchy of goals; from basic needs to luxuries.

Figure 2.8. The family as a social system: Arrows indicate the input and output interchanges between functional subsystems and between the farm family and other social systems (e.g., the farm firm). Numbers indicate stages in the action cycle (Rushton and Shaudys, 1967:57).
Figure 2.9. The relationship of the farm firm subsystem to the farm family. The asymmetry of the farm firm subsystem within the farm family system indicates that the farm firm plays more an adaptive role than an integrative one (Rushton and Shaudys, 1967: 59)
(e.g., food commodities) and monetary (e.g., cash income) returns for family use. Figure 2.10 summarizes these relationships.

<table>
<thead>
<tr>
<th>Family</th>
<th>Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requests income</td>
<td>Requests resources</td>
</tr>
<tr>
<td>Furnishes resources</td>
<td>Furnishes income</td>
</tr>
</tbody>
</table>

Figure 2.10. The input-output relationship between the farm family and farm firm systems (Rushton and Shaudys, 1967:58)

The preceding introductory remarks should serve to indicate the general similarity between the concepts of the farm family and farm firm on the one hand and, on the other, the RAS and the CPS. Accordingly, in the following discussion, the CPS and farm firm concepts will be used interchangeably; similarly, the RAS and farm family concepts will be used interchangeably.

**The Small Farm System (SFS)**

With the above considerations in mind, we may now proceed to provide a definition of the small farm system concept that is considerably similar, if not identical, to definitions of the "small farm" and "small farm agriculture" found in the literature. A **small farm system** (SFS) is defined as a type of social system in which a CPS (farm firm) is embedded within a RAS (farm family) in such a way that the following conditions are met:

A. **Size of farm**: The quantity of land operated by the RAS is absolutely small (e.g., less than five hectares) or relatively small in comparison with other farms in the region and is principally (although not exclusively) concentrated in the less favorable ecological areas of an LDC, with limited access to external produc-
tion input factors (e.g., credit) and commodity disposition factors (e.g., markets);

B. **Level of market interaction:**
   1. The RAS provides the bulk of the inputs (e.g., labor force, capital, management) required for operation of the CPS;
   2. The output of the CPS largely serves the direct consumption needs of the members of the RAS, with the exception that if there is a surplus after having met the RAS's various consumption requirements, such surplus may be:
      a. Saved (e.g., seed) for investment in a subsequent CPC; and/or
      b. Exchanged in local or regional markets for other goods, services, and/or money which, in turn, may be invested, saved, or used to purchase other goods and services; and

C. **Level of living:** A "subsistence" or materially "low, or survival, level of living" (Owen, 1974:39) is provided.

This definition of a SFS encompasses most, if not all, of the various criteria used in the literature to define the nature of small farm agriculture in the LDCs. First, Adams and Coward (1972:6) note that the principal meaning of the term "small farmer" is that the "cultivator has access to only a modest amount of land." Second, the small farm family has a relatively low level of market interaction. "Those farms which are heavily subsistence in nature, buying and selling only a minor portion of their farm inputs and outputs [are]...considered small farms" (Adams and Coward, 1972:6). The relatively low level of market interaction of the small farm family in an LDC is reflected in the observation by Diaz and Potter (1967:}
that "in peasant societies the domestic unit is also the production
unit: a group of kinsmen (sometimes with a few additional persons who are
not relatives) bound together in such a fashion that their roles as family
members also define their roles as producers and consumers." Or, as Owen
(1974:39) expresses the idea of a low level of market interaction, the gen-
erally noncommercial or subsistence orientation of the small farmer indi-
cates "a type of economy—a way of living—in which production mainly
serves the direct consumption needs of the members of the producing enter-
prise or local economy." Third, Owen's reference to a "subsistence" or
materially "low, or survival, level of living" is reflected in CIAT's
(1974b:3) definition of a "small farm" as a "farm enterprise in which pro-
duction and productivity is low, rural income is low, and the principal
source of labor is the farm family."

It is beyond the scope of this dissertation to specify the exact num-
ber of small farm systems (SFS)s which exist in any LDC. However, utiliz-
ing the first criterion in the above definition of a SFS, a rough estimate
for any particular LDC would be given by the number of agricultural hold-
ings which are less than 5 hectares. To illustrate, Table 2.1 gives the
distribution of the percentage of farms and total area by farm size in
Columbia and the Colombian department of Córdoba. Approximately 60% of the
farms in Colombia are less than 5 ha. and occupy less than 4% of the total
farm area. Using solely the first criterion in the above definition, more
than half of all the farms in Colombia would be classified as small farm
systems.

Examples of CPS To provide an example of a CPS, the reader is
referred to Figure 2.11 in which the production phase of a CPS is illus-
Table 2.1. Distribution of number of farms and total area by farm size in Colombia and the Department of Córdoba (CIAT, 1974b:3)

<table>
<thead>
<tr>
<th>Farm size (ha)</th>
<th>Colombia (1970)</th>
<th>Córdoba (1971)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farms (%)</td>
<td>Area (%)</td>
</tr>
<tr>
<td>Less than 5</td>
<td>59.5</td>
<td>3.7</td>
</tr>
<tr>
<td>More than 5</td>
<td>40.5</td>
<td>96.3</td>
</tr>
</tbody>
</table>

Figure 2.11 specifies sequence of activities involved in producing maize and sesame in a typical cropping cycle in La Máquina, Guatemala. Since at least two types of plants are involved in this CPS, the system would be classified as a Multi-CPS. In addition to the various activities involved in growing these commodities (e.g., land preparation, planting, weeding, harvesting, etc.), the reader will observe that Figure 2.11 also specifies some of the various limitations on and factors affecting the CPS.

A second example of a CPS within a SFS is provided by Adams and Havens (1966:210-211) who describe the pattern of farm organization in the Colombian community of Contadero:

Farms in Contadero are typically small, highly fragmented, and oriented toward production for home consumption. Usually, one-quarter of the area in each unit is devoted to native corn, interplanted with several varieties of beans and squash. About the same proportion of land is devoted to barley and wheat and a similar amount in potatoes and other vegetables. The remaining one-quarter of the land is devoted to pastures. The livestock enterprises often include one or two dairy cows plus replacements, a few sheep, several pigs, one or two draft animals, a few chickens, and some guinea pigs for home consumption. Wheat, barley, and potatoes are almost always double-cropped. Corn and beans, on the other hand, take up a full crop year.
Figure 2.11. An example of a CPS: The production phase of a typical commodity production cycle (CPC) in a SFS in La Máquina, Guatemala (adapted from CIAT, 1974b:13).
Farm units range in size from less than one hectare to over 80 hectares. The modal size is three to four hectares. Almost all units include more than one parcel of land, the average being about four. Oxen plus hand labor are the means of cultivation.

Generally, operators use a set rotation of corn-potatoes-cereals-corn in their various lots. Commercial fertilizers are applied in limited quantities to potatoes, but are only rarely applied directly to cereals, corn, or pastures. Limestone is occasionally applied, and potatoes are regularly sprayed with insecticides.

**Complexity of SFS**

The interrelationships within and between CPS and the RAS of a SFS are complex. First, the CPS is basically concerned with the interaction between (1) the natural environmental system (e.g., land, water, weather, plant, animal, etc.) and (2) the RAS's (farm family's) application of the production input and commodity disposition factors involved in processing a particular commodity. Second, the RAS is basically concerned with (1) the intra-familial interaction among the members (e.g., father, mother, children) of the social organizational unit responsible for decision-making with respect to and operation of the CPS and (2) inter-familial interaction between one farm family and other families in the wider social system (e.g., the village). Third, there is the interaction between each of the two systems (RAS and CPS), particularly as these two systems interact in such a way as to produce a subsistence-type level of living for the members of the RAS. The complexities, however, do not end with these considerations.

The SFS is interlinked not only with the natural environmental system through the operation of the CPS by the RAS but also with a broader social environmental system through the RAS's interrelationship with the wider social system in the rural areas of an LDC. These complexities highlight
the necessity of taking a social systems approach to the analysis of the SFS. This point has been emphasized by CIAT (1973:219).

An essential element of the systems approach is the recognition that a family farm system is really a system within a larger agricultural sector. The focal system is one in which the farm family and others living on the farm assemble individual enterprises into a production, consumption, and a marketing system, in which biological and physical factors interact with social, political and economic systems. The explicit recognition of the importance of these interactions is a key part of the methodological approach towards the development of a process for identification, analysis and facilitation of technological change of small farms.

It is thus in the context of a RAS's interrelationship with both a specific CPS and a general or wider social system beyond the SFS that the various social organizational, social psychological, and social economic elements of the SFS as a social system become relevant. To elaborate on this point, the following discussion presents an exploratory modeling of the SFS in terms of each of the social system elements in the SSEM. The objective of the discussion is not to exhaust but rather to illustrate some of the possible ways in which each of the social system elements can enter into the small farmer's decision-making with respect to and operation of the CPS.

The complexities involved in attempting to develop models of the SFS are numerous and merit considerable further theoretical specification and empirical investigation. Thus, for example, in attempting to develop a model to determine the income potential of small farms in Guatemala, Johnston (1974:242-243) noted:

It is difficult to judge precisely how well the model reproduces the position of the small farmer, because there is not much information which can be relied upon to tell us what the small farmer's position is. There is not even a clear definition of
who is a small farmer. Does the small farmer have one hectare of land, three hectares of land, or five hectares of land?

Hopefully, the discussion which follows is a significant step toward a more adequate conceptualization of the SFS as a social system.

A SSEM of the SFS

Several assumptions underlie the SSEM of the SFS that is to be presented:

1. The social organizational elements (power, rank, status-role) of the integration subsystem of the SFS enter into, either constraining or facilitating, the small farmer's decision-making with respect to and operation of the CPS. For example, the small farmer's restricted access to external facilities (e.g., credit) limits the alternative possible technologies which he might utilize to more optimally achieve his objectives.

2. The social psychological elements (norm, belief, sentiment) of the latency subsystem of the SFS enter into, either constraining or facilitating, the small farmer's decision-making with respect to and operation of the CPS. For example, the small farmer's lack of knowledge of technologies which would enable him to more optimally achieve his objectives limits the productivity, income, and employment levels on the small farm.

3. The social economic element of facilities and, relatedly, technology of the adaptation subsystem of the SFS provides the principal means for achieving the objectives or ends of the goal attainment subsystem of the SFS; relatedly, the social economic element of
sanction functions in a way that ensures that facilities and technology are utilized to achieve the objectives of the RAS.

These are, of course, general assumptions; however, they do provide an overall flow or agenda for discussing the interrelationship of the CPS with each of the nine elements of the SFS as a social system. This interrelationship is represented in the SSEM of the SFS that is presented in Figure 2.12. With respect to Figure 2.12, the discussion will proceed in the following order: the social organizational elements (power, rank, status), the social psychological elements (norm, belief, sentiment), and the social economic elements (objective, sanction, facility). Various qualitative data and in some instances survey data will be presented to illustrate the manner in which each of the nine social system elements can enter into the small farmer's decision-making with respect to and operation of the CPS.

**Social organizational elements**

The social organizational elements of the SFS involve three social system elements: power, rank, status-role.

**Power**

A frequently utilized criterion in defining small farm agriculture is that of the size of the land holding operated by the small farmer. Harrison and Shwedel (1974:2) note in this regard that:

What is a small farm for one crop may not be considered small for another. Similarly a small farm in one region may not be small in another. ...if we are considering a specific type of farm in a given region of a given country with certain factor endowments, then experience suggests that in crop cultivation or livestock handling activities the small scale farm may be equally or more efficient than larger scale farms (i.e., there are no significant economies of scale in cultivation activities).

The validity of this theoretical position, however, is considerably compromised by the distribution of power in an LDC and the way that this distribution limits the ability of the individual small farmer to operate
Figure 2.12. A SSEM of the SFS: The CPS as interrelated with each of the nine social system elements of the RAS (represented by the outer discontinuous circle)
his CPS in a manner that is optimally favorable to the small farm family. As the reader will recall, power is generally defined as the capacity to control others, with an individual's power over others residing in the control which that individual exercises over the things which other actors value. There are at least four areas in which power may come to bear, favorably or unfavorably, on the decision-making of the small farmer: (1) the commercialized market system; (2) the land tenure system; (3) the community-level decision-making system; and (4) the SFS-level decision-making system.

**Commercialized market system** Economies of scale are more likely to be present in the performance of market related activities (e.g., capital and input procurement, consumer goods procurement, and commodity marketing). The following illustration is cited by Harrison and Shwedel (1974:2):

The unit base price, transaction costs, handling costs, transportation costs and application costs may be significantly higher if a given farmer purchases only one ton of fertilizer per year than if he purchases fifteen tons, especially if his farm is located on a road where delivery can be made by truck.

The potentially higher unit marketing cost necessary to supply the small farmer's low volume requirements places the farmer at a bargaining power disadvantage.

This situation is aggravated in the extent to which the SFS exists within an information scarce and imperfectly competitive market (e.g., monopsony in commodity market). While a large percentage of a given commodity (crop) or even the total agricultural production may come from the small farm agricultural sector, the particular commodity in question is produced on a large number of small farms. "What exists is an atomis-
tic market structure where, as both a seller and input purchaser, the individual farmer is a price taker, i.e., he has no power as an individual to influence the market" (Harrison and Shwedel, 1974:4).

The small farmer's individual inability to influence the market is all-pervasive. "The vast majority of small farm agriculture...is in small-scale individual (family) holdings. This atomistic structure...tends to raise input prices while lowering output, or commodity prices for the small farmer" (Harrison and Shwedel, 1974:3). Solely as an individual decision-maker, the small farmer has little access to and control over the external facilities (e.g., credit) whereby he might operate the CPS in a manner that is more optimally satisfactory to the small farm family. While "small farmers do manage their firms rather well, given the total resource package" (Harrison and Shwedel, 1974:3), productivity is typically low relative to what would be possible if the farmer had access to and was able to use alternative facilities and/or technology.

Alternative technology, however, requires alternative production input and commodity disposition factors, and these are a scarcity within the context of the SFS. The availability of credit to the small farmer in Contadero, Colombia, is illustrative.

...capital resources are extremely limited in Contadero. Almost all of the institutional credit is provided by the agricultural development bank, but this amounted to only a little over ten dollars per capita in 1964. Interest rates for loans from this bank are very reasonable, but loans by private individuals often carry rates of three to five percent per month. Most of the smaller farmers do not or cannot obtain credit from the bank. They typically rely on private sources of credit to meet unexpected needs. Private capital outside of investments in land and livestock is practically nonexistent. Most people, when faced with a sudden cash outlay, sell livestock or land to cover the cost (Adams and Havens, 1966:211).
Credit at reasonably low interest rates is not the only CPF which the small farmer finds it difficult to obtain. Information on market conditions is also hard to come by "and when it is available, its reliability is often doubtful" (Harrison and Shwedel, 1974:3).

In summary, given the small farmer's lack of bargaining power, it follows that "his preferences are the last to be considered" (Harrison and Shwedel, 1974:3). As a result, the small farmer is power deficient in those CPFs, notably production credit and timely market information, that would equip him to better compete in the broader market economy of an LDC.

**Land tenure system** The land tenure system concept may be defined as "the pattern of land distribution and of the rights and obligations of occupancy and land use" (Hexem, 1971:76). Currently within and among the LDCs there are a variety of tenure arrangements: landless laborers and squatters who possess no legal rights to land, extensive plantations and state-owned and operated farm systems, owner-operators, producers operating under tenancy arrangements of varying terms, and tribal or communal holdings and operation of land. Generally, "combination of these types of tenure are typically found in differing geographical areas in varying economic and social systems" (Hexem, 1971:76-77).

The importance of land tenure systems in relation to the SFS lies in the way that these systems operate to the disadvantage of the small farmer. Based in part on field work conducted by a team of specialists carried out in Ceylon, Greece, Spain, Turkey, Mexico, and Israel as part of a five-year study of land tenure systems, Weitz (1971:155) concluded that: "The big landowner class has...become the main obstacle to change or any real effort for development" Numerous other critics echo similar claims against the
existing land tenure systems in the LDCs. Jacoby (1971:274), for example, states that "almost everywhere in the developing world the big landowner is the center both of political and administrative influence and control."

Writing on the specific case of Latin America, Dorner (1966:4, 13, 18) argues:

Without employment alternatives and effective collective action with which to confront the landowner, the ownership of land is also the virtual ownership of labor. It is the basis of social class distinctions and the basis of power--power to command others to do one's bidding. It is true that this power has been eroding with increasing labor mobility, some industrialization, and in some instances effective rural labor organizations. But a concentration of economic and political power remains one of the key issues in rural Latin America.

Land ownership distribution and the power associated with ownership of large tracts of land sets the pattern for the distribution of income in the rural sector. Efforts to increase productivity cannot have their full impact until the institutional arrangements controlling income distribution are altered.

Whereas Dorner argues that the distribution of income is largely determined by the distribution of land ownership, Barraclough (1969:21) extends the argument as follows: "The social structures of poor rural societies are practically synonymous with their land tenure systems." The central importance of land tenure systems is explained by Barraclough (1969:22) as follows:

...land is the main source of wealth. As a result, control over the land largely determines income, wealth and power.... Income from land, however, cannot be realized without labour. Therefore, the distribution of property rights in land is necessarily accompanied by a system of interpersonal and intergroup relationships. In brief, landownership is closely associated with the power to make others do one's will.

Individual LDCs, of course, vary in the extent to which the small farmers who reside therein are victims rather than beneficiaries of the existing land tenure systems. In the high, more densely populated regions
of Latin America, "a specific type of agricultural organization arose, namely, the hacienda. These units were devoted to cattle or agricultural production for local consumption. To the laborers living on these estates, a small plot was given for family food production as a reward for labor" (CIAT, 1974b:1-2). The case of Peru in 1966 is illustrative:

...1% of the agricultural population controlled 80% of the agricultural land.... These large owners had nearly all the agricultural credit, the irrigation water, the technical assistance and were practically the only farmers with access to modern inputs and to national and international markets. They controlled local power and were highly influential nationally. . . .

The 88% of the rural population who were small producers and farm workers, on the other hand, not only had practically no farm land—only 5% of the total—but also had none of the other advantages of the large owners. They were poor, powerless and mostly illiterate. It was common in many haciendas for workers to render labour services to the owner in return for the use of a small parcel of land. Cash wages were minimal or in some cases nonexistent (Barraclough, 1969:22).

While the predominant land tenure system in Latin America is that of latifundia, the land tenure systems in Asia are based on tenancy and indebtedness to landlords and money lenders (Barraclough, 1969:23). In South Asia, for example, the high growth rate of the agricultural population and consequent high man/land ratios have reduced the size of individual land holdings and furthered fragmentation of holdings (through traditional patterns of inheritance). As a result, landlords have been able "to exact tenancy arrangements largely on their own terms. With nonfarm employment opportunities limited, the relatively more disadvantaged are willing to work under traditional tenancy arrangements or even more inequitable ones" (Hexem, 1971:77).

Despite these structural differences in the tenure systems in Latin America and Asia, "land tenure systems in both regions have much in common
insofar as fundamental power relationships are concerned" (Barraclough, 1969:23) and, also, in the way that the small farmer's power deficiency impinges on the operation of a CPS. Raup (1963:9) has suggested several ways in which the tenure arrangements under which facilities (e.g., resources such as land) are held and used affect the farm family's pattern of expenditure, saving, and investment and, consequently, the farmer's decision-making with respect to, allocation of facilities to, and operation of the CPS. Tenure arrangements affect the operation of a CPS by their influence upon:

1. The small farm family's time preference for money income;
2. The allocation of expenditures between the farm firm (CPS) and the farm household (RAS);
3. The allocation of expenditures within the farm household as between goods and services for direct consumption and expenditure upon the family residence;
4. The disposition of the total available labor time of the farm family; and
5. Attitudes toward and uses made of credit.

While each of these factors could be discussed at length, let us briefly consider the two examples which serve to illustrate the manner in which the land tenure system enters into the decision-making of the small farmer and his operation of the CPS. The first example is drawn from the analysis by Adams and Havens (1966) of farm organization in Contadero, Colombia.

Although most of the land in Contadero is owned in fee simple by local residents, it is common to find complex sets of tenure arrangements involved in the actual operation of the land. For example, just 20 percent of the farm units in Contadero included only land which was "purely" owner-operated. Production decisions are often shared in these units through a method of share-cropping called médias. Under this arrangement, the land owner
supplies one-half the seed and one-half the fertilizer (if used). The sharecropper furnishes all of the labor and the balance of the production inputs. This arrangement is especially prominent between the older individuals or single women who own land and younger individuals who take the land as "croppers." A number of special arrangements for the use of land are also common between relatives. Production decisions are, therefore, often shared between at least two individuals. Few of the tenure contracts are written, and the length of time is only occasionally for more than one year. Nothing exists in these contracts which would encourage sharecroppers to make any long-run land improvements (Adams and Havens, 1966:211).

In short, as Adams and Havens (1966:211) emphasize, the system of land tenure can have "significant implications for the kinds of enterprises which will be undertaken on the farm, the types of investments that will be made, the flexibility which is present in the farm operation, and the manner in which production decisions are made and carried out."

The second example to be discussed illustrates not only the effect of the existing land tenure system on the operation of the CPS of a small farm but also that the land tenure system's interrelationship with the procedures for obtaining credit from the commercialized market system can place the small farmer at an even greater power disadvantage. The availability of credit is interrelated not only with the terms of exchange (e.g., interest rates) of the commercialized market system but also with the system of land tenure. Whether provided by a bank, a cooperative, or some other source, institutional credit "usually requires land as collateral for loans--collateral to which tenants and landless laborers do not have access" (Hexem, 1971:78). Even where the small farmer could invest in improved facilities, "the proportion of the net returns going to the landlord and(or) the proportion accruing to the marketing middleman may tend to discourage such investment" (Hexem, 1971:78).
When the nature of the commercialized market system and the land tenure system in the LDCs are taken into, it becomes clear

...that the critical common denominator is that peasants have very little control over the conditions that govern their lives. They find that the basic decisions that affect their lives are made from outside their communities, and have always been so made. Peasants are not only poor, but they are relatively powerless. Or at least they look upon themselves as powerless. (Foster, 1967:8).

Although peasants or small farmers are relatively powerless, this is not to say that one need look no further than the commercialized market system and the land tenure system in attempting to understand the nature of the distribution of power in relation to the SFS. Indeed, the decision-making alternatives—short of social movements (Stavenhagen, 1970)—are severely constrained by the nature of the (1) commercialized market and (2) land tenure systems. Yet there are two additional arenas of power distribution in relation to the SFS which may be taken into account: (3) the community level decision making system and (4) the SFS-level decision-making system.

**Community-level decision-making system**  
The individual small farm family does not live as an isolate but rather in the context of a wider social system beyond the SFS, namely, the village or community. Diaz and Potter (1967:164) note that many peasant societies have established mechanisms for dealing with persons of superior power, wealth, and prestige, whether these persons are wealthy landlords, merchants, officials, or simply educated men who have a knowledge of the world outside the peasant community.

Peasants seek ties with such persons in order to gain increased economic security, to have political protection, and to have some powerful person on whom they can rely when dealing with persons and institutions in the wider society. In many peasant societies, these ties are formalized as patron-client relations. In
return for his services to peasants, the patron gains prestige and has his status validated in the eyes of society. By accumulating large numbers of clients dependent on him, he also gains in political power (Diaz and Potter, 1967:164).

Thus, in peasant or small farmer communities, there is a distribution of power which operates at least to some extent in a manner that is beneficial both to the "patron" and the "client." However, the nature of this power distribution is such that the wealthy and prestigious often have more authority and power than well-intentioned governmental officials.

Political directives passed down through the state administration are by no means automatically carried out by local leaders; usually there is a lengthy process of compromise with lower-ranking state officials, and often state directives are evaded or simply ignored.

Making decisions on behalf of an entire village usually involves informal consultation among important members until a consensus is reached. Since the peasant community is usually an intimate, face-to-face social unit, ignoring any of the important men might lead to the formation of bitter factions and cliques that might seriously disrupt village life. If unanimous agreement among important villages is not reached, the matter is usually dropped and not pursued further. Decisions are almost always arrived at by informal consultation behind the scenes; formal meetings, if held at all, do little more than rubber-stamp agreements previously made (Diaz and Potter, 1967:162-163).

SFS-level decision-making system While familial-related considerations are discussed at greater length in relation to the social system element of status-role, it may be briefly emphasized here that there will be a distribution of power within the farm family (RAS). The nature of this power will reside primarily in the authority which certain family members (e.g., the father) have over other family members (e.g., the children). Bell and Vogel (1968:24), however, have argued that the nature of the distribution of authority within the family has often been oversimplified:
Although one family member may receive normal deference from others, this does not necessarily mean that he has the power to ensure that his opinions are carried out by others. Often the person who exercises the greatest actual leadership is one who "works behind the scenes." Even if the one receiving the most deference formally makes the decisions, the critical issues in the decision may, in fact, have been settled by other members of the family. The person receiving greater deference may have the right of leadership when he desires it, but may not take a prominent part in the ordinary decisions, and often his decisions are concerned only with certain aspects of family behavior. In this area of activities, as in task activities, a differentiation of authority spheres usually develops.

Inasmuch as decision-making about how the CPS will be operated occurs within the SAS (the farm family), it would be well to know "who makes the decisions" as well as "who takes the credit" or leadership in announcing and implementing a decision in regard to the crop that will be produced and the resources that will be utilized to complete the production phase of the CPS.

Summarizing with respect to the social organizational element of power, there appear to be at least four arenas within which power is distributed in relation to the SFS in an LDC: (1) the commercialized market system; (2) the land tenure system; (3) the community-level decision-making system; and (4) the SFS-level decision-making system. The various illustrations presented suggest that the nature of power distribution in relation to the SFS is an important contingency which the small farmer must take into account in his decision-making with respect to and operation of the CPS.

**Rank**

Rank has been defined as the value an actor has for the system in which the rank is accorded. Smith (1972:85) has argued that:

...a high degree of concentration in the ownership and control of the land inevitably produces a society in which there are only two classes, a small landowning elite at the very top of the
social scale and a huge, amorphous mass of tenants and laborers at the base. Under such circumstances any manual labor, work with the hands of any type, comes to be the indelible mark of grossly inferior social status, at the very least, and in a large proportion of the cases the indicator of servile condition as well. Therefore, anyone who is in position to claim any position in society other than that of the most debased must avoid as he would the plague anything that even suggests he might toil in the fields or at any other task.

One may generally conclude from this line of thought that the peasant agricultural laborer or small farmer is accorded relatively low social rank by the broader society in most LDCs. And to the extent that this is indeed the case in any particular LDC, the broader society is not likely to look on its rural population as an essential input to national agricultural and economic development.

Of greater interest here, however, are not the criteria by which the greater society ranks the small farmer but rather the rank-related criteria that enter into the small farmer's decision-making with respect to and operation of the CPS. The particular foods, for example, which the farm family consumes reflect that they take rank-related criteria into account in a number of ways. Lewis (1960:11), for example, found that in Tepoztlán, "bread is considered a very desirable food, and the social and economic status of a family is judged in terms of the amount of bread it consumes." McIntosh (1975:101) cites that farmers in India are growing fewer pulses and more grain, a substitution that "may indicate a lowering of the protein available for consumption." This example illustrates that the manner in which the farm family operates the CPS may actually lower the nutritional quality of the food available for consumption by the family.

The resources available for investment in the CPS are also affected by rank-related criteria. Thus, for example, Diaz (1967:54) notes that in
peasant societies the individual can advance in rank through special types of interaction with other members of the peasant community. "By spending on ritual, on feasts, on elaborate religious festivities, the individual acquires prestige, for he has used his wealth for the benefit of the community in ways which are meaningful to its members" (Diaz, 1967:54). Of course, the financial resources expended on ritual might alternatively have been more productively invested in the small farmer's CPS.

**Status-role**  The SFS is operated through the allocation of various facilities to the one or more operational units (e.g., land, plant, animal) of the CPS. One of the principal facilities which can be applied to any operational unit is that of labor. The available supply of labor within a SFS, however, is allocated to the CPS according to the status-roles held by each individual within the RAS (farm family). Diaz and Potter (1967:155) observe that the family (which they call "the domestic unit") will vary across societies from three generation extended families to two generation nuclear families composed of one married couple and their unmarried children. In most peasant groups, however, the most common form of domestic unit is the nuclear family (Diaz and Potter, 1967:155).

Characteristically within the family as a specific social organizational type, there is a division of labor (role differentiation) that is "evidently universal...the world over" (Bell and Vogel, 1968:22; Zelditch, 1968:345-354). As Bell and Vogel (1968:22) suggest:

The biological nature of the mother-child bond ordinarily leads the mother to perform tasks connected with the child, particularly when it is small, and the father to perform (frequently away from home) activities that, directly or indirectly, will produce the needed goods and services.
On the one hand, the relative confinement of the mother in the home "ordinarily leads to her performing other incidental tasks in the home" (Bell and Vogel, 1967:22). Thus, Lewis (1960:55) found in his Tepoztlán study that "though the wife is subordinate to her husband, it is she who has the central role within the house. She is responsible for planning, organizing, and managing the household, and for the training and care of the children." Lewis also found that the husband's earnings are traditionally turned over to the wife; thus "she is...in a good position to do a great deal of spending, borrowing, and paying back in secret."

In contrast to the status-role held by the wife, instrumental leadership is generally allocated to the male's husband-father-provider status-role. This role requires "a manipulation of the external environment, and consequently a good deal of physical mobility. The concentration of the mother on the child precludes a primacy of her attention in this direction although she always performs some instrumental tasks" (Zelditch, 1968:350).

There can, of course, be exceptions to the general trend in role differentiation as in the case of the predominantly matrilocal organization and decision-making structure of the farm family in the Caribbean zone (e.g., the North Coast of Colombia). "Due to the instability of the nuclear family unit, the continuity of the role of the mother in many families places increasing responsibility with her to sustain production and a food supply for the family" (CIAT, 1974b:4). Even in the more typical case of small farm agriculture in the LDCs, the woman's status role is not always limited solely to that of wife-mother, as she is also likely to be responsible for taking care of some form of a CPS around the home (e.g., cooking, feeding chickens, gardening, etc.).
In view of the possibility that responsibility for operating a CPS may be shared however unequally by husband, wife, and even their offspring, national efforts to reach small farmers cannot assume that the only relevant audience is that of the relatively more mobile male. The audience of small farmers can be realistically defined only by identifying exactly what the status-roles are within the typical SFS of a particular region.

Such an attempt to identify the nature of the status-roles in the SFS would likely encounter that children may also be utilized for labor purposes on the farm. As students of the family have observed: "if family activities require a great amount of relatively unskilled labor, it is likely that children may be required to participate in them" (Bell and Vogel, 1968:22). The SFS may also at various times of the year require labor resources beyond that which can be supplied by the members of the nuclear family (RAS). Such labor may be recruited either (1) by hiring landless laborers in the immediate locale or surrounding region or (2) by utilizing labor given in reciprocal exchange by members of the extended family and neighboring farm families. Thus, for example, "the kinship system enables a peasant to form a work group for harvest" (Diaz and Potter, 1967:157).

One way to identify the existing status-roles in a SFS is to observe which activities are performed by which persons. In studying the distribution of status-roles within a family in relation to the operation of the CPS, the observer should take into account those activities which are required to carry out not only the production phase but also the disposition phase of the CPS. In relation to the production phase, for example, a study of 100 small farms in La Máquina, Guatemala, revealed that "the
majority of the year the farms are in a 'labor-deficit' state, using hired labor to sow, weed and harvest the crops. These operations are performed principally by a migratory labor force from the highlands" (CIAT, 1974b: 14). And in relation to the disposition phase, for example, Bell and Vogel (1968:21) note:

...the nuclear family performs a variety of tasks which may be referred to as "finishing." Additional preparation making goods ready to use adds to their value. Additional preparation may include such things as cleaning and cooking food, installing equipment, sewing, ...and the like. It may involve selection, transportation, and placing of facilities in a particular location so that they may be...conveniently used....

The preceding examples provide a basis for emphasizing the importance of fully identifying (1) exactly which status-roles are required for operation of a CPS (either the CPS currently operated by the farm family or proposed alternatives to that CPS) and (2) whether the family has available or can obtain an adequate supply of labor to fill these status-roles. For example, does the family need to recruit labor from beyond the family in order to operate the existing CPS? This information is relevant both in examining the CPS currently in operation within a SFS and in assessing the feasibility of alternative CPSs, i.e., alternative technologies. As CIAT (1974b:14) notes in regard to small farm agriculture in La Máquina, "Any proposed changes in technology must consider the absence of surplus family labor, and the social question of potential displacement of migratory workers."

Social psychological elements The social psychological elements of the SFS involve three social system elements: norm, belief, and sentiment.

Norm The maintenance of a CPS is achieved through the interaction of individuals who occupy status-roles within the RAS or the farm
family. Appropriate behavior as perceived by the individual generally corresponds to the expectations held by other persons with whom the individual interacts. These mutually-held expectations in regard to appropriate behavior are one way of defining what the norms are in a social system. In any social system, however, there are likely to be a great variety of norms; here we are interested primarily in those norms which most directly relate to the operation of a CPS.

Insofar as the norms of a particular social system define appropriate behavior for individuals in given status-roles, it follows that certain norms or expectations will be associated with certain status-roles. The case of the small farm family in Tepoztlán, Mexico, is illustrative:

Division of labor by sex is clearly delineated. Men are expected to support their families by doing most of the work in the fields, by caring for the cattle, horses, oxen, and mules, by making charcoal and cutting wood, and by carrying on all the larger transactions of buying and selling. . . . At home the men provide wood and water, make or repair furniture or work tools, repair the house, and help pick fruit.

Women's work centers about the care of the family and the house. Women cook, clean, wash, iron, do the daily marketing, shell corn for daily consumption, and care for the children. . . . Many women raise chickens, turkeys, and pigs to supplement the family income; some grow fruit, vegetables, and flowers. Tepoztecan women are not expected to work in the field (Lewis, 1960:25).

Thus, it is clear that the status-roles of men and women within a SFS will involve certain norms or expectations that each sex engages in a particular variety of tasks related to the operation of the CPS, with some tasks taking place within the production phase and others within the disposition phase of the CPS.

In terms of a functional perspective, the norms which are adhered to in the interaction of the members of the farm family have generally over
the years provided reasonable guidelines for decision-making and survival. Of course, from the standpoint of an outside observer, the small farmer's behavior may appear unreasonable or irrational; nevertheless, such behavior is functional. In Tepoztlán, for example, the farm family saves for a rainy day not by depositing money in a bank or by establishing a reliable credit rating through payment of purchased commodities but rather

...by giving away the major part of the perishable meat of a slaughtered animal in order to receive fresh meat when his friends slaughter theirs. He attempts to spread his risks by entering into complex arrangements whereby six of his piglets are fattened by six people in return for a set share of the meat after the slaughter. He saves by giving gifts and working for others.... The modesty of his credit and banking systems must be held up against the fact that probably such were the institutions of most of the world's population for at least the last thousand years (Diaz, 1967:56).

Thus, although it may be that the small farm family is "the most self-sufficient unit found in any society, it cannot exist as a social isolate" (Diaz and Potter, 1967:156). Survival depends on the ability of the small farmer to withdraw from his socially diffuse savings and credit accounts in times of economic, social, and emotional needs. As Diaz (1967:51) succinctly puts it, the small farmers "depends on those around him for extra hands for building a house and for harvest, for spouses for his children, and for assistance at birth, death, and famine."

To the outsider, existing norms may be perceived as having the function of conserving existing patterns or at least of slowing down the process of change (Bell and Vogel, 1968:29). However, an awareness of the particular norms which small farmers hold in regard to the SFS in general and the CPS in particular should serve to highlight for the researcher some of the key criteria which are being taken into account in the small farmer's
decision making. At a minimum, by recognizing the existing norms, those attempting to introduce change into the SFS and the broader community should be able to design technologies which are more likely to be perceived as normatively acceptable rather than being rejected for their lack of such appropriateness. Similarly, an awareness of the existing norms should also serve in developing strategies whereby these technologies can be more rapidly diffused to small farmers.

Belief Foster (1965:294-296) has argued that peasants and, of particular importance here, peasant farmers have a certain type of cognitive orientation which Foster has insisted as "something 'psychologically real.'" Foster (1965:296) suggests:

...that broad areas of peasant behavior are patterned in such fashion as to suggest that peasants view their social, economic, and natural universes—their total environment—as one in which the desired things in life such as land, wealth, health, friendship and love, manliness and honor, respect and status, power and influence, security and safety, exist in finite quantity and are always in short supply as far as the peasant is concerned. Not only do these and all other "good things" exist in finite and limited quantities, but in addition there is no way directly within peasant power to increase the available quantities. It is as if the obvious fact of land shortage in a densely populated area applied to all other desired things: not enough to go around. "Good," like land, is seen as inherent in nature, there to be divided and redivided, if necessary, but not to be augmented.

Foster describes his verbal modeling of the peasant's cognitive orientation: The Image of Limited Good. If it is further assumed that the community in which the peasant lives is a relatively closed system, there is a primary corollary to the Image of Limited Good:

...if "Good" exists in limited amounts which cannot be expanded, and if the system is closed, it follows that an individual or a family can improve a position only at the expense of others. Hence an apparent relative improvement in someone's position with respect to any "Good" is viewed as a threat to the entire commu-
nity. Someone is being despoiled, whether he sees it or not. And since there is often uncertainty as to who is losing—obviously it may be ego—any significant improvement is perceived, not as a threat to an individual or a family alone, but as a threat to all individuals and families (Foster, 1965:296-297).

Foster applies the model of The Image of Limited Good to what has herein been termed the CPS as follows. An average village of small farmers produces only a finite amount of wealth which cannot be increased through any amount of extra work without introducing new technology and/or resources (facilities). The possibility of producing greater wealth is further diminished as land becomes increasingly limited by population growth, fragmentation of holdings, and soil deterioration. As a result, Foster (1965:298) suggests that:

...it seems accurate to say that the average peasant sees little or no relationship between work and production techniques on the one hand, and the acquisition of wealth on the other. Rather, wealth is seen by villagers in the same light as land: ... Wealth, like land, is something that is inherent in nature. It can be divided up and passed around in various ways, but, within the framework of the villagers' traditional world, it does not grow (Foster, 1965:298).

Foster (1965:310) argues "that the primary task in development is...to try to change the peasant's view of his social and economic universe, away from an Image of Limited Good toward that of expanding opportunity in an open system." Foster further proposes that the means whereby the peasant's cognitive orientation can be changed is "through changing access to opportunity," although he does not specify exactly how one would proceed to accomplish this latter feat.

One possible approach to "changing access to opportunity" and, thereby, the farmer's cognitive orientation is to change the structure of
limitations that impinge from the broader social system on the SFS. Zulberti (1974:20) has argued that:

...the first information requirement in initiating appropriate action programs is to know the limitations impeding change for the rural people. . . . Professionals must work together with the rural population in order to determine the real limitations and the causes of these limitations before attempting to implement solutions.

Duncan (1974:1) notes in this regard "that scientifically 'sound' information can be nullified by nonacceptance because it is not 'sound' in terms of local social knowledge." Thus, a first step in determining "local social knowledge" in the case of the small farmer is to identify what the farmer's beliefs or perceptions are in regard to the factors which he sees as limiting the production of the CPS. Two recent studies provide illustrative data.

The first study emphasizes the importance of identifying the farmer's own concept or definition of well-being. Utilizing participant observation and formal, controlled interviews with small farmers in Caqueza, Colombia, Duncan (1974:8) was able to determine the farmer's own conceptualization of well-being.

Among farmers, social knowledge about corn is male knowledge. Women do not directly make decisions about crops. Research has shown that men are more conservative about risk and change behaviors. . . . Men are more willing to accept the sure minimum than try for the possible maximum. They said "We plant corn and leave it, and we know that at harvest the attics of our houses will be full, and we will have enough food for the year. It does not need fertilizer or attention. Sometimes weavels are bad."

This cognitive orientation is then translated by Duncan into five variables that illustrate the manner in which the farmer's conceptualization of well-being enters into his decision-making with respect to and operation of his CPS (i.e., his cultivation of corn). These variables are:
V 1) Corn is the Food Supply. Farmers object to selling corn because they think that they might run short and have to buy corn later. It is best to store it.

V 2) Corn is cheap. Since it is for consumption and not for sale, insecticides and fertilizers are not used because that would increase the price of the family's food.

V 3) Corn is easy. No special cultivating has to be done. Other cash crops may fill labor demands to the maximum in peak work periods, which could leave little labor capacity to expand cultivation of corn.

V 4) Corn is sure. Traditional cultivation is dependable and known. There is minimum risk, also minimum expectation.

V 5) Corn has low productivity. Not using fertilizers or insecticides means low productivity. That level of productivity is known and acceptable. Experimenting with production might lead to crop failure. A sure, minimum production is more acceptable than possible failure and no food (Duncan, 1974:8-9).

When this information on the farmer's cognitive orientation is combined with agronomic and economic information, research and extension workers can develop technologies that the small farmer is more likely to adopt rather than reject.

A second study also illustrates the importance of identifying what the small farmer's perceptions are in regard to the factors which limit his production. Anthropological surveys (CIAT, 1974b) conducted in the lowland tropics generated the data presented in Table 2.2 which compares the importance as specified by the small farmer of various production limiting factors. The surveys were conducted in five sites: Yurimaguas (a development site in the Peruvian jungle), La Mataquina (a recent settlement on the South Coast of Guatemala), Cacaotal (an established village on the North Coast of Colombia), Altamira (an "Agrovila" on the Trans-Amazonica Highway in Brazil), and the Llanos (east of the Manacacias in Colombia). Data relat-
Table 2.2. Comparison of rankings on production limiting factors by farmers and agricultural technicians at five sites (CIAT, 1974b:9)

<table>
<thead>
<tr>
<th>Ranked by farmers</th>
<th>Yurimaguas</th>
<th>La Máquina</th>
<th>Cacaotal</th>
<th>Altamira</th>
<th>Llanos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low prices for products (9)</td>
<td>Lack of machinery (4)</td>
<td>Water for irrigation (1)</td>
<td>Poor health (6)</td>
<td>Lack of transportation (1)</td>
</tr>
<tr>
<td>2</td>
<td>Lack of credit (4)</td>
<td>Pests and diseases (2)</td>
<td>Lack of land (8)</td>
<td>Lack of seeds and fertilizers (4)</td>
<td>Low prices for products (8)</td>
</tr>
<tr>
<td>3</td>
<td>Lack of seeds and fertilizers (1)</td>
<td>Low prices for products (3)</td>
<td>Lack of seeds and fertilizers (3)</td>
<td>Lack of transportation (1)</td>
<td>Lack of seeds and fertilizers (2)</td>
</tr>
<tr>
<td>4</td>
<td>Lack of machinery (8)</td>
<td>Lack of labor (6)</td>
<td>Lack of machinery (13)</td>
<td>Low prices for products (2)</td>
<td>Lack of machinery (2)</td>
</tr>
<tr>
<td>5</td>
<td>Weeds (3)</td>
<td>Lack of seeds and fertilizers (1)</td>
<td>Lack of feed for animals (7)</td>
<td>Pests and diseases (3)</td>
<td>Lack of credit (7)</td>
</tr>
</tbody>
</table>

Number in parentheses indicates the ranking of this factor by agricultural technicians working in the area.
ing to agricultural specialists' perceptions of factors limiting production on small farms were also collected.

The rankings in Table 2.2 of limiting factors were obtained in a paired comparison test of 14 such factors believed by the farmer and the agricultural specialist in each location to limit production. The five most important factors in each location are presented in Table 2.2 in the order ranked by farmers. As the reader will easily observe, the specific factors and their rankings are not the same across sites, i.e., factor rankings differ across agricultural zones. Moreover, there is a discrepancy between the rankings of factors assigned by farmers and those by the specialists. Thus, what farmers believe to be the problems insofar as increasing production is concerned and, therefore, the solution they would more likely perceive as relevant can be quite different than the solutions proposed by agricultural specialists. These considerations suggest not only "the complexity to be faced in designing improved agricultural technology for small farmers," but also "that those responsible for the design and delivery of agricultural technology have a different perception of the limiting factors in each zone than do the farmers" (CIAT, 1974b:8).

Thus, in summary, an awareness of the small farmer's beliefs or cognitive orientation is likely to provide agricultural development planners and technicians valuable clues as to what the possible limiting factors actually are at the level of the SFS. If these factors can be changed by national development programs or if these programs would provide means whereby farmers could gain greater access to those factors they view as scarce or limited (e.g., credit), then it is likely that the farmer's cog-
itive orientation of "Image of Limited Good" would change "toward that of expanding opportunity in an open system."

**Sentiment** The sentiments or feelings which small farmers have about things (including people), events, or places are often conventionally referred to as attitudes. An attitude may be defined as "the individual's outlook or subjective estimation, whether rational or irrational, of his capacity to control or influence the forces which interact to affect his economic and social well-being, i.e., the realization of his value structure" (Hexem, 1971:267). The relationship of attitudes to the adoption of technological innovations by farmers has been the subject of a number of research studies (cf. Rogers, 1969; Beal and Sibley, 1967). Rogers (1969), for example, outlines a number of theoretical and research variables on adoption-related attitudinal dimensions: fatalism, familism, limited view of the world (perceived limited good, localiteness, limited mass media exposure and low political knowledgesbility, illiteracy), low aspirations (lack of deferred gratification and low Achievement Motivation), low empathy, and lack of innovativeness.

A principal impetus to the investigation of these kinds of variables lies in the assumption that these are perhaps the variables which explain why farmers apparently resist adopting new technology in particular and accepting change in general. However, as reflected in Beal and Sibley's (1967) study of the adoption of agricultural technology by Guatemalan Indians, attitudinal variables must be examined in the context of immediate situational variables (e.g., the farm firm) as well as perceptual variables in regard to such factors as the credit, input, and market systems.
Byrnes (1966) has suggested an additional context within which the attitudinal dimension must be considered, namely, that of "learned resistance" to change agents (e.g., extension workers). In this regard, Byrnes (1966:254) advances the proposition that:

...change [agent] systems and their representatives frequently generate much of the resistance they encounter:

* They tell people what to do rather than ask them what and why they do what they do.

* They preach practices rather than teach farmers how and why.

* In training efforts, they stress extension methods rather than technical competence.

* They talk about rather than demonstrate practices.

* They send inadequately prepared people to teach farmers.

* They fail to discriminate among those workers who are technically adequate and those who are not.

Supporting this proposition with a variety of survey and qualitative evidence, Byrnes (1966:254) suggests:

To the extent that change agencies maintain these orientations and continue these practices, we can expect resistances to continue and perhaps to mount. Those who seek changes on the farm must first concentrate on assessing and changing, where necessary, the operations and orientations of bureaucracy. Part of the answer lies in modifying the perceptions bureaucrats have about the behavior of farmers, while other aspects require attention to the underlying problems of staffing and administering extension activities and the training of extension workers.

Byrnes (1966:245) concludes:

What, then, can we say about resistance? Do farmers resist change? Undoubtedly some do; but others do not. More frequently, what they seem to resist is not the change, but the manner in which change is presented, or what they perceive the change to be. They also may resist the perceived or actual technical inadequacy of the change agent or the inappropriateness, for them, of the proposed change. If the resistance is based on a valid perception of inadequacy or inappropriateness then even the mos
competent extension worker, in a communication or methodological sense, will encounter resistance.

Where change agents seek to introduce new technologies to farmers, the burden of proof must lie on the former's and not the farmer's shoulders. Of course, a few enterprising small farmers "may perceive that by substituting a cash crop for a crop previously consumed, the income from selling the cash crop will more than cover the expenditures for purchasing the crop consumed but previously produced" (Hexem, 1971:287). However, where the small farmer must contemplate such new investment opportunities,

...the decision-making process becomes much more complex: (1) The planning horizon must be lengthened and the net returns from the investment estimated; (2) With a longer planning period, additional uncertainties are introduced; price variability, production variability, and tenurial security must be taken into account; and (3) The investor must decide between productive investments and those made for security, prestige, and liquidity purposes. The determination of net returns from alternative investments is a complicated problem for producers, regardless of the stage of economic development (Hexem, 1971:288).

In the face of these specific complexities and the broader social organizational context within which the SFS exists, the various attitudinal dimensions (e.g., fatalism) which some social scientists have attempted to measure would perhaps be better interpreted as symptoms of rather than the underlying causes of the "vicious circle" which outsiders view as characteristic of the life situation of peasants or small farmers in the developing world (Rogers, 1969). Thus, the particular attitudes held or expressed by peasants perhaps would be more profitably (for social scientists and national development planners) be interpreted as reflectors of the "optimism" or extent to which small farmers find their lives "satisfying" rather than assuming that if such attitudes were to change, then peasants or small farmers would be more entrepreneurially innovative, economi-
ally rational, or more highly productive in terms of the commodities which they produce within the SFS.

**Social economic elements** The social economic elements of the SFS involve three social system elements: objective, sanction, and facility.

**Objective** Among the various elements involved in attempting to understand the overall functioning of a SFS are the objectives or desired state of affairs sought by members of the RAS or, more specifically, the small farmer or small farm family. As the specific objectives of small farmers will vary depending on the particular SFS in question, it would be presumptuous to attempt to specify here a list that purported to detail all of the objectives sought by small farmers. Moreover, even if we could assume that any particular listing of "small farmer objectives" did contain all the objectives of small farmers and only the objectives which are sought by small farmers, it would be presumptuous to assume that the specific ordering of the objectives included in such a list in any way corresponded to the priority which farmers in fact do assign these objectives.

A second consideration is that the objectives held by actors in any social system are not static but rather dynamic. As objectives of first or lower priority are met, remaining objectives which have not yet been achieved move up in priority (e.g., a new objective is consciously or unconsciously assigned highest priority). Also, as new objectives are specified, the overall priorities of all objectives must be reassessed by the individual. This consideration provides a basis for emphasizing that in studying the SFS, one should not confuse (1) what actors currently view as their objectives and (2) what actors subsequently at a later point in time will in fact view as their objectives.
A final consideration involves the difference between what small farmers feel their objectives are and what national development planners feel the objectives of small farmers should be. While migration to the capital city may be an objective of high priority among small farmers, their accomplishment of this objective is likely to be in conflict with the planner's objective to reduce the rate of migration from rural to urban areas. At the same time, however, the objectives of national planners to increase foreign exchange earnings through the sale of exportable agricultural commodities (e.g., sugar, coffee, etc.) may be in conflict with the objectives of small farmers to improve the quality of life on the small farms in the rural areas in which they live. These examples suggest that there are likely to be tradeoffs between and among any pair or larger combination of objectives which might be specified. Thus, for example, a simulation study of small farm systems in La Máquina, Guatemala, found:

...that bringing more land into production would require a reallocation of cash and other resources that would cause a reduction in total family consumption, even with the use of credit. Since the farmer will try to satisfy his subsistence needs first, it is apparent that he has little incentive to increase production by expanding the area planted (CIAT, 1974b:21).

Rather than attempting to specify a definitive list of "small farmer objectives," the discussion that follows will consider nine dimensions along which "small farmer objectives" could be specified. These nine dimensions are not intended to be exhaustive of the dimensions along which small farmers might specify objectives nor is it assumed that the decision-

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1Adams and Havens (1966:214) note that objectives or "goals may or may not be consistent, and they may be wholly or partially competitive or complementary." This would apply both to objectives as defined by the small farmer and the development planner.
making of small farmers consciously takes into account each and every
dimension proposed here. It is hypothesized, however, that if small farm-
ers were to specify objectives along any one or more of the nine dimensions
to be proposed and, subsequently, were to achieve the specified objectives,
such achievement would constitute from the standpoint of national develop-
ment planning either a **directly** or an **indirectly beneficial change** in the
SFS.

The concepts of a "directly beneficial change" and an "indirectly ben-
eficial change" are formalized to a considerable extent in the following
definitions. A **directly beneficial change** is one which constitutes an
improvement in the level of living of the members of the RAS (farm family).
On the other hand, an **indirectly beneficial change** is one that constitutes
an increase in the productive capacity of the CPS (farm firm). If we
interrelate the two types of beneficial change (directly beneficial and
indirectly beneficial) and the SFS's two component subsystems (RAS and
CPS), we may construct a heuristic device (see Figure 2.13) for classifying
the nine dimensions of "small farm objectives" into four basic categories:
consumption (cell A); disposition (B); production (C); and participation
(D).

**Consumption** In the consumption cell (A), we have two
dimensions of "small farmer objectives": (1) the nutritional quality of
the farm family's diet and (2) the cash flow received by the farm family.

(1) The nutritional level of the farm family's diet is not necessarily
a dimension along which a farm family consciously formulates objectives
(McIntosh, 1975). Nevertheless, farm families engage in decision-making
with respect to the allocation of resources to and the operation of the CPS,
<table>
<thead>
<tr>
<th>Resource Allocation System</th>
<th>Commodity Process System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Consumption</strong></td>
<td><strong>B. Disposition</strong></td>
</tr>
<tr>
<td>1. Nutritional quality of farm family's diet.</td>
<td>3. CPS's efficiency of utilization of commodity disposition facilities.</td>
</tr>
<tr>
<td><strong>Directly</strong></td>
<td><strong>Beneficial</strong></td>
</tr>
<tr>
<td>2. Size, regularity, and frequency of cash flow received by farm family</td>
<td>4. CPS's production and productivity (per unit of operation).</td>
</tr>
<tr>
<td><strong>Beneficial</strong></td>
<td><strong>C. Production</strong></td>
</tr>
<tr>
<td>8. Extent to which CPS requires involvement of farmer in political decision-making processes in broader social system beyond the SFS.</td>
<td>5. Productive potential of unit of operation (whether land, plant, animal).</td>
</tr>
<tr>
<td><strong>Indirectly</strong></td>
<td>6. Level of on-the-farm employment.</td>
</tr>
<tr>
<td><strong>Beneficial</strong></td>
<td>7. CPS's efficiency of utilization of production input facilities.</td>
</tr>
<tr>
<td>9. Extent to which CPS generates off-the-farm employment opportunities which can absorb currently underemployed or unemployed labor.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.13. Nine dimensions along which "small farmer objectives" could be specified by national development planners and/or small farmers.

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1 The reader is cautioned not to equate or confuse the form or content of Figure 2.13 with Figures 2.1, 2.4, 2.7, 2.8, and 2.9. The dimensions of "small farmer objectives" specified in Figure 2.13 relate in functional terms to the goal attainment subsystem of the SFS as an overall social system comprised of both the RAS as the farm family and the CPS as the farm firm. Thus, the reader should relate items 1 through 9 in Figure 2.13 solely with cell 4 (goal attainment subsystem) in the various figures cited immediately above. The focus on the goal attainment subsystem in respect of the dimensions of "small farmer objectives" and, relatedly as the reader will shortly see, on the social economic element of facilities and technology reflects assumption 3 on page 51 in regard to the primary importance of facilities and technology (within the adaptive subsystem of the SFS) as the principal means for more optimally achieving the objectives (in the goal attainment subsystem of the SFS) specified in Table 2.5 on page 107.
thereby consciously or unconsciously making decisions as to the kinds of food that are to be produced (or bought) and subsequently consumed—in short, making choices in regard to levels of nutritional intake. The nutritional level of the family diet includes both (a) the quantity of food ingested and (b) the quality of that food in terms of carbohydrates, proteins, vitamins, etc.

(2) As SFSs become integrated into the national market economy of an LDC, the cash flow received by the farm family becomes an increasingly important contingency in the family's decision-making (CIAT, 1974b). The idea of cash flow involves several subdimensions: (a) the size (or amount) of money received by the family at any point in time or during a fixed period of time; (b) the regularity (or periodicity) of the flow of cash—however large the amount may be at the time of receipt; (c) the frequency of the flow of cash—again, however large the amount may be at time of receipt; and (d) the overall security (or stability) of the flow which may be seen to be a function of the size, regularity, and frequency of the flow of cash received by the farm family.

Small farmers will vary in the extent to which cash flow is priority-rated as an objective. Cash flow will be a higher priority objective in those instances where farmers require money: (a) to purchase basic necessities—the "salt and shoe money"; (b) to purchase the broad range of consumption goods and services defined by the farmer as relevant to upgrading his perceived level of living relative to the standard of living the family aspires to; (c) to purchase production input and commodity disposition factors required for continued operation of the CPS; and (d) to pay such rents or taxes as the farmer may be required to pay in cash.
Disposition

In the disposition cell (B), we have two dimensions: (3) the CPS's efficiency of utilization of commodity disposition factors and (4) the CPS's production and productivity (yield per unit of operation).

(3) Once a commodity has been produced in a CPS, it must be disposed of in some way (Harrison and Shwedel, 1974). While the farm family may consume the bulk of the commodity produced by the CPS, portions of the produce may either be marketed and/or saved for subsequent investment (e.g., seed saved for planting in the next crop season). Thus there are three channels through which a commodity may be disposed: (a) consumed as food or utilized for some other consumption purpose (e.g., making clothing); (b) marketed; or (c) saved (and reinvested into the CPS). Whether a given commodity is consumed, marketed, saved, or some combination of these, the farm family's operation of the CPS will evidence some degree of control over the efficiency of utilization of commodity disposition factors. The manner in which the family prepares a commodity for its disposition through consumption, marketing, or saving constitutes a level of efficiency in the utilization of the commodity disposition factors involved in that preparation and provides an indication of the priority which this efficiency has in the overall objectives of the small farm family.

(4) In order to be able to dispose of a commodity, it must first be produced. There are three possible units of operation which may be utilized in the production phase of a CPS: a piece of land, the individual plant, and a head of livestock. Whether the farm family is operating a Plant-CPS, an Animal-CPS, a Multi-CPS (two or more plants or two or more animals), or a Mixed-CPS (at least one plant and one animal), farm families
are concerned about both: (a) Production: the total quantity yielded by the total number of units of operation allocated to the production of a particular commodity and (b) Productivity: the yield per unit of operation. Whether farmers seek to maximize yields per unit of operation, however, is another point for discussion, particularly as it is not meaningful to talk about maximization of yields without specifying the constraints to which such maximization is subject. Such constraints can involve any number of factors: other objectives valued by the farmer such as ensuring some minimum size, regularity and frequency of cash flow, some minimal quantity intake of food, or some minimum acceptable levels of risk (discussed below under the social system element of sanction); limitations on the availability of production input and commodity disposition factors; or any one or more of the social organizational or social psychological elements previously discussed. Those constraints more directly related to productivity are now discussed in relation to the production cell (C).

Production In the production cell (C), we have three dimensions along which small farmers may specify objectives: (5) the productive potential of the unit of operation (land, plant, animal); (6) the level of on-the-farm employment; and (7) the CPS's efficiency of utilization of production input factors.

(5) A farm family will operate the CPS in a way that either increases or reduces the productive potential of the units of operation that are involved. While the small farmer is not likely to work a draft animal to death, the animal's work efficiency may be considerably impaired by parasites or lack of proper nutrition; such problems may similarly plague his swine operation. The productive capacity or accumulated fertility of the
soil will be considerably depleted by continued replanting of the same crop year in and year out on the same piece of land. In analyzing a SFS, one can thus examine the extent to which activities are present which serve to rehabilitate, maintain, or improve the natural units of operation (land, plant, animal) utilized by the CPS (Schumacher, 1973).

(6) A second dimension within the production cell is that of the extent to which a CPS utilizes the existing labor supply within the RAS (i.e., the members of the farm family) or in some instances (e.g., at harvest) requires the hiring of additional labor. In Colombia, for example, there is a high percentage of unemployment or underemployment in the agricultural sector, reaching in some places 25% of the total economically active population (CIAT, 1974b:3). The employment situation within and beyond the typical SFS in Colombia, however, is complex in that "there is a labor deficit in specific regions and during certain seasons, due to the cropping cycles and peak labor demands for such critical operations as planting, weed control and harvest" (CIAT, 1974b:3). But, in general, "surplus agricultural labor is a problem in most developing countries" and "low cost labor-using, rather than capital-using, techniques must be employed to the greatest extent possible in agriculture" (Waterson, 1974:23). Where more rather than fewer laborers can be employed in either the production or disposition phases of a CPS, such increased labor utilization is beneficial not only in helping to absorb underutilized labor supplies (i.e., reducing underemployment and unemployment) in rural areas (Schumacher, 1973) but also in providing for greater beneficial change in the cash flow and nutrition objectives of the consumption cell (A).
(7) A third dimension of the production cell is that of the CPS's efficiency of utilization of production input factors. This dimension is a principal concern of the commodity production systems programs of agricultural researchers (cf. CIAT, 1973). There is also increasing discussion, in relation to the dimension of the level of on-the-farm employment, of the appropriateness or selective employment of mechanization on small farms (Fisk, n.d.; Stout and Downing, 1974; Johnson and Link, 1970). A key concern here is that of identifying ways in which the SFS can be mechanized in a way that increases not only productivity but also labor utilization.

Participation In the participation cell (D), we have two dimensions: (8) the extent to which the operation of the CPS requires that the small farmer be involved in the political decision-making process in the broader social system beyond the SFS and (9) the extent to which the CPS generates off-the-farm employment opportunities which can absorb currently underemployed or unemployed labor.

(8) The operation of a CPS may require that the small farmer become involved in the political (broadly defined) decision-making process in the wider social system beyond the SFS. For example, in order to obtain credit for production inputs (e.g., fertilizer), the individual farmer may need to associate himself with other individual farmers in a "credit society" or a cooperative. The latter type of organization provides the small farmer an arena in which decision-making can be oriented not only to the specific requirements of the individual CPS but also to the possibility of group or collective action on issues of community concern, e.g., whether to utilize cooperative profits for some community self-help project such as digging a well or launching a needed business enterprise. Insofar as such participa-
tion involves group decision-making and individual choice in electing persons to serve as farmer representatives--either in local or regional cooperatives or in positions of elected governmental responsibility, small farmers experience the opportunity to exercise both voice and vote in the decision-making processes of the broader social system in which the individual SFS lies and which in one way or another affect the lives of the farm family within and beyond the SFS.

(9) The final dimension along which objectives may be specified is that of the extent to which a CPS is operated in a way that generates off-the-farm employment opportunities as opposed to displacing labor from rural to urban areas. The SFS which generates a volume of output beyond its capacity to consume or save can dispose of the surplus through its sale in nearby local or regional markets. This latter commodity disposition alternative, however, is only possible if the small farms in a given region can generate sufficient volumes of the kinds of commodities which, if properly processed, can then be marketed to consumers in urban or rural areas. Where there is adequate consumer demand for the processed commodity and sufficient production (volume of output) to make the commodity's processing a profitable venture, then the door is open to the kinds of investment that would set up a processing industry and, in doing so, create the range of jobs that would be required to operate such an industry. Here the off-the-farm processing of commodities produced within the SFS is understood to include all the processes that would be involved in handling and transforming the commodity from the time it leaves the hands of the farmer until the time the processed commodity is in the hands of the consumer.
In connection with the possibility of employing rural labor in industries to process the volume of agricultural commodities sold by the farmer to the market, Waterson (1974:23) has urged that:

...small-scale, labor-using, light industries with low capital requirements should be established in rural areas to supplement employment opportunities in agriculture. ... as experience in the People's Republic of China and Israel has shown, light industry should concentrate mainly on two kinds: (a) the processing of agricultural commodities produced in the area concerned, which might include fruit and vegetable canneries, flour and rice mills, woodworking factories, slaughterhouses, creameries and milk powder plants, sugar refineries, paper mills, and processing units for cotton ginning and edible oils; and (b) the fabrication on inputs for agriculture, such as cattle, pig, and poultry feed mills, fertilizer mixing plants, small toolmaking shops, and clay, brick, and tile works.

These various off-the-farm labor-employing industries should serve to suggest some of the possible constructive rural developmental endeavors in which the small farmer's involvement should be encouraged by national development planners and project implementors.

In summary, the discussion of the social economic element of objectives has specified nine different dimensions along which farmers might specify objectives for the operation of the CPS. It must be emphasized, however, that any definitive statement as to what the objectives of small farmers are in a given region of SFSs would require empirical study involving observation as to what small farmers do, the explanations they provide for their action, and what they see as the objectives which they are working to accomplish within the context of the SFSs in which they live. In taking a systems approach to analyze the SFS, CIAT (1973:219) has emphasized that "the farmer's objectives [must] be made explicit. For the farm family these objectives probably include income, nutrition, cash flow, security, health, and education." However, as CIAT (1973:219) cautions:
There is no clear nor explicit understanding of these objectives as yet. In addition, public-policy goals are frequently not made explicit. Much research effort can be misdirected unless there is a clear specification of the problem so that objectives are not confused with the activities that can be undertaken to achieve those objectives.

Sanction  Sanctions have been defined as the rewards or penalties which promote an actor’s conformity to the objectives (ends), facilities (means), and norms of a social system. In relating the idea of the social economic element of sanction to the SFS, two types of sanctions may be discussed as most relevant to the farm family’s operation of the CPS: (1) economic sanctions and (2) social sanctions.

Economic sanction  An economic sanction may be defined as the expected return which the small farmer anticipates receiving from the operation of a CPS. This return may be analytically divided into the overall physical return and the associated cash return, if any, from disposal of a portion of the commodities produced through sale in the market.

Cash return  Where the small farmer has the option of selling a portion of the output of the CPS to the market, the price that the farmer expects to receive provides either an incentive (positive sanction) or a disincentive (negative sanction) to sell or, more basically, to even produce for the market. Thus, the decision to produce or not to produce for the market defines in large part whether a highly subsistence-oriented CPS will continue to be operated as such or whether appropriate changes will be made in the CPS that will allow a greater response to market incentives, i.e., increased productivity and production for sale to the market.
The Food and Agricultural Organization of the United States (FAO) notes in regard to the response of farmers in the LDCs to market incentives that "a growing volume of evidence is accumulating to show a direct response to price incentives and disincentives" (FAO, 1967:9). However, while there is increasingly less doubt that small farmers are responsive to price related economic sanctions that will affect cash returns, small farmers are rarely in the position to sell their produce at the time when prices are high. In this regard, FAO (1967:6) emphasizes the seasonal flow of agricultural commodities in the LDCs and this flow's influence on price levels:

Most crops are harvested once, occasionally two or three times a year, and even livestock production shows marked seasonal swings. There are periods of abundance and periods of shortage. . . . The characteristic cycle is a sharp fall in the prices of crops immediately after the harvest, . . . followed by a gradual recovery in prices as supplies become scarcer. Most farmers in developing countries . . . lack the financial resources to wait for high prices. They are usually badly in need of ready cash and frequently in debt, so that they must sell practically the whole of their marketable surplus as soon as their crop is harvested and when prices are lowest.

Thus, faced in most cases by monopsony power—effective access to only one local buyer, subsistence farmers are in a weak bargaining position and are not likely to view prices (which they expect to or know will be low) as positive sanctions (i.e., incentives) but rather as negative sanctions or disincentives.

Physical return Given the problem of "low prices" as received by the small farmer in the LDCs, students of the economics of small farm agriculture are now seeking to answer the question: How much "incentive" constitutes an economic incentive for the small farmer? Hill (1964) has proposed that increases in output from the subsistence sector in
the LDCs "is going to be slow at the outset unless relatively simple combinations of improved practices are available, capable of increasing yields by at least 25 to 50 percent on good soils with good water supplies. Increases of 50 to 100 percent would be still better."

Hill's hypothesis merits empirical test. Wharton (1968) provides a conceptual framework for approaching the problem. While space limitations do not permit redevelopement of the complexity of Wharton's thesis, his argument may be summarized as follows:

...while agricultural innovations are a potential force for change in subsistence agriculture, peasant farmers resist adopting varieties, practices, and/or combinations of these which they perceive as not maximizing survival. The risks and uncertainties associated with yield, cost, and market price variabilities combined with low levels of income (output) and subsistence levels of living produce a strong "survival" element in decision-making. What is important for the farmer under these conditions is his expectation of output variance if the innovation is adopted as compared with the current output variance obtained under the conditions of the farmer's present technology (Byrnes and Byrnes, 1971:336-337).

Wharton (1968) then proposes:

The subsistence farmer has learned that any recommended technological introduction has associated with it a different expected variance on his fields—a variance which may be wider than that on the fields of the research station. Under these circumstances the determining factor is the comparison between the expected variance of the new technology and the known variance of the traditional technology.

If the small farmer expects or sees the negative variance in yield per hectare (i.e., the worst that the innovation would yield) to be below what he perceives as the minimum yield which he must achieve in order to provide for his family's subsistence needs, the farmer will resist adoption. Thus,

...even though the average expected yield may be considerably higher than his average yields with current varieties and practices, the variance in expected yields with the alternative technologies as viewed subjectively by the individual farmer are far
more important in determining the adoption of the new seed, practice or factor input (Wharton, 1968).

In light of these considerations, Wharton hypothesizes "that adoption is more likely to occur when the negative standard deviation of yield distributions is above the traditional average output, i.e., that the worst the innovation could do is still better than what the farmer now gets on the average" (Byrnes and Byrnes, 1971:337).

Recent experience (IRRI, 1967; Wharton, 1968) with innovations (high yielding rice varieties IR8, IR5, and attendant rice production practices) developed at the International Rice Research Institute supports the hypothesis. A sample of rice farms in Rizal province, Philippines, was drawn, and farmers were asked to recall their yields for the 1966 and 1967 dry seasons. Not only was the IR 8 average yield higher than the local variety average yield (5.86 as compared to 3.17 metric tons per hectare), but also the local variety yield of 3.17 was still lower than the IR8 yield at one negative standard deviation (3.24) of its yield distribution. Stated most simply, a sizable number of farmers whose IR8 yields were less than the IR8 average yield for Rizal province still had higher yields than obtained on the average by farmers using the local variety.

In addition to the increase yield, Table 2.3 demonstrates that the innovations provided considerably larger net returns than obtained by using the local variety. The data in Table 2.3 also illustrate the rapidity with which IR8 and related innovations were adopted by Rizal farmers. Similar rapid adoption rates have since been reported (Abbasi et al., 1968; Barker, n.d.).
Table 2.3. Comparison of net returns from two rice varieties (IRRI, 1967)

<table>
<thead>
<tr>
<th>Dry growing seasons</th>
<th>Net return (in pesos)</th>
<th>No. farms growing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IR8</td>
<td>Local variety</td>
</tr>
<tr>
<td>1966</td>
<td>1829</td>
<td>904</td>
</tr>
<tr>
<td>1967</td>
<td>1615</td>
<td>921</td>
</tr>
</tbody>
</table>

Adoption rates of improved technology in the LDCs, however, are characteristically low among small farmers. This may be explained in part by the small farmer's tendency to avoid the negative sanctions or disincentives of technical risk (e.g., expected low physical return or yields) and economic risk (e.g., expected low cash return). This avoidance pattern would thus explain the characteristic tendency of small farmers to continue to utilize the same technology from one CPC to the next. Technical and economic risks, however, are not the only potential sources of risk which come to bear on the SFS. As the small farmer evaluates opportunities to adopt new technology, he is likely to subjectively discount the expected negative variance in yield in view not only of the perceived technical and economic risks but also the potential psychological and social risks (Yetley, 1972).

Social sanction A social sanction may be defined as those nonmomentary forms of communication which may be directed—by the members of either the SFS or of the broader community surrounding the SFS—toward the individual small farmer or any member of the SFS to encourage that a CPS is operated in a way that ensures the family's subsistence needs. Where the actions taken by a member of the small farm family are
perceived by other family members as jeopardizing the attainment of the family's objectives, the individual is likely to become the object of sanctions. As Bell and Vogel (1968:26) note in regard to family behavior in general:

If a family member is losing interest in family activities in ways considered inappropriate, the family will apply various sanctions, either positive or negative, to renew the individual's aspiration. Any lack of motivation is always a potential threat to the entire group, and the family cannot let deviance from family norms occur without attempting to supply motivation to correct this deviance or at least making clear that such behavior is unacceptable.

In the broader community, the small farmer will tend to make certain decisions in terms of his responsibilities to others in the community rather than simply on a self-centered basis. As Diaz (1967:51) notes: "He dare not risk ostracism by becoming a free agent, for he depends on those around him for extra hands for...harvest...and for assistance at...famine."

Similarly, agricultural commodities should be disposed of in a way that benefits the subsistence needs of the family and the social traditions (e.g., fiestas) of the community rather than be utilized for individual gain: "Conspicuous consumption...calls up negative sanctions--distrust, gossip, ostracism, and witchcraft" (Diaz, 1967:54). When the small farm rice producer has the opportunity to consult with an extension agent,

...his neighbors may disapprove of him seeking advice and counsel from an "outsider" who is not a farmer and whose "knowledge" of rice culture is questionable. Or, the farmer may be uncertain of what his neighbors will think of him if he plants the new variety and it fails to outperform the old variety. In this case he may be thought of and treated as a "foolhardy fellow" (Yetley, 1972).

In summary, to say that the small farmer perceives the risks--whether technical, economic, psychological, or social--to be high in adopting new technology is to say, in effect, that he subjectively perceives the prob-
ability of failure as quite high or, conversely, the probability of success as quite low. Thus, the farmer's perception of high risk may be seen, in effect, to also operate as a negative sanction, i.e., to discourage the farmer from making those adjustments in the CPS which he perceives as having a high probability of failure. If the farmer is going to try a new technology, he must be sure not only that he will not be negatively sanctioned for adopting it, i.e., that the technical, economic, psychological, and social risks are low, but also that there is a high probability of being positively sanctioned (socially and economically rewarded) for his venturesome effort in adopting the new technology.

Facility The small farm family's objectives are attained through the allocation of resources or, more specifically, facilities to the CPS. The type or facility of focal interest here is that of technology which has been defined as a highly specific combination of facilities utilized by an actor to attain one or more specific objectives valued by the actor. Technology in the context of a SFS would involve the specific combination of commodity processing facilities (CPF$s$), i.e., production input and commodity disposition factors utilized by the farm family in operating the CPS. The various CPF$s$ utilized by the farm family to operate the CPS may be obtained either from within the SFS or from sources within the Agri-Support System. If we interrelate (1) the idea of the two types of CPF$s$: production input factors and commodity disposition factors and (2) the idea of the two sources from which any particular CPF is obtained (either from the SFS or from the Agri-Support System), we may construct a heuristic device (see Table 2.4) for classifying the diverse types of CPF$s$ that might enter into the CPS of any particular SFS.
Table 2.4. A partial listing of Commodity Processing Facilities (CPF) by source and type: Production input factors and commodity disposition factors

<table>
<thead>
<tr>
<th>Type/source</th>
<th>Agri-Support System</th>
<th>Small Farm System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production input</td>
<td><strong>A. Technological information</strong> on improved technology</td>
<td>A. Human labor</td>
</tr>
<tr>
<td></td>
<td><strong>B. Technical</strong></td>
<td>B. Capital</td>
</tr>
<tr>
<td></td>
<td>1. Supplies</td>
<td>1. Land (soil nutrients; solar energy; soil and air temperature, moisture, changing weather)</td>
</tr>
<tr>
<td></td>
<td>a. seed (including improved or hybrid)</td>
<td>2. Irrigation and accumulated fertility</td>
</tr>
<tr>
<td></td>
<td>b. fertilizer</td>
<td>3. Livestock</td>
</tr>
<tr>
<td></td>
<td>c. insecticides</td>
<td>4. Equipment (implements and machinery): source of power—human, animal, motor (fuel)</td>
</tr>
<tr>
<td></td>
<td>d. herbicides</td>
<td>C. Biological</td>
</tr>
<tr>
<td></td>
<td>2. Equipment</td>
<td>1. Seeds</td>
</tr>
<tr>
<td></td>
<td>a. implements (tools)</td>
<td>2. Timing of planting/harvesting</td>
</tr>
<tr>
<td></td>
<td>b. machinery</td>
<td>D. Chemical</td>
</tr>
<tr>
<td></td>
<td>3. Fuel</td>
<td>1. Natural fertilizer; manure, compost</td>
</tr>
<tr>
<td></td>
<td><strong>C. Financial</strong></td>
<td>2. Timing of application (including commercial fertilizer, herbicides, and insecticides)</td>
</tr>
<tr>
<td></td>
<td>1. Credit</td>
<td>E. Agronomic (specific cultural practices)</td>
</tr>
<tr>
<td></td>
<td>2. Insurance</td>
<td>1. Contour plowing</td>
</tr>
<tr>
<td></td>
<td><strong>D. Cooperation</strong></td>
<td>2. Crop rotation</td>
</tr>
<tr>
<td></td>
<td>1. Traditional reciprocity of labor and commodities (including irrigation) among farmers</td>
<td>a. inter-cropping</td>
</tr>
<tr>
<td></td>
<td>2. Modern</td>
<td>b. multiple cropping</td>
</tr>
<tr>
<td></td>
<td>a. hired labor</td>
<td>3. Weeding practice</td>
</tr>
<tr>
<td></td>
<td>(1) persons from other farms</td>
<td>4. Timing of practice</td>
</tr>
<tr>
<td></td>
<td>(2) landless laborers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. irrigation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) paid through tax</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) paid through direct transfer of funds to supplier of water</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. organized group effort (e.g., cooperatives)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1) unifunctional</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) multi-functional</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.4. (continued)

<table>
<thead>
<tr>
<th>Type/source</th>
<th>Agri-Support System</th>
<th>Small Farm System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodity disposition</td>
<td>A. Markets (local and regional)</td>
<td>A. Processing (e.g., cleaning, cooking)</td>
</tr>
<tr>
<td></td>
<td>B. Market information</td>
<td>B. Storage</td>
</tr>
<tr>
<td></td>
<td>C. Farm to market roads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Transportation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E. Storage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. Processing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G. Assembly</td>
<td></td>
</tr>
</tbody>
</table>

When analyzing the SFS in terms of the social system element of facilities, the item of basic concern is "how the farm family transforms its resources of time, land, energy, species, information, etc., into crops and real income" (CIAT, 1973:219). Where the outsider is critical of the low productivity of the SFS, it must be remembered that:

The small farmer has had few if any profitable opportunities. He responds to the set of rewards and penalties he perceives. He has evolved farming systems that are often near optimal for the economic, political and ecological environment in which he operates, given the alternatives he can perceive. This essential rationality of the small farmer implies that successful agricultural development requires new production alternatives that are adapted to his environment, that increase his income, that recognize this risky nature of his decision problems, and that fall within the availability of input supplies and stable markets (CIAT, 1973:218; emphasis added).

These considerations are illustrated in Tinnermeier's analysis (1974) of the problems involved in attempting to utilize the CPF of production credit to increase the production and income earning potential of the small farmer in the LDCs. Tinnermeier (1974:100) proposes that credit

...should be extended on the basis of its potential for increasing farm incomes. ...the primary objective of...credit...should be to help the farmer increase the value of output more than the
increases in the input costs, leaving him with a net gain...
[that] allows loan repayment and permits increased family con-
sumption or capital formation.

In attempting to attain and use production credit, however, the small
farmer confronts a number of constraints which Tinnermeier (1974:100) lists
as follows:

1. Farms are small and often fragmented;

2. Where at least some small farmers do not migrate from their
farmers, there is little potential for any of the remaining
farmers to increase the size of their holdings;

3. The small farmer's land is often poor in soil quality and
lacks access to irrigation water;

4. Land tenure rights are rarely officially recorded and are
thus insecure;

5. Small farmers have little or no access to off-farm CPFs,
including new technology;

6. Such technology that does reach the small farmer is often in
a form which he cannot use;

7. Commodity marketing is difficult and further impeded where
local prices are highly sensitive to changes in supply;

8. Purchased CPFs are unavailable in the small-sized units
required or their costs are high; and

9. The small farmer has little access to technical assistance
that would help him adopt new practices.

Despite the limited facilities available to the small farmer, he must
yet

...simultaneously solve many problems...--small cash flows, fam-
ily consumptions needs, production requirements, and unpredicted
adversities. The interaction of these variables is especially
significant for the small farmer. Cash flow problems arise from
the deficits and surpluses inherent in the production cycles.
Crop inventories to meet food requirements of the household are
as important as providing cash to meet farm operating expenses or
to pay off any loans (Tinnermeier, 1974:100-101).
Tinnermeier (1974:101) concludes that the small farmer's limited net worth and his restricted loan repayment capacity, arising from small cash flows, limit the farmer's access to credit. Thus, the complexly interrelated conditions under which the small farmer operates severely restrict the farmer's ability to make production credit work for him.

One possible means of providing the small farmer greater access to credit in particular or, in general, to achieving the objectives which he defines as important would consist of his utilization of technologies which would provide him physical and cash returns sufficiently high to more than adequately cover any costs incurred. In talking about more productive technologies, one should bear in mind that:

It is now generally accepted that most farm operators in less-developed countries operate in a rational economic manner. This implies that farm production cannot be significantly increased by either reallocating the given resources or by adding more of the traditional inputs. A number of studies confirm this conclusion (Tinnermeier, 1974:101-102).

Thus, in support of Schultz's (1964) original thesis that it is unprofitable to further expand traditional technology, Tinnermeier (1974:102) concludes:

...that few profitable investment opportunities are available for small farmers when applying existing technology. The additional returns from the investments do not cover the additional costs. This conclusion, then, forces us to turn to the introduction of new technology if we expect to increase incomes in the small farm sector.

Too frequently, however, new and purportedly improved technology has not been "locally adapted or tested under conditions similar to those faced by the farmer. Or, if shown to be physically better than local conditions, such technology still may be unprofitable" (Tinnermeier, 1974:103).

"Unfortunately," as Tinnermeier (1974:104) observes, "very little or no
testing of the profitability of recommended practices...takes place at the farm level." Therefore, as Tinnermeier (1974:104) argues, "to assume that all new technology is profitable, especially for the small farmer, is very questionable." In summary, Tinnermeier (1974:104) concludes that "profitable technology is not always available to the farmer.... Furthermore, an important explanation for the low profitability is the lack of output-increasing technology. New, appropriate technology may be the key to small farmer programs, as well as to the general development of the LDC's."

Whether such technologies can be developed is a "question [which] can only be answered by thoroughly researching the problems faced by the small farmers" (Tinnermeier, 1974:105).

Toward developing appropriate or small farmer technologies, Tinnermeier (1974:105-106) has proposed a number of researchable areas which, if investigated, might provide answers for solving the production problems of the small farmer. Some possibilities include:

1. New water management techniques for storing and using water, including the economics of small scale irrigation projects;

2. Water-nutrient interactions for crops presently grown on small farms as well as those with potential, i.e., horticultural crops, fruits and nuts, especially under less-than-ideal rainfall or under-irrigated conditions;

3. New output-increasing techniques for the more traditional crops such as cassava, potatoes, and legumes and for livestock activities;

4. Information on the sensitivity of yields to land preparation and time of planting;

5. Feeding rations utilizing the increased output from the traditional crops;

6. Seeds with high yields but with less variation under different climatic conditions;
7. New animal-powered farm implements;
8. Mechanical tillers and other small power implements, as needed;
9. Low-cost and effective on-farm storage and drying facilities;
10. New techniques of multiple- and inter-cropping to increase incomes and reduce risk; and
11. Techniques for improving managerial skill.

In addition to research on the production-related problems of the CPS, research is also needed on the disposition phase of the CPS, particularly with respect to the consumption (McIntosh, 1975) and marketing (Harrison and Shwedel, 1974) of agricultural commodities. Reporting on a seminar on marketing problems associated with small farm agriculture, Harrison and Shwedel (1974:7) propose that:

...where it was determined that a bimodal market system existed questions would be asked to determine: (1) types and quality of services to the small farmer vis-a-vis the large farmer; (2) the sources of the small farmer's competitive disadvantage; and (3) how much of this disadvantage is related to economic factors (e.g., economies of scale) and how much to externalities (e.g., subsidized capital).

Harrison and Shwedel (1974:7) also cite the research of Purdue University and the Brazilian Research Company to identify development alternatives in Minas Gerais for low-income groups at the farm level. These groups include landowners, sharecroppers, renters, and permanent and temporary farm workers. Using the family as the basic unit of analysis, information has been gathered across four points in time on: (1) family history and previous work experience; (2) the resource base of the household--quantity and quality of human and nonhuman resources; (3) income and expenditures by source and type; (4) extent of labor market participation and other activities; and (5) characteristics of the existing agricultural
production system—type of cultivation, technology, credit use, etc. Follow-up interviews were also used to determine: (1) use of time; (2) labor force participation; (3) changes in the resource base; and (4) expenditures during the reference period.

There are, thus, a variety of research problems which might be investigated and an even greater number of items on which data might be gathered in regard to how the small farm family actually through the operation of the CPS "transforms its resources...into crops and real income" (CIAT, 1973:219). One means of getting at this question of resource transformation within the CPS of the SFS is through the creating of "physical and analytical models of prototypical farming systems and their components to predict the impact of new technology" (CIAT, 1973:219). CIAT (1973:219; 1974b), one of the pioneers of this type of approach, has argued that the analysis of existing SFSs and the synthesis of prototypical farming systems (i.e., CPSs)

...should produce the requisite information to specify the technology which is feasible for introduction into small farms in order to better achieve farm family and national food production goals. The knowledge gained in earlier phases [i.e., during the analysis of the family farm system] would permit the biological scientists on the team to select and specify the cultural practices, the species mixes, the levels of inputs, etc. to be tested for potential introduction to the family farm.

**Summary of SSEM of SFS** The preceding discussion has presented an exploratory application of the SSEM to the context of the SFS. Although relying heavily on qualitative data for its empirical support, the model does illustrate the complexity of the SFS and the manner in which the various social system elements can enter into, either constraining or facilitating, the small farmer's decision-making with respect to and operation of
the CPS. Specifically, the social economic element of objectives was con­ceptualized as containing at least nine dimensions along which the small farmer might specify objectives and along which change in a positive direc­tion would be either directly or indirectly beneficial for the small farm family. It was also emphasized that the social economic element of facili­ties and, relatedly, the technology utilized to operate the CPS are the principal means whereby the objectives of the farm family are achieved.

In turning to the concept of small farmer agricultural development, the reader will see that this concept's definition is primarily concerned with the social economic elements of objectives, facilities, and, thus, also technology. This is not to deny the importance of taking into account the social organizational and social psychological elements when developing new technology for the small farmer. The emphasis, however, does reflect the author's assumption that it is more feasible and beneficial to improve the small farmer's level of living through equipping him with a more pro­ductive technology than to attempt to solely change either his sentiments (e.g., attitudes) or power (e.g., land tenure status). The author's assumption is reflected in Biggs' (1974b:165) recent conclusion in regard to the subsistence agricultural sector:

Small size and traditional production techniques have placed lim­itations on production possibilities and thus, family incomes. Nevertheless, the small farming sector can make a positive con­tribution to the developmental process if the production con­straints are broken. In the short run, the solution of increas­ing the size of the operation is unfeasible for most countries. Introducing new production technologies seems to hold the most promise for raising income levels and encouraging integration of the rural peasantry with the modern society.
Small farmer agricultural development

The concept of small farmer agricultural development as defined below presupposes three assumptions which must first be stated as well as a concept of "Small Farmer Technology" (SFT) which must also be defined.

Three assumptions The assumptions may be stated as follows:

1. The decision-making of the small farm family and its consequent allocation of CPFs to and operation of the CPS (farm firm) necessarily involves a conscious or unconscious specification of objectives along each of the nine dimensions of "small farmer objectives" listed in Figure 2.13. These nine dimensions are again listed in Column 1 of Table 2.5.

2. A movement in a positive direction on any one or combination of two or more of these nine dimensions constitutes either a directly or an indirectly beneficial change in the SFS or possibly both. Recall that a directly beneficial change was defined as any change which constitutes an improvement in the level of living of the members of the RAS (farm family). An indirectly beneficial change is one that constitutes an increase in the productive capacity of the CPS (farm firm). Given the nine distinct dimensions, each of these dimensions can be rewritten in the form of a national policy or small farmer objective as listed in Column 2 of Table 2.5. It is not assumed that small farmers are necessarily conscious of all the dimensions along which they might specify objectives. It is assumed that national development planners should recognize the relevance of these nine objectives as priority goals in national agricultural development.
Table 2.5. Specification of small farmer objectives

<table>
<thead>
<tr>
<th>Dimension of objective</th>
<th>Small farmer objective (directly or indirectly beneficial change)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. CONSUMPTION</strong></td>
<td></td>
</tr>
<tr>
<td>1. Nutritional quality of farm family's diet</td>
<td>1. To increase (improve) the nutritional quality of farm family's diet</td>
</tr>
<tr>
<td>2. Size, regularity, and frequency of cash flow received by farm family</td>
<td>2. To increase the size, regularity, and frequency of cash flow received by farm family</td>
</tr>
<tr>
<td><strong>B. DISPOSITION</strong></td>
<td></td>
</tr>
<tr>
<td>3. CPS's efficiency of utilization of commodity disposition facilities</td>
<td>3. To increase CPS's efficiency of utilization of commodity disposition facilities</td>
</tr>
<tr>
<td>4. CPS's production and productivity per unit of operation</td>
<td>4. To increase CPS's production and productivity per unit of operation</td>
</tr>
<tr>
<td><strong>C. PRODUCTION</strong></td>
<td></td>
</tr>
<tr>
<td>5. Productive potential of unit of operation (whether land, plant, or animal)</td>
<td>5. To increase productive potential of unit of operation (whether land, plant, or animal)</td>
</tr>
<tr>
<td>6. CPS's efficiency of utilization of production input facilities</td>
<td>6. To increase the level of on-the-farm employment.</td>
</tr>
<tr>
<td>7. Level of on-the-farm employment</td>
<td>7. To increase CPS's efficiency of utilization of production input facilities.</td>
</tr>
<tr>
<td><strong>D. PARTICIPATION</strong></td>
<td></td>
</tr>
<tr>
<td>8. Extent to which CPS requires involvement of farmer in political decision-making processes in broader social system beyond the SFS.</td>
<td>8. To increase the extent to which CPS requires involvement of farmer in political decision-making processes in broader social system beyond the SFS.</td>
</tr>
<tr>
<td>9. Extent to which CPS generates off-the-farm employment opportunities which can absorb currently underemployed or unemployed labor.</td>
<td>9. To increase the extent to which CPS generates off-the-farm employment opportunities which can absorb currently underemployed or unemployed labor.</td>
</tr>
</tbody>
</table>
3. Alteration (change) in the technology (or the specific combination of facilities of a CPS) currently utilized by the small farmer to operate the CPS is the minimum requisite for a more optimal achievement of the various small farmer objectives. This assumption is intended not to deemphasize the individual importance of the social organizational (power, rank, status-role) and social psychological (norm, belief, sentiment) elements but rather to suggest that any alternative technology must be assessed not only in terms of its appropriateness vis-à-vis the existing social organizational and social psychological elements but also, and minimally, in terms of whether that alternative technology can indeed more optimally achieve beneficial changes in the SFS.

**Small Farmer Technology (SFT)** The concept of Small Farmer Technology as utilized in this dissertation is defined as a combination of CPFs that is:

1. **Beneficial** in the sense that the combination of CPFs in question, in comparison with the technology currently utilized by the small farmer to operate the existing CPS, would, if utilized by the small farmer, enable him to more optimally achieve at least one or more of the nine small farmer objectives; and

2. **Workable** within the context of the CPFs to which the small farmer has access either within the SFS or from sources outside the SFS.

Whether or not SFT is indeed an appropriate solution to the problems of small farmers will vary from one SFS or region of SFSs to the next, depending on the extent to which rural poverty actually stems from limited land and/or lack of a well-developed infrastructure. In such instances,
"The role of new agricultural technology in promoting the welfare of... rural poor is limited, and would be of lower priority in many zones than other programs" such as land reform (change in the power element) rural public works programs (change in the status-role element), and/or programs to develop rural agri-support and other industries (CIAT, 1974b:7).

Whether there is a need for SFT will also depend on the level of technological efficiency embodied in the existing CPS. Consider, for example, the differences in potential returns from the typical CPS in the "highlands" of Latin America as compared to the potential returns from the types of CPSs possible in the sparsely populated "lowlands":

...the agriculture of the highlands has evolved over long periods of time on relatively fertile soils, and is believed to be operating at a level near its potential. With these traditional but efficient systems, the probability of substantially increasing food supplies through new agricultural technology is low.

It is believed that in the lowlands there is a greater potential for increasing the total food output on the small farm and improving family incomes. This potential is based on natural conditions which allow two or more crops per year, where rainfall is available or water is controlled, and the vegetative cycle of most basic food crops is shorter. Furthermore, some factors known to limit production are subject to manipulation through the development and application of new agricultural technology. These limiting factors include less fertile soils in some regions and a prevalence of insects, diseases and weeds. Water control is also a frequent problem in many areas (CIAT, 1974b:7).

Thus, whether a particular technology is or would be appropriate depends in large part in whether the existing CPS is utilizing available natural facilities to optimal efficiency. And this can only be known through observation of the existing CPS in relation to its natural environment. It cannot be assumed prior to such observation that the small farmer's adoption of any purportedly "improved" technology would indeed constitute a more efficient utilization of existing natural resources.
This point is supported by data drawn from a simulation study of the production subsystem of a typical small farm in La Máquina, Guatemala (CIAT, 1974b). Simulated increases in production and net income through varying levels of input of fertilizer and herbicide were found to be relatively small. The Small Farms Systems Program of CIAT concludes: "There appears to be little incentive for increased production through the use of these two factors. These results indicate that with the technology available in the zone..., farmers have had little or no incentive to expand the use of modern factors of production or credit" (CIAT, 1974b:20, 24).

Indeed, preliminary analysis of data from the Public Sector Planning Office in Guatemala on 156 farms in La Máquina that participated in a supervised credit program in 1973 suggested "that the supervised credit program encouraged fertilizer use on the average beyond its economic optimum level in this zone" (CIAT, 1974b:29).

Finally, it should be emphasized that agricultural technicians have generally designed agricultural technology to be either land-saving or labor-saving (CIAT, 1974b:10). These two criteria alone, however, may not fully take into account the complexity of the SFS. It may be, for example,

...that the criteria used by the farmer to evaluate his own agricultural technology [are] more complex, including such measures as the following: (1) a quantity and quality of a variety of agricultural products for consumption and sale, (2) a cash income, (3) return to labor, and (4) security.

Farmers apply these performance criteria in an intuitive way. However, in order to design production technology that is appropriate for small farmers, we must understand in a formal way how these various criteria interact, and the relative importance that the farmer assigns to each of these (CIAT, 1974b:10).

**Small Farmer Agricultural Development (SFD) defined**

With the above three assumptions and the definition of Small Farmer Technology (SFT) in
mind, the concept of Small Farmer Agricultural Development (SFD) is defined as a more optimal achievement of at least one or a combination of two or more of the small farmer objectives through the small farmer's adoption and utilization of SFT. To facilitate exposition of the argument, the "Small farmer agricultural development" concept will hereafter frequently be referred to by the acronym "SFD" or, in words, "Small Farmer Development," with the understanding that the discussion is specifically in reference to the agricultural development of small farmers.

**Social Action for Small Farmer Agricultural Development (SA-SFD)**

Having defined SFD, the concept of "social action for small farmer agricultural development" can now be defined. The concept of social action for small farmer agricultural development is defined as a type of SFD in which a change agent system (that is a social system other than the SFS) purposively instigates action to develop SFT and to diffuse that technology to a target system of SFSs wherein that technology is adopted and properly utilized by the small farmer. To facilitate exposition of the argument, the "social action for small farmer agricultural development" concept will hereafter frequently be referred to by the acronym "SA-SFD" wherein the "-" represents the word "for" in the concept "social action for small farmer agricultural development."

**Specification of relevant social systems in SA-SFD** Four social systems are defined as relevant in SA-SFD: (1) the primary target system, (2) the secondary target system, (3) the primary change agent system, and (4) the secondary change agent system.
Primary target system: SFS
The Small Farm System (SFS) is designated as the primary target system in SA-SFD.

Secondary target system: NAS
The functional importance in agricultural development of the various nationally-based agri-support subsystems (e.g., credit) in an LDC is widely recognized (Mosher, 1969; Weitz, 1971; Owens and Shaw, 1972; Axinn, 1974). If the various agri-support systems in a particular LDC fail to provide the necessary production input and/or commodity disposition factors required for proper utilization of a particular SFT, then small farmers will find it difficult, if not impossible, to adopt and properly utilize that SFT. In view of their central role in providing facilities for and as carriers of action (Beal et al., 1966:63), the nationally-based agri-support system (NAS) and its various subsystems (NASs) in an LDC are designated as the secondary target system in SA-SFD.

Primary change agent system: NAREO
At the level of the SFS, SA-SFD seeks through the RAS's adoption and utilization of SFT to achieve one or more of the specified directly and/or indirectly beneficial changes. Small farmers obviously cannot adopt SFT which either does not exist or for which they do not have access to the requisite commodity processing facilities. This problem can be solved only by developing the requisite SFT, where such does not already exist, and, as importantly, developing the institutional means (e.g., credit) whereby small farmers can gain access to the commodity processing facilities required for adoption and proper utilization of the SFT in question.

National agricultural research and extension organizations in the LDCs are increasingly recognizing the need for identifying the production and
marketing (the latter herein referred to more generally as disposition) problems of small farmers and in developing agricultural technology that would assist small farmers to improve both the productive capacity of the farm firm and the level of living of the farm family. In response to this need, national agricultural research and extension organizations are now seeking strategies whereby more appropriate technologies can be developed and diffused to small farmers. In view of these considerations, the national agricultural research and extension organization (hereafter frequently referred to by the acronym "NAREO") is designated as the primary change agent system in SA-SFD.

Secondary change agent system: IARC Individual NAREOs, however, being nationally-based and, thus, primarily concerned with identifying what works and doesn't work in the particular LDCs in which they are respectively located, are not in a position to easily profit from each's experiences in developing strategies of SA-SFD. This is not to deny that each LDC must develop its own strategies for developing and diffusing SFT to small farmers in light of the "cultural peculiarities" and other contingencies of each country. It is to say, however, that if a NAREO simply does nothing more than its "own thing," in complete disregard of strategies successfully implemented by NAREOs in other LDCs, and fails, then there is no basis for knowing whether the NAREO in question would have been successful if it had instead followed one or another of the other strategies which had previously been demonstrated to be successful in one or more other LDCs. In short, if each NAREO operates solely on a purely "trial and error" basis, not taking into account or advantage of any of the strategies which have already been demonstrated to be successful in other LDCs, then
it is not likely that SFD will rapidly proceed on any major scale in any of the LDCs.

To overcome the disadvantage of developing a successful strategy of SA-SFD through the individualized, country-by-country approach described above, those strategies which have proved successful in a particular LDC and which appear to be potentially transferable to or applicable in other LDCs must, accordingly, be put to the test in other LDCs, i.e., on a multinational basis. The execution of such testing (evaluation) and, where required, modification of specific strategies, would require a high degree of coordination on a multi-national or international basis of the individual research (testing) programs conducted by a number of NAREOs in their respective LDCs. This criterion is met in the 1970's by only one social organization: the "international consortium of nations and foundations known as the Consultative Group in International Agricultural Research" (Wade, 1974:1191). This organization now sponsors nine international agricultural research centers (hereafter frequently referred to by the acronym "IARC") which "together cover most of the major regions and crops of the world" (Wade, 1974:1191). The official names of the nine existing IARCs and their respective acronyms are listed in Table 2.6.

The IARC emerged in the 1960's as a key research and action input to international and national agricultural development efforts in the LDCs. While it is true that any one IARC is geographically located within a specific LDC, each of the Centers is nevertheless operationally set up to work on a cooperative basis not only with the NAREO of the host country but also with IARCs and NAREOs in other LDCs. For example, the International Rice Research Institute (IRRI) in Los Baños, Philippines, works closely not only
Table 2.6. List of existing International Agricultural Research Centers (CIAT, 1974c)

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Name</th>
<th>Location</th>
<th>Founded</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRRI</td>
<td>International Rice Research Institute</td>
<td>Philippines</td>
<td>1960</td>
</tr>
<tr>
<td>CIMMYT</td>
<td>Centro Internacional de Mejoramiento de Maíz y Trigo</td>
<td>Mexico</td>
<td>1966</td>
</tr>
<tr>
<td>IITA</td>
<td>International Institute of Tropical Agriculture</td>
<td>Nigeria</td>
<td>1966</td>
</tr>
<tr>
<td>CIAT</td>
<td>Centro Internacional de Agricultura Tropical</td>
<td>Colombia</td>
<td>1967</td>
</tr>
<tr>
<td>AVRDC</td>
<td>Asian Vegetable Research and Development Center</td>
<td>Taiwan</td>
<td>1971</td>
</tr>
<tr>
<td>CIP</td>
<td>Centro Internacional de la Papa</td>
<td>Peru</td>
<td>1972</td>
</tr>
<tr>
<td>ICRISAT</td>
<td>International Crops Research Institute for the Semi-Arid Tropics</td>
<td>India</td>
<td>1972</td>
</tr>
<tr>
<td>ILCA</td>
<td>International Livestock Center for Africa</td>
<td>Ethiopia</td>
<td>1974</td>
</tr>
<tr>
<td>ILRAD</td>
<td>International Laboratory for Research and Animal Diseases</td>
<td>Kenya</td>
<td>1974</td>
</tr>
</tbody>
</table>

with the College of Agriculture, University of the Philippines, but also with NAREOs in a number of other rice-producing South and Southeast Asian countries. Similarly, the International Center for Tropical Agriculture (CIAT) in Palmira, Colombia, works not only with the Colombian Institute of Agriculture (ICA) and the College of Agriculture of the National University but also with NAREOs in several of the Central and South American countries. In addition to their cooperative research and training programs with NAREOs throughout the LDCs, the IARCs also interact to a considerable extent with one another, particularly in the areas of research, training, and information exchange.

By the end of the 1960's, the IRRI and CIMMYT (the International Maize and Wheat Improvement Center) had played a major role in developing the
improved technologies which sparked the Green Revolution (Hayami and Ruttan, 1971; Wortman, 1973; Wade, 1974). More recently, however, and increasingly sensitive to the criticism that the Green Revolution has tended to primarily benefit only the larger, more commercialized farmers in the LDCs (Skorov, 1973; Wade, 1974), the IARCs have recognized that greater attention must now be directed to the specific problems of small farmers in the LDCs. Several IARCs have already expressed interest in and/or allocated resources to the study of the SFS and to develop SFT for SFSs (cf. CIMMYT, 1969, 1970b; CIAT, 1972, 1973, 1974a, 1974b). CIMMYT, for example, working with the Mexican National Institute of Agricultural Research (INIA), initiated the Puebla Project with the objective of rapidly increasing corn yields on small holdings (CIMMYT, 1969). More recently, CIAT started a "small farm systems program" (CIAT, 1973).

In view of this central role which the IARC has played, is playing, and is likely to continue to play in promoting SFD in general and, in particular, in working cooperatively with and providing research and other support services to the NAREOs (Moseman, 1970:90-94), the International Agricultural Research Center (IARC) is designated as the secondary change agent system in SA-SFD.

The respective change agent and target systems designated in the preceding discussion are set forth in Figure 2.14 in the format previously introduced in Figure 2.6.

Later, in Chapter 4, the discussion will examine one case study (the Puebla Project in Mexico) which contains each of the four relevant social systems outlined in Figure 2.14. As we shall see, the SFS will consist of the small farm holdings in the Puebla region. The NAS will consist of the
### Figure 2.14. Specification of relevant social systems in social action for small farmer agricultural development (SA-SFD)

<table>
<thead>
<tr>
<th>Target System</th>
<th>Change Agent System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary</strong></td>
<td></td>
</tr>
<tr>
<td>Primary Target System</td>
<td>Primary Change Agent System</td>
</tr>
<tr>
<td>SFS</td>
<td>NAREO</td>
</tr>
<tr>
<td>Small Farm System</td>
<td>National Agricultural Research and Extension Organization</td>
</tr>
<tr>
<td><strong>Secondary</strong></td>
<td></td>
</tr>
<tr>
<td>Secondary Target System</td>
<td>Secondary Change Agent System</td>
</tr>
<tr>
<td>NAS</td>
<td>IARC</td>
</tr>
<tr>
<td>Nationally-Based Agri-Support System</td>
<td>International Agricultural Research Center</td>
</tr>
</tbody>
</table>

Various agri-support subsystems within and surrounding the Puebla region. The NAREO will consist of the National Institute of Agricultural Research (INIA). The IARC will consist of the International Maize and Wheat Improvement Center (CIMMYT). While we have designated the NAREO as having the ultimate responsibility for initiating a program to develop SFT and to diffuse this technology to small farmers in the LDC in which the NAREO operates, it should be noted that the Puebla Project was largely initiated and carried out through the efforts of CIMMYT (1969).

**Summary**

This chapter has articulated a social action perspective and applied this perspective to the context of small farm agriculture in the LDCs. A major portion of the discussion focused on the development and presentation of a Social System Elements Model (SSEM) of the SFS to illustrate the vari-
ous social organizational (power, rank, status-role), social psychological (norm, belief, sentiment), and social economic (objective, sanction, facility) elements which may enter into the farm family's decision-making with respect to and operation of the CPS within the SFS.

Nine dimensions along which a small farm family might specify objectives were proposed, and it was suggested that SFT can assist small farmers to more optimally achieve developmental change along the nine specified dimensions. Finally, the national agricultural research and extension organization (NAREO) in an LDC can play a key role as a change agent system in developing and diffusing SFT to designated target areas of small farm systems (SFSs).

While Chapter 2 provides a general framework for approaching the problem of developing a model of a strategy to develop and diffuse SFT to an LDC's small farmers, the framework itself is neither a strategy nor a model of a strategy. Accordingly, in Chapter 3, the methodology utilized by the author to develop a model of a strategy of SA-SFD or, more specifically, a model of a strategy to develop and diffuse SFT to an LDC's small farmers is presented. Then, in Chapter 4, this model is presented and is there referred to as a "Construct of Social Action for Small Farmer Agricultural Development."

---

A final point to emphasize with respect to social development is the importance of instigating change in the organizational (power, rank, status-role) and psychological (norm, belief, sentiment) elements of the SSEM where one (or more) of these elements is a constraint on development. This dissertation, however, focuses primarily on facilities (technology) as the principal independent variable (X) and on objectives as the dependent variable (Y). Accordingly, emphasis is not placed here on the organizational and psychological elements as dependent variables at the level of the SFS.
CHAPTER 3. METHODOLOGY

The methodology utilized in developing the "Construct of Social Action for Small Farmer Agricultural Development" as a strategy for (1) developing Small Farmer Technology and (2) diffusing such technology to small farmers in an LDC is discussed in the following sections: need for a tentative hypothesis; selecting a theoretically-based model of social action; selecting an empirically-based model of social action; and synthesis of the two models.

Need for a Tentative Hypothesis

The author proceeded on the assumption that one means of developing a model of a strategy to develop and diffuse SFT to an LDC's small farmers would be to attempt to synthesize, on the one hand, a general sociological model of social action and, on the other, a specific "real world" model of an actual program to develop SFT in an LDC and to diffuse that technology to that LDC's small farmers. Such a synthesis, in effect, would involve working simultaneously with two models of social action which are at polar levels of abstraction: (1) one at a general or more theoretical level of abstraction, i.e., the sociological model of social action, and (2) the other at a specific or more empirical level of abstraction, i.e., the "real world" model of an actual program to develop and diffuse SFT to small farmers in an LDC. Having made this assumption, however, the author faced the question of the criteria that would be utilized in selecting for each of the two levels of abstraction one and only one model.

One possible approach which might be utilized to select a model for each of the two levels of abstraction would be to conduct a complete survey
or representative sample survey of: (1) all general or theoretically-based models of social action and (2) all specific or empirically-based models which have been utilized to date in the LDCs to develop and diffuse SFT to small farmers. On the basis of the information or data collected on the population or sample of models at each of the two levels of abstraction, one would proceed: (1) to induce from the theoretically-based models what might be called a master general (or theoretically-based) model; and (2) to induce from the empirically-based models what might be called a master specific (or empirically-based) model. One would then synthesize the two master models into a "middle-range" strategy that would specify the steps which, if followed, would lead to the development and diffusion of SFT to an LDC's small farmers.

Before taking this approach, however, one would be well advised to consider Hempel's (1966:11) argument with respect to what he has called the "narrow inductivist conception of inquiry." This conception of scientific inquiry may be described as follows:

First, all facts would be observed and recorded, without selection or a priori guess as to their relative importance. Secondly, the observed and recorded facts would be analyzed, compared and classified, without hypothesis or postulates other than those necessarily involved in the logic of thought. Third, from this analysis of the facts generalizations would be inductively drawn as to the relations, classificatory or causal, between them. Fourth, further research would be deductive as well as inductive, employing inferences from previously established generalizations (Wolfe, 1924:450).

Hempel argues, however, that this conception of scientific inquiry is untenable:

Scientific knowledge...is not arrived at by applying some inductive inference procedure to antecedently collected data, but rather by what is often called "the method of hypothesis", i.e. by inventing hypothesis as tentative answers to a problem under
study, and then subjecting these to empirical test. It will be part of such test to see whether the hypothesis is borne out by whatever relevant findings may have been gathered before its formulation; an acceptable hypothesis will have to fit the available relevant data. . . . Hence, while scientific inquiry is certainly not inductive in the narrow sense..., it may be said to be inductive in a wider sense, inasmuch as it involves the acceptance of hypotheses on the basis of data that afford no deductively conclusive evidence for it, but lend it only more or less strong "inductive support" or confirmation (Hempel, 1966:11-18).

We may conclude from Hempel's observations not only that it would be impractical, if not impossible, to derive a model of a strategy of SA-SFD "by applying some inductive inference procedure to antecedently collected data" but also that the development of such a SA-SFD model should proceed by "the method of the hypothesis." Recognizing that one cannot proceed to develop a SA-SFD model without at least some initial hypothesis as to what might constitute a successful strategy of SA-SFD, the author utilized as an initial or working hypothesis: (1) the theoretically-based model or "Construct of Social Action" (Beal et al., 1966) and (2) the empirically-based model or strategy utilized in the Puebla Project (CIMMYT, 1969) in Mexico to develop and diffuse improved technology to the small farmer. The basis for selecting these two particular models is set forth in the following two sections.

Selecting a Theoretically-Based Social Action Model

The task of developing a SA-SFD model lies in that area of sociological research that may be classified as exploratory (or hypothesis-generating) rather than hypothesis-testing (Riley, 1963; Hempel, 1966:16-18; Kaplan, 1964:13; Rudner, 1966:5-7). Riley (1963:68) has emphasized, however, that exploratory research is "not to be confused...with raw empiricism, with fact gathering that is unrelated to sociological theory." In
this regard, the author has assumed that the development of a SA-SFD model would be considerably facilitated if undertaken in light of a general model or strategy of instigated social change which had been found in previous research to be empirically supported.

There are a number of theories of instigated social change which might be drawn upon to assist in developing a SA-SFD model. Rothman (1970) and Chin and Benne (1972) have developed taxonomic frameworks for systematically classifying many of these theories. A comparative perspective on the respective taxonomies of Rothman and Chin and Benne is presented in Table 3.1. Interestingly, neither of the republications (Rothman, 1970; Chin and Benne, 1972) of either of the original publications (Rothman, 1968; Chin and Benne, 1969) make any reference to the original contribution of the other party's taxonomy.

However, if we examine in Table 3.1 the basic description of each of the principal models or strategies of instigated social change proposed by these writers, we see that any one model (as proposed by Rothman) is similar to, if not identical with, one and only one strategy (as proposed by Chin and Benne). Thus, Table 3.1 lays out three distinct pairs (a model and a strategy) of theories of instigated social change. Each pair is laid out in a separate row of Table 3.1, with one of Rothman's models located in the left column and that model's corresponding Chin and Benne strategy situated in the right column. At the same time, when any pair (model and strategy in a given row) is compared with any other pair (in either of the other two rows), we see that each pair (a given model and its corresponding strategy) assumes instigated social change to largely initiate in either the social organizational (power, rank, status-role), social psychological
Table 3.1. Similarities and differences in theories of instigated social change. A comparative perspective on the respective taxonomies of Rothman and Chin and Benne

<table>
<thead>
<tr>
<th>Change initiates in the... elements of a social system</th>
<th>Column 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Within any row,</strong> 3 models of community organization practice&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Model A: Locality Development</td>
</tr>
<tr>
<td></td>
<td>&quot;broad participation of a wide spectrum of people at the local community level in goal determination and action&quot;</td>
</tr>
<tr>
<td></td>
<td>Model B: Social Planning</td>
</tr>
<tr>
<td></td>
<td>&quot;exercise of the technical abilities&quot; of &quot;expert planners&quot; involved in &quot;a technical process of problem-solving with regard to substantive social problems&quot;</td>
</tr>
<tr>
<td></td>
<td>Model C: Social Action</td>
</tr>
<tr>
<td></td>
<td>organization of &quot;a disadvantaged segment of the population..., perhaps in alliance with others, in order to make adequate demands on the larger community for increased resources or treatment more in accordance with social justice&quot;</td>
</tr>
</tbody>
</table>


<sup>b</sup>Source: Chin and Benne (1972:234-5).
Type 2: Normative-Reeducative
"Action...supported by sociocultural norms and...commitments...of individuals to these norms. Norms are supported by...attitude and value systems of individuals. Change in...action...will occur...as persons involved are brought to change their normative orientations to old patterns and develop commitments to new ones. And changes in...orientations involve changes in attitudes, values, skills, and significant relationships, not just change in knowledge, information, or intellectual rationales for action or practice."

Type 1: Empirical-Rational
"Assumption...that men...will follow their rational self-interest once...revealed to them. A change is proposed by some person...[who] knows of a solution that is desirable, effective, and in line with...self-interest of...person, group, organization, or community which will be affected by the change. Because...person (or group)...assumed...rational and moved by self-interest,...assumed...he (or they) will adopt the proposed change if it can be rationally justified and...can be shown by...proposer(s) that he (or they) will gain by the change."

Type 3: Power-Coercive
"Application of power. The influence process...basically that of compliance of those with less power to...plans, directions, and leadership of those with greater power. Often...power to be applied is legitimate....Thus...strategy may involve getting...authority of law or administrative policy behind...change to be effected. Some power strategies may appeal less to...authoritative power...than to...massing of coercive power, legitimate or not, in support of the change sought."
(norm, belief, sentiment), or social economic (objective, sanction, facility) elements of a social system.

More importantly, however, we see that all of the models or strategies included in Table 3.1 involve "planned change--in which attempts to bring about change are conscious, deliberate, and intended, at least on the part of one or more agents related to the change attempt" (Chin and Benne, 1972: 233). And, with respect to this dissertation's emphasis on the development and diffusion of SFT as a means of achieving beneficial change in the SFS, it may also be suggested that all of the models or strategies in Table 3.1 involve:

...the conscious utilization and application of knowledge as an instrument or tool for modifying patterns and institutions of practice. The knowledge or related technology to be applied may be knowledge of the non-human environment in which practice goes on or of some knowledge-based "thing technology" for controlling one or another feature of the...environment. ... As attempts are made to introduce...new...technologies..., the change problem shifts to the human problem of dealing with...the people affected by the change. So the change agent, even though focally and initially concerned with modifications in...thing technology..., finds himself in need of more adequate knowledge of human behavior, individual and social, and in need of developed "people technologies," based on behavioral knowledge, for dealing effectively with the human aspects of deliberate change.

This line of reasoning suggests that, whether the focus of planned change is in the introduction of more effective thing technology or people technologies into institutionalized practice, processes of introducing such changes must be based on behavioral knowledge of change and must utilized people technologies based on such knowledge (Chin and Benne, 1972:234).

While Chin and Benne recognize that programs of planned change must (1) be based on behavioral knowledge of change and (2) utilize people technology based on such knowledge, this recognition does not provide any indication whether a specific program of SA-SFD would most optimally be pursued through application of one rather than another of the variant models
and strategies of instigated social change summarized in Table 3.1. Moreover, having isolated these various models and strategies of instigated social change, "it would be well to point out that we are speaking of analytical extremes and that in actual practice these orientations are overlapping rather than discrete" (Rothman, 1970:23). Finally, as Rothman points out: "Practice in any of these orientations may require techniques and approaches that are salient in another orientation" (Rothman, 1970:23).

Though we may conclude from these considerations that a program of SA-SFD must be based on behavioral knowledge of change, it also becomes clear that such a program could potentially draw upon any one or more of the models and strategies summarized in Table 3.1. This suggests that it would be a potential mistake to attempt to develop a SA-SFD model solely on the basis of one rather than another of the models or strategies of instigated social change outlined in Table 3.1. Moreover, each of the theories collectively represented by the models or strategies summarized in Table 3.1 was developed primarily, if not solely, within the context of American society during the twentieth century. This is not to deny the potential applicability of any particular theory of instigated social change to the situation of the LDCs in the 1970's and beyond; rather it is to suggest that a SA-SFD model should be based on a broader theory of instigated social change than is provided by any one of the models or strategies included in Table 3.1. Additionally, such a broader theory should provide either a basis of behavioral knowledge of change on which a program of SA-SFD can be developed or a methodology whereby such behavioral knowledge of change can be developed. Finally, such behavioral knowledge as is
developed should, in turn, serve as a basis for developing "people technologies" that can be utilized to increase the efficacy of a program of SA-SFD.

Though not specifically alluded to in either the Rothman or the Chin and Benne articles, the "Construct of Social Action" (Beal et al., 1966; see Appendix B) provides a theory of instigated social change which meets each of the requirements specified above. First, the "Construct of Social Action" has proven to be quite broad in its applicability as a theory, model, or strategy of instigated social change (Beal et al., 1964; Beal et al., 1966; Fleischman, 1967; Mulford et al., 1969; Beal and Hobbs, 1969; Powers, 1971).

Second, to the extent that it has been developed to date, the "Construct of Social Action" provides both a basic behavioral knowledge of change and a methodology whereby such knowledge can be developed. In regard to "a basis of behavioral knowledge," Beal and Hobbs (1969:2) note:

It has been found that successful and efficient social action projects usually do not just "happen" but are carefully conceived and planned. It has also been found by research and observation that successful social action projects tend to follow a certain identifiable sequence of steps. Certainly not all social action projects follow the same procedure from start to finish. But sufficient similarities have been noted to justify the discussion of social action in terms of a sequence of steps. Depending on the magnitude of the project, these steps may be highly formalized and easily identified or may blend into one another so that there is almost a continuous flow of action. The steps may not occur in the exact sequence stated—but sometime during the program all of the functions explicit in the steps seem to get performed.

On the other hand, in regard to a methodology whereby behavioral knowledge of change can be developed, the "Construct of Social Action" provides specific action steps (e.g., evaluation) that requires the change agent system to assess (1) whether preceding action steps and/or behavioral knowledge of
change (e.g., gained through analysis of the prior social situation and the existing social system) have been of utility in planning and implementing the social action program in question or (2) whether the program's experience warrants that supposedly valid behavioral knowledge of change be modified.

Third, the "Construct of Social Action" provides a guideline for developing "people technologies," particularly in regard to its emphasis on analysis, organization, and mobilization of resources (Fleischman, 1967).

At the same time, however, the "Construct of Social Action" (Beal et al., 1966) is formulated at such a general level of abstraction that it cannot itself provide any substantive information as to what the needs or problems are vis-à-vis small farmers in the LDCs or, relatedly, what the specific policies and programs would be whereby these problems or needs, once identified, could be solved or met. In the presence of such indeterminancy, two different change agent systems, each utilizing the same "Construct of Social Action," could possibly reach completely different definitions not only as to what the small farmer's problems are but also as to the policies and programs which should be implemented to deal with these problems. Thus, formulated at a general level of abstraction, the "Construct of Social Action" per se does not itself provide a replicatable, empirically testable model of SA-SFD.

Selecting an Empirically-Based Social Action Model

To counter the inability of the "Construct of Social Action" to provide a replicatable, empirically-testable model of a strategy of SA-SFD, the author selected one empirically-based model of a social action program
which has been moderately successful in developing and diffusing SFT to small farmers in an LDC. The specific social action program selected is the Puebla Project in Mexico. While there are other agricultural and rural development models or strategies (Adams and Havens, 1966; Fairchild, 1968; Stevens, 1974) which the author might have selected, the Puebla Project was selected in view of the fact that it provides a "real word" case of a specific change agent system (CIMMYT) which sought through purposive action (i.e., the development and diffusion of SFT) to alter certain systemic elements (e.g., corn yields per hectare) of a specific target system (the small farm holdings in the Puebla region of Mexico).

In drawing upon the Puebla Project to provide a specific model of a strategy SA-SFD, the author faced the problem of identifying exactly what the strategy of the Puebla Project was. In tackling this problem, the author relied principally on the following document: The Puebla Project 1967-1969: Progress Report of a Program to Rapidly Increase Corn Yields on Small Holdings (CIMMYT, 1969). Unfortunately, this document, being quite loosely descriptive, is frequently open to various interpretations in regard to the exact step-by-step strategy utilized in the Puebla Project, thereby leaving the reader somewhat in doubt as to exactly what occurred at any given point in time, particularly in regard to which Project activities occurred simultaneously and which in temporal sequence. More specifically, for example, to find out what activities were undertaken by the Puebla Project in 1968, one must read five different chapters which each describe a functionally-specific set of activities not only for 1968 but also for each of two other years (1967 and 1969) of the Project's first three years of existence: operation of the Project, agronomic research, genetic
improvement, communication of information, and evaluation. Even after reading all five chapters, however, one may still have a somewhat less than clear idea of the temporal flow of the various Project activities and their interrelationships to one another at any point in time.

To deal with the problem of identifying the basic strategy utilized in the Puebla Project, the author consulted other descriptive materials relating to the Puebla Project (CIMMYT, 1968, 1970a, 1970b, 1972). Of course, the reports published by CIMMYT might be viewed by some as being overly favorable in their description and evaluation of the Puebla Project, inasmuch as CIMMYT was the principal change agent system in implementing the Puebla Project. Several other sources (Winkelmann, 1973; Felstehausen, 1973; Biggs, 1974b), however, provided not only additional references for understanding the basic strategy of the Puebla Project but also an independent perspective on the extent to which the Puebla Project has been successful in instigating developmental change in the SFSs of the Puebla region. A favorable conclusion in this regard was a logical prerequisite to utilization of the Puebla Project as an empirically-based model of social action for the development and diffusion of SFT in an LDC.

Synthesis of the Two Models

The methodology employed to develop the SA-SFD model may be summarily described as an attempt to derive from the Puebla Project experience a more general level strategy to develop SFT and diffuse that technology to small farmers in an LDC, a strategy which applies at a more specific level the principal concepts of the "Construct of Social Action." On the one hand, the model of social action employed in the Puebla Project is utilized as a
working hypothesis which provides a tentative, empirically-based answer to the problem of how to develop SFT and diffuse that technology to small farmers in an LDC. On the other hand, the principal concepts of the "Construct of Social Action" are utilized as a basis for classifying the specific action steps of the Puebla Project into a more general model of that Project's technological development and diffusion strategy. This process of attempting to synthesize two models of social action at polar levels of abstraction--the general (i.e., the "Construct of Social Action") and the specific (i.e., the Puebla Project) --into an empirically-testable "Construct of Social Action for Small Farmer Agricultural Development" is illustrated in Figure 3.2. Frequently, hereafter, the "Construct of Social Action for Small Farmer Agricultural Development" will be referred to by the acronym "CSA-SFD."

There is, of course, a basic limitation in using a single case study, albeit the Puebla Project, the "Construct of Social Action," or a combina-

![Diagram](image-url)
tion of both (as is the case here) as one's basis for generalization, i.e., formulation of a hypothetical strategy or "Construct of Social Action for Small Farmer Agricultural Development." As Riley (1963:74) points out, a research who engages solely in "analysis of a single system will encounter limitations on the generality of his findings. . . . He can hardly expect to represent accurately by a single case the many other unstudied cases of possible interest." The present author believes, however, that the utilization of solely the two selected models of social action as a basis for synthesis and generalization provides several overriding or compensating advantages.

1. The freedom to work with the Puebla Project, as contrasted to having to work with many such programs, allows the author to select for analysis a program which has already been moderately successful in developing SFT and diffusing such technology to small farmers in an LDC. Data on the strategy employed in the Puebla Project, for example, can serve not only to suggest the particular action steps which may have played a key role in assisting the Puebla Project to achieve a moderate degree of success and, thus, might play a key role in programs of SA-SFD in LDCs other than Mexico but also to document the specific sequence in which these steps occurred and, thus, the apparent sequence in which key action steps should be taken in order to enhance the probability the program of SA-SFD will be successful.

2. The insights gained through such an analysis, in turn, can be utilized not only to suggest ways in which the general "Construct of Social Action" could be adapted to the level of a more specific "Construct of Social Action for Small Farmer Agricultural Development" but also to illustrate various action steps of that specific construct as a hypothetical
strategy of SA-SFD. Thus, for example, where a particular action step included in the "Construct of Social Action" is also included in the CSA-SFD, that step's inclusion *per se* or the reason for the step's inclusion in the CSA-SFD can be illustrated by reference to an empirical example drawn from the Puebla Project. The inclusion of the "legitimation" concept from the "Construct of Social Action," for example, can be illustrated by reference to those activities undertaken by the Puebla Project to legitimize itself vis-à-vis relevant agri-support subsystems.

3. In those instances, however, where the action steps of the CSA-SFD are presented in a different order in relation to one another than is the case in the "Construct of Social Action," examples drawn from the Puebla Project can serve to provide more empirical reasons for ordering the action steps differently in the CSA-SFD than in the general "Construct of Social Action." Thus, for example, the CSA-SFD differs from the "Construct of Social Action" in that the former emphasizes the action step of legitimation (see step B1 in Table 4.1) prior to the action phase (C) of evaluation or, more specifically, problem specification/hypothesis formation, the order (between legitimation and evaluation) being reversed in the latter. In this particular instance, reference to examples drawn from the Puebla Project would serve to illustrate the empirical basis for ordering the action steps in question differently in the CSA-SFD than they are ordered in the "Construct of Social Action."

On the other hand, in those instances where the action steps of the CSA-SFD are presented in a different order in relation to one another than these same or similar steps were ordered in the Puebla Project, reference to the "Construct of Social Action" can serve to provide more theoretical
reasons for ordering the action steps differently in the CSA-SFD than they were ordered in the Puebla Project.

4. Utilization of a single case (i.e., the Puebla Project) in conjunction with the "Construct of Social Action" thus serves to provide a specific theoretical-empirical unit of analysis for the exploratory (hypothesis-generating) rather than hypothesis-testing function of Chapter 4's "Construct of Social Action for Small Farmer Agricultural Development." If, however, more than one case were utilized, the analysis would necessarily become more complex at the risk of obfuscating rather than clarifying the CSA-SFD that is to be presented. Thus, for example, if we were to attempt to include several empirically-based models of SA-SFD, each with its own particularly unique sequence of action steps (i.e., "who" did "what" with "whom" at "what time" and "why"), it would become almost impossible in one dissertation to "induce" from these various models any common strategy. The argument applies equally with respect to the inclusion of only one rather than several or many theoretically-based models of social action (instigated social change).
CHAPTER 4. A CONSTRUCT OF SOCIAL ACTION FOR SMALL FARMER AGRICULTURAL DEVELOPMENT

Introduction

In developing the Construct of Social Action for Small Farmer Agricultural Development (see Table 4.1 on page 148), the author has endeavored to present the strategic action steps of the Puebla Project at a higher or more general level of abstraction, i.e., as the CSA-SFD. At the same time, the CSA-SFD itself represents the author's effort to apply key concepts of the "Construct of Social Action" (Beal et al., 1966) at a lower or more specific level of abstraction.

Of course, the CSA-SFD as a strategy for developing and diffusing Small Farmer Technology (SFT) in an LDC cannot be implemented without an implementor. As the reader will recall from Chapter 2, four social system levels were designated as relevant in SA-SFD in a less developed country (LDC): the primary target system or small farm system (SFS); the secondary target system or the nationally-based agri-support system (NAS); the primary change agent system or the national agricultural research and extension organization (NAREO); and the secondary change agent system or the international agricultural research center (IARC). It is assumed that the principal responsibility for implementing the CSA-SFD in any particular LDC lies with the NAREO in that LDC.

While responsibility for implementing the CSA-SFD in an LDC theoretically is assumed to lie with the NAREO in that LDC, the responsibility for actually operationalizing the implementation of the CSA-SFD is assumed to lie with what will be referred to as a Small Farmer Development Project (SFDP). In this regard, the reader is cautioned to bear in mind that the
subsequent discussion will frequently refer to a Small Farmer Development Project in general and, at other times, to the Puebla Project as a concrete example of a Small Farmer Development Project. To facilitate the distinction between these two levels of abstraction, a Small Farmer Development Project is referred to either as a "SFDP" or "project" (with small case "p"), while the Puebla Project is referred to either as the "Puebla Project" or "Project" (with large case "P"). It is also to be noted that to facilitate exposition of the discussion and to provide empirical support for the argument, each action step of the CSA-SFD in general and the SFDP in particular will be illustrated by reference to examples drawn from the Puebla Project.

With these introductory considerations in mind, a few additional remarks are also in order in regard to the SFDP. The discussion which immediately follows is divided into two sections: (1) Conditions for social action in a SFDP and (2) An overview of the CSA-SFD: Stages, phases, and steps in a SFDP. Immediately following this latter section, the presentation of the CSA-SFD will commence.
Conditions for social action in a SFDP

All instances of social action may be conceptualized in terms of a space-time dimension that subsumes three subdimensions: territoriality, size, and time (Beal et al., 1966; Mulford et al., 1969; Powers, 1971). Each of these dimensions is elaborated below in regard to the SFDP and illustrated by descriptive material on the Puebla Project.

Territoriality  Mulford et al. (1969:16) define territoriality as "the geographic base...of social systems that are...designated as meaningful areas of...social action." Generally, in SA-SFD, four social systems are assumed as the "meaningful areas of...social action" in an LDC:

A. Primary target system: The small farm system (SFS).
B. Secondary target system: The nationally-based agri-support system (NAS).*
C. Primary change agent system: The national agricultural research and extension organization (NAREO).
D. Secondary change agent system: The international agricultural research center (IARC) which may or may not be located in the LDC in which the SFS, NAS, and NAREO are located.

*In addition to the social system elements and conditions of social action, Loomis (1967) also outlines a specific structural-functional category and process corresponding to each element. Loomis also specifies six comprehensible or master processes (e.g., systemic linkage). These conceptual areas were not defined in Chapter 2 nor are they explicitly dealt with here in this chapter which focuses explicitly on the action steps in a SFDP. It is assumed, however, that the specific processes as well as the master processes are implicit in the discussion, particularly in view of this chapter's objective to specify a model of the process or flow of social action in developing and diffusing SFT to an LDC's small farmers. For the interested reader, the additional conceptual areas elaborated by Loomis are presented in Appendix B.

The author will use "NAS" to refer to the "nationally-based agri-support system" or, more simply, "agri-support system," whereas "NASs" will refer to the various "agri-support subsystems" within or surrounding a particular territoriality.
In defining the territoriality (or geographic base) of a SFDP, there are two general cases. These two cases are represented in Figure 4.1.

In Case 1, the secondary change agent system or IARC (i.e., D) lies on the same geographic base (i.e., 1st LDC) as the primary target system or SFS (A), the secondary target system or NAS (B), and the primary change agent system or NAREO (C). On the other hand, in Case 2, the secondary change agent system or IARC (D') is located in a distinct territoriality (3rd LDC) from that in which the primary change agent system or NAREO (C'), the secondary target system or NAS (B'), and the primary target system or SFS (A') are located (i.e., in 2nd LDC). In either case, the primary target system (SFS), the secondary target system (NAS), and the primary change agent system (NAREO) are assumed to lie on the same geographic base (i.e., within the same LDC).

An LDC, however, is in itself a rather large geographic base on which to instigate a SFDP, particularly in view of the limited resources that are likely to be available to a NAREO. Accordingly, the CSA-SFD assumes a narrower definition of the territoriality condition, i.e., that a SFDP would be more readily implementable at the regional level. As used here, "region" is understood to refer to a geographic area smaller than an LDC and larger than a locale-specific area such as a village. The Puebla Project as an example of a SFDP was implemented on a regional level geographic base within the State of Puebla, Mexico. The Project area per se included 32 municipios, a municipio consisting of "a principal village and usually several ancillary population units" or villages (CIMMYT, 1969:9, 69). Thus, "a regional level geographic base" might be referred to as an "inter-village system" (Young, 1966; Young et al., 1968; Byrnes, 1974a, 1974b).
Figure 4.1. Two possible cases of linkage of secondary change agent system (IARC) with the three other relevant social systems in SA-SFD
The Puebla Project provides an illustration of Case 1 in that the secondary change agent system (CIMMYT), the primary change agent system (INIA or the National Institute of Agricultural Research at Chapingo), the secondary target system (the various agri-support systems in the Puebla region), and the primary target system (the small farm holdings in the Puebla region) are located on the same geographic base, i.e., Mexico. In contrast, Case 2 is illustrated by the possibility that while a particular LDC (2nd LDC) may not host an IARC, that LDC may nevertheless have a SFDP through either the initiative of the NAREO in that LDC or the participation of that country's NAREO in a program of cooperative research with an IARC (D or D'') located in another LDC (1st or 3rd LDC). Thus, in the latter possibility, Thailand might have a SFDP through the participation of the Thai NAREO in a cooperative research program with the IRRI in the Philippines.

As defined above, Case 1 and Case 2 are clearly two distinct types of linkage between secondary (IARC) and primary (NAREO) change agent systems on the one hand and secondary (NAS) and primary (SFS) target systems on the other. To the extent, however, that representatives of the secondary change agent system (IARC) are available to interact with members of each of the other three relevant systems (NAREO, NAS, and SFS), the distinction between the two cases becomes less clear. In the Puebla Project, for example, the primary target system of small farm holdings within the 32 municipios (that defined the Puebla Project's target area) is located about two hours from Chapingo where the secondary (CIMMYT) and primary (INIA) change agents systems are located. Thus, as illustrated in the Puebla Project, while the secondary change agent system and, even more importantly, the
primary change agent system may not lie on the exact same geographic base as the primary target system (SFS), they may be located in relatively close geographical proximity. Indeed, in those cases where the target area of a SFDP is considerably distant from the geographical site of the NAREO, arrangements could be made for some of the SFDP staff to actually reside in the target area.

Finally, in those instances where the secondary change agent system (IARC) is located in another LDC from that in which the SFDP is to be implemented, the CSA-SFD outlined in this chapter is sufficiently general that it could be implemented in the LDC in question through either (1) the aforementioned program of cooperative research between the NAREO located in the LDC in which the SFDP is to be implemented and an IARC located in another LDC or (2) by the NAREO itself assuming the role of principal or sole change agent system.

Beyond the considerations just discussed, the condition of territoriality is also significant in a second important way. It is reasonable to suggest that actors (e.g., farmers, extension workers, etc.) in each of the relevant social systems are accustomed to making decisions largely in the context of the routine social situations in which they usually find themselves. Thus, for example, the decisions of the members of the RAS of the SFS are largely made in reference to the CPS which they operate. The territoriality relevant in this regard is generally limited to the small amount of land available for the family to work, although the relevant territoriality may be considerably expanded to the extent (1) that production inputs are obtained from beyond the SFS or (2) that the commodities produced by the CPS are partially disposed of through exchange or sale in the
market rather than totally consumed or otherwise utilized within the SFS. Relatedly, if SA-SFD is to proceed, small farmers may need to come together at the level of the NAS into some form of voluntary association (e.g., a cooperative) to facilitate the acquisition of various CPFs which isolated small farmers cannot individually obtain.

At the primary change agent system level, the NAREO in a particular LDC may have generally assumed the relevant territory as that on which the larger, more commercialized farmers operate their CPSs (CIMMYT, 1969). If a SFDP is to be successful, those who participate in the project as representatives of the NAREO—and even the NAREO itself—must have a clear understanding that the project is designed to deal with a quite different territoriality, namely, that on which small farmers operate.

Finally, where the requisite CPFs are not available in the SFDP's target area of SFSs, successful implementation of the CSA-SFD will require that the SFDP deal with a variety of relevant agri-support subsystems (NASs) within and surrounding the project's target area. Accordingly, the successful implementation of the CSA-SFD will depend on the ability of the SFDP (1) to seek out the relevant facilities in whatever territoriality they may lie beyond the target area of SFSs and (2) to develop mechanisms whereby small farmers in the target area can gain access to the CPFs that will be required in order to properly utilize such SFT as is developed by the SFDP.

Size A SFDP operates not only with respect to social systems on a geographic base (territoriality) but also within a context of the size of (1) that geographic base, (2) the number of SFSs operated in that area, and (3) the population (both agricultural and nonagricultural) living in the territoriality. Were responses unlimited, a SFDP could readily be initi-
ated in response to all SFSs throughout the country. Resources, unfortunately, not being so abundantly available in any LDC, must be invested in a SFDP in a way that results in a positive impact not only on those farmers who are able to initially participate in the project but also with the passage of time on other small farmers in the region and beyond.

These considerations in regard to size, along with the condition of territoriality, had to be taken into account in the Puebla Project. According to survey data obtained through interviewing a probability sample of farmers in the Puebla area,

...an estimated 47,536 farmers operate land in the project area. On the average they farm 2.457 hectares per family. These farm operators include all who operate any land in the area, whether as owners, renters, sharecroppers and ejidatarios. Altogether they grow about 80,000 hectares of corn, or an average of about 1.7 hectares per family. ...the total population included in the families of farm operators is approximately 260,000 (CIMMYT, 1969:14).

Time Time enters as a condition for social action in a SFDP at each of the four social system levels. First, each of the four social system levels—whether secondary change agent system (IARC), primary change agent system (NAREO), secondary target system (NAS), or primary target system (SFS)—operates within a framework of time. Some activities occur during a relative short period of time, while others take longer to complete. Some activities may coincidentally occur at the same point in time or during the same period of time. Certain activities, in contrast, may need to be completed before others can be undertaken. The success of other activities may depend on their simultaneous execution.

Second, it is essential whether activities at any of the four social system levels occur sequentially or simultaneously, that a SFDP's activi-
ties (or action steps) be coordinated in light of the flow of activities at each of these four social system levels.

The condition of time in SA-SFD was also present in the Puebla Project. Initially, in 1967, the Project was seen as "a program to rapidly increase yields on small holdings" (CIMMYT, 1969). But this objective could not be achieved instantaneously, as the seasonal nature of maize production at the SFS level imposed certain time related constraints to which the Puebla Project had to adjust. For example, if the action step of hypothesis formation (e.g., identification of the experimental research plots that would be planted) had not been taken sufficiently prior to the time during which farmers planted their fields, then the Project would not have had adequate lead time to prepare to take the next action step (i.e., planting the experimental plots at the time farmers planted their fields). Throughout the duration of the Puebla Project, CIMMYT (secondary change agent system), INIA (primary change agent system), and the various NASs in the Puebla region (secondary target system) had to continually adjust the timing of their activities to ensure that the various activities of the Puebla Project (as a SFDP) were coordinated with the sequence of activities at the level of the SFS (primary target system).

Overview of the CSA-SFD: Stages, phases, and steps in a SFDP

Before proceeding further, the author wishes to encourage the reader to frequently refer throughout the remainder of this chapter to the Construct of Social Action for Small Farmer Agricultural Development (CSA-SFD) as presented in Table 4.1 on page 148. As the reader will quickly realize, discussion of the CSA-SFD will entail continual reference either to a
particular action step or to one or more action steps which occur either prior to or after the particular action step that is principally being discussed. Thus, reference to the CSA-SFD (Table 4.1) will assist the reader considerably in following the discussion.

The CSA-SFD lays out in a step-by-step manner the various activities of a SFDP. At the most general level, the various project activities specified by the CSA-SFD are divided into two temporally sequential Stages. Stage I is referred to as the Initiating Sets and involves three temporally sequential phases. Phase A (Convergence of interest) is concerned with the initial activities of implementing a SFDP, principally staff recruitment (see Step A2 in Table 4.1) and target area selection (A3). Phase B (Reconnaissance and Legitimation) subsumes the interrelated activities involved in delineation of (BO^$^1$) and acquisition of information about (B2, B3, B4) the relevant social systems and legitimation (B1) of the project vis-à-vis the social systems delineated as relevant to the project.

Phase C (evaluation) is concerned with (1) specifying on the basis of data collected during steps B2, B3, and B4 what the problems of the small farmer are and (2) on the basis of this information and available scientific knowledge (e.g., theories about the interrelationships among the factors on which data has been collected), formulating a set of hypotheses in regard to the kinds of technology that might assist small farmer to better solve the problems which have been specified. These hypotheses will then serve to guide the SFDP in developing and diffusing appropriate Small

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$^1$The number "0" in Step "BO" is purposively used in order that the numbers "1," "2," and "3" may be consistently used throughout the CSA-SFD.
Farmer Technology (SFT) to small farmers in the project's target area during Stage II.

Stage II is referred to as the Diffusion Sets and is concerned with the actual steps involved in developing and diffusing SFT to small farmers in the target area. This second stage subsumes six distinct phases: experimentation (D), evaluation (E), innovation (F), evaluation (G), large-scale adoption (H), and total evaluation and continuation of the SFDP (I). Each of these phases, in general, involves a number of action steps. While the various phases and steps of Stage II are discussed more fully during Stage II, two action steps—research experiment (D3) and research trial (F3)—should be briefly defined here as they are frequently referred to in the discussion of the action step of legitimation (B1) and elsewhere during Stage I.

The Puebla Project utilized "experimental research plots" within the SFS to develop SFT (i.e., recommended practices for farmers to follow) and then field-tested this SFT within the SFS on what were labelled "high yield plots." The terms "research experiment" (e.g., an experimental research plot) and "research trial" (e.g., a "high yield plot") are used in the CSA-SFD to distinguish between research that is oriented to developing SFT and that which is oriented to field-testing a SFT that has tentatively been developed during the research experiment step.

The reader should bear in mind that in developing the CSA-SFD, the author has attempted to specify the temporal sequence in which a SFDP would take each of the various action steps. In this regard, the CSA-SFD designates as an action "step" any specific activity which is carried out by the SFDP. For example, phase B contains five theoretically distinct action
steps. In practice, however, a SFDP may encounter that it must or may need to take several action steps almost simultaneously. This will become particularly clear when we subsequently discuss phase B's various action steps. Given this possibility of simultaneity, the notion of an action "step" does not serve to designate whether a particular activity occurs before or after any other activity; also, the notion of a "stage" specifies temporal sequence only at a very general level. Therefore, as an additional means of taking temporal sequence into account, the CSA-SFD also utilizes the notion of a "phase" to designate that the series of action "steps" subsumed by the "phase" in question occurs either prior to or following the action "steps" contained in any other "phase." Thus, for example, whereas some or all of the five action steps in phase B may need to occur simultaneously in an actual SFDP, these steps are recognized in the CSA-SFD as occurring temporally after the action steps in phase A and prior to the action steps in phase C.

A Construct of Social Action for Small Farmer Agricultural Development

Stage I: Initiating Sets

The first stage in the CSA-SFD involves a "limited initiation of action" (Beal et al., 1966:80). As the second phase of the CSA-SFD (see B in Table 4.1) will require that the SFDP engage in "consulting with the key leaders of...relevant social systems or in some cases with groups as a whole" (Beal et al., 1966:80) in order to carry out various "sounding-board, consulting, and legitimation functions" (Beal et al., 1966:80), the requisite personnel to carry out these various action steps must first be recruited (A2) by the NAREO in the LDC in which the SFDP is to be imple-
Table 4.1. A construct of social action for small farmer agricultural development (CSA-SFD)

**Change agent system:** Small Farmer Development Project (SFDP)

**Target systems:**
- **Secondary:** Nationally-based Agri-support System (NAS)
- **Primary:** Small Farm System (SFS)

**Stage I:** Initiating Sets

- **Phase A:** Convergence of interest
  - **Step A1a:** Rationale for SFD
  - **Step A1b:** Formulation of goals and decision on means
  - **Step A2:** Mobilization of NAS (Staff recruitment)
  - **Step A3:** Target area selection

- **Phase B:** Reconnaissance and Legitimation
  - **Step B0:** Delineation of relevant social systems
  - **Step B1:** Legitimation
  - **Step B2:** Research analysis of NAS
  - **Step B3:** Research analysis of SFS
  - **Step B4:** Research analysis of prior social situation

- **Phase C:** Evaluation (Problem specification/Hypothesis formation)

**Stage II:** Diffusion Sets

- **Phase D:** Experimentation
  - **Step D1:** Legitimation
  - **Step D2:** Mobilization of NAS
  - **Step D3:** Research experiment

- **Phase E:** Evaluation (SFT specification)

- **Phase F:** Innovation
  - **Step F1:** Legitimation
  - **Step F2:** Mobilization of NAS
  - **Step F3:** Research trial

- **Phase G:** Evaluation (Result demonstration)

- **Phase H:** Adoption
  - **Step H1:** Legitimation
  - **Step H2:** Mobilization of NAS
  - **Step H3:** Large-scale adoption

- **Phase I:** Total evaluation and continuation of SFDP
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<tr>
<th>Stage</th>
<th>Phase</th>
<th>LEGITIMATION</th>
<th>CHANGE AGENT SYSTEM</th>
<th>SECONDARY TARGET SYSTEM</th>
<th>PRIMARY TARGET SYSTEM</th>
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<tr>
<td>I</td>
<td>A</td>
<td>A1a → A1b → A2 → A3</td>
<td>Small Farmer Development Project (SFDP)</td>
<td>Agri-Support System (NAS)</td>
<td>Small Farm System (SFS)</td>
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<td>I</td>
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The personnel who comprise the staff of a SFDP constitute the principal "Initiating Sets" in SA-SFD. While their initial task is that of selecting the target area (A3) in which the SFDP will work, this task may require that they first execute some or all of the various action steps of phase B.

For example, before coming to a final decision as to the SFDP's target area (A3), the project staff may first need to delineate the relevant social systems (B0) and "key individuals and groups with whom consulting, legitimation, and sounding-board functions" (Beal et al., 1966:80) can be performed. Of course, a decision as to which social systems are relevant and with which leaders or groups the SFDP should be legitimated perhaps cannot be made without first making some initial analysis or assessment as to the status of the existing small farm (B3) and agri-support (B2) systems as well as the situation which previously (B4) existed in these social systems. For expository purposes, however, target area selection (A3), delineation of relevant social systems (B0), and legitimation (B1) are discussed prior to research analysis of existing of agri-support (B2) and small farm (B3) systems and research analysis of the prior social situation (B4).

Finally, on the basis of the data collected on the small farm (B3) and agri-support (B2) systems, the SFDP will specify during phase C what the problems of the small farmer are and will formulate hypotheses as to the kinds of technology which would assist the small farmer in solving the specified problems.

**Phase A: Convergence of interest** SA-SFD may be hypothesized as beginning when a NAREO in an LDC decides to initiate activities to estab-
lish a Small Farmer Development Project (SFDP). During this initial phase (convergence of interest) of Stage I, the NAREO will have as its primary objective to secure the cooperation that will be necessary in order to establish a SFDP.

**Step Ala: Rationale for SFD** The NAREO must have a clear understanding of why SFD is an essential part of rural, agricultural, economic, and social development and the way in which a SFDP contributes to the process whereby SFD is furthered. If the NAREO lacks this understanding, it is not likely that the NAREO will be able to communicate the crucial ideas to key target systems at subsequent action steps. In turn, if the relevant target systems (both NAS and SFS) do not have a clear understanding of what the SFDP is designed to accomplish, it is not likely that the target systems will participate in the SFDP. Material relevant to the specification of the rationale for SFD was presented in Chapter 1.

**Step Alb: Formulation of goals and decisions on means** At a more general level, Chapter 2 specified the goals (or objectives) which are to be achieved in SFD, i.e., to secure changes in the SFS which are either directly or indirectly beneficial to the small farm family. Then, also at a more general level, Chapter 2 also specified the means whereby SFD can be achieved, i.e., to develop and diffuse the SFT that would assist small farm families in attaining the kinds of directly and indirectly beneficial changes that were specified in Chapter 2 (Table 2.5). If the NAREO agrees with these general goals and means, this constitutes a "convergence of interest." Beal et al. (1966:76) write: "Social action begins when the interest and definition of need of two or more people converge and the decision is made to act." Beal (1965:28) also notes: "In the process of
deciding to act there must be at least some tentative definition of the problem, the goals to be attained and decision on means for action, even if only for 'next steps' action." In terms of this perspective, a "convergence of interest" in regard to SFD constitutes a "tentative" or general definition of:

1. the problem, namely, that small farm families currently use technologies which are not adequately profitable or otherwise sufficiently beneficial;

2. the goals, namely that small farm families should use alternative technologies which are more adequately profitable or otherwise beneficial than the technologies they currently use; and

3. the means, namely, that more adequately profitable or otherwise beneficial technologies, i.e., SFT, should be developed and diffused to small farm families.

Relative to these more general decisions as to the goals of and the means for SFD, the CSA-SFD is itself a general level "plan of work." Beal et al. (1966:85) write: "Within the framework of decided-upon goals and... means, a...series of actions must be planned and described formally or informally." It is in this context that the CSA-SFD is presented as a "series of actions" designed to provide the "means" whereby the "goals" of SFD can be achieved. In actual use of the CSA-SFD, a NAREO may find that more concrete goals and means must be specified within any given stage, phase, or step, such specification being required in view of the peculiar circumstances of the particular LDC in which the SFDP is to operate. As presented here, however, the CSA-SFD is a general "series of actions" specifically formulated to provide a framework for implementing a SFDP. As
the CSA-SFD is empirically based largely in the strategy employed in the Puebla Project, it would be useful here to provide the reader a general overview of the Puebla Project Strategy.

The Puebla Project has generally been described as "basically an experimental approach to develop and test strategies for quickly increasing yields of a basic food crop—in this case corn—among farmers producing at subsistence levels with traditional methods" (CIMMYT, 1969: Introduction). More specifically, the objectives of the Project were stated as: "1) to develop, field test, and refine a strategy for rapidly increasing yields of a basic food crop among small holders; 2) to train technicians from other regions in the elements and successful use of this strategy" (CIMMYT, 1969: Introduction).

Relative to more traditional approaches to agricultural research and extension, the Puebla Project involved a number of socio-technological innovations in strategy and program implementation. First, the Puebla Project assumed:

...that the production of information and its dissemination are part of a continuum and cannot profitably be compartmentalized. The program calls for an integrated approach to producing and disseminating knowledge in which there is a constant interaction and feedback along the continuum (CIMMYT, 1969: Introduction).

Second, this assumption implied:

...that the action program should consist of a small team of well-trained scientists with an adequate budget and freedom to operate at any political or technical level. The team should live and work in the project area and cooperate closely in carrying out the field trials, demonstrations, farmer meetings, etc., that are needed to achieve the goals of the program (CIMMYT, 1969: Introduction).
Third, this organizational structure implied that:

...success or failure...would depend on a large number of decisions taken over time. This is where skillful administration plays its role—above all in constantly defining and redefining priorities (CIMMYT, 1969: Introduction).

The strategy is essentially a simultaneous and integrated plan of attack on the many problems limiting farmer use of adequate production technology. The action program is expected to rapidly bring into existence any of the following essentials for change that are lacking in the area: 1) high-yielding maize varieties, 2) information on optimal production practices, 3) effective communication of agronomic information to farmers and agricultural leaders, 4) adequate supplies of agronomic inputs at easily accessible points when they are needed, 5) crop insurance, 6) favorable relationships between input costs and crop values, 7) adequate production credit at a reasonable rate of interest, and 8) accessible markets with a stable price for maize. This means that the program must conduct applied research, convince farmers to use a package of improved practices, and work closely with political leaders, agricultural agencies, and suppliers of agronomic inputs (CIMMYT, 1969: Introduction).

Many of the decisions must take into account simultaneously both knowledge and expectations related to weather, attitudes of farmers, institutional organization, the personal goals of individuals in key positions, and other factors. These kinds of decisions require high skill in giving appropriate weight to various factors at different points in time (CIMMYT, 1969: Introduction).

It is perhaps at this point that the strategy of the Puebla Project and the strategy hypothesized in this chapter somewhat diverge. In the Puebla Project, it was assumed that:

The only way that this decisive aspect can be taken into the model is to say that a basic requirement is to select staff with the vision, initiative, and personality characteristics needed to work well in a group effort, plus good basic training in the discipline for which they will have primary responsibility. Then we must add that equally important is the ability to identify opportunities and limiting factors and then make prompt decisions on priorities. This is a most useful quality for the corn breeder, the agronomist, the evaluation specialist, and the farm advisor; it is crucial for the coordinator (CIMMYT, 1969: Introduction).
While these several factors are indeed important, this chapter's strategy (i.e., the CSA-SFD) assumes in contrast that the "decisive aspect" can be taken into "the model." In other words, the CSA-SFD is an attempt to demonstrate that "decisions taken over time" and frequently "simulta­neously" as part of an "integrated plan of attack on the many problems limiting farmer use of adequate production technology" can be systemati­cally laid out in a manner that is open to sociological scrutiny and, thereby, to testing through scientific replication.

It should be emphasized at this point that while the CSA-SFD is largely based on the strategy utilized in the Puebla Project to develop SFT for a single crop (maize) and diffuse that technology to small farmers, it is hypothesized that the CSA-SFD provides a general framework for developing and diffusing a wide variety of SFT and not necessarily only SFT for a single crop (e.g., maize) or livestock CPS. Thus, while the strategy of the Puebla Project in developing a SFT for a maize CPS is drawn upon in formulating the CSA-SFD and in illustrating each of the action steps, phases, and stages in SA-SFD, the CSA-SFD as formulated is yet sufficiently general that its basic steps, phases, and stages could be followed to develop SFT for Multi- and Mixed-CPSs. Indeed SFT for Multi- and Mixed-CPSs is receiving increasing attention as one means of increasing employment (e.g., reducing seasonal unemployment) in the SFSs in LDCs (CIAT, 1973; Merrill, 1974). The strategy and experience of the IARCs and the NAREOs in developing SFT for single-CPSs, particularly the Puebla Project strategy and experience as systematically laid out in the CSA-SFD, should serve as useful guides as agricultural research and extension organizations increas­ingly turn their attention to the problem of developing the wide variety of
specific SFTs to meet the diverse needs of SFSs throughout the developing world.

**Step A2: Mobilization of NAS (staff recruitment)** Once the NAREO has decided to utilize the CSA-SFD as a guide in implementing a SFDP, the NAREO then proceeds to mobilize the personnel that will staff the SFDP. This step in SA-SFD parallels several steps in the general "Construct of Social Action" (Beal et al., 1966), namely, "Definition of need by the more general relevant social systems" (Step 14), "Commitment to action" (Step 16), and "Mobilizing resources" (Step 24). If the NAREO does not view SFD as "their problem" (paraphrasing Beal et al., 1966:83), it is unlikely that the NAREO would be willing to make a wholehearted "commitment to action" in implementing a SFDP. The key indicator of the NAREO's willingness to support and participate in a SFDP is whether the NAREO allocates competent personnel to work on the SFDP.

The importance of recruiting an adequate staff for a SFDP was clearly recognized in the Puebla Project. In that Project, it was assumed:

...that the quality of the project staff would be the most important factor in assuring the success of its operation. . . . Once chosen, to hold the best people available requires that they feel challenged by the program and that they be compensated adequately for their participation. Salaries, travel expenses, and fringe benefits were set up to do this. Also, the young, highly qualified agronomists selected for the project are in many cases interested in additional graduate training. Provisions were made so that staff members could continue their formal preparation after a period within the project (CIMMYT, 1969:27, 28-29).

Such factors, of course, are important considerations which must be taken into account in planning a SFDP. However, they are not sufficient to guarantee that a SFDP will be successful. If a SFDP is to have any chance for success, it must deploy into the rural areas a staff that minimally
possesses the competencies required in order to develop and diffuse SFT to small farmers. In short, a SFDP's success in responding to the problems of the small farmer will depend on that project's staff competence: the quality of being adequate or sufficient for the purpose. The more underdeveloped an LDC's agriculture, the more competent must a SFDP's staff be—and in more areas of competence, for there are few others on whom the small farmer can reliably depend.

The illiterate farmer in the developing country...does not have the diversity of communications media (telephone, radio, television, newspapers, farm magazines, etc.) or ready access to other information sources (experiment stations, local commercial input distributors, supervised credit advisers, etc.) that are available, for example, to the farmer in Iowa (Byrnes and Byrnes, 1971:328).

If a SFDP staff gives wrong advice or cannot competently respond to a small farmer's questions, the farmer and many others suffer. As the farmer's "test of relevance is whether a practice proves superior on his farm or on his neighbor's farm, and not on the experiment station farm" (Castillo, 1963), the SFDP must be able to demonstrate in the farmer's environment (i.e., the SFS) that adoption of a particular technology will indeed be beneficial to the farmer.

SFDP staff competence

Whether a particular technology will be beneficial to the small farmer may be determined by testing that technology in an environment similar, if not identical, to that of the small farmer's own unit of operation. This requires that a SFDP staff possess competency in at least five areas: technical competency, economics

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\(^1\) The material in this section paraphrases work previously published by Byrnes and Byrnes (1971).
competency, science competency, farming competency, and communication competency (Byrnes and Byrnes, 1971).

**Technical competency**, or the level of knowledge (the ability to recall specific bits of information and facts and a familiarity with terminologies) and understanding (the ability to apply principles and generalizations in a given specific problem-situation) which the project staff possesses relevant to the commodities (crops and/or livestock) the farmer produces, the production practices involved, and the physical environment in which the production takes place. This includes, but is not limited to, the ability to diagnose typical problems and abnormalities correctly, plus knowledge and understanding in the application of proper treatments.

**Economics competency**, or the ability to weigh (e.g., calculate cost-benefit ratios, interests, etc.) alternative CPSs (i.e., alternative combinations of production input and/or commodity disposition factors) as a basis for determining whether adoption of a particular technology will assist the farmer to improve the small farm family's level of living. An effective strategy must be based on, and can go no further than, the availability of the necessary CPFs.

**Science competency**, or a basic understanding of the philosophy of science and the ability to conduct a simple replicable field experiment which objectively tests whether adoption of the technology in question will be beneficial to the small farm family.

**Farming competency**, or the willingness and skills to perform the range of physical tasks involved in producing a specific crop or animal. This includes, but is not limited to, the ability of the SFDP staff to perform at least the range of physical tasks within the existing competency of the
farmer. Also, as mechanization advances, the SFDP staff must acquire the relevant knowledge, understanding, and skill in the operation and maintenance of various energy-driven machines and processes.

In employing these four competencies to develop and validate a particular technology's hypothesized beneficial impact on the SFS, a fifth competency, namely, communication competency, becomes particularly vital.

**Communication competency**, or the ability to specify and coordinate specific behavioral objectives for relevant social systems whose changed behavior is necessary for a particular technology to be adequately tested. This includes, but is not limited to, the ability to plan, prepare, and present appropriate messages for and to obtain feedback from the relevant NASs in the farmer's environment: e.g., landlord, credit agency, input distributor, wholesaler, retailer, or even consumer. The most appropriate message for the SFS, of course, is a SFT which has been validated in an environment similar, if not identical, to the farmer's own unit of operation. Relatedly, where small farmers may speak a different language or dialect, the SFDP staff in the field must possess sufficient fluency in the farmer's idiom so as to facilitate rather than hinder communication between both parties.

Support for the hypothesis that a SFDP staff requires competence in these five areas is found as fortuitous or qualitative data in case studies of development projects (Alers-Montalvo, 1957:3-5; Einsiedel, 1960; Niehoff, 1966; Niehoff and Anderson, 1965). While such studies usually lack control over intervening factors, there is ample data to suggest the validity of the hypothesis (cf. Byrnes and Byrnes, 1971, for a systematic review of each of the five competencies based on available data drawn from
over thirty studies). Indeed, at least three of the five competencies were also emphasized to some extent in the Puebla Project, as the following excerpts demonstrate in regard to the communication, science, and technical competencies.

Communication competency was generally implied in the Project's emphasis on health and age, motivation, and maturity, respectively:

Only candidates with perfect health, both physical and mental, were considered. . . . Because of the strenuous nature of the work and the need for flexibility and innovation in resolving problems, a preference was shown for people between 30 and 35 years of age. However, the physical condition of the candidate and his intellectual attitude were given more importance than age (CIMMYT, 1969:28).

Prospective employees were informed in detail of the objectives, organization, and functioning of the project. They visited the area, discussed the project with the other staff members, and talked with farmers. It was emphasized that the staff worked together as a team in carrying out experiments, working with farmers, and collaborating with public and private agencies. In this way, the candidates came to understand that the project offered an opportunity to make an important contribution to agricultural development, but it also meant long hours and absolute dedication. Only those candidates who responded enthusiastically to the challenge of the project were considered further (CIMMYT, 1969:28).

By observing their reactions in field interviews, every effort was made to select only those people capable of working smoothly with other staff members and all kinds of farmers. Also, candidates were judged on their ability to communicate effectively with technical people, and with representatives of agricultural institutions from small distributors of inputs to high government officials (CIMMYT, 1969:28).

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1 Economics competency was emphasized in the Puebla Project through utilization of the personnel trained in economics who were employees either at INIA or CIMMYT. As will become apparent at a later point, farming competency was less stressed as a requisite skill for the professional personnel employed by the Puebla Project. However, the Puebla Project did "build in" this competency through the Project's operation in such a way as to involve the small farmer in the carrying out of the research experiment (D3) and research trial (F3) steps.
Such factors as health and age, motivation, and maturity are particularly important in the sense that communication competency involves understanding and controlling one's own behavior and mental orientations as significant communication variables as well as having a sense of urgency for SFD and assuming personal responsibility within the realm of one's sphere of daily influence (Byrnes and Byrnes, 1971:342).

Science competency was generally implied in the Project's emphasis on "ethics":

In interviewing candidates and studying their previous activities, every effort was made to assure that they employed the scientific method with complete honesty and were eager to present their plans and results for the criticism of others (CIMMYT, 1969:28).

Technical competency was generally implied in the Project's emphasis on "technical ability":

Previous employment and especially the academic preparation and professional goals of the candidate were given important weight in evaluating his technical qualifications (CIMMYT, 1969:28).

While it is not likely that anyone would disagree about the importance of competency,

...some may disagree about which competencies and how much of each are important. Others may argue that we have neglected the most important virtues or characteristics of agricultural workers—a dedication to service, an interest in agriculture, and a desire to help one's fellow men. Such characteristics are desirable, but we cannot accept them as substitutes for competency (Byrnes and Byrnes, 1971:347).

It would be difficult to find any one agricultural worker who possesses all five competencies, as these are usually distributed as a function of education and training over at least three specialized roles: the technical specialist (e.g., agronomist), the agricultural economist, and the extension worker. Thus, for example, during the 1967-69 period of the Puebla
Project, an approximate total of 20 agricultural workers served in various functional areas: 1 coordinator, 5 soils specialists, 6 geneticists, 2 production agronomists, 2 evaluation specialists, and 4 extension specialists (CIMMYT, 1969).

The specific functional areas that will be required in any SFDP, of course, will vary. What will not vary, however, is the necessity that the five competencies (technical, economics, science, farming, and communications competencies) be standard equipment for a SFDP staff. If any one competency is missing, the SFDP is not likely to succeed.

Organization of staff competency

It remains for the NAREO to determine in what way the five competencies are to be supplied. Where staff positions within the SFDP cannot be filled by personnel from the NAREO or by other national personnel (i.e., when a LDC lacks personnel who are trained in one or more of the five competencies), the missing competencies could be supplied by personnel from one of the IARCs or from one of the more agriculturally developed countries.

If an LDC has difficulty in mobilizing adequately trained manpower to staff even one SFDP, the national government in that LDC should possibly seek opportunities for more nationals to acquire training in the various competencies. Without a sufficient number of persons trained in the five competencies, the NAREO will be severely limited in its ability to respond to the objectives of SFD (Chaparro and Alle, 1960; Adams, 1968; The Rockefeller Foundation, 1974).

Step A3: Target area selection

Once recruited, the SFDP staff must select the target area, i.e., the specific territoriality of SFSs and surrounding agri-support subsystems (NASs) in which the project
will work. The author hastens to qualify, however, that in selecting a target area the SFDP may first need to initiate at least at a very general level the various reconnaissance and legitimation steps of phase B (discussed in greater detail below). At the same time, the SFDP would not likely have unlimited resources for an exhaustive study of SFSs throughout the LDC in which the SFDP is to be implemented. Accordingly, the SFDP must at some point designate a particular area as the geographical base (or territoriality) of the project's primary (small farm) and secondary (agri-support) target systems. Then the SFDP can proceed to more thoroughly carry out phase B and subsequent action steps within the selected target area.

Any decision as to the region that will be the SFDP's target area reflects the criteria which the project staff uses in making that decision. CIMMYT and INIA utilized two general criteria in selecting the Puebla area:

...1) an ecological environment that will permit substantial yield increases, and 2) a general political environment favorable toward increased production. Many regions in most countries satisfy these conditions (CIMMYT, 1969: Introduction).

Several characteristics of the Puebla area made it a desirable location for the Project. It was felt that an area of 50,000 to 100,000 ha of corn was necessary to adequately study the effectiveness of...[the Puebla Project strategy] in rapidly accelerating yields; the selected area comprises about 116,000 ha, used largely for corn production. Also, the land is divided into very small holdings, average yields are low, production practices are traditional, and most of the harvest is consumed directly on the farm. These aspects of agriculture are generally thought to be related to a slow rate of growth in agricultural production and, consequently, were desirable characteristics for the project area....the interest of public agencies....was forthcoming from both state and federal officials... (CIMMYT, 1969:9).

The project area can be reached in about two hours from...the National Agricultural Center at Chapingo. This was desirable so that consultants...could maintain close contact with the project. Communications within the project area are adequate, and most villages are connected with a network of all-weather roads (CIMMYT, 1969:9, 11).
These excerpts from *The Puebla Project* report illustrate not only the numerous criteria or considerations that were taken into account in selecting the Puebla region as the target area for the Puebla Project (as a SFDP) but also that a considerable amount of information was already available on the Puebla region at both the primary target (small farm) and secondary target (agri-support) system levels. However, as indicated above, the selection of a target area for a SFDP may require that the project first engage at least at a more general level in the various reconnaissance and legitimation steps of phase B. Such more general level reconnaissance and legitimation may not be necessary during phase A if sufficiently accurate, complete, and relevant data are already available on the various agricultural regions within the LDC in which the SFDP is to operate.

While many criteria can be taken into account in selecting a target area for a SFDP, as is well illustrated in the above excerpts on the Puebla Project, one criteria is paramount: the selected area (region) must contain a sizable population of SFSs. Without such a population, the SFDP would have no primary target system for which to develop SFT or to which to diffuse that technology once developed.

**Phase B: Reconnaissance and legitimation** Once the SFDP's staff has been recruited and the target area selected in phase A, the SFDP enters phase B in which activities are undertaken to achieve two general objectives: (1) Reconnaissance: to delineate relevant social systems and obtain information on prior and existing social system elements in the delineated systems; and (2) Legitimation: to initiate the process of legitimation of the SFDP vis-à-vis the Small Farm System (SFS) and surrounding agri-support subsystems (NASs).
As indicated by Beal (1965:28), definitions in regard to the problem, goals, and means are only tentative, and thus incomplete, at the initial or "convergence of interest" phase of social action. This holds true in SA-SFD. It should almost go without saying that such incompleteness hardly provides an adequate basis for designing and implementing a SFDP that will have any realistic chance of being successful. In order to counteract the possibility of disappointment, for example, of developing technologies that are subsequently found to be either unworkable or not beneficial within the context of the SFS, considerable information must be known about not only the SFS but also the various NASs which do or can facilitate and/or impede the small farmer's operation of the CPS.

These considerations provide a rationale for incorporating here in the second phase of the SFDP what are in the "Construct of Social Action" (Beal et al., 1966:75-82) actually four different action steps:

B0: Delineation of relevant social systems (Step 6)

B1: Legitimation (Step 10)

B2 and B3: Analysis of existing social systems (Step 1)

B4: Analysis of the prior social situation (Step 3).

The reader must bear in mind that while these steps will be discussed in a definite sequence, the implementation of some action steps may need to occur simultaneously rather than sequentially in time. For example, while "legitimation" (B1) is presented and discussed prior to "analysis of existing social systems" (B2 and B3), an actual SFDP may first need to analyze the existing NASs at least to a limited extent, if only to identify the key power figures in those systems who are in a position to be able to legitimize the project, before proceeding to the action step of legitimation. On
the other hand, the project may first need to obtain a modicum of legitimation before proceeding to attempt to acquire certain kinds of information about a particular social system or subsystem. In light of these examples, it is clear that in a SFDP, two or more action steps may need to occur relatively simultaneously, particularly if the steps in question are interdependent, as in the case of the specific action steps B1 and B2 and B3.

Step B0: Delineation of relevant social systems

The nature of the SFDP's objectives to develop and diffuse SFT to small farmers in a particular target area (region) of an LDC limits the number of subsystems likely to be directly involved in the project. Beal et al. (1966:79) note: the "tentative delineation of...relevant groups and individuals allows...planners to begin to narrow down the systems so that limited resources of time and personnel may be used more effectively." Beal et al. (1964:330) further emphasize:

It is important for the change agent to determine which of the social subsystems within general social systems are relevant to the specific action program proposed. Generalizations as to which subsystems these are can be made in terms of their interests and needs and the functions they may assume in the action program. Some subsystems may perform multiple functions, others only single functions. The change agent should determine the types of functions necessary to carry out his action program and then select the subsystems possessing the ability to carry out the necessary tasks.

These considerations suggest that a SFDP should carry out a more extensive research analysis of the SFS (B3) in the target area prior to any final decision as to which agri-support subsystems are relevant. At the same time, however, it must be remembered that: "As the planning process progresses from one stage [stage, phase, step] to another, certain systems may drop out of the relevant classification, and others may have to be
added" (Beal et al., 1966:79). At any point in this process, any one or
more of several general criteria may be utilized by the SFDP to determine
whether a particular subsystem is relevant to the implementation of the
project (Beal et al., 1966:79-80; Beal et al., 1964:58-61). These criteria
as they might apply in a SFDP are listed below along with an example of
each criterion as it might apply in regard to SA-SFD.

1. Which social system is the primary target system, i.e., has in its
membership the people to be ultimately benefitted by the SFDP? The small
farm family which operates the CPS of a SFS is, obviously, the primary tar­
get system for a SFDP in an LDC.

2. Which agri-support subsystems do or can potentially represent the
needs and interests of the SFS? The various credit subsystems which have
been developed in the private and public sectors to assist farmers to
finance their operations will vary in the extent to which they are mandated
or are even operationally able to be responsible to the SFS. Indeed, the
mandate and ability of these subsystems to deliver credit may exist largely
for or only with respect to those farmers who produce primarily or solely
for commercial sale, particularly for the export market. The success of a
SFDP could very well depend on whether the agri-support subsystem(s)
responsible for financing agriculture can become more responsive to the
small farmer. To achieve such a change will require that the SFDP recog­
nize that a particular agri-support subsystem should be dealt with as a
secondary target system in which change must also be sought.

3. Which agri-support subsystems are representative of relevant power
groups from which legitimation should probably be obtained? While the
process of legitimation (B1) is discussed more fully below, we may note
that certain individuals (e.g., high government officials such as the head of state or of one of the governmental ministries) may have the power to legitimize the SFDP in general or some particular change that the project seeks. One such change, for example, might be the broadening of the mandate and operational capability of the public sector agricultural credit subsystem in such a manner as to make it more responsive to the financial requirements of small farmers who seek to adopt SFT.

4. Which agri-support subsystems should be involved in planning, sponsoring, or carrying out the SFDP or in affecting communications pertaining to it? A prime example is the small farmers who, as will be discussed more fully (at step B3), (a) will assist the SFDP's staff in obtaining a first-hand knowledge of the operation of a SFS or, more particularly, the CPS, (b) will participate in the project's execution of the research experiment (D3) and research trial (F3) steps, and (c) will serve as communication links (e.g., in a role as opinion leader) in helping to diffuse information about and enthusiasm for SFT which they have adopted (H3).

5. Which agri-support subsystems (groups and individuals) are likely to judge that the SFDP may conflict with their own views or impinge on their programs, members, or status? Allocation of resources to the SFDP may be viewed as incompatible with an LDC's national goals of expanded food production and creation of employment opportunities (Sinha, 1973). Those holding this view may not realize that "small farmers are an important source of food production in many countries. In Guatemala, for example, 84% of the farmers each have less than 7 hectares. They occupy 17% of the land in use, yet produce close to 60% of the basic grains (wheat, rice, beans, maize and sorghum)" (Franklin and Scobie, 1974:6).
While the specific NASs relevant to a SFDP will vary from one LDC to the next, particularly depending on which criteria are used to delineate subsystems as relevant, the following are likely to be to a greater or lesser extent potentially relevant to the implementation of a SFDP:

1. Public sector planning and economic policy subsystems at the national and subnational (e.g., state) levels;
2. Public sector agricultural subsystems (e.g., research, extension, education, credit, insurance, marketing, land reform, etc.);
3. Private sector production input and commodity disposition subsystems;
4. Community level social organization (e.g., the "existing power structure": officials holding formal positions of authority, individuals who control the land tenure system, etc.);
5. Farmer associations (e.g., cooperatives); and
6. Informal communication subsystems between and among small farmers.

A schematic diagram of the SFS in relation to potentially relevant agri-support subsystems, the NAREO, and the IARC in an LDC is presented in Figure 4.2 and serves to emphasize the multiple subsystems which a SFDP is likely to encounter as relevant in implementing the CSA-SFD. Once the relevant subsystems have been delineated, the SFDP's next step is that of legitimizing the project at the agri-support and small farm social system levels.

**Step B1: Legitimation** Here legitimation is used in the sense of "giving sanction (authority, approval, or justification) for action" (Beal et al., 1966:81). Beal et al. (1966:81) observe that "in most social systems there are certain key people that have the power of legitimation
Figure 4.2. Schematic diagram of SFS in relation to potentially relevant agri-support subsystems (secondary target system), the NAREO (primary change agent system), and the IARC (secondary change agent system which may or may not be located in the LDC in question)
for most action programs and/or for specific action programs." Whether these "key people" are individuals in formal positions of authority or informal leaders in positions of influence, legitimation "consists of consultation with the formal and informal leaders of...the relevant social systems...for their reactions and suggestions on the new program...and how it might be carried out" (Beal et al., 1966:81). Since such consultations are likely to provide many people their initial contact with (1) the SFDP, (2) what the project is trying to accomplish, and (3) the strategy and activities which the project plans to utilize in developing and diffusing SFT to small farmers, it is important that these consultations be used to build favorable expectations of and attitudes toward the project.

The response of legitimizers to the SFDP may

...range from a flat refusal to go along with ideas to wanting to become the center of the promotional activity. One caution may be raised.... Legitimizers often will put forth no effort to help initiate or carry on the action program. They will not commit themselves as a resource in subject matter competence, time, energy, or influence. However, if legitimation is not obtained from them, they may throw all of their resources into the blocking of the program. ...if they are bypassed on legitimation often enough, they cease to be legitimizers, a status and role they prize (Beal et al., 1966:81-82).

Finally, the process of legitimization also serves in a SFDP to "improve the clarity of thinking of those initiating the action and be of aid in making decisions regarding the efficacy of the program, planning strategy, timing, and next-step actions" (Beal et al., 1966:82).

The process of legitimation will be discussed at several action steps (B1, D1, F1, and H1). To provide a general framework for discussing legitimation at later steps, the topic is discussed at somewhat greater length here at step B1. The discussion per se is divided into two sections: NAS
legitimation and SFS legitimation. As the discussion will frequently refer to subsequent or preceding steps of the CSA-SFD, frequent reference to Table 4.1 will assist the reader considerably.

**NAS legitimation**  
If a SFDP is to be successful, it will initially require legitimation from not only the planning and economic policy subsystems but also the public and private sector agri-support subsystems. Early and continuing support of the SFDP by officials in the higher echelons of government is especially crucial, particularly in the extent to which the LDC's government is highly centralized. In this vein, CIMMYT notes:

The Puebla Project could not have achieved the success it has without the firm support of the highest authorities of the Mexican Government. The Ministry of Agriculture has given strong backing at both the federal and state levels. The Government of the State of Puebla, where the Project is located, views it as an effective means for beginning an economic and social transformation of the area. The backing given by high governmental authorities and private enterprises has made it possible to improve credit facilities and to make more readily available the essential inputs and services (CIMMYT, 1969: Preface).

Thus, high officials in national and state level government are in a position to encourage the cooperation with and participation in the SFDP of subordinates in lower echelon governmental administrative, research and extension, and other public sector subsystems, particularly those individuals (e.g., the head authority in the local governmental administrative unit) whose geographic area of jurisdiction and/or operational responsibility includes the area of the SFDP's target area of SFSs. It is also essential that the SFDP secure legitimation from those key individuals in the private sector of the NAS, particularly in those subsystems concerned with the supply of CPFs.
As discussed further below, authorities at the level of the local governmental administrative unit can be particularly helpful in assisting the project to identify small farmers in the target area who would be willing to cooperate with and participate in the initial research analysis (B3) and subsequent action steps of the SFDP in their area. At the outset, such participation would consist of allowing and assisting the project staff to study the SFS as a basis for (1) specifying the nature of that system's CPS and (2) formulating for subsequent experimental and/or other research (e.g., genetic improvement) a set of hypotheses as to which technological changes in the CPS might assist the small farm family to more optimally achieve its objectives. To the extent that this involvement serves to generate curiosity and interest on the part of the farmer, as well as a willingness to further cooperate with the researchers, the SFDP can proceed to identify farmers who would be willing to permit segments of their farm operation (e.g., plots of land) to be used for testing of the formulated hypotheses at the research experiment step (D3).

The reason for conducting research in the context of a small farmer's own operation is quite simple, being based on a philosophy that the results of research conducted on (within) the SFS "can be immediately interpreted in terms of specific recommendations for farmers without going through an intermediate step of adaptation trials" (CIMMYT, 1969:67) on a number of small farms as would necessarily be the case, for example, if agronomic research were initially conducted at a regional or national experiment station. Moreover, by being in touch with farmers rather than isolated at the experiment station, the SFDP is better able to learn what the farmer sees as his problems, objectives, and the kinds of technological alternatives he
thinks would work best with his own farm operation. Thus, the CSA-SFD outlined here views the entire target area "as the experimental station and farmers' field [as] the experimental plots" (CIMMYT, 1969:67).

Once the process of on-the-farm research (D3) has identified an improved technology (E), the SFDP can proceed to identify farmers (F1) who would be willing to participate at the research trial step (F3) and to ensure that the requisite CPFs are mobilized in the agri-support system (F2). Those farmers who successfully utilize the SFT in question during the research trial step will serve, in effect, to further "legitimate" or validate the technology in question in the eyes of other farmers in the area and, thereby, to speed adoption of the technology by other farmers and, consequently, the diffusion of the technology throughout the target area of SFSs (Byrnes, 1966; Byrnes and Byrnes, 1971:326-351). As Beal et al. (1966:81) note, "final legitimation for any action program rests with the majority of the people in the relevant social system."

The process of legitimation described in the preceding paragraph (cf. validation of SFT in the eyes of small farmers) must occur not only throughout the informal system of communication among small farmers but also within the broader agri-support system surrounding the SFS. Each component subsystem of the NAS must not only be convinced that the SFT in question will work on the SFS but also be prepared to deliver on schedule the CPFs that must be available if the farmer is to be able to adopt and properly utilize that SFT. Thus, for example, even before the SFDP is ready to provide specific recommendations to the farmer that he use X
amount more of fertilizer than he is currently using, the project may yet be able to estimate that any recommendation that is likely to be made to farmers will require the use of a greater quantity of fertilizer than is currently the practice. Accordingly, if increased farmer demand for fertilizer is to be met, manufacturers, distributors, and retailers of fertilizer will need to have on hand greater quantities than they currently produce, handle, or stock. The problems involved in "gearing up" to make such a change may be numerous, complexly interrelated, and require a relatively lengthy period of "lead time" if the fertilizer industry is to be able to adequately respond to the expected increase in farmer demand. The SFDP must, therefore, allow itself adequate lead time not only to make contact with and secure legitimation of the project in the eyes of the fertilizer industry but also, and as importantly, to specify the role which that industry must play (e.g., the quantity of fertilizer that the industry must be ready to supply) if the project is to be successful in terms of developing the mechanisms whereby small farmers can gain access to the full range of inputs that they will require in order to be able to adopt and properly utilize the SFT in question.

Another example is readily apparent. If small farmers are not able to finance the purchase of the requisite inputs (e.g., fertilizer) out of their own pocket, then they will require credit, thereby, placing an additional demand on the agri-support system. The experience of the Puebla Project is instructive in this respect:

...the amount of capital needed for purchasing fertilizers, insecticides, and other inputs will increase sharply as the program begins to reach most of the farmers in the area. Much of this capital will have to be supplied in the form of short term loans. At present, the agricultural credit banks do not have
sufficient credit allotted to corn production to cover the potential demand. Consequently, either the banks must find a way to increase the credit available for corn or new sources of financing will have to be found (CIMMYT, 1969:29).

The problems involved in providing credit to small farmers participating in the Puebla Project were also interrelated with the problems involved in providing crop insurance to these farmers. The Puebla Project found that officials

...at the state and local levels considered that the changes recommended by the project implied new risks, not only in terms of the additional credit, but also with respect to the prestige of the institution in the eyes of the farmers and the national leaders.

The crop insurance agency maintained that once the new recommendations had been accepted by the credit banks and their clients, such operations could qualify for insurance. However, this agency was found to have well-defined operating procedures that did not permit coverage for individual small farmers. Again, change was necessary for the crop insurance agency to participate, and this meant the presentation of proposals to higher authorities and favorable action at that level (CIMMYT, 1969:31).

A SFDP will thus need to decide on which procedures to follow to establish legitimation of the project in the eyes of each relevant NAS. The Puebla Project experience serves as an example of one approach to the problem of securing and maintaining legitimation from the various NASs. Early in the Puebla Project, the Project's coordinator established contact with the various national, state, and local agricultural-related institutions (CIMMYT, 1969:29):

Interviews were held with the leaders of the different institutions and they were informed of the program and the part they could play in assuring its success.

It was believed that if these agencies were adequately informed of the objectives, organization and functioning of the project, they would participate effectively in promoting a rapid increase in maize yields.
The Puebla Project was presented as a coordinated effort of the project staff, farmers, and these agricultural agencies. The importance of the role of each institution was emphasized, and it was made clear that all were a part of the project.

These contacts were thus used to initiate the process of legitimation of the Puebla Project. Efforts to legitimize the project must not stop once initial cooperation with and participation in the project are forthcoming from the various NASs. The Puebla Project, for example, continued to maintain contact with the participating NASs both (1) individually at specific points in time as particular problems arose and (2) collectively once a year at an "Annual Meeting of the Puebla Project." These activities to sustain legitimation, however, are discussed more fully at steps D1, F1, and H1 below.

SFS legitimation The process of legitimating a SFDP continues through time with respect to not only the various NASs but also the SFSs in the project's target area. Since forthcoming action steps (B3, D3, and F3) will require that the SFDP staff have access to the SFS, the project will also require legitimation vis-à-vis small farmers in the project's target area. Such legitimation, for example, would consist of the farmer's permission for the SFDP staff to initiate a research experiment on the farmer's land at step D3 or, even more basic, to study the SFS at step B3. How should a SFDP secure and maintain such legitimation? While the approach to this problem may vary depending on the particular LDC in question, the Puebla Project again may be drawn upon to illustrate a general strategy.

Some background data If we take the widely disseminated descriptive report (CIMMYT, 1969) of the Puebla Project as generally
complete, it is apparent that the Puebla Project did not place any particular emphasis on legitimation vis-a-vis the "existing power structure in each community" (CIMMYT, 1969:69) either at the time farmers were initially studied (in early 1967) to identify a set of hypotheses (see B3 below) for subsequent testing at the research experiment step or shortly thereafter at the time that permission was obtained to actually set up the research experiments on the farmer's own land. The Puebla Project only began to emphasize such legitimation (in early 1968) at the time the Project was ready to initiate the research-trial step of "high yield plots" on each of a relatively large number of farms. Even then, however, the consideration of legitimation vis-a-vis the "existing power structure" came only after the Project's evaluation team had discovered that the Project had been generating resistance among farmers in the form of a "negative attitude...and in some cases hostility" (CIMMYT, 1969:69) toward the Project itself.

Prior to this negative feedback, and having already developed a set of technological recommendations on the basis of the research experiments which the Project's agronomists had conducted in the fields of some farmers in 1967, the Project planned to set up a program of research trials or "high yield plots" throughout the Puebla region as "a demonstration program...so that farmers...[could] see with their own eyes the advantages of these new practices" (CIMMYT, 1969:68). In this regard, the Puebla Project initially planned to "largely" follow:

...the usual system for planning and locating demonstrations—choosing highly accessible points on good soils where the largest possible number of farmers could see the plots. The approach implied that the field should be located first and the owners
then convinced to participate with demonstrations on these par-
ticular fields (CIMMYT, 1969:68).

It was at this point that the Project encountered the measure of "neg-
ative attitude" and "hostility" among the farmers toward the Project. To
counter this resistance, the Project decided that a "change of strategy"
was required:

...that it would be best to work through the existing power
structure in each community. This meant identifying, first of
all, the people of authority and then working through them. For
this reason, the first step in locating the high-yield plots was
not the selection of the geographic site but rather the selection
of the farmers to participate in the demonstration program
(CIMMYT, 1969:69).

Despite the Puebla Project's earlier limited contacts with farmers at
the research analysis (B3) and research experiment (D3) steps, it was
finally at this point, i.e., just prior to the research trial step (F3),
that the Project recognized that it was the farmers themselves who "would
provide the nuclei for expanding the project in future years" (CIMMYT,
1969:69). It is this realization in conjunction with the Project's recog-
nition that "it would be best to work through" a community's "existing
power structure" that provides the rationale for discussing here at step Bi
the crucial role of legitimation vis-à-vis the agri-support system, partic-
ularly those subsystems (e.g., authorities in the local governmental admin-
istrative unit) which are part of a community's power structure. If the
"people of authority" were able to assist the Puebla Project in identifying
farmers who would be willing to participate in that Project's research
trial ("high yield plot") step (F3), it is reasonable to assume that the
same individuals in positions of authority could also have been of assist-
tance to the Project at earlier action steps which required the farmer's
involvement, for example, at both the research analysis (B3) and research experiment (D3) steps.

Therefore, the description of the Puebla Project's actual strategy in establishing contact with farmers at the research trial step (F3) will be suggested as a model which the Project should have followed or, in the general case, a SFDP could follow as a procedure for implementing the research analysis of SFS step (B3). Once this model or procedure has been discussed, it will again be referred to in subsequent legitimation steps (D1, Fl, and H1). Before presenting the model, however, it is instructive to briefly review some of the reasons which perhaps provide some insight on the Puebla Project's initial neglect of the "existing power structure."

More background data  The relative neglect of the "existing power structure" at the local or community level at the early research analysis of SFS step (B3) and subsequent research experiment step (D3) of the Puebla Project, as compared to the attention which that structure later received at the research trial step (F3), reflects an initial tendency early in the Puebla Project to narrowly define the problem of the small farmer as primarily one of deficient agronomic technology. Thus, for example, the Puebla Project's

...production agronomist and maize breeder were selected in March and April of 1967 as the first members of the project staff. The coordinator was named in July. In January, 1968, the evaluation expert was selected and in March of the same year the farm advisor was chosen (CIMMYT, 1969:27).

It is not unreasonable to assume, given this sequence of personnel selection and Project implementation, that the production agronomist and maize breeder proceeded to initiate, as quickly as possible in 1967, a program of experimental agronomic and genetic improvement research, particularly as
the data of planting in the Puebla region is from early March to the middle of May. Indeed the "installation of the experiments was begun on April 18 and the last one was planted on June 3; 25 of the experiments had been planted by May 11" (CIMMYT, 1969:41).

The decision to conduct this particular type of agronomic research, however, was made on the basis of two particularly narrow criteria. First, it was assumed that the Project's resources would best be allocated in trying to develop technology to rapidly increase corn yields on small holdings. There is a hidden assumption here that an increase in yields would be the most beneficial change which SFT would assist the small farmer to achieve. The potential invalidity of this assumption is seen in light of the diversity of potentially relevant small farmer objectives discussed in Chapter 2.

Second, it was assumed that the agronomic and genetic improvement researchers would be able to define the most relevant research hypotheses (e.g., that applying increased rates of fertilizer would increase yields substantially). The hidden assumption here is that the production agronomist and maize breeder would (1) collect all of the information that would be relevant to the formulation of the research hypotheses which the Project would most fruitfully pursue and (2) obtain this information in a way that would lay the basis for facilitating rather than hindering (cf. "negative attitude," "hostility," etc.) the Project's implementation at subsequent action steps. This second assumption will be briefly examined in greater detail.

The Puebla Project's agronomic researchers used two sources of information as the basis "to determine which management studies should be given
priority" (CIMMYT, 1969:37). First, "existing information on agronomic practices relevant to the project area was reviewed" (CIMMYT, 1969:37).

Second,

Several visits were made to the project area to question farmers concerning their production practices and to observe soil characteristics at maize locations. Also, agricultural scientists with experience applicable to the region were interviewed to obtain their ideas on management practices being used by farmers (CIMMYT, 1969:37-38).

It is apparent from these descriptions that the production agronomists sought a particularly narrow range of information perceived as relevant to the problem as they defined it. Thus, in a discussion of the Project's agronomic research program, one reads:

The amount of corn produced on a given area depends upon the soil and climatic conditions, the variety employed, and the management practices used in growing it. The physical environment cannot be readily changed and thus determines the yield potential of a region. Varietal characteristics and management practices, on the other hand, are readily changed by man, and improvement of these factors is his means of achieving higher yields. The objective of the agronomic research in the Puebla Project is to produce information on how to manage the soils and the best available varieties so that farmers may realize maximum returns from their production investments (CIMMYT, 1969:37).

In contrast to the agronomic researcher's narrower view of the information relevant to determining the farmer's problem, both the Puebla Project's coordinator and its evaluation expert had a much broader criterion in seeking information.

On joining the project in August, 1967, the Coordinator initiated a general reconnaissance of the area, traveling over most of the all-weather roads in the area, defining regions where corn production was concentrated, and observing characteristics of farmer's plantings such as population density, fertilization, weed controls, etc. Farmers were interviewed informally about their production practices, average yields, relationships with agricultural institutions, and possible interest in participating in the project.
This exploration revealed that many farmers were using some chemical or organic fertilizers, and a few were using insecticides and improved corn varieties. It also called attention to the advantages of making the evaluation an integral part of the project. Obviously, accurate information was needed as soon as possible on the characteristics of the agriculture, present levels of production, and attitudes of the farmers toward change. Decisions were taken that led to the initiation of the evaluation study in late 1967 (CIMMYT, 1967:30).

The information collected by the Puebla Project's coordinator and evaluation team, however, had relatively little opportunity to serve as an input in formulating hypotheses that could subsequently be tested at the research experiment step (D3). Indeed, the agronomic researchers had already initiated their research experiments prior to the time that the Project's coordinator and evaluation team would have finished their studies and been able to supply information on the SFS or surrounding agri-support system. It is conceivable that an alternate set of research hypotheses might have been more fruitfully investigated on the basis of such information.

This illustration serves to emphasize that a considerable degree of coordination is necessary to ensure that each member of a SFDP, as well as each participant in the NAS, supplies at the appropriate time the input(s) which that individual or subsystem must supply if the project is to be successful. CIMMYT notes, however, in regard to the Puebla Project that while...

...close coordination of the activities of all members of the project staff was established as a principle at the beginning, such team action was not immediately achieved. Men trained in different disciplines were inclined to associate with others of the same discipline and not seek closer ties with other project colleagues (CIMMYT, 1969:30).

It is apparent in light of the documentary material on the Puebla Project cited above that the inclination of Project staff trained in one
discipline to associate with others who were similarly trained had been problematic in the Project from the outset. For example, agronomic researchers proceeded to define the Project's research hypotheses without the opportunity to take into account the information which the coordinator and evaluation team were subsequently in the position to be able to provide. The coordinator, for example, specifically attempted in his initial reconnaissance of the Puebla area to identify farmers with "possible interest in participating in the project" (CIMMYT, 1969:30). Such information could have been utilized by the agronomic researchers in contacting farmers at any and all of the initial action steps of the Project: the research analysis of SFS step (B3), the research experiment (fertilizer rate studies) step (D3), and the research trial (high yield plot) step (F3).

The agronomic researchers, however, proceeded on a different basis to locate farmers, a basis which in retrospect was inappropriate and could have been avoided if the Project had initially utilized the farmer identification/selection procedure that was finally adopted after the negative feedback received by the Project at the research trial (high yield plot) step (F3). To clearly illustrate the procedure initially utilized by the Puebla Project "in locating farmers to cooperate in the [Project]" (CIMMYT, 1969:32), the difficulties which this approach generated, and the farmer selection procedure that was eventually adopted, consider the following description of the Puebla Project's operation:

With the initiation of the field trials in 1967, recommendations of agricultural institutions in the area were followed in locating farmers to cooperate in the studies. During the remainder of 1967 and early 1968 this procedure of contacting individual farmers was followed as the program continued to develop. This procedure for contacting farmers was changed in early 1968, largely because of the experience obtained in the evaluation study.
As will be described in detail later, a benchmark study was conducted in January and February, 1968, that involved the interviewing of a statistically selected sample of 251 farmers. In several villages the reaction of the farmers to the evaluation group was negative and sometimes openly hostile. This experience, together with other observations in the area, made it clear that contact should be made directly with the local or municipal authorities of each community. The Coordinator proceeded to establish contact with each village in the area and hold meetings to explain the objectives and functioning of the project and assess the interest of farmers (CIMMYT, 1969:32-33).

This excerpt reemphasizes the fundamental importance of legitimation both initially and throughout a SFDP and brings us to the point where we can now discuss in detail the procedures employed by the Puebla Project at the research trial (high yield plot) step (F3) to identify and select farmers who would be willing to participate in the Project. The reader should bear in mind that the farmer identification/selection procedure actually utilized by the Puebla Project at the research trial step (F3) is presented below as a proposed general model which the Puebla Project as a SFDP could have and, indeed, should have initiated here at step B1, prior to the research analysis of SFS step (B3). Had the Puebla Project followed the general model as proposed here, that Project would have initiated contact with local authorities prior to the research analysis of SFS step (B3) in early 1967, rather than waiting to contact "each municipal president in January and February, 1968" (CIMMYT, 1969:69), just prior to the research trial (high yield plot) step (F3).

A small farmer identification/selection model

The small farmer identification/selection model consists of two steps: (1) meetings with local authorities and (2) meetings with farmers.

Meetings with local authorities

The nature of the "local power structure" will vary from one LDC to the next. In Mexico,
the governmental administrative unit at the local level is the "municipio." Each "municipio" consists of "a principal village and usually several ancillary population units" (CIMMYT, 1969:69). The principal or head village is the "cabecera municipal" and is the residence of the municipal president and other local authorities. In turn, each of the other communities or villages (i.e., the ancillary population units) has auxiliary authorities responsible to the municipal president.

In order "to meet with local authorities in as many communities as possible" (CIMMYT, 1969:69), the Puebla Project staff first contacted the municipal president in each "cabecera municipal" and explained "the project and its goals" (CIMMYT, 1969:69). The process of legitimizing the Project vis-à-vis the municipal president and, subsequently, other local authorities was greatly facilitated by the Project's ability to present to the municipal president:

...a report of the 1967 results..., a map showing all of the points where experiments were carried out during 1967, a list of the cooperating farmers, and a brief description of the project (CIMMYT, 1969:69);

and

...an official letter...signed by the General Agent of the Ministry of Agriculture, the state director of agriculture, and the coordinator of the project. The letter explained the responsibilities of the municipal authorities in organizing the proposed meetings and the important role they had to play in developing the project. It also suggested the social and economic importance that the project might have for farmers in each municipio (CIMMYT, 1969:69).

While an "official letter" is a tactic which any SFDP could use as early as step B1, the Puebla Project did not take this action until step F1, just prior to the time that the Project wished to set up the research trials (high yield plots) in farmer's fields at step F3. On the other
hand, however, the procedure of providing "a report of the 1967 [research experiment] results...", etc. would not have been possible if local authorities had originally been contacted at step B1 in the hypothetical strategy, thus considerably prior to the time when the research experiment step (D3) would even begin.

In each principal village, the president was asked "to arrange a general meeting with all of the municipal authorities in order to provide complete information about the Project and the work plans for" the future (CIMMYT, 1969:69). After providing time for the municipal president "to arrange a general meeting with all of the municipal authorities," he was again contacted and

...places, dates, and hours were set for meetings with municipal authorities. Meetings of this kind were carried out in all but one of the municipios in the half of the Puebla area in which extension work was to be initiated in 1968 (CIMMYT, 1969:69).

At each of these meetings,

...a careful explanation was given of what the project might provide and what farmers would be expected to do. At the same time, an effort was made to evaluate the level of interest in the project. At the completion of each meeting, the participants were asked which farmers in the locality would be interested in the project (CIMMYT, 1969:69).

In addition to serving as the initial step in establishing contact with farmers, meetings with local authorities also serve to provide a SFDP with "a better understanding of the local power structure" (CIMMYT, 1969:69). This is mentioned in passing to emphasize that the acquisition of information about and the research analysis of a social system (B2, B3, and B4) may need to occur simultaneously with activities which have other stated purposes, in this case, to introduce a SFDP to and legitimate it with local authorities.
It is reasonable to assume that local authorities who attend a meeting such as those described above may not want or may not be able to give the names of farmers in their area who possibly would be interested in participating in the project without first having the opportunity to return to their villages to explain the project to local farmers and to find out which farmers might be interested. Thus, even when the Puebla Project staff held meetings with local authorities in early 1968, just prior to that Project's research trial step (F3), and were able to show to the authorities photographic documentation of the positive results of the 1967 research experiments (D3), the "authorities usually asked for time to return to their villages to explain the project and find out who might be interested" (CIMMYT, 1969:69).

Remember, however, that the model outlined here is proposed for utilization at step B1 (legitimation) which is considerably prior to the execution of the research experiment step (D3). It is thus reasonable that at step B1, the SFDP should allow and encourage authorities to "return to their villages to explain the project and find out who might be interested."

In the Puebla Project, it was left up to the local authorities to set up meetings for the Project technicians "to explain the project to farmers and suggest how they might participate" (CIMMYT, 1969:69).

Through this two-step process it was finally possible to have meetings with the farmers themselves, along with the local officials in many communities of the area. In every case, the authorities were encouraged to invite all members of the community. The advantage of this approach was that the authorities took the initiative in organizing the meetings in each community, and this gave the technicians of the project a chance to evaluate the level of influence of these authorities and the level of community organization (CIMMYT, 1969:69).
Where authorities did not express interest in the Puebla Project, the Project staff decided not to take any further action with respect to those authorities' villages until the research trial step (F3), when the high yield plots of participating farmers would be ready for inspection by non-participating farmers and local authorities during the result demonstration phase (G). However, in terms of the CSA-SFD as diagrammed in Table 4.1, if a SFDP staff is able to establish legitimation of the project vis-a-vis local authorities prior to step B3 (research analysis of SFS), then the project would have the option of attempting to spark the interest of hesitant local authorities at three later points in time: (1) at the much later result demonstration step (G) following the research trial step (F3); (2) at the legitimation for research trial step (F1) following the SFT specification step (E); and (3) at the legitimation for research experiment step (D1) following the problem specification/hypothesis formation step (C). Once initially disinterested authorities have had a chance to see the positive outcome of a successfully completed action step--either the results of the research experiment step (D3) or the trial research step (F3), some may reassess their initial decision not to cooperate with the project. Indeed, on the basis of the information (e.g., photographic documentation) that the Puebla Project was able to provide in the meetings with municipal officials at the legitimation for research trial step (F1),

...several...were ready to guarantee that the farmers of their villages would be interested. And in a few cases the authority himself was ready to be one of the participants and to initiate work in his village with the Puebla Project (CIMMYT, 1969:69).

When officials are given the opportunity (1) to learn about and participate in a SFDP and (2) to assist in identifying farmers in their vil-
lages who would be willing to also participate in the project, the SFDP will be in a stronger position vis-à-vis legitimation than if the project tries to go it alone, bypassing the "existing power structure" and individually contacting farmers, only to find that the project in doing so has accomplished little more than to generate "the negative attitude...and...hostility of many farmers" (CIMMYT, 1969:69).

Meetings with farmers

The Puebla Project held a total of 31 meetings with farmers. Since the Project carried out the legitimation step vis-à-vis local authorities prior to the research trial step (F3), the objective was to select farmers who would be willing to participate in the research trial program of high yield plots. Also, as the Project was interested in conducting further research experiments (fertilizer rate and other studies) in the farmer's fields, the Project continued to seek farmers who would be willing to let segments of their SFSs to be used for research experiments.

The task here, however, is to outline a model or procedure for selecting farmers who would be willing to permit researchers to study the SFS at step B3 (research analysis of SFS). While the SFDP staff might discuss with farmers in the target area the possibility of their eventual participation at the research experiment (D3) and/or research trial (F3) steps, it should be remembered that these steps (D3 and F3) are yet in the future. Accordingly, here at the legitimation step (B1), the SFDP is concerned only with the objective of working through the "existing power structure" as the means of setting up meetings with farmers at which the project staff can explain the project to farmers and provide them an opportunity to participate in the project at the research analysis of SFS step (B3).
In view of the fact that the research experiment (D3) and research trial (F3) steps are still considerably distant, the SFDP staff may not wish to even discuss these steps with farmers here at step B1. Indeed the procedure of contacting all municipal presidents in the target area and holding meetings both with local authorities and then with farmers, as outlined above, may be somewhat elaborate relative to the limited objective of legitimation at B1, i.e., of selecting farmers who would be willing to let their SFSs be studied by the SFDP staff. A decision in this regard is perhaps one which a SFDP must make in view of the particular situation of the target area in which the project is to operate. And this decision perhaps cannot be made without first acquiring a modicum of understanding about the nature of the target area's small farm and agri-support systems (see steps B2 and B3 below). Should the SFDP staff deem the model or procedure for identifying and selecting farmers as too elaborate in light of the limited objective here at step B1 and the information available to the project about the target area's agri-support and small farm systems, the procedure could be considerably scaled down by contacting fewer local authorities and, in turn, fewer farmers.

The important point, however, is that legitimation is a crucial requisite at the outset (B1) with respect to the activities which the SFDP wishes to undertake at step B3, as well as throughout the various steps involved in implementing the CSA-SFD. Consequently, legitimation has been discussed at great length in regard to step B1 in order to develop a framework for discussing legitimation at subsequent steps (D1, F1, and H1).

**Steps B2 and B3: Analysis of existing social systems**

The SFDP gains access through the process of legitimation (B1) to the various
agri-support and small farm systems in the project's target area and, thereby, to considerable information on key elements in each of the delineated subsystems. This information will be essential if the SFDP is to avoid the pitfall of not "looking" before "leaping," i.e., of launching a "crash program" to develop technologies that are later found to be either unworkable with or not beneficial for the small farmer. If the process of generating such information "is adequate, and existing institutions are discovered, then, whatever the decision for action may be, it may be possible to predict some of the [potential] sources of...rejection" (Axinn, 1971:15-16) to the SFDP in general or to SFT in particular. If the SFDP ignores analyzing the existing agri-support and small farm systems (B2 and B3), in effect, making "the assumption that nothing exists, then rejection will come from unknown sources" (Axinn, 1971:15).

The Social System Elements Model (SSEM) presented in Chapter 2 provides a heuristic outline of the kinds of specific elements that a SFDP should attempt to identify both in the SFSs for which SFT is to be developed and in the various NASs whose CPFs small farmers may require in order to be able to adopt a particular SFT once it is developed. While a SFDP may not actually undertake an extensive research analysis of the NAS (B2) until after having conducted the research analysis of SFS Step (B3), the analysis of the agri-support system is first discussed here in light of the argument advanced in the preceding section on legitimation (B1) that the SFDP will need to work through the agri-support system as a means of establishing contact with small farmers. In the process of legitimizing the SFDP vis-à-vis the agri-support system, the project staff will come in contact with various persons or organizations that can serve as sources of
information in the various agri-support subsystems even before the project establishes contact with small farmers.

**Step B2: Research analysis of NAS**

The information which a SFDP obtains on the various social system elements of each NAS is essential in assisting the project to estimate the capacity of each subsystem to provide such CPFs as farmers may require from the NAS in order to be able to adopt a particular SFT. In those instances where estimated capacity falls short of projected needs, the SFDP can seek to achieve at the various agri-support system mobilization steps (D2, F2, and H2) the necessary changes in those subsystems whose estimated capacities have been found to be deficient. In view of these considerations, a SFDP would be well advised to learn as much as is feasible about the NASs that are likely in one way or another to be involved in the project. As the Puebla Project encountered:

> An understanding of the resources and functioning of the agricultural institutions, together with a projection of the needs of the project for the coming years, provides a basis for seeking change within an institution (CIMMYT, 1969:29).

To illustrate the general applicability of the SSEM in identifying relevant elements in the NAS, each of the social system elements is again briefly defined below (cf. previous discussion of a SSEM in Chapter 2) along with an example for each element drawn from The Puebla Project report.

**Power** is the capacity to control others through either authority or influence. **Example:** The Puebla Project staff attempted to identify the "chains of command of both federal and state agencies and...how federal and state agricultural activities are meshed" (CIMMYT, 1969:29). The importance of a SFDP's awareness of the distribution of power in the LDC in
which the project is to operate is illustrated both in a number of the preceding examples and in the discussion that follows. If certain changes requisite for the success of a SFDP cannot be realized at the local level, the project staff must know at which level of the NAS the desired changes can be achieved. Generally, in the LDCs, considerable power lies at the national or federal government level, if not at the state or regional level. As observed in The Puebla Project report:

The essential aspect of the political environment is that government must warmly support the objective of rapidly increasing...yields and have the will and the power to modify existing policies and agencies as necessary for achieving this goal. This is especially important in respect to availability of key inputs, orderly marketing of [produce], and the relationship between the cost of principal inputs and the price of [outputs] at the farm. The government must more than passively approve of the idea; it must actively participate in removing obstacles that prevent or slow down farmer use of modern technology (CIMMYT, 1969: Introduction).

Rank is the value an actor has for the system in which the rank is accorded. Example: The importance of an awareness of the social organizational element of rank within the NAS is demonstrated in the Puebla Project. The success of the Project was dependent in part on an understanding of the social structure of the village as a social system and of the structure of leadership within the village:

The head village is known as the "cabecera municipal" where the municipal president and other local authorities reside. Each community within the municipio has auxiliary authorities responsible to the municipal president (CIMMYT, 1969:69).

In initially bypassing the local officials of important rank, the Puebla Project jeopardized the success of the Project; once, however, the Project staff began to work through these officials, the legitimacy of the Project and its chances for success were considerably enhanced.
Status-role is that which is expected from an incumbent of a social position. Example: In familiarizing themselves with the various NASs involved in agricultural development in Mexico, those who coordinated the Puebla Project also attempted to identify the "responsibilities of key individuals in the different organizations and their relationships one to the other" (CIMMYT, 1969:29). This familiarity was an essential in subsequently working out interrelated changes in the various NASs. To illustrate:

The crop insurance agency maintained that once the new recommendation had been accepted by the credit banks and their clients, such operations could qualify for insurance. However, this agency was found to have well-defined operating procedures that did not permit coverage for individual small farmers. Again, change was necessary for the crop insurance agency to participate, and this meant the presentation of proposals to higher authorities and favorable action at that level (CIMMYT, 1969:31).

A SFDP, therefore, must know the responsibilities of individuals at each level as a basis for determining at which level the project should be seeking the changes that will be necessary in the NAS if the project is to be successful.

Norms are rules which prescribe what is acceptable or unacceptable in a particular situation. Example: The Puebla Project staff discovered that at the time the Project was initiated the fertilizer...
We see in this example that two agri-support subsystems (i.e., the Ejido bank and the crop insurance agency) had certain "rules" or norms as to what was the acceptable way of handling the distribution of fertilizer and obtaining crop insurance. If the Puebla Project had not recognized these elements and arranged means whereby farmers would be able to get credit and crop insurance, the farmers would not have been able to adopt the particular SFT recommendations that would be formulated by the Project technicians.

Beliefs are propositions about the universe which are thought to be true or right. Example: A SFDP must be aware of what actors believe to be true and how an actor's beliefs influence his or her actions. This awareness is even more crucial for a SFDP to have in regard to its own beliefs. Thus, for example, the Puebla Project assumed in setting up its "demonstration" program of high yield plots to follow

...largely the usual system for planning and locating demonstrations--choosing highly accessible points on good soils where the largest possible number of farmers could see the plots. This approach implied that the fields should be located first and the owners then convinced to participate with demonstrations on these particular fields (CIMMYT, 1969:68).

As discussed earlier in the section on legitimation (Bl), the Project staff eventually realized that it would be better to locate the high yield plots by first working through the local authorities, i.e., through the existing community-level decision-making system. In contrast to the success the Project encountered utilizing the latter approach, it may be seen that the assumptions or beliefs underlying the former approach were erroneous.

Sentiments are feelings which an actor has about a thing, an event, or a place. Example: As illustrated above in regard to beliefs, sentiments
also have a bearing on the decisions which an NAS will or will not make.
Thus, in the process of analyzing the various NASs, the Puebla Project found that the various institutions

...accepted the findings of the project, but were uncertain as to their participation. In the case of the three officials banks, there was reluctance to introduce changes of the suggested magnitude before their value had been demonstrated in a network of commercial plantings. . . . The general feeling was that more information was needed before the local institutions could recommend to their superiors at the national level that...policy be changed (CIMMYT, 1969:31; emphasis added).

This excerpt illustrates the important influence which "feelings" or sentiments can play in the decision-making of the NASs whose participation will be essential for the success of a SFDP.

Objectives or ends are the changes which a social system's individual actors expect to accomplish through interaction with the system. Example: Those who coordinated the Puebla Project attempted to familiarize themselves with "all the national, state, and local institutions, as well as private organizations, involved in agricultural development" (CIMMYT, 1969:29). In The Puebla Project report, it is noted that the coordinator attempted to identify the "objectives...of each institution" (CIMMYT, 1969:29). Relatedly, it was noted that "governmental yield increase programs are usually aimed primarily at the commercial farming sector" (CIMMYT, 1969: Introduction).

Sanctions are the rewards (positive sanctions) or penalties (negative sanctions) which motivate an actor's conformity to the objectives, facilities, and norms of the system. Example: An agri-support subsystem is not likely to change its procedures if such change is likely to jeopardize the
rewards (positive sanctions) which their current procedures ensure. Thus, in the Puebla Project, it was found to be difficult to convince

...private fertilizer distributors to substitute ammonium sulfate and superphosphate for 10-8-4. The main problem was that distributors had already ordered the 10-8-4, and were not sure they could sell an additional order of fertilizer materials. Also, the distributors were uncertain that farmers would accept the new recommendations and know how to use it properly (CIMMYT, 1969:32).

In other words, the existing procedure for distributing fertilizer provided the private dealers with certain sanctions (i.e., profits). Without an awareness of the dealers' hesitancy to change their present procedures, the Puebla Project staff might have proceeded under the assumption that the right kind of fertilizer would be available to farmers on time for its proper application. The Project staff, however, was aware of the distributors' hesitancy to make the recommended changes in regard to fertilizer and, accordingly, sought other means to ensure that a mechanism was set up whereby farmers would be able to obtain the appropriate fertilizer on time.

Facilities are the means which actors (individuals or subsystems) use to attain their objectives. Example: The Puebla Project also attempted to identify the "organization and operating procedures of each institution" (CIMMYT, 1969:29). In the process of doing so, the Project discovered that

...the agricultural credit banks [did] not have sufficient credit allotted to corn production to cover the potential demand.
...either the banks must find a way to increase the credit available for corn or new sources of financing will have to be found (CIMMYT, 1969:29).

It was also found that the crop insurance agency had "well-defined operating procedures that did not permit coverage for individual small farmers" (CIMMYT, 1969:31). Thus, the facilities (e.g., credit allotted, operating procedures, etc.) of two NASs (i.e., the agricultural credit banks and the
crop insurance agency) were not set up to serve the SFS. Had the Puebla Project staff not analyzed the existing NAS and identified therein the bottlenecks to increasing corn yields at the SFS level, adequate information to determine exactly which changes were required in the NAS would not have been available.

**Step B3: Research analysis of SFS** In addition to the research analysis of NAS step (B2), the SFDP must also analyze the existing SFS (B3) in the project's target area. While the SFS may vary in certain characteristics (e.g., the nature of the tenure system) from one LDC to the next, Chapter 2 nevertheless utilized the SSEM to provide a general framework for classifying a variety of small farm-related phenomena. The SSEM is again drawn on here in step B3 to suggest the possibly relevant elements in the SFS. As the nine social system elements have previously been defined (cf. Chapter 2 and step B2), the author will only provide some brief examples to illustrate each of the nine elements in the context of the Puebla Project. While the SSEM (as developed in Chapter 2) was not utilized to guide the Puebla Project's collection of data at the SFS level in the Puebla area, the variety of data reported (CIMMYT, 1969) can nevertheless be readily, though perhaps somewhat loosely, organized in terms of the SSEM. Accordingly, each of the nine elements listed below is followed by a brief narrative or excerpt from *The Puebla Project* report which contains data illustrative of the more general level social system element under which the excerpt or narrative is classified.

**Power:** Only a small percentage of farmers in the area were renters (4%) or sharecroppers (4%), the majority of the farmers being ejidatarios (38% with 32% of the total area), private small holders (28% with 30% of
the total area), or ejido-private holders (34% with 37% of the total area) (CIMMYT, 1969:16). Compared to the small farmers in other areas of the world, the majority of the farmers in the target area of the Puebla Project were not the victims of an onerous tenure system. As is noted in *The Puebla Project* report.

Beginning about 50 years ago, at the time of the agrarian revolution, the large haciendas in the area were broken up into small private holdings and ejidos. In nearly all cases the ejidatarios in the area have also chosen to operate their land individually. Consequently there are 50,000 individual decision makers who have the final say on whether to introduce new production practices (CIMMYT, 1969:17).

**Rank:** The small farmer in Mexico ranks relatively low in social stratificational terms. This is demonstrated by the following data.

a. The average number of years of schooling is 2.36 years; "at least half of those who read and write do so with considerable difficulty" (CIMMYT, 1969:17).

b. The average amount of land per family is 2.457 hectares; the average number of hectares planted in corn per family is 1.7 ha (CIMMYT, 1969:14).

c. Eighty-three percent of the farmers have their land divided up into at least two parcels (CIMMYT, 1969:16).

d. The average income per family is U.S. $505 (CIMMYT, 1969:18).

e. The following percentage of families are without the stated service: electric lights (37%); radio (40%), sewing machine (65%), gas, electricity or fuel oil for cooking (71%), pumped water in home or street (87%) (CIMMYT, 1969:18).

**Status-role**

At certain peak labor periods, such as planting and harvest, the whole family helps in the field and additional workers may be hired. As the fields are often far from the village, the women sometimes bring the noon day meal (CIMMYT, 1969:17).
Norms

The ejido land, by law, cannot be further subdivided; the ejidatario can name a single heir to take over the use rights to his land (CIMMYT, 1969:16).

Complete weed control runs contrary to the common practice of leaving the weeds which develop around the plants after the second cultivation to be cut for animal feed during the growing season (CIMMYT, 1969:68).

Beliefs

...the quantities applied, the formulas used and the time of application are far from optimum, yet the farmers have a good reason for each. The quantity is determined, not in terms of maximizing gains, but rather of, "if I don't use fertilizer, I don't harvest enough to feed the family." They see a need to use some fertilizer as a way to avoid a crop failure (CIMMYT, 1969:20).

Sentiments

...farmers, rightly or wrongly, feel that the cost [of crop insurance] is too high and that they receive too little in return. Instead of viewing crop insurance as a desirable thing, they cite it as an important disadvantage of official credit (CIMMYT, 1969:24).

Objectives or ends

At the time of the bench mark survey in January-February 1968, ...production was being carried out...with little thought given to maximizing returns to land, labor or capital (CIMMYT, 1969:19).

When asked why they plant corn every year, the following replies were obtained (CIMMYT, 1969:19).

Because this is what the family lives on 52.2%

The land is only good for corn 35.0%

The reasons given for deciding when to sell indicate...that price criteria play a limited role in this decision. Of primary importance are the needs of the moment (CIMMYT, 1969:22).

Sanctions

The...question...is whether there was in fact available a hybrid which would yield better than local varities. ... The 1968
data...appear to indicate yield superiority of the hybrids which were recommended for the region before the Project began. At six locations H-28 varied from 5% under the local criollo to 39% above. H-129 varied from 9 to 19% above the criollo. However, these potential yield differences were either not great enough to be noted visually by the farmers or were not sufficiently consistent from year to year to impress them. Less than 1% of the farmers planted a hybrid in 1967 (CIMMYT, 1969:21).

Facilities

The most prevalent farm unit throughout the area is the family farm. The family, with an average of 5.537 members, provides both the management of the resources used in agricultural production and most of the labor used on the farm (CIMMYT, 1969:17).

...production was being carried out in traditional ways (CIMMYT, 1969:19).

The time of application--not using any at planting--is the way that farmers avoid losing the fertilizer in case of poor germination or failure of the planting for any other reason. They prefer to wait until the stand is well established and the rains appear to be coming regularly (CIMMYT, 1969:20).

Admittedly, these few excerpts cannot begin to give a complete picture or detailed social system analysis of the SFS as a primary target system in a SFDP. The excerpts, however, do serve to suggest that the SSEH encompasses the wide range of information on the SFS which the Puebla Project staff had to take into account as an objective basis for determining what the actual CPS of the small farmer was, the problems which were involved relative to the objectives the farm family sought through operation of the CPS, and what the feasible technological solutions to these problems might be.

In addition to considerations as to the kinds of data which a SFDP wishes to obtain on the SFS in the project's target area, the project must also address the question of how these data are to be obtained. The Puebla Project experience provides some guidelines in this respect.
The Puebla Project utilized primary and secondary data sources to collect data on the SFS in the Puebla area and that system's relation to the NAS. It should be pointed out, however, that the Project did not initiate the collection of primary and secondary data on the SFS to any considerable extent until late 1967 and early 1968, several months after the Project had concluded the fertilizer rate studies at the research experiment step (D3) during the growing season of 1967. In other words, the Puebla Project had initiated the research experiment step (D3) prior to initiation of the various primary and secondary data collection efforts of the evaluation team that were to later provide the broader set of data that was necessary for a more thorough analysis of the SFS. In terms of the CSA-SFD, a SFDP would have engaged in such a "more thorough" research analysis of the SFS (B3) prior to undertaking the research experiment step (D3). Accordingly, the discussion which immediately follows encompasses both the research analysis activities undertaken by the agronomists at the outset of the Puebla Project as well as the broader data collection efforts later initiated by the evaluation team.

Rather than undertaking a comprehensive study of the SFS at the outset of the Puebla Project, the Project's agronomists relied largely on informal visits to the project area as the principal means of acquiring the information that would be utilized in specifying what the farmers' problems were and in formulating hypotheses which could be subsequently tested at the research experiment step (D3).

Several visits were made to the project area to question farmers concerning their production practices and to observe soil characteristics at many locations. Also, agricultural scientists with experience applicable to the region were interviewed to obtain their ideas on management practices being used by farmers.
In this way it was possible to arrive at the following tentative
description of existing production methods in the region.

Shortly after harvest in November and December most farmers
plow their land and smooth the surface by dragging it with a
heavy log or similar object. In February and March they plow and
smooth the surface a second time. At planting, the land is
rowed-out quite deeply and the seeds are placed about 10 cm below
the bottom of the furrow by opening the soil with a hand shovel.
Generally two to three seeds are planted in hills about one meter
apart in rows 90 cm wide. This planting procedure results in
about 15 to 25 thousand plants per hectare. The date of planting
in different parts of the region was found to vary from early
March to the middle of May, depending largely on the amount of
residual moisture conserved by the soil and the time and inten­
sity of the rains. Many of the farmers were accustomed to apply­
ing a small amount of a fertilizer containing nitrogen, phospho­
rus and potassium as a side dressing at the time of the first or
second cultivation. Weeds were controlled by two cultivations
given at about 30 and 60 days after planting (CIMMYT, 1969:38).

Only a few months later, once the coordinator was hired, did the Proj­
et really begin to be "conceived...as a test of a methodology for obtain­
ing rapid yield increases among small holders" (CIMMYT, 1969:81). Rela­
tedly, only then was it recognized that it was "essential to know precisely
what happens as a result of the project and to the extent possible, min"
(CIMMYT, 1969:81). To answer these questions,

...the decision was...made to include evaluation as an integral
part of the project in order to obtain not only before-and-after
measurements but also a more or less continuous feedback to those
in charge of the action program. . . . The coordinator was
especially interested in having rapid and easy access to evalua­
tion of different problems, key limiting factors and potential
solutions; such information would be of value to him in con­
stantly assessing and redefining strategy. . . . Consequently,
it was imperative to: 1) immediately establish bench marks on
yield, technology employed, level of living, etc., for future
comparisons, 2) obtain information about the farmers and their
present level of technology for use in planning the action pro­
gram, and 3) obtain information on the infrastructure of the
region -- fertilizer distribution, agricultural credit crop
insurance and price support programs (CIMMYT, 1969:82).
Once the Puebla Project recognized the need for a broader approach to
the study of the SFS, efforts were initiated to obtain more complete data
on the SFS through various primary and secondary data sources. First,
eexisting information (secondary data) on the Puebla region was collected.

Unpublished data for 1960 covering the municipios in the study
area were obtained from the Census bureau. This gave a tentative
idea of the total area and number of farm families involved, the
total area planted to corn and amount produced, and an idea of
the size of holdings.

Yearly data by municipio from the Dirección General de Eco-
nomía Agrícola provided additional data on area, production and
yield. The methods of data collection and yield estimation
employed by this latter agency were studied to determine whether
such data would provide an adequate estimation of yield changes.
It was decided that in this case it would be convenient to obtain
a more precise measure of yield in order to be certain to detect
minor year-to-year changes (CIMMYT, 1969:82).

In order to obtain more precise estimates of yield and characteristics
of the farming population, the Puebla Project conducted a personal inter-
view survey of a probability sample of the small farmers (farm operators)
and their families. The sample would also serve as a basis for "later...
objective yield measurements of the kinds now being used successfully in
various crops and various parts of the world" (CIMMYT, 1969:82). In view
of problems previously encountered in other parts of Mexico in attempting
to use Census lists by municipios as a sampling frame and that eight years
had passed since the lists were last drawn for the 1960 Census, the Project
decided to use an area sampling technique. This technique was feasible in
the Puebla Project "because of the availability, at a moderate price, of
aerial photos taken just six months earlier" (CIMMYT, 1969:82).

Excerpts describing the procedure of executing the area sampling tech-
nique follow:
In order to keep costs at a reasonable level, a two-stage sample was drawn. The sample was selected in the following manner. Using a map of the region provided by the Mexican Defense Department, the project area was first delineated. Then 25 points were identified by locating coordinates with a list of random numbers. These points were then transferred to the aerial photos and a 5 cm x 5 cm square was drawn with the point as the center. This 25 cm² area was equal to 100 hectares. These squares were then photographed and enlarged to a size which simplified identification of individual parcels and in a proportion which permitted more precise measurement and easy calculation of area. For example, an area 5 cm by 2 cm was equal to 1.0 hectare.

The first stage of the field work consisted of locating the segments and finding reference points--trees, cross-roads, gulleys--that would help to identify the parcels in the segment photo. Once the segment boundaries were established, the next step was to obtain the names of those who had operated each piece of land in 1967. Anyone who operated any land within the segment, even though most of his land was outside of the segment, therefore became part of the sampling frame. The plots were numbered chronologically on the map as identified and the names of operators corresponding to the numbers were listed on a separate sheet. This list of names served as the sampling frame for the second stage. The number of segments to be included in the sample and the number of farmers needed in each segment were estimated from the variability in two sets of data: 1) yield data from the fertilizer trials planted throughout the area in 1967, and 2) yields measured on a sampling of farmers' fields in two municipios of the area in the fall of 1967.

Based on these data, a 12% sample was drawn in each segment in order to finally obtain 10% of the farm operators in the segment. A total of 251 farm operators were interviewed in the 25 segments (CIMMYT, 1969:82).

In December, 1967, the interview schedule was pretested and subsequently revised.

Students, principally from the National School of Agriculture at Chapingo, conducted the bulk of the interviews during a six-week period from January 2 to February 15, 1968 (CIMMYT, 1969:84).

Step B4: Research analysis of prior social situation In addition to identifying the relevant elements in the existing agri-support (B2) and small farm (B3) systems, it is also important that a SFDP analyze to the
extent possible the prior social situation in both of these systems in
terms of each of the nine elements of the SSEM. An awareness or knowledge
of events which occurred in the past in either the agri-support or small
farm systems may be of assistance to the SFDP. Thus, for example, it would
be useful to know if small farmers have had some sort of negative experi­
ence in the past with extension workers (status-role) which has led farmers
in the present to generally not trust (sentiment) extension workers
(Byrnes, 1966:242-256). If those planning a SFDP are aware of the relevant
elements in the prior as well as the existing social situation, this aware­
ness should provide a "basis for sounder planning and action" (Beal et al.,
1966:78).

Once the SFDP has conducted a research analysis of the prior and exist­
ing agri-support and small farm systems (in steps B2, B3, and B4), or at
least collected a broad spectrum of data on these systems, the project is
ready to evaluate this data at the problem specification/hypothesis forma­
tion step (C).

Phase C: Evaluation (Problem specification/hypothesis formation)
Evaluation may be generally defined as the review and analysis of previous
action steps to determine whether these steps have been successful in
attaining their objectives. "On the basis of this evaluation, projections
should be made as to logical next step actions" (Beal et al., 1966:77).
In view of "the importance of constant evaluation throughout a social
action program" (Beal et al., 1966:77), the CSA-SFD incorporates the evalu­
ation step not only at phase C but also at phases E (Small Farmer Technol­
yogy specification), G (Result demonstration), and I (Total evaluation and
continuation of SFDP) during Stage II's Diffusion Sets.
While it may be concluded on the basis of evaluation that a SFDP should move on to the next action step in the CSA-SFD, i.e., to the legitimation for research experiment step (D1), the conclusion might also be drawn either that one or more of the steps taken to date by the SFDP was not successful or that the project failed to execute one or more steps which should have been taken. In either case, the SFDP would need to consider the possibility of repeating one or more of the steps previously taken and/or introducing steps which should have been taken. Once a decision is reached on the adequacy of previous steps, the SFDP must make plans to implement the decision into action. Finally, on the basis of these plans, the appropriate action steps should be implemented.

It is important to emphasize that the SFDP has to this point developed no recommendations in regard to technological changes which small farm families in the target area should make in their CPSs or, similarly, in regard to action which the agri-support subsystems should take with respect to small farmers. Indeed, to this point, there has been no empirical demonstration that any technological alternative would be any more beneficial to small farmers than the technology which they currently employ or that any technology which might be more beneficial would also be workable in the SFS. To this point, the SFDP has been concerned only with acquiring a wider input of information on which to base an understanding of the SFS and the various agri-support subsystems. Given, however, that a wide input of information on the target area has been collected during phase B's research analysis steps (B2, B3, B4), the SFDP must now (1) specify what the problems of the small farmer are in the target area and (2) formulate hypothe-
ses as to the kinds of technology which might be developed to assist small farmers in solving the specified problems.

Such hypotheses, however, are only that, for there is no guarantee that the hypothesized technological changes in the farmer's CPS would indeed prove to be workable and beneficial. The only way that this can be known, of course, is to conduct the appropriate experimental research within a number of SFSs. Additionally, even if the technology in question is found to be both workable and beneficial, the SFDP will also have to ensure that mechanisms are established within the various agri-support systems, whereby small farmers can gain access to any CPFs necessary for adoption of the technology. The mobilization of the NAS in this regard, however, will not become a major concern to the SFDP until the agri-support mobilization step (F2) during the innovation phase (F) which follows the SFT specification step (E).

Of course, before the SFT specification step (E) can be taken, the SFDP must first undertake the experimental research (D3) without which workable and beneficial technology (i.e., SFT) cannot be identified. In turn, before the research experiment step (D3) can be taken, the SFDP must first complete the problem specification/hypothesis formation step which comprises the initial evaluation phase (C).

The experience of the Puebla Project provides a more detailed example of the problem specification/hypothesis formation step (C). On the basis of the data collected by the Project's production agronomists in early 1968, the Project staff was able to specify a number of problems in the production phase of the small farmer's CPS.
Research information from the Project area and similar regions indicated that existing management practices were irrational in several ways. Available information suggested that the optimal plant population for the area should be 50,000 per hectare for well-fertilized plantings, instead of the 15 to 25 thousand per hectare that farmers were using. The amount of fertilizer in use was obviously too small, and it seemed likely that the proportion of nitrogen to phosphorus should be increased and potassium should not be applied. Also, it was expected that, in contrast to existing practice, the phosphorus and a small amount of the nitrogen should be applied near the seed at planting time, and the remainder of the nitrogen should be added as a sidedressing (CIMMYT, 1969:38).

These conclusions reflect that the Puebla Project staff perceived the small farmer's problems as lying in technological deficiencies in the way the farmer combined the various CPFs. While these conclusions reflect some consideration of the ways in which the technological deficiencies might be overcome, there is no clear cut statement as to specific hypotheses which an experimental research program should test. This step, however, was taken once the Puebla Project set the priorities for its experimental research program.

Although all the production practices were in need of study, it was decided that plant density, kind and amount of fertilizer, and time of applying the fertilizers should be the aspects receiving first priority. Furthermore, it was felt that information from other regions on plant population and time of applying the fertilizers could be extended to the project area with reasonable success. Therefore, it was decided to concentrate the research effort in 1967 on determining the amounts and kinds of fertilizers to apply and postpone other agronomic studies until 1968. The general strategy was to keep the agronomic program flexible, so that the experimental studies conducted in a given year would take into account the findings of the previous years (CIMMYT, 1969:39).

These excerpts illustrate that a SFDP must specify at phase C what the small farmer's problems are (e.g., low yields, suboptimal plant populations and fertilizer rates). Then the SFDP must formulate hypotheses as to the kinds of technology that would assist the farmer in solving the specified
problems. In the case of the Puebla Project, for example, the Project staff hypothesized that an experimental research program would most likely meet "with reasonable success" if initially concentrated on "determining the amounts and kinds of fertilizers to apply." The Puebla Project, thus, decided that the small farmer would be most assisted by solving the problem of how to increase yields. If the Project could develop a technology which specified the amount and kind of fertilizers that, in combination with other management practices, would increase the farmer's yields, the problem would be solved. The reader will note in terms of Chapter 2 that the Puebla Project focused primarily on attempting to develop SFT to assist the small farmer to more optimally achieve objective number 4 in Table 2.5.

Once a SFDP makes a decision (i.e., formulates a hypothesis) that it would be better to initiate an experimental research program on a particular set of hypotheses, the project is ready to proceed to the legitimation for research experiment step (D1) of the experimentation phase (D). As this step (D1) is the first step in the initial phase [Experimentation (D)] of Stage II, an overview of both Stage II (Diffusion Sets) and phase D (Experimentation) will first be discussed.

**Stage II: Diffusion Sets**

Once the SFDP has specified (during phase C) what the small farmer's problems are and has formulated one or more hypotheses as to the kinds of technology which might assist the small farmer in solving the specified problems, the project is ready to begin Stage II of the CSA-SFD. This second stage involves (1) developing SFT either directly through experimental research on-the-farm or indirectly through crop or livestock varietal
improvement research and subsequent on-the-farm experimental testing of the new varieties and (2) diffusing that technology to small farmers throughout a SFDP's target area. Beal et al. (1966:82) have suggested that the Diffusion Sets involve two different aspects.

First, the planning group [e.g., the SFDP] must make major decisions relative to the next step strategies of the program before moving to the next step. Such decisions should be made taking into consideration the suggestions and reactions of the consultants [e.g., the small farmer] and/or legitimizers [e.g., key individuals in the agri-support system such as local authorities] in preceding steps. The second aspect of this step is:

...the preparation to diffuse the basic ideas of the new program to the target group. ... There may be a need at this stage to involve people to help conceptualize the strategy of communication. Once the general strategy is agreed upon, people should be involved who can best conceptualize and diffuse the essential ideas of the new program to the relevant target systems. The people who perform these functions are called the Diffusion Sets (Beal et al., 1966:82-83).

The CSA-SFD designates small farmers as the principal Diffusion Sets in SA-SFD. Throughout Stage II, the SFDP will attempt to further involve small farmers in the various action steps of the project. These activities will include the research experiment (D3), research trial (F3), result demonstration (G), and legitimation for large-scale adoption (H1) steps. It may be hypothesized in regard to these action steps that the small farmer whose family has benefitted through the farmer's adoption of a particular SFT is better able to communicate or "diffuse the essential ideas of the new" technology to other farmers in the target area than persons in any other status-role (e.g., a SFDP staff member). This hypothesis is clearly supported in the Puebla Project although there is ample evidence to
suggest its validity in numerous other instances (Byrnes, 1966; Byrnes and Byrnes, 1971).

Phase D: Experimentation Once the SFDP has identified at the problem specification/hypothesis formation step (C) which hypotheses merit further investigation at the research experiment step (D3), the project is ready to enter the experimentation phase (D). In this phase, the SFDP is primarily concerned with the steps involved in preparing for and carrying out the experimental testing of the selected hypotheses within the SFS. As the reader will note (see Table 4.1), phases D (experimentation), F (innovation), and H (adoption) are divided into three distinct steps: legitimation (1); mobilization of NAS (2); and the action step carried out at the SFS level (3)—specifically, the research experiment (D3), research trial (F3), and large-scale adoption (H3) steps.

Step D1: Legitimation This step in the implementation of a SFDP considerably parallels two steps in the general "Construct of Social Action": "Definition of Need by the More General Relevant Social Systems" (Step 14) and "Commitment to Action" (Step 16). It is at this step that the SFDP initiates activity to at least further involve the small farmers who have already been participating in the project since the research analysis of SFS step (B3) in the project's next step at the SFS level, namely, the research experiment step (D3). At step D3, the problem of developing and diffusing SFT becomes, in effect, even more "the farmer's problem" (paraphrasing Beal et al., 1966:83-84). To recruit farmers to participate in assisting the SFDP to set up and carry out the research experiments at step D3, the project would utilize here at step D1 the small farmer identification/selection model previously discussed in step D1.
A general pattern for executing the legitimation for research experiment step (D1) may be drawn from the Puebla Project experience. Recall that the Puebla Project held a total of 31 meetings with farmers to explain the project and suggest how the farmers might participate in the 1968 program by providing plots for experimental work. In carrying out the experiments,

...the farmer would be expected to provide his land, his work, his equipment, and his time for giving special care to the plot. . . . Because of the great...care needed for an experiment and the fact that check plots and low-fertilizer treatments would yield very little, the project provided the fertilizer. ...the technicians of the Puebla project would take full responsibility for the technical direction of the experiment (CIMMYT, 1969:69-70).

It is important to emphasize here as a point of clarification that the Puebla Project had already completed an initial round of research experiments (i.e., the 1967 fertilizer rate studies) prior to the meetings held with farmers in 1968, just prior to that Project's research trial step (F3) of high yield plots. While the Puebla Project did seek in these meetings to find additional farmers to participate in the Project's program of research experiments (i.e., the continuation of the research experiment program begun in 1967's fertilizer rate studies), the primary emphasis was to utilize the meetings as a vehicle for selecting farmers to participate at the research trial step (F3) of high yield plots. The legitimation step that a SFDP takes with regard to this latter step (F3), however, is not discussed in the present construct until step F1 (legitimation for research trial step).

Generalizing from the Puebla Project experience, a SFDP would seek at step D1 (legitimation for research experiment) to recruit a number of small
farmers who would each be willing to assist the project staff in setting up a research experiment on the farmer's own unit of operation. In the case of a plant-CPS, the farmer would be expected to provide the family's own land, for an animal-CPS, the family's own livestock. In addition, the farm family would be responsible for taking routine care of the experiment (e.g., weeding the plot, feeding the pigs, etc.) on its own time and using its own equipment. While the farm family would be responsible for the actual execution of tasks necessary to care for the experiment, the SFDP staff would be responsible for providing technical direction as to which tasks to do and at what time the various tasks are to be done. In short, the SFDP would seek to recruit farmers who would be willing to responsibly care for the research experiment as if it was their own operation. Of course, once the SFDP has obtained the necessary data on the results of the experiment, any harvest would be left with the farm family for it to dispose of as best seen fit.

In addition to the recruitment of farmers at step D1 to participate at the research experiment step (D3), the SFDP may find that certain NASs must be mobilized in regard to the research experiment step (D3). This possibility is briefly discussed in step D2 (mobilization of NAS).

Step D2: Mobilization of NAS

Compared to subsequent agri-support system mobilization steps (F2 and H2), step D2 has relatively minor importance at this early point in the SFDP. To the extent, however, that execution of the research experiment step (D3) requires some type of agri-support input, the SFDP would need to ensure that the necessary CPFs from the NAS are available for the farm family to carry out its responsibility vis-à-vis the research experiment. Thus, for example, if a SFDP seeks to
carry out research experiments with farmers who are tenants (i.e., do not own the land they operate), the project may first need to ensure that the landlord will permit the farmer to use a portion of the landlord's land for experimental research purposes (Byrnes, 1972). As another example, a SFDP might need to secure the support of the individual who controls the flow of water for irrigation, to ensure that water flows at the appropriate time required by the technology being tested in the research experiment. These are just two examples of the way in which the NAS might be important for the SFDP to take into account prior to initiating the research experiment step (D3). The agri-support system mobilization step will, however, become quite important in phases F (innovation) and H (adoption).

**Step D3: Research experiment** The SFDP is primarily concerned at this step with the technical supervision of the farmer's operation of the research experiment as per the conditions previously discussed during the legitimation for research experiment step (D1). Some excerpts from *The Puebla Project* provide an example the various on-the-farm activities conducted by the Puebla Project staff and the farmer in order to execute the research experiment hypothesized as relevant in phase (C).

Twenty-seven...fertilizer rate studies were conducted on farmer's fields during...1967. The experiments were distributed throughout the Project area,... The objective was to distribute the experiments uniformly over the area in the hopes of adequately sampling major variations in climate and soil. ... Standard, non-recording rain gauges were installed near each experiment so that the cooperating farmers could maintain a record of daily rainfall.

The individual plot consisted of 6 rows 8 meters long, so the total area occupied by an experiment was approximately 0.3 ha. The phosphorus, potassium, zinc, and one-tenth of the nitrogen was applied in a band in the bottom of the furrow. The insecticide, Aldrin, was applied as a dust along the furrow for the control of subterranean insects. The local variety, Pinto de Salva-
tori, was seeded in 10 experiments, Amarillo de Salvatori in 13 experiments, and Amarillo Rubin in 4 experiments. Four or five seeds were placed in hills 44 cm apart and at a depth of 10 to 15 cm below the bottom of the furrows.

When the young seedlings were about 15 cm tall, the plants were thinned to two per hill, corresponding to a population of 50,000 plants per hectare. At the time of the second cultivation, when the corn was about 60 cm tall, the remainder of the nitrogenous fertilizer was applied as a sidedressing. Weeds were effectively controlled by the two usual cultivations.

During the course of the growing season the experiments were visited regularly and observations were made on the conditions affecting growth...

As soon as the grain reached maturity, the ears were harvested from the four inside rows of each plot. These ears were weighed and the moisture content of the grain was determined gravimetrically. Observations were made on the percentage of rotten kernels, pollination percentage, and shelling percentage (CIMMYT, 1969:40-42).

The particular excerpts cited above provide an illustration of a research experiment on a single plant CPS. A SFDP, of course, could set up research experiments on not only single plant or animal CPSs but also Multi- or Mixed-CPSs. Once a SFDP's research experiments reach the point that the data (or results) are ready to be analyzed, the project is ready to begin an important evaluation phase (E) in which the project staff will specify exactly which combination of CPFs qualifies as SFT.

**Phase E: Evaluation (SFT specification)** On the basis of the data obtained at the research experiment step (D3), the SFDP determines whether the hypotheses formulated at phase C (problem specification/hypothesis formation) have been supported. If not supported, continued experimentation is obviously required. At minimum, the SFDP knows that it has avoided the negative consequences that would have followed if the project had recommended that the small farmer adopt the technology in question and that technology had subsequently proven to be a failure. On the other hand, if
the hypotheses have been supported, the SFDP must translate the research results into specific recommendations (SFT) which can be followed by the small farmer.

Based on the 1967 research experiment (D3) data, the Project staff was able through standard microeconomic computational techniques (CIMMYT, 1969: 42-48) to elaborate specific recommendations for increasing corn yields in 1968. These recommendations as well as the traditional practices are listed in Table 4.2. If the reader compares the two columns in Table 4.1, two basic changes are evident:

...an increased investment in fertilizer and a change in farm management and farming techniques. In the case of fertilizer use, this consisted of a better understanding of fertilizer elements, learning to mix the fertilizer elements for oneself, a higher level of fertilization, and a greater investment of time for the application. In the case of plant population, it meant leaving the same separation between rows but closing up the distance between hills. The better weed control was obtained by traditional cultivation and hand labor, but through convincing farmers that their higher fertilizer investment required more care in eliminating all weeds. Complete weed control runs contrary to the common practice of leaving the weeds which develop around the plants after the second cultivation to be cut for animal feed during the growing season (CIMMYT, 1969:68).

The example of the specific recommendations made by the Puebla Project for increasing corn yields is presented here as one type of SFT. The crucial point to be made here is that the SFDP must, on the basis of the experimental research it carries out at the SFS level (D3), come to some decision as to exactly which technology or combination of CPFs (production input and commodity disposition factors) qualifies for status as SFT. Once a workable and beneficial technology has been developed in the experimentation phase (D) and specified as SFT in phase (E), the SFDP is ready to test that SFT on a wider scale during the innovation phase (F).
Table 4.2. Comparison of traditional and recommended practices (CIMMYT, 1969:68)

<table>
<thead>
<tr>
<th>Practices</th>
<th>Traditional</th>
<th>New recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fertilization (N, P, K)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity (kg/ha)</td>
<td>50-25-10(^a)</td>
<td>130-40-00</td>
</tr>
<tr>
<td>Form of purchase</td>
<td>Mixture</td>
<td>Elements</td>
</tr>
<tr>
<td>Form of application</td>
<td>By hand, around the hill</td>
<td>By hand, along the row</td>
</tr>
<tr>
<td>Distribution at planting</td>
<td>None</td>
<td>All of the (P_2O_5) and 20% of the N</td>
</tr>
<tr>
<td>at first cultivation</td>
<td>All</td>
<td>None</td>
</tr>
<tr>
<td>at second cultivation</td>
<td>None</td>
<td>The rest of the N</td>
</tr>
<tr>
<td><strong>Population (plants/ha)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainfed plantings</td>
<td>15,000-25,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Irrigated plantings</td>
<td>25,000-30,000</td>
<td>60,000</td>
</tr>
<tr>
<td><strong>Weed control</strong></td>
<td>Incomplete</td>
<td>Complete and timely</td>
</tr>
<tr>
<td><strong>Insect control</strong></td>
<td>None</td>
<td>Control of rose chafer at flowering when necessary</td>
</tr>
</tbody>
</table>

\(^a\)Average applications of the 70% of the farmers who fertilized in 1967.
Phase F: **Innovation**  
This phase (F) is termed the innovation phased because it is during this phase that a large number of small farmers will **try** the **new** technology (i.e., innovation) for the **first** time on a more full-scale basis (cf. research trial at step F3), encouraged by the positive results which were previously achieved by those small farmers who experimented with the technology during the research experiment step (D3).

**Step F1: Legitimation**  
The process of legitimation becomes considerably more complex with respect to preparing for and carrying out the research trial step (F3). Not only must an adequate number of farmers be recruited to participate at the research trial step (F3) but also the necessary CPFs must be readily forthcoming from the NAS. Accordingly, the SFDP's action steps in each of these regards will be outlined below.

**NAS legitimation**  
The execution of the research trial step (F3) requires considerably greater assistance on the part of the NAS than was the case with the execution of the research experiment step (D3). This assistance will be forthcoming only if the SFDP informs the NAS of the SFT's requirements sufficiently in advance to allow the various relevant public and private sector agri-support subsystems ample time to prepare the respective roles that they will have to play if the research trial step (F3) is to be successful.

One way in which the SFDP can continue to legitimize itself vis-à-vis the NAS is to meet with key officials of the various NASs to bring them up-to-date on the progress of the project. Thus, for example, in the Puebla Project:

The first "Annual Meeting of the Puebla Project" was held at Puebla in December, 1967. Representatives of all agricultural institutions were invited, and the project staff explained their
experimental findings and recommendations for 1968. It was con­sidered important that the meeting be held in December, as this is when institutions such as the agricultural credit banks pre­pare their plans for the following year. Since the recommenda­tions of the project implied operational changes for certain institutions, it was important that they be completely informed while there was still time to modify plans (CIMMYT, 1969:30).

Several of these implications will be examined more closely in step F2 (mobilization of NAS).

**SFS legitimation** A second arena of legitimation crucial at step F1 is that of recruiting farmers to participate at the research trial step (F3). This can be a sizable task in a SFDP. For example, the Puebla Project planned to undertake approximately 100 high yield plots, each consisting of "an area of 0.25 to 1.0 ha on which the farmer [employs] the recommendations of the project under the supervision of the project staff" (CIMMYT, 1969:31). On the basis, however, of the SFDP's earlier efforts to recruit farmers at action steps B1 and D1, a basis has been laid for recruiting additional farmers to participate at the research trial step (F3). Here the SFDP would again utilize the small farmer identification/selection model as earlier outlined in step B1 as the principal means of recruiting farmers.

As mentioned earlier, the Puebla Project held 31 meetings with farmers to explain the Project and how a farmer might participate in the 1968 research trial program of high yield plots. The farmer's responsibility at the research trial step (F3) was summarized as follows:

...the farmer would be expected to provide his land, his work, his equipment, and his time for giving special care to the plot. ...the farmer would be expected to purchase the recom­mended amount of fertilizer and have it on hand well before planting. ...[Compared to the Project's technical direction of the experimental research plots],...the farmer would have more responsibility in the case of the high-yield plot.
In the case of the high-yield plots, where the farmer had to obtain his own fertilizer, help was offered in obtaining credit from a private or governmental institution. This did not imply that any certain harvest was guaranteed. The technicians pointed out only that the research experience of the previous year, under the ecological conditions of the area, indicated that the recommended application of fertilizer would make possible a substantial yield increase. This increase would be of a magnitude which would permit paying the cost of production and obtaining an attractive profit on each hectare (CIMMYT, 1969:69-70).

In summary, the SFDP is concerned at step F1 in legitimizing the research trial step (F3) at both the agri-support and small farm systems levels. Whereas the research experiment step (D3) of the SFDP was concerned with testing whether a particular technology qualified to be designated as SFT, the research trial step (F3) has as one of its goals to blanket the target area with research trials. This strategy was utilized in the Puebla Project:

The idea was to not wait for a trickle-down effect, but to attempt to cover the area as quickly as humanly possible. The result of having 20 or 25 high-yield plots distributed around the village should be that even those who might not want to see the plots could hardly avoid them in 1969. On their way to their field and home again, they would see the development of the plantings throughout the growing season. In early plantings made in some communities, the neighbors could see the difference as soon as the plans were 20 to 30 days old. The vigor, height, color and density of population all gave a much more attractive presentation than the traditional plantings (CIMMYT, 1969:78).

At the same time the SFDP is legitimizing the research trial step (F3) (e.g., recruiting small farmers to participate at step F3), the project must also initiate those activities which are necessary to mobilize the various NASs whose CPFs small farmers will need if they are to carry out their responsibility at the research trial step (F3).
**Step F2: Mobilization of NAS**

As indicated in step F1, the execution of the research trial step (F3) will require considerable input from the various NASs. For example, in the Puebla Project:

The...recommended practices for 1968 implied three...changes for the agricultural infrastructure: 1) An increase...in...credit...to purchase fertilizers, 2) Substitution of ammonium sulfate and ordinary superphosphate for the formula 10-8-4, and 3) Availability of...credit and fertilizer materials at the local level in March rather than in May (CIMMYT, 1969:31).

If the requisite inputs are to be forthcoming from the NAS, the SFDP must ensure that each of the relevant subsystems is prepared to supply the CPFs that the farmers will need for proper utilization of the SFT that is to be tested at the research trial step (F3).

The task of mobilizing the various NASs in the Puebla Project was handled in the following manner.

Following the annual meeting of the project in December, 1967, the changes implied by the new recommendations were discussed...with representatives of the different institutions...to determine the interest and capacity of each institution to participate in getting farmers to use the recommendations in 1968 (CIMMYT, 1969:31).

While a SFDP will need to work with a variety of agri-support subsystems, the Puebla Project's experience in mobilizing credit illustrates the problems which a SFDP can encounter.

The Puebla Project identified three areas in which the banking subsystem could assist considerably in the effort to raise corn yields.

1) Increased funds were needed to finance fertilizer for a much larger area; 2) The amount allowed per hectare for fertilizer would have to be increased from the existing rates of $411 and $467 to about $700 per hectare; 3) As fertilizer is generally provided instead of cash, the formulas provided and the time they are made available would have to be changed to correspond to results of the soils research in the Puebla Project (CIMMYT, 1969:31).
It turned out, however, that the agricultural banks decided not to change their procedures in 1968, therefore,

...alternative private credit was sought. . . . Fortunately, a distributor was found who was willing to provide the fertilizer on credit at a rate of 1.5% per month to those farmers recommended by agronomists of the project, with the understanding that the project would underwrite the loans. Credit was also made available for some high yield plots by one of the banks, and some farmers financed their own high yield plots. The total number of these plots, 141, exceeded appreciably the number originally proposed (CIMMYT, 1969:32).

In addition to establishing the mechanisms whereby a small farmer can gain access to the various CPFs which a SFT requires, the SFDP may also need to play a role in assisting these mechanisms to function smoothly. Thus, for example, in the Puebla Project:

The procedure used by Project personnel to authorize credit from the distributor consisted of a simple form with an original and two copies. The technician filled out the form indicating the quantity of simple superphosphate and ammonium sulfate. One copy was given to the farmer, one to the fertilizer dealer and one kept by the agronomist. The farmer then had the obligation to take his form to the fertilizer dealer in Puebla, sign a loan agreement to repay the loan no later than Dec. 10, and transport the fertilizer to his farm to have it on hand well before the time for planting his high-yield plot (CIMMYT, 1969:31-32).

Of course, some NASs may be hesitant to play their role vis-à-vis provision of necessary CPFs. As earlier noted in regard to the Puebla Project, the crop insurance agency "maintained that once the new recommendation had been accepted by the credit banks and their clients, such operations could qualify for insurance" (CIMMYT, 1969:31). Once the Puebla Project had established a mechanism whereby farmers could obtain credit and fertilizer, the way was opened for the crop insurance agency to play its role.

After the plantings had been made, the crop insurance agency entered to insure them. This was an experimental operation for the insurance agency, as the usual procedure was to insure only plantings of 5 hectares or more, principally private holdings.
The plots financed... varied from .25 to 1.0 hectare and it was difficult at first for the insurance agency to include them. However, the risk aspects of rainfed plantings were of special interest to the project, and the participation of the crop insurance agency was finally arranged. The insurance agency made the necessary inspections of the plantings, and discarded 14 plots which were considered, for various reasons, not acceptable to them. The rest were fully insured (CIMMYT, 1969:71).

The various NASs which are to be mobilized here at step F2, of course, will depend on the specific CPFs necessary for the SFT's proper utilization at the research trial step (F3).

**Step F3: Research trial**

In contrast to the research experiment step (D3) wherein the farmer was technically supervised by the SFDP staff, the farmer assumes two responsibilities at the research trial step (F3): (1) the actual execution of the research trial on the farmer's own unit of operation and (2) the initiation of the farmer's role as a Diffusion Set. In other words, in assuming principal responsibility for the conduct of the research trial at step F3, the farmer also begins to exercise a key role in the diffusion of the essential ideas of the new technology to other farmers. This dual role was clearly emphasized in the Puebla Project.

Each farmer was told what the work would consist of and where special attention would be needed at each step in the growing cycle. He was also told of the availability of credit, the interest rate, and what the role of crop insurance could be in reducing risks from natural causes such as frost, drought, and hail. He was told that he had a responsibility in conducting a high-yield plot to show his neighbors the advantages of the new practices. He should tell his neighbors how he initiated contact with the technicians of the project and the conditions under which he was conducting the plot, the date it was planted, how much it had cost him to establish it, how he obtained financing for fertilizer, what kind of harvest he was looking for, and how he calculated the possible profit in changing from the traditional to the new method (CIMMYT, 1969:70).
If the SFDP fails to ensure that farmers understand that they are to play a dual role in conducting their individual research trials, the diffusion of the SfT will be considerably slowed. The responsibility of playing a dual role, of course, requires that participating small farmers expend greater effort than would normally be the case were they to be solely concerned with the operation of their own CPSs in the traditional manner. Those farmers who are responsible for research trials must not only learn how to use a new technology but also engage in activities to diffuse information about their use of the new technology.

The dual nature of the small farmer's role at the research trial step (F3) of the Puebla Project is clearly evident in several passages from The Puebla Project report:

In deciding on planting dates for the high-yield plots, the farmer himself was considered the best authority. . . . Before planting, a date was fixed to carry out a demonstration with neighbors present. In some cases, the farmer made the fertilizer mixture several days before planting. In others, the mixing was part of the demonstration. The materials were carried to the field so that the neighbors could learn by participating.

The next step was to show the farmers how and when to apply the mixture so that the fertilizer would be evenly distributed at the bottom of the furrow. . . .

The new plant population was demonstrated in terms of a distance between hills of about ½ step in contrast to one long step in the traditional plantings. The higher population required learning a new rhythm of planting and, in fact, inserting the shovel, opening and covering twice as many holes per hectare. The farmers learned very quickly and then continued alone, sometimes under the guidance of a field assistant of the project. These field assistants were young farmers from the region who had been trained in the project, many of them in the experiments conducted during the previous year. They worked full-time during the growing season (CIMMYT, 1969:71).

Frequent contact was kept with the high yield plots throughout the growing season. As the plantings were completed, attention was given to weed control, once again following the farmers'
usual cultivation procedure. . . . Demonstrations for neighboring farmers were carried out again at the second cultivation when the second fertilizer application was made. The visiting farmers learned which fertilizer and how much to apply as well as how to keep fertilizer out of the bud to avoid damaging plants (CIMMYT, 1969:73).

The Puebla Project experience also serves to suggest three final points which may be quickly noted about the nature of the research trial step (F3). First, the SFDP can make use of farmers who participated at step D3 (research experiment) here at step F3 (research trial) as "field assistants," i.e., to assist the SFDP staff in teaching a larger number of small farmers how to use the SFT. As new farmer-participants learn about the SFT and diffuse information about the technology to other farmers, they acquire experience which the SFDP can draw upon at a later point in time (e.g., when the project needs more farmers to be trained to serve as "field assistants").

Second, it is important to emphasize that the "demonstrations for neighboring farmers" utilized in the Puebla Project are not to be confused with the result demonstration step (G) to be discussed shortly. The emphasis in what the Puebla Project referred to as "Demonstrations for neighboring farmers" (CIMMYT, 1969:73) is on demonstrating how the new technology (SFT) is used, i.e., how the various ingredients (e.g., fertilizer, weeding, plowing, etc.) are put together. When these neighboring farmers later see the results of the research trial of a participant-farmer, they can better see the relationship between these results and the SFT which the participant-farmer utilized to obtain the results.

Third, the tactic of using one set of farmers to demonstrate usage of the SFT to another set is nevertheless a sort of forerunner to the next
step in implementing the SFDP, namely, the result demonstration step (G). Once the research trial step (F3) is under way, the SFDP must begin to turn its attention to the activities which will be undertaken to utilize the positive results of the research trials as, in effect, "demonstrations" of what other small farmers can achieve through utilization of the SFT. While neighboring farmers will have kept tab on the research trials of participant-farmers during step F3, a much wider audience of small farmers will learn about the target area research trials during phase G's local and regional result demonstrations.

Phase G: Evaluation (result demonstration) From the time that a particular SFT begins to be utilized in the SFSs of the target area, either at the research experiment (D3) or research trial (F3) steps, the SFDP must begin to capitalize on this utilization to generate additional interest in the project among other farmers in the target area as well as among key individuals in the various agri-support subsystems. Thus, for example, the SFDP encourages participant-farmers at the research trial step (F3) not only to informally diffuse information about the SFT to other (neighboring) farmers but also to permit the operation of their research trials to be utilized as demonstrations of the actual use of the SFT.

In general, however, information about a SFT can be communicated through at least two channels: (1) audio-visual materials and (2) on-site inspection. As audio-visual materials would be of potential assistance either separately or in conjunction with on-site inspections, the former channel will be considered first.

Audio-visual materials As a SFDP progresses, it is crucial that the project maintain a visual record of its origins and accomplishments.
This documentation can begin as early as steps B3 (research analysis of SFS) and D3 (research experiment) and should continue throughout the various steps of the project's implementation. The Puebla Project's utilization of a variety of audio-visual materials is illustrated in the following excerpts in which emphasis has been added by the author:

...audio-visual materials of different kinds were prepared using the results obtained in 1967 and the experimental plantings and high yield plots available. These were prepared specifically for use in reaching large numbers of farmers when the extension effort would be expanded (CIMMYT, 1969:33).

In meetings with the farmers it was always impressive to see that even those who were barely literate took notes on the recommendations on scraps of paper. To assure that there would be no error and that the recommendations would be presented as completely as possible, mimeographed and printed materials were prepared.

At the end of 1968 a pamphlet was published with specific recommendations for increasing corn yields with the title "Would You Like to Increase Your Corn Yields?". The text was kept to a minimum, and the essential data were presented in illustrations. In this way, farmers attending a meeting could first hear the recommendations and then take home a folder which functioned in this case as a more accurate form of note-taking.

The idea was not to prepare material for mass distribution, but rather to provide a type of visual aid that farmers could take home and show to their neighbors. Consistent with this idea, the folder was used by agronomists during the meetings as a kind of text or outline. In this way, farmers also saw how they could use it in their local meetings. The same folder was used during visits to the demonstration plots. In contrast to areas where printed matter is more available, no one discarded the bulletin and many asked for extra copies to take back to neighbors in their home communities.

During the 1968 growing season, a 16 mm film in color was produced with farmers in the region. The title of the film is "Would You Like to Increase Your Harvest?". This film was used extensively in early 1969 to organize groups of cooperating farmers to participate in the high-yield program.

One of the ideas in developing printed and mimeographed materials was to have in each community a permanent center of information with bulletins, posters, and one or more persons who
could provide farmers with accurate and timely information without necessarily having to consult the technical personnel of the project (CIMMYT, 1969:75-76).

Thus, a SFDP can use a variety of audio-visual materials in a number of ways to facilitate the communication of information about a SFT. It must be emphasized, however, that while audio-visual materials can provide a SFDP with an additional channel for communicating information about a SFT, this channel is of little use if there is no SFT about which to code messages.

If small farmers and key individuals in the agri-support system are to fully appreciate the strengths and weaknesses of the SFT, they must observe it in the context in which it was developed and is currently utilized. Such observation is possible through the channel of on-site inspection.

On-site inspection The observation of participant-farmer research trials at step F3 by neighboring farmers is, in effect, an informal communication of information about the SFT through the channel of on-site inspection. The channel of on-site inspection, however, is considerably formalized in what may be referred to as a "field day." The utilization of on-site inspection as a channel for communicating information about a new technology in a SFDP is clearly illustrated in the Puebla Project.

From the time the corn began to flower until harvest the experimental plantings and the high yield plots were used as demonstrations of the importance of improved production practices. Field days were held for representatives of the agricultural infrastructure and for groups of farmers. The field days for the former groups had two principal objectives: 1) convince the leaders of these organizations that recommendations based on these field experiments represented the most reliable information available for increasing yields, and 2) have these leaders become acquainted with the project staff. It was felt that an appreciation for the technical preparation of the staff would enable these leaders to accept the recommendations with greater confidence.
The field days for farmers sought to demonstrate the results they could expect by employing the recommended practices. The following conclusion was stressed: "The experimental results obtained in a given year show how to obtain immediate yield increases. Nevertheless, the information available at any time should be considered tentative, inasmuch as research in subsequent years will almost certainly result in better recommendations." In this way it was hoped to teach the farmers that change is a dynamic and continuous process (CIMMYT, 1969:33).

In general, there are two types of on-site inspections which a SFDP can encourage: local result demonstrations and regional results demonstrations. Each of these types is illustrated below with material drawn from The Puebla Project report.

Local demonstrations The key objective in a local demonstration is to provide a forum in which farmers who participated at the research experiment and research trial steps, and thus now have experience with the SFT, can explain to other farmers what they found the results to be in using the new technology and can answer such questions as the other farmers may have about the technology.

For the local demonstration, neighbors in the same community and in the neighboring communities were invited personally by local sound equipment, by circular letter, and posters to attend the demonstration. The name of the farmer was always included in the invitation. Generally, the farmer on whose land the demonstrations would be held, circulated the invitations. In other cases, the municipal authorities sent circular letters to farmers whom they thought would be interested. The demonstration itself consisted of 3 parts: an explanation by an agronomist of the Puebla Project and its goals, a report by the farmer on his experience with the high yield plot, and open discussion led by the farmer and the agronomist. An interesting aspect of this was the obviously greater confidence which the visiting farmers felt in raising questions and making comments to the farmer-demonstrator. In spite of the good rapport that the agronomist had developed with the farmers who had the high-yield plots, the neighbors preferred to get their information from the farmer. ... The important fact is that the farmers themselves were able to awaken interest among the visitors (CIMMYT, 1969:73).
Regional demonstrations  The organization of regional demonstrations is somewhat more complex than that of the local demonstration, particularly as one objective is to have the participating farmers assume the leadership in preparing for such demonstrations. The Puebla Project illustrates how this may be approached and some of the beneficial results which follow from encouraging the small farmer to assume positions of leadership.

The approach was...to organize a committee of the most enthusiastic people with the formal title, Committee for Organizing the Agricultural Field Day. The committee took charge of: 1) inviting the authorities, both of the federal and state governments, 2) inviting the neighbors, 3) organizing the event locally by naming a person to receive each of the groups as they arrived from the different communities, 4) naming commissions to look after the smooth functioning of the demonstration to assure that there would be an environment of hospitality. . . .

The technical personnel of the project took the responsibility for inviting farmers from the entire region. In addition to personal contact, they used a poster and circular letter, and sent personal invitations to all of the farmers with high-yield plots. The result was a good attendance of farmers....

For the farmers who organized the events, these were experiences of lasting value in that they realized they could carry out demonstrations of this type. The attendance was greater than they had imagined could be possible, including farmers from the more distant villages. Both of the regional demonstrations were held at locations where farmers could see both a high-yield plot and an experiment. As it turned out, the demonstrations were especially effective in interesting farmers from distant points where high-yield plots were not planted in 1968. Many of the farmers who planted high-yield plots in these villages in 1969 were precisely those who had heard of or seen the regional demonstrations (CIMMYT, 1969:74-75).

In summary, the SFDP seeks during the result demonstration phase (G) to utilize audio-visual materials and on-site inspections (both local and regional demonstrations which have been organized by small farmers) as channels for diffusing information about the SFT to a wider audience of
small farmers throughout the target area as well as to key representatives of relevant agri-support subsystems. Once the result demonstration phase (G) is under way, the stage is set for the next phase in implementing the SFDP, namely, the large-scale adoption phase (H).

**Phase H: Adoption**  
As the objective of the SFDP is to achieve a rapid and wide diffusion of the SFT in the project's target area, the number of farmers actually using the SFT must increase considerably during the large-scale adoption step (H3). To this point, however, the number of farmers currently using the SFT in the target area is relatively small. In the Puebla Project, for example, the Project staff to this point had worked with only the sample of 251 farmers interviewed at the research analysis of SFS step (B3), the 27 farmers at the research experiment step (D3) of fertilizer rate studies, the 141 farmers at the research trial step (F3) of high yield plots, and an uncounted number of neighboring farmers who observed the operation of the research experiments and/or the research trials during steps D3, F3, and G.

At the same time, however, as illustrated in the research trial step (F3) and the result demonstration phase (G), small farmers in the target area have increasingly assumed responsibility for diffusion of information about the SFT. Additionally, the SFDP has encouraged the formation of committees to carry out various activities related to the execution of the result demonstration phase (G). The organizational experience acquired by small farmers during phase G will be profitably utilized by the SFDP as a resource during the execution of the adoption phase (H). Whereas the SFDP staff worked primarily with individual farmers during the preceding phases, the staff now turns its attention to the further organization of farmer
groups during phase H and the utilization of these groups as a mechanism whereby farmers throughout the target area can gain access to the CPFs required for adoption and proper utilization of the SFT.

**Step H1: Legitimation** As in preceding action steps B1, D1, and F1, legitimation of the SFDP continues in the adoption phase (H).

**NAS legitimation** As in step F1, the SFDP must continue to legitimate itself vis-a-vis the NAS. And, as illustrated in step F1, one way in which a SFDP can continue to sustain legitimation is through meeting with high agri-support system officials to bring them up-to-date on the project's progress. This is clearly illustrated in the Puebla Project.

At the time of the Second Annual Meeting of the Puebla Project in December, 1968, it was clear that the project demonstrated the following points: 1) Large increases in corn yields could be readily obtained throughout the project area, 2) The results obtained in research, extension, and evaluation had stimulated greater commitment of representatives of the local, state, and national institutions, who now realized that without their participation in the Project its progress would be greatly limited, 3) The farmers who had cooperated in the high yield plots were convinced of the value of the recommendation and were ready to assist other farmers in applying it, 4) The project staff, farmers, and agricultural institutions could be effectively coordinated in working to achieve the goals of the project (CIMMYT, 1969: 33).

In addition to bringing the NAS up-to-date on the SFDP's progress, the project must now reach a decision as to the extent to which the project will seek to extend its impact on the target area. In reaching this decision, a SFDP must take into account a number of considerations: the goals that the project will seek to achieve in terms of directly or indirectly beneficial changes for small farmers, the size of the area that is to be involved, the number of farmers that are to be involved, the reliability of the SFT, the degree of commitment on the part of NASs, the extent to which
past participant-farmers will be able to assist the project in carrying out the large-scale adoption phase (H), and the number of additional members which the project staff will require and in which of the five competency areas.

Many of these considerations were involved in the Puebla Project at the legitimation for large-scale adoption step (H1).

The major question...was how many farmers or how large an area should be reached...in 1969. The corn production recommendations...were looked upon as highly reliable. The farmers who had cooperated in previous years were prepared to assist in extending the recommended practices to other producers. The agricultural institutions were committed to active participation in the project. ... One further consideration was that the project was committed to doubling the average corn yield in the area by 1972, and to achieve this goal it was important to reach a significant part of the total farming population (CIMMYT, 1969:34).

In 1968, ...a maximum of 5% of the farmers of the area had any contact with the project. In 1969, it is hoped to reach at least 25 to 30% of the farmer with some information about the project. At this rate, it seems reasonable to expect that nearly all of the farmers of the area should know how to produce better yields of corn within the next two or three years (CIMMYT, 1969: 79).

A decision was taken only after careful consideration and discussion by the project staff and state representatives of national agricultural institutions. In fact, the decision took the form of a recommended plan of action which was transmitted by the institutions for approval at the national level (CIMMYT, 1969:34).

The Puebla Project decided to increase the number of research trials (high yield plots) from 141 in 1968 to about 5,000 in 1969. This increase meant that the Project's recommendations (i.e., the SFT for producing higher maize yields) would be utilized in not 80 but 10,000 hectares (CIMMYT, 1969:34). Implied in this goal was that "each agronomist should work with about 1,250 farmers--18 times more than the number with which he
worked in 1968 [at the research trial step (F3) of high yield plots]" (CIMMYT, 1969:76). While the Puebla Project recognized that this was a difficult goal, its achievement "was considered necessary if the Puebla Project was to serve as a realistic model for other areas" (CIMMYT, 1969:76).

In order to achieve such broadened objectives, a SFDP can utilize a combination of (1) increasing the size of its staff and (2) using a portion of the increased staff to organize farmers into groups. Thus, for example, the Puebla Project found not only that the size of its staff had to be increased but also that a portion of the Project staff should be utilized to organize farmer groups as a vehicle for reaching the enlarged number of farmers.

To expand the program in this way required a larger project staff. Five young agronomists, who had just completed their professional training, were added. The agronomic practices and corn breeding programs each received one new man, while the extension program received three. A second reason for increasing the project staff was so that a larger number of people would gain experience in the project and thus be available at a later date to help organize similar projects in other areas (CIMMYT, 1969:34).

The plan of action for 1969 implied a drastic change in operating procedures by the four extension agronomists. In 1968 the two farm advisors had worked individually with each cooperator. In 1969, four people had to work with up to 5,000 farmers. Obviously, these farmers had to be organized into groups so that each farm advisor would be working with a reasonable number of groups. The...project area was divided into four regions, and one of the farm advisors was given the responsibility for extension activities in each (CIMMYT, 1969:35).

**SFS legitimation** There are two objectives in organizing farmers into groups here at step H1. On the one hand, organized into groups (e.g., cooperatives), small farmers can gain access to the CPFs required by the SFT and which they individually would not be able to
obtain. On the other hand, a farmer organization serves as a communication link between the SFDP and the individual farmer, facilitating communication of information about the SFT (e.g., explanation of the SFDP and the use of the SFT, presentation of films on how farmers can benefit throughout utilization of the SFT, and distribution and explanation of printed materials such as mimeographed bulletins containing detailed instructions on how to appropriately use the SFT).

Again, in organizing farmers into groups, the SFDP can utilize the small farmer identification/selection model previously discussed at legitimation steps B1, D1, and Fl. Also, the organizational experience acquired by those farmers who served on committees to carry out the various activities related to the execution of the local and regional result demonstrations (G) provides an additional resource on which the SFDP can draw in organizing farmer groups.

These general ideas are clearly illustrated when we examine the experience of the Puebla Project at the legitimation for large-scale adoption step (HI). As mentioned above, each extension worker (farm advisor) was responsible for extension activities in a particular subregion of the overall Puebla region.

His first task was to contact any existing organized groups working with any of the credit institutions and then to stimulate the organization of other groups. This work began in early 1969 and continued up to planting time. Meetings were held in each community with a clear exposition of how the farmers could work together to reach higher levels of production (CIMMYT, 1969:35).

A typical meeting began with an explanation of the project and presentation of results obtained by farmers who had high-yield plots the previous year.
This was a key point in raising the level of interest. Then the colored film, "Would You Like to Increase Your Corn Harvest?" was projected.

This film occupied a key position in bringing together groups of farmers, demonstrating exactly how increased yields could be obtained. It also lent credibility to the recommendations by careful documentation with local names and places where successes had been obtained in the previous year.

This was especially effective in communities where none of the farmers had seen the high-yield plots in 1968. After seeing the film, they often felt that they knew enough about the project and decided to participate. In this way the film both motivated the farmers to participate and provided specific information on how to obtain higher corn yields. About halfway through, the projection was stopped to provide an opportunity for questions and answers. During this intermission, a mimeographed map of the region giving recommendations for each community was distributed. In this way, each farmer could identify his own location and then on the back of the sheet find the specific fertilizer recommendations. The discussion at this point also covered how to calculate the correct fertilizer mixture and how to determine the amount to apply at planting and at the second cultivation (CIMMYT, 1969:77).

It should be emphasized that the organization of farmers into groups is also important from the standpoint of achieving one of the principal objectives in SFD. As the reader will recall from Chapter 2, one of the key indirectly beneficial changes which can take place in the SFS in conjunction with the farmer's utilization of SFT is the farmer's greater involvement in the political decision-making process. The organization of farmers into groups at step H1 is highly instrumental in this regard as the following excerpts from the Puebla Project illustrate.

Working with groups greatly facilitated the selection of participants in 1969, as the farmers themselves, not the technicians, decided who would participate. The groups, in turn, nominated their representatives in a democratic manner. These representatives were the link for requests for both credit and technical assistance. Project personnel worked either through the representative or with the entire group when the representative preferred to call together all of the members (CIMMYT, 1969:78).
In view of the fact that practically no organization existed in the area when the project began, it is particularly interesting that it was possible to crystallize the interest of so many people, so rapidly, in a particular project, and to organize local groups. . . . It appears that farmers are willing to work together for a well-defined objective and that in most cases they are making plans already for next year. In some cases, where the original group was large, it was divided into several groups by communities. No attempt has been made to give a general name to the groups such as "society" or "cooperative". Rather, this has been left to develop over time as the farmers begin to identify the functions which they wish their groups to perform (CIMMYT, 1969:79).

Once the process of organizing farmers into groups is well under way, the SFDP must turn its attention to the mobilization of the various NASs (H2) whose collaboration will be essential for a large-scale adoption (H3) of the SFT by small farmers.

**Step H2: Mobilization of NAS** While a SFDP's success at the research trial step (F3) and emphasis on that success at the result demonstration step (G) may provide various NASs with sufficient motivation to become more responsive to the needs of small farmers, the project cannot leave such changes to chance. Excerpts from *The Puebla Project* report again illustrate the manner in which a SFDP must seek to mobilize the relevant NASs during the large-scale adoption phase (H).

It became clear in planning the activities of the Puebla Project for 1969 that the lack of the right fertilizers and adequate credit at the local level would limit adoption of the recommended SFT. In order to provide the needed credit for sufficient fertilizer to cover the 10,000 hectares meant that a total of about seven million Mexican pesos would be required (CIMMYT, 1969:35). The Puebla Project was able to handle this problem in part by obtaining the approval at the national level of a plan whereby several different banks would each finance a proportion of the
total hectares to be fertilized. The remainder of the "problem was solved ...by the previously-mentioned fertilizer distributor who took the initiative to establish subdistributors at the local level throughout the region" (CIMMYT, 1969:78).

The Project also sought a modification in the operation of the crop insurance agency. While each farmer that participated in the Project at the research trial step (F3) of high yield plots in 1968 was insured individually, "it was decided that farmers would have to be organized in groups of 10 or more to qualify for crop insurance" (CIMMYT, 1969:35) at the large-scale adoption step (H3) in 1969.

In addition to working with the various individual agri-support sub-systems, a SFDP must also ensure that the CPFs required for adoption of the SFT are available to small farmers on time. This involves a problem of coordination which the Puebla Project successfully handled.

Early 1969 was perhaps the most crucial period in the development of the project. Although the specific functions of the project staff and participating institutions were defined well in advance of planting, there still remained the task of coordinating all activities so that the farmers would have their fertilizers on time. This coordination was made especially difficult by the fact that planting dates in the area vary from early March to late May. The correct fertilizer materials had to be ordered early, freight cars had to be available to transport the material to Puebla, this had to be received by the distributors and dispatched to their representatives in the villages, and the farmer had to have credit arranged so that he could pick up the fertilizer that he needed. Problems developed at all points in this chain of events and only through continuous contact by the Coordinator and a clear understanding of the operation of each institution was it possible to reduce to a minimum delays and loss of prospective cooperators (CIMMYT, 1969:35).

Once the SFDP has ensured that all CPFs required for adoption of the SFT will be available on time to small farmers in the target area, the project is ready to initiate the large-scale adoption step (H3).
Step H3: Large-scale adoption  While the primary concern in step H1 was the organization of farmers into groups and in step H2 the mobilization of the agri-support subsystems whose CPFs are required for adoption of the SFT developed by the SFDP, the objective of step H3 is to ensure that farmers appropriately utilize that SFT in their own CPSs. In the Puebla Project, a variety of communication channels was utilized in an integrated manner to keep in touch with the small farmer.

The four farm advisors played a critical role at the farmer level in assuring an efficient operation of the program. They kept the farmers informed, assisted them in arranging for credit, prepared them for receiving the fertilizers, and instructed them in the correct use of the materials. In their relationship with the farmers, however, the farm advisors operated in such a manner that arrangements for credit and fertilizers were always made between the representatives of the institutions and the leaders of the groups of farmers. In this way the responsibility for procuring credit and agricultural chemicals remained with the individual farmer or the group leader (CIMMYT, 1969:35).

Obviously, a SFDP's staff cannot keep in touch with the individual operation of each and every small farmer who had adopted the SFT. It is at this time that a SFDP will find the mass media, particularly the medium of radio, an essential means of communicating information to small farmers in the target area. This is clearly demonstrated in the Puebla Project.

A radio program was initiated in March, 1969, on a local radio station which covers the project area. This program is aired Sunday mornings from 7:30 to 8:00—one of the most convenient hours for farmers, according to data collected by the evaluation team. The initiation of the radio program was also due in part to data collected in evaluation which showed that 60% of the farmers have radios. The program was not initiated until the project personnel felt they had sufficient research and demonstration experience in different parts of the area to be able to initiate a sound area-wide program. The intent...was not to use radio as a mass medium in itself, but rather in close integration with the over-all program. Individuals and groups were advised of the program through a flyer which included the topics, the radio station, the hour, and the date, and these farmers were invited to tell their neighbors of the program.
As to content, the radio program includes recommendations and news notes about what is happening at the moment. For example, that fertilizer has now arrived at such and such a place; that farmers who have their land ready should now mix their fertilizers to be ready for planting; that they should mix simple superphosphate and the ammonium sulfate in certain proportions and take such and such precautions to preserve it. In other words, the program attempts to provide specific technical information on situations certain farmers have experienced that are of extreme interest to those with similar problems in other places within the area.

The radio program has been useful for alerting farmers to specific actions in relation to the crop recommendations and has stimulated the participation of a growing number of farmers in the project. The program receives financial support from the fertilizer distributor, Agronómos Unidos, and other commercial firms which distribute agricultural inputs in the city of Puebla. The program is considered a source of credible information, as it is operated by a member of the technical team of the project whom the farmers know and identify as a friend (CIMMYT, 1969:78).

Through the medium of radio, the SFDP can reach the widely dispersed audience of small farmers with timely information useful to the proper utilization of the SFT. It should be emphasized, however, that radio is not utilized to "promote" the SFDP or the SFT which the project has recommended that small farmers adopt. Indeed, if there is any "promotion" of the SFT or of the SFDP, such promotion is responsibly handled by small farmers in their Diffusion Sets role.

Moreover, "promotion" is also informally handled through the ancient process of "seeing is believing." Thus, for example, in the Puebla Project,

...more farmers are participating in the project now than signed up at the beginning of the year. Part of the reason is ... the fact that the nonparticipants began to see that the fertilizer for the participating farmers did arrive in the various communities. Many had doubted that it really would.

In this way the number of participants originally included in the list for 1969 continued to grow in nearly all of the communities, in some cases even doubling or tripling. The outlook
appears optimistic. When the farmers have watched their plants develop through the entire growing season up to the harvest, and when they have had time for long discussions in the villages on the effects of fertilization and following the new practices, the number who want to participate next year should increase sharply (CIMMYT, 1969:78).

As the completion of step F3 nears, the SFDP must begin to prepare for an evaluation of the extent to which the project has been successful in diffusing the SFT to small farmers in the target area and, relatedly, in achieving the SFD objectives which the technology was developed to assist farmers to achieve.

**Phase I: Total evaluation and continuation of SFDP** Throughout the course of developing and diffusing a SFT, the SFDP monitors the progress (or lack thereof) that is being made. Acquisition of data on those variables which can be taken as measures of the SFDP's success as well as data on variables which may account for that success must be collected at various points along the way and analyzed as a basis for identifying progress to date and where the obstacles to further progress lie. When fed back into the SFDP, such data provide a basis for making better informed decisions on the changes which need to be made in order to improve the project's design and impact.

The various data collected by the Puebla Project's agronomists and evaluation team provided a basis for analyzing the impact of the Project. While some of these data are reported in *The Puebla Project* report (CIMMYT, 1969), several more recent analyses have become available which may be utilized here (CIMMYT, 1970b; Myren, 1971; Jiménez Sánchez, 1971; Jones, 1972; Winkelmann, 1973; Biggs, 1974b; Jiménez Sánchez and Laird, 1974; Diaz-Cisneros, 1974). Generally, to this point, a rather "rosy" picture of
the Puebla Project has been painted by the author, reflecting the optimism of The Puebla Project report (CIMMYT, 1969) which the author has utilized as a source of data. As Biggs (1974b:149) notes:

During the early years, the results of the Project were so impressive that many observers believed that the riddle of how to extend new technologies to subsistence farmers had been solved.

This vision, however, is balanced by "more recent results [which] indicate that earlier prophesies have not been fulfilled" (Biggs, 1974b:149). Relevant data are reported in Table 4.3.

The sharply rising rates of participation in the early years of the Puebla Project were most likely due to the economic advantage of adopting the recommended practices. By adopting these practices, farmers could increase their yields from about 1.5 tons per hectare (using traditional technology) to 3.9 tons (using the recommended practices). While the new technology required a 90% cost increase (e.g., to pay for the recommended increase in fertilizer), a government agency offered a guaranteed price of 900 pesos per ton of shelled corn meeting the 12% moisture requirement. Farmers were thus able to net a profit of 1574.50 pesos (US $130 per hectare), nearly five times larger than that possible using traditional practices. Assuming an average farm size in the Project region of 2.5 hectares, the estimated additional family income per maize crop was nearly US $250.00, an increase of 117% in income from crop sales and a 50% increase in total family income from all sources (CIMMYT, 1969:92, 18; Biggs, 1974b:153).

After reaching the level of 4833 participant farmers in 1970, however, the participation rates did not continue to grow rapidly. As of 1971, the
Table 4.3. Puebla Project area, yields, participation, and credit, 1968-71 (Biggs, 1974b:154-155)

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<tr>
<td><strong>Yields (kgs./ha.):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Participants&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3894</td>
<td>2765</td>
<td>2670</td>
<td>2618</td>
</tr>
<tr>
<td>2. General for area (including participants)</td>
<td>2091</td>
<td>1790</td>
<td>1917</td>
<td>1883</td>
</tr>
<tr>
<td>3. Difference (1 minus 2)</td>
<td>1803</td>
<td>975</td>
<td>753</td>
<td>735</td>
</tr>
<tr>
<td><strong>Participation:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Area in high-yield plots (hectares)</td>
<td>95</td>
<td>5642</td>
<td>12500</td>
<td>14438&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>5. Cultivators</td>
<td>103</td>
<td>2561</td>
<td>4833</td>
<td>5240&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>6. Producer groups</td>
<td>3</td>
<td>128</td>
<td>218</td>
<td>183</td>
</tr>
<tr>
<td><strong>Credit (hundred thousand pesos):</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0.75</td>
<td>49.0</td>
<td>96.0</td>
<td>76.0&lt;sup&gt;d&lt;/sup&gt;</td>
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<sup>a</sup>Participants are defined as those who obtained bank credit for fertilizer purchases. This ignores cultivators who utilized the recommended practices but financed purchases of inputs out of past savings or used non-bank sources for credit.

<sup>b</sup>For 1971, participants accounted for 19% of total area sown in maize and 36% of the total maize production.

<sup>c</sup>It is estimated that the number of cultivators for 1972 is about 5200.

<sup>d</sup>Part of the explanation for the large decrease in the value of credit is due to a 20% reduction in the price of fertilizer from the government operation, Guanomex.
number of participants made up only one-tenth of the estimated 47,536 farmers in the region. Problems arising at each of the three social system levels (SFDP, NAS, SFS) appear to explain the slowing in the growth rate of farmer participation in the Puebla Project and suggest areas and ways in which the Project might be modified in order to ensure greater success in the future. To illustrate, each of the social system levels will be discussed in relation to problems which observers of the Puebla Project have identified at that level. Specifically, the discussion will cover these social system levels and associated problem areas: (1) SFDP: technical-production problems inadequately solved by the Puebla Project staff; (2) NAS: organizational and institutional problems in the agri-support system within and surrounding the Puebla region; and (3) SFS: problems related to farmer decision-making at the level of the small farm holding.

**SFDP: Technical-production problems** Line 1 of Table 4.3 shows that yields on the participants' plots fell from 3894 in 1968 to 2618 kgs/ha in 1971—a 33% drop. While there had been adequate precipitation levels in 1968, late rains in 1969 and 1970, plus generally dry conditions throughout 1971, created a moisture stress condition which adversely affected yields from 1969 through 1971. Given a densely planted field and a growing period in which precipitation is below normal, "the intense competition of the increased plant population for available moisture actually causes absolute yields to fall" (Biggs, 1974b:156).

This particular illustration with respect to a technical-production problem (i.e., moisture stress) is not one of minor and isolated significance. As Biggs (1974b:156) emphasizes:
The experience of the Puebla Project...is not dissimilar from that associated with the development and introduction of new agronomic practices in other parts of the world. ...new technologies, particularly those requiring increased amounts of off-farm inputs (new seeds and fertilizers) are quite often vulnerable to moisture stress. New technologies developed and field tested under adequate moisture conditions often perform worse than the local technologies when subjected to rainfall deficiencies.

Where a SFDP encounters such interactions, that project would need "to devise more flexible recommendations which can take into account variations in rainfall patterns" (Biggs, 1974b:157).

**NAS: Organizational and institutional problems**

This second category reflects the problems which arise as a result of not adequately mobilizing the agri-support subsystems in a SFDP. Biggs (1974b) subdivides this category into those problems associated with particular subsystems: (a) the agricultural infrastructure (NAS), (b) the research and extension team (SFDP), and (c) the farmer (SFS).

**Agricultural infrastructure (NAS)**

The key services provided by the NASs in the Puebla Project were the extending of credit and the supplying of fertilizer. However, in 1968, the Project's first year, the public sector credit institutions chose not to participate in the project and credit had to be obtained through a private fertilizer distributor. When the public banks finally decided to participate in the Project, after having seen the positive results of the new technology, small farmers found the banks' procedures for obtaining credit somewhat complicated; some farmers even complained that credit was not available from the banks. One explanation which may be suggested for this complaint problem follows:

...there is a tremendous communication gap between the peasant and the bank personnel. The peasant often does not fully comprehend the impersonal contracting procedure for obtaining bank
credit. He very often finds the required paperwork confusing and he ends up deciding "no vale la pena" (it's not worth the trouble) (Biggs, 1974b:157).

Rather than suffer the frustration of dealing with the impersonal financial institution (i.e., the bank), the small farmer may instead choose to secure credit from a rural moneylender even if at exorbitant interest rates.

There also appears to be a second explanation for the complaint that credit was not available. The lack of adequate rainfall in 1970-71 and resultant lower yields meant heavy losses for many farmers who, subsequently, defaulted on the loans which they had obtained in order to purchase fertilizer. The instances of default may have damaged the credit worthiness of these farmers, thus making it difficult or impossible to secure credit for the subsequent growing season.

The problems involved in supplying credit provide an interesting case of the self-fulfilling prophecy. The marked increase in demand for fertilizer following the government's lowering of the fertilizer price in 1971 aggravated an already existing problem of assuring adequate and timely fertilizer supplies. Then, in 1972,

...many farmers did not receive fertilizer in time for the sowing because the local distributor had failed to allow a sufficient lead time in ordering the ingredients from his supplier in Mexico City. Part of the neglect was due to inadequate foresight on the part of the producer group leaders who should have made sure that the orders were placed well in advance of the planting season. Some observers suggested that the previous year's harvest experience was so poor that it was assumed that the farmers would not participate in the Project the next year. Thus, the expected demand for fertilizer would be much below that of previous years, discouraging the local distributor from ordering as much as in the past (Biggs, 1974b:158).

Thus, as Thomas and Thomas (1928:572) so aptly observed: "If men define situations as real, they are real in their consequences." Key individuals
in the NASs assumed that the farmers would not participate. As a result, many farmers did not because they could not get the fertilizer that the distributor did not order because he thought there would not be many farmers who would want to purchase it.

Research and extension team (SFDP) The Puebla Project staff was composed primarily of relatively young men who had recently completed a bachelor's or master's degree. While Biggs (1974b) notes that these men were technically competent and enthusiastic to work in the field, he also offers several critical observations concerning the technical team.

First, while there was a fifty-fold increase in the number of farmers participating in the Project (see Table 4.3), the number of team members only doubled. Thus, the extension coordinator was no longer able to work as closely with the financial institutions to facilitate credit transactions (Biggs, 1974b:158). Similarly, extension workers could not spend as much time with each farmer as before. Biggs (1974b:159) suggests that this dilution of effort occurred even despite the efforts of the extension workers to facilitate their work through the formation of the producer groups.

A second factor was that of the relationship between CIMMYT and the Mexican national extension service. Biggs (1974b:159) offers the following interpretation:

The Mexican national extension service [could have been] a source of manpower to assist the CIMMYT team; however, there appear to be some problems of cooperation between the two organizations. It was explained that in the initial years of the program the assistance of the national extension service was not solicited to support the Project effort. This neglect bred a sense of jealousy and competitiveness so that in subsequent years, CIMMYT was unable to obtain the cooperation that was needed to extend the effort over a large number of farmers.
This observation demonstrates the importance of the NAREO assuming responsibility as the primary change agent system in SA-SFD and that the IARC should play a supportive role rather than one that may be perceived by the NAREO as a competitive one.

The third factor relates to the use of various printed media (e.g., pamphlets) to communicate information about the new technology (e.g., how to use the recommended practices). One may raise the issue of how best to interpret the Puebla Project benchmark survey result in regard to the 77% of the farmers who reported themselves to be literate when the average number of years in school was only 2.36. With this in mind, Biggs (1974b:160) observes: "The pamphlets seemed to be rather technical, raising some doubts as to their effectiveness in the hands of semi-literate peasants."

Finally, while conceding technical competency insofar as textbooks and formal education are concerned, Biggs (1974b:160) notes that "the problem of how to modify the optimal practices to account for the unpredicted moisture deficiency may take a number of years of experience in the field." In this connection, Jones (1972:24) points out that detractors have concluded "that the Project shouldn't have started with such a short research base" and "that it was wrong to focus exclusively on maize." These conclusions would tend to support the contention that a SFDP should not fail to adequately conduct the research analysis of SFS step (B3) before proceeding to the research experiment step (D3).

Farmer (SFS) The intent in forming the various producer groups was to provide a mechanism whereby the research and extension team could disseminate information about new technologies, assist in obtaining credit for individuals, and to expedite repayments. Several difficulties,
however, nevertheless arose. First, not being legal entities, these groups could not contract as a group with production input suppliers. Also, as Biggs (1974b:160) observes,

...the peasant farmer does not like to associate with groups and would refuse to do so even if it means foregoing credit. Forcing participants to join the groups may in fact have limited participation rates. In addition, the groups may limit membership to prospective participants because a single defaulter may prevent the entire group from obtaining credit the following season.

On the other hand, Felstehausen (1973) views the producer groups more favorably, arguing that these groups served to break down traditional barriers to agricultural credit and have initiated movement in the direction of a more favorable distribution of improved technology among farmers as a whole. Moreover, the groups "quickly discovered that their group mechanism was also ideal for other kinds of farm and community developments" (Felstehausen, 1973:7). Some groups used their experience in borrowing funds to go after and obtain much larger sums to finance such projects as the drilling of tube wells, the purchase of pumps, the initiation of such activities as livestock enterprises, truck farming, and input supply transportation. Finally, "organizations of whatever kind tend to shift local power arrangements. Small producers gain some leverage they did not have before. Traditional power holders may criticize the project because of these changes" (Felstehausen, 1973:7).

**SFS: Farmer decision-making** Two general areas of decision-making may be examined (Biggs, 1974b:161): (1) those decisions relating to whether to participate—"what motivates the farmer to participate or not, and if the decision is made to participate, what motivates the farmer later to cease participation" and (2) those decisions relating to how closely the
farmer follows the recommendations which, of course, influences yields and, in turn, affects future participation levels.

**Whether to participate** The risk the farmer perceives in using new technology is an important factor influencing whether he'll adopt that technology. In general, the small farmer is a risk averter. If a farmer was to invest heavily in the fertilizers required by the new technology and subsequently had a poor crop, he would not only jeopardize family income but also personal savings. Thus, continued participation in the Puebla Project was probably considerably discouraged among those farmers who incurred debts as the result of the poor rainfall and poor harvest during 1970 and 1971. Where these farmers decided not to participate again, it is likely that they were avoiding risk. Indeed, experimental data from the Project area verified the farmers' impressions that risk was greater when using Project recommendations than when following traditional practices (Winkelmann, 1973:3).

The farmer's perception of risk in using the new technology would likely have been lower if he would have had access to an effective crop insurance program rather than to simply a loan insurance program. This is to say that the insurance to which farmers had access was only loan insurance to protect the lender from farmer default in the event of bad weather. Thus, in case of loss, the farmer would only receive in insurance that which he owes the lender (i.e., the value of the fertilizer) but would otherwise lose any other expenses as well as the gross income that would have resulted if there had not been a crop loss. Under these conditions, those farmers who obtained low levels of production and subsequently defaulted on their loans rationally dropped out of the program.
Whether to follow recommendations

While weather may have played a key role in depressing yields below maximum levels, there is also evidence that many participating farmers did not follow the recommendations precisely. And as more farmers became participants, it became increasingly difficult to monitor closely each farmer's plot and the practices he used. Many participants were hesitant about applying fertilizer at the sowing, arguing that they would wait until the first cultivation—only by then did they feel that they could determine if the rains had been adequate to assure a reasonable crop; if the rains came too late, the fertilizer applied at the sowing as well as the money invested in it would be lost.

Biggs (1974b:163-164) lists a number of other factors which similarly influenced whether optimal practices were followed.

1. Whether the farmer in fact applied the appropriate mix and quantity of fertilizer at the correct time;

2. Whether he applied all the fertilizer he bought—in some cases, the farmer saved some fertilizer, thereby enabling him when in need of cash to sell part of the fertilizer to a neighbor or family member who was not able to obtain credit;

3. The increased fertilizer dosage and the application of it in precise amounts was laborious, requiring stooping in order to apply the correct amount by hand that often caused a back-ache;

4. The extra work in applying the new technology (and also having to hire help for fertilizer application at the sowing) was not worth the additional return;

5. Late receipt of fertilizer due to late loan applications and difficulty in processing them through the bank;

6. Planting low densities to reduce risk;

7. Participants not fully informed on the recommendations;

8. Credit constraint in purchasing fertilizers; and

9. Difficulty of judging seeding densities properly.
In short, these various practices combined to inhibit the use of optimal practice and, accordingly, yields which, in turn, affected participation rates. As Biggs (1974b:164) concludes,

...these practices by farmers appear to be irrational given the tremendous return that could be reaped if they were to follow more closely the recommendations. When analyzed more deeply, however, these decisions seem to be perfectly rational in light of the physical, financial and institutional constraints confronting the farmer. It can be generally concluded that the risk factor plays a very important role in the peasant's decision to participate or not, and how closely to follow the recommended practices.

The various problems identified in the course of the Puebla Project have been reviewed here to illustrate that in order to evaluate the progress of a SFDP and to identify the obstacles to further progress, the SFDP staff must monitor the project not only at the SFS and NAS levels but also at the level of the project staff itself. By identifying what the actual problems are, the SFDP staff can then seek ways to modify the design of the project that will enhance its impact on the SFS. The ultimate test, of course, of whether a SFDP is making progress lies in whether and the extent to which there has been directly and indirectly beneficial change at the level of the SFS.

The SSEM of the SFS outlined in Table 2.5 identified nine dimensions of "small farmer objectives" along which directly and indirectly beneficial change can occur in the SFS. In retrospect, it may be seen that the Puebla Project focused primarily on increasing maize yields in the Puebla Project area. This, of course, is one of the nine dimensions specified in Table 2.5. In attempting to achieve this objective or as a result of achieving this objective, the Puebla Project also made progress along some of the other eight dimensions, a result which may owe less to a conscious effort
on the part of the Puebla Project staff and more to the extent to which the achievement of the other objectives was highly interrelated with the actual increase in the production of maize yields.

There have been numerous discussions on the extent to which the Puebla Project strategy might be used in other developing countries (CIMMYT, 1970b; Myren, 1971; Jiménez Sánchez, 1971; Jones, 1972; Biggs, 1974b; Jiménez Sánchez and Laird, 1974). Diaz-Cisneros (1974:x-xi) has emphasized in this respect that:

...the validity or irrelevancy of the strategy of the Puebla Project as an alternative to deal with the problems of subsistence agriculture in other regions of Mexico or in other countries will not be tested by arguments in favor of or against it. Its validity or irrelevancy will be established only by an objective evaluation of the achievements obtained by the campesinos of Puebla who are the Subjects of the project action.

This criterion serves to emphasize that if small farmer agricultural development (SFD) is to be measured by the extent to which there has been a more optimal achievement of directly and indirectly beneficial changes in the SFS, then the success of social action for small farmer agricultural development (SA-SFD) must be measured by the extent to which a SFDP has been able to develop and diffuse SFT which assists small farmers to more optimally achieve the specified directly and indirectly beneficial changes in their own SFSs.

This then becomes the key objective in evaluating a SFDP's impact on the target area of SFSs. While the Puebla Project staff did not articulate the particular framework of the nine dimensions of "small farmer objectives," the author has attempted to identify data in various reports about the Puebla Project that would serve to illustrate the extent to which the Puebla Project staff was able--consciously or unconsciously--through the
implementation of the Puebla Project strategy to more optimally achieve beneficial change along most, if not all, of the nine specific dimensions. These data are reported in the format of Figure 2.13 in Table 4.4.

While the present chapter has illustrated the CSA-SFD primarily through the Puebla Project's activities to develop technology that would increase the productivity (yields) of maize, Table 4.4 illustrates that the Puebla Project was also effective in achieving beneficial changes along several other dimensions within the SFS. Most notably, in terms of Chapter i's emphasis on employment and income as well as productivity, Table 4.4 illustrates the positive changes which occurred not only in the productivity of the small farmer's CPS but also the additional employment and income that were generated by utilizing the new technology. It should also be emphasized that many of these changes were realized as a partial result of the farmer's participation in the credit societies which also served as a vehicle for launching other enterprises (e.g., drilling of the tube wells).

Thus, in evaluating its own success, a SFDP must minimally take into account the impact which the project has had on the SFS. As Felstehausen (1973:7) notes with respect to the Puebla Project:

...the Puebla Project cannot be evaluated strictly in terms of corn production.... The project has resulted in the creation of a new infrastructure which means that the typical variables for evaluation must be rearranged.

It is in this regard that the nine dimensions of "small farmer objectives" provide one possible approach to arranging some of the variables that appear to be central to the monitoring of developmental change at the SFS level.
Table 4.4. Utilization of data pertaining to the Puebla Project to illustrate extent of directly and indirectly beneficial change in the SFS in the Puebla Project area

<table>
<thead>
<tr>
<th>Resource Allocation System</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Consumption</td>
</tr>
<tr>
<td>1. Nutrition:</td>
</tr>
<tr>
<td>Directly Beneficial</td>
</tr>
<tr>
<td>Btw. 1967-73, families with potable water increased from 13% to 21% (Diaz-Cisneros, 1974:461); population in Project area consumes more meat (chicken) and fruits than before the start of the Project (CIMMYT, 1974:58); btw. 1967-70, proportion of families who ate fish every four to seven days tripled from 3.2 to 11.3% and cheese and egg consumption increased (Diaz-Cisneros, 1974:460).</td>
</tr>
<tr>
<td>Indirectly Beneficial</td>
</tr>
<tr>
<td>Increase in additional family income of nearly US $250.00 per maize crop (Biggs, 1974:153); average total family income increased from $660 (1967) to $825 (1970) or a 23.8% increase (Diaz-Cisneros, 1974:450).</td>
</tr>
<tr>
<td>D. Participation</td>
</tr>
<tr>
<td>8. Involvement in the political decision-making process:</td>
</tr>
<tr>
<td>Indirectly Beneficial</td>
</tr>
<tr>
<td>Number of producer groups (credit societies) increased from 3 (with 103 participants) in 1968 to 183 (with 5240 participants) in 1971 (Biggs, 1974:154). For example: &quot;most campesinos of the region would prefer not to work off the farm if they could find enough year-round work on the farm&quot; (Diaz-Cisneros, 1974:457).</td>
</tr>
<tr>
<td>9. Level of off-the-farm employment</td>
</tr>
</tbody>
</table>

Commodity Process System

B. Disposition

3. Efficiency of utilization of commodity disposition factors:

Some farmers have utilized extra corn for fattening pigs or growing more chickens; "the campesinos... explained that to have their storage bins filled with grain after repaying their loans had freed them from a concern they had known since childhood" (Diaz-Cisneros, 1974:452); increased production of corn stalks may be sold or used as forage (CIMMYT, 1969:48).

4. Productivity and production:

Between 1967-70, a 34.2% increase in avg. net income per hectare (Diaz-Cisneros, 1974:457); between 1967-73, yield increased from an average 1.7 to 2.5 ton/ha.; also, a 48% increase in maize production (CIMMYT, 1974:58).

C. Production

5. Productive potential of unit of operation:

Between 1967-73, use of nitrogen fertilizer in Project area increased 130% from an average of 34 kg/ha to 78 kg/ha (CIMMYT, 1974:58).

6. Efficiency of utilization of production input factors:

For example: "In one extreme case the difference in yield between the no-fertilizer treatment and the best application was 6,990 kg/ha of shelled corn" (CIMMYT, 1969:47); "according to the results of the experiments of 1967, the soils of the area with 130 kilos of N and 40 kilos of P2O5, yielded the best results with 50,000 plants of corn per hectare" (Diaz-Cisneros, 1974:86).

7. Level of on-the-farm employment:

"All recommendations...absorbed labor and created employment" (Diaz-Cisneros, 1974:455); "farm employment...increased by the time spent in applying fertilizers and harvesting and shelling the ears" (CIMMYT, 1969:48); estimated 12.1 extra man-days through harvest required by the recommended practices; an estimated 397,388 additional man-days for 1973 over 1967, an increase of 11.8%; 9.26 additional man-days required in each family; farmers had to hire extra labor in peak periods of activity (Diaz-Cisneros, 1974:455-466).
At the same time, of course, other variables must be incorporated into any assessment of a SFDP's overall impact such as, for example, whether as a result of the farmer's participation in the project he is less fatalistic or, similarly, more optimistic about the future. Diaz-Cisneros (1974:453-454), for example, reports that the Puebla Project had an important noneconomic effect on the farmer's attitudes and expectations:

Evidence of a productive and optimistic orientation came in the campesinos' answers to two questions asked during the research surveys of 1967 and 1971. In response to the query "what would you do if you suddenly were to receive an amount of money larger than your annual income?" Fifty three percent of the heads of families of 1967 stated that they would continue to farm, using the money to purchase more fertilizers to increase their yields. In 1971, after they had observed the potential of improved technology for three years, the proportion of campesinos who said they would invest in more fertilizers and other modern inputs rose to 73 percent. A specific 1971 sample of participants in the credit program produced 85 percent who stated they would continue to farm, purchasing modern inputs and making further improvements with the potential windfall.

The second question on their expectations proposed a scale with nine levels representing the entire range of living conditions of the campesinos in the region, the lowest level corresponding to the worst living conditions and the highest to the best. The campesinos were asked where they and their families now stood on that scale and where they thought they would stand within five years.

The proportion of campesinos who located themselves in the lowest two levels decreased from 28.3 percent in 1967 to 22.2 percent in 1971. A similar reduction was observed in the proportion of campesinos who expected to remain in the lowest two levels after five years.

These results with respect to the attitudes and expectations of the small farmer in the Puebla Project serve to emphasize, as noted in Chapter 2's discussion of the social psychological element of sentiment, that the various attitudinal dimensions (e.g., fatalism) of the small farmer would best be interpreted as symptoms of or reactions to the social system in
which he lives. Where the farmer has a reasonable opportunity to make a better life for himself and his family through a more productive CPS and succeeds, it is to be expected that his attitudes would also become more optimistic.

Continuation The final consideration in outlining the CSA-SFD is that of the manner in which the SFDP is to be continued. In the short run, the basic research and evaluation processes will identify both at the small farm and agri-support system levels a number of problems that will require the SFDP's further attention. In working out solutions to these problems, the SFDP will proceed by following the steps laid out in the CSA-SFD. In view of the problems which have been identified, the SFDP may need to identify new target areas (step A3) or delineate new social systems as relevant (B0). Further legitimation (B1) may be required as well as additional research analysis of the SFS (B3) and NAS (B2) or even of the prior social situation (B4).

Based on the data which have been collected at the research analysis steps, the SFDP must come to some decision as to what the problems are and formulate hypotheses as to the kinds of technology which might be developed to assist the former in solving the specified problems. Beyond this evaluation phase (C), the SFDP must conduct research experiments (D), evaluate (E) the results of these experiments and specify which technologies qualify as SFT, innovate (F) through research trials of the specified SFT, evaluate (G) the results of these trials and make these results, where favorable, available for other farmers to see in result demonstrations and, finally, provide for the adoption phase (H) and its large-scale adoption. Anywhere throughout this process the SFDP may need to back up to a previous step to
correct mistakes which have been made or to fulfill steps which were bypassed.

In the long run, however, what will become of the SFDP? Perhaps the biggest problem which a SFDP must resolve is that of responding to the yet unidentified problems at the level of the SFS throughout the LDC in which the SFDP has been implemented. This problem is one of the great challenges in the decades to come. The problem is that of ensuring that the SFDP does not become just another pilot project. As Myren (1971:37) has emphasized,

...pilot projects in each country must prove their ability to expand, train people and cover a broader area. A series of small pilot projects will obviously do very little to correct the enormous problems of the small holders on a worldwide basis. The program still has to prove its ability to expand and operate on a much broader scale.

Hopefully, the CSA-SFD will be of utility in helping to search for a better way to develop and diffuse SFT to an LDC's small farmers.
CHAPTER 5. DISCUSSION AND IMPLICATIONS

This dissertation was written with the objective of developing a model or prototype strategy of the steps that are involved in developing and diffusing improved agricultural technology to an LDC's small farmers. The approach taken in meeting this objective has been largely sociological as contrasted to a purely agronomic, economic, or other relevant disciplinary approach. Drawing upon an existing theoretical model of instigated social change (i.e., the "Construct of Social Action") and a "real world" strategy to develop and diffuse improved agricultural technology to small farmers in an LDC (i.e., the Puebla Project in Mexico), the author formulated what he termed a "Construct of Social Action for Small Farmer Agricultural Development" (CSA-SFD).

In historical perspective, the CSA-SFD reflects a period of transition from an older to a newer conceptualization of what constitutes a viable strategy to reach and benefit the small farmer in an LDC. There has been increasing disenchantment with the agricultural technology development and diffusion model which emphasizes a high degree of division of labor between research and extension operations (Brown, 1968; Felstehausen, 1968; Myren, 1971; Byrnes and Byrnes, 1971). The Puebla Project is in large part a response to this disenchantment and demonstrated that it is possible to bring the talents from a variety of disciplines to bear in an integrated manner on the problem of developing improved technology which is appropriate to the environment of the small farmer and securing that such technology is adopted by the small farmer. Several LDCs (e.g., Colombia, Honduras, El Salvador, Peru, and other states in Mexico) have since
attempted to replicate the Puebla Project strategy which in itself is an indicator of the potential viability of that strategy.

While the Puebla Project thus represents a trend toward greater interest in finding more effective solutions to the problem of developing and diffusing technology which can be profitably utilized by the small farmer, it must not be forgotten that no one project (e.g., the Puebla Project) can be viewed as the final answer. A key input in the search for more effective technological development and diffusion strategies is that of the systemic conceptualization and testing of alternative strategies. This dissertation represents the author's effort to systematically conceptualize or construct a sociological model of a strategy to develop and diffuse SFT to an LDC's small farmers. Reflecting on this model (the CSA-SFD as presented in Chapter 4) as well as on the social action perspective elaborated in Chapter 2 and the methodology utilized in developing the CSA-SFD (presented in Chapter 3), three general areas of implication for future research will be briefly proposed: application, evaluation, and theory.

Application

Having developed the CSA-SFD, the next research step is that of putting the CSA-SFD to an empirical test. Is it viable or valid? In other words, will it get the job done? In a recent seminar on technology and social change in Latin America held during the winter 1975 quarter at Iowa State University, a member of the audience raised the question of whether the Puebla Project strategy would work in other regions of Mexico, to which the speaker (an agronomist) replied: "Well, it would depend on whether the ecological and rainfall conditions were the same as in the Puebla region."
The author has no way of knowing whether the interrogator also had a similarly narrow conceptualization of the term "strategy." Of course, the specific technological recommendations for the Puebla region might not work in other parts of Mexico. The point is, however, that the basic "strategy" which the Puebla Project used to develop the specific technological packages for the Puebla area could also be effectively used in other regions of Mexico as well as in other developing countries to develop and diffuse appropriate technologies to small farmers. Indeed, as mentioned above, several LDCs are already implementing Puebla Project-type strategies.

While such efforts should provide an appropriate context within which to put the CSA-SFD to an empirical test, the ideal empirical test of the model would require that one or more NAREOs utilize the CSA-SFD as a strategy or prescriptive model of the steps which should be taken in order to develop SFT and diffuse this technology to the small farmers in the LDC in which each NAREO operates. It must be remembered, however, that this approach would require that each NAREO be able to mobilize the full complement of personnel (i.e., the SFDP staff) that would be required in order to develop the requisite SFT and diffuse this technology to the LDC's small farmers.

This mobilization of a SFDP staff would not be problematical except that an LDC is characteristically short in competent personnel in the area of agricultural production (Byrnes, 1974). The provision of competence in a SFDP is not achieved by simply recruiting individuals who have received their education in the various disciplines perceived by the NAREO as important. In one manner or another, the NAREO must recruit for the SFDP staff a complement of personnel who have singularly or collectively the range of
competencies which are required in order to carry out the specific tasks that are involved in developing and diffusing SFT to the small farmer. These competencies were identified within the CSA-SFD as minimally five: technical competency, economics competency, science competency, farming competency, and communication competency.

If these five competencies are not integrated within a total effort to develop and diffuse SFT to small farmers, institutional bottlenecks will certainly impede progress at the level of the SFS. How the NAREO provides for these competencies is another question. As Burton T. Swanson, former training officer at CIMMYT, recently noted:

...the Puebla Project...has apparently developed a rather satisfactory division of labor in solving both the technical and institutional problems connected with increasing maize yields, yet maintaining a well integrated production team. Certain team members are concerned with developing the optimal agronomic package of practices and can be systematically trained to carry out these functions.

Others are concerned with the institutional problems and focus on organizing farmer groups, the availability of credit and other inputs. Again these team members can be trained to help farmers fill out credit applications, to assist with high-yielding production plots, etc. (cited in Byrnes, 1974:224).

Thus, a key factor in putting the CSA-SFD to an ideal empirical test lies in whether a NAREO can, in one way or another, mobilize the requisite competencies into an integrated SFDP staff.

One means of improving the competency levels of current or future professional agricultural workers in the LDCs is through the development of agricultural education curricula designed to improve the individual's competency in any one or more of the five competency areas. Such curricula would include both classroom activities as well as actual work in the field, for example, learning how to grow the particular crop (e.g., maize)
about which the student or trainee will later be making recommendations to
the farmer. Short of putting the CSA-SFD to an actual empirical test, it
could be incorporated into curricula for competency development and uti-
lized as a learning device to sensitize the learner to the various social
processes and related considerations (e.g., technical, economic, etc.) that
are involved in developing and diffusing agricultural technology to the
small farmer. The student's or trainee's examination, analysis, and dis-
cussion of the CSA-SFD can also serve to provide a critical feedback loop
into the model and, thereby, short of an empirical test, provide an alter-
nate avenue for its improvement.

Evaluation

Where a NAREO is considering the possibility of putting the CSA-SFD to
an empirical test, the problem of evaluation arises. How is the success
or failure of the SFDP or the implementation of the CSA-SFD to be evalu-
ated? The question itself suggests that a SFDP may also need a sixth com-
petency--evaluation competency, if such is not already provided under the
general area of science competency. Assuming that a SFDP does have the
necessary evaluation or science competency, what are some of the possible
areas of evaluation which might be fruitfully explored?

The first area is that of developing objective measures for each step
in the CSA-SFD. One approach to this measurement problem would be to
develop a schedule or list of the "conditions to be met" (Beal et al.,
1966:71) at each step of the CSA-SFD. Such a list would provide a
detailed specification of the objectives to be accomplished at each step in
the CSA-SFD in order to maximize the probability of success at subsequent
steps. For example, an important objective or condition to be met at the research analysis of agri-support system step (B2) would be the identification of the community-level decision-making system. The Puebla Project, however, initially bypassed this step completely and subsequently discovered in the face of farmer hostility toward the Project that the Project staff had to back up (in terms of the CSA-SFD) to step B2 and identify and work through the existing power structure (i.e., municipio leadership) to ensure that the Project was legitimated. If, however, the Puebla Project would have utilized a strategy which specified the conditions to be at each step, the Project would have identified the community-level decision-making system at step B2. Admittedly, a principal objective of the Puebla Project was to devise and field test a strategy for developing and diffusing improved technology to small farmers. However, lacking any specification as to the conditions to be met at each step, the Puebla Project had to devise procedures as it went along and, thus, had to learn through trial and error whether the devised procedures were appropriate.

A second area in which evaluation procedures could be devised is that of utilizing the CSA-SFD as a framework for comparatively analyzing other "real world" projects to develop and diffuse agricultural technology to small farmers. This approach, incidentally, would provide an indirect test of the CSA-SFD. Would the more successful projects be found to have included a significantly greater number of the action steps in the CSA-SFD as compared to the less successful projects? Would the steps in the successful projects be found in the same order as in the CSA-SFD? For example, in examining Röling's (1974) description of a project to diffuse improved agricultural technology to small farmers in Kenya, the author
found that the prototype alternative extension strategy being tested in Kenya not only contained many of the steps in the CSA-SFD but also had ordered these steps in a quite similar pattern or flow of action as that contained in the CSA-SFD.

A third area in which evaluation procedures as well as analytical models are needed is that of identifying lines of agricultural research that would most likely pay off in the development of SFI. If such procedures could be developed, the information which they would provide could be utilized in making decisions on how additional research resources could be allocated. Such a capacity would be of considerable utility at the research analysis of SFS step (B3) in indicating the kinds of data which should be collected on the SFS or how collected data can be evaluated at the problem specification/hypothesis formation stage (C). The development of this kind of information generating capacity is becoming an important concern of various national and international agricultural research centers (cf. Johnston, 1974; Pinstrup-Anderson, 1974; Pinstrup-Anderson and Byrnes, 1975).

A fourth evaluation area, one which is interrelated with the preceding topic in regard to research resource allocation, is that of developing social indicators to monitor the status or performance level trends in the various dimensions along which farmers define objectives. Chapter 2 specified nine different dimensions along which small farmers might set priorities or define objectives. It was suggested that these dimensions are not only significant from the standpoint of the level of living of the individual farm family but are also important concerns for national and agricultural development planners. Were social indicators of the small farm agri-
cultural sector available, they would provide a significant input not only to agricultural development planning but also to the carrying out of the various research analysis and evaluation steps within the CSA-SFD.

Theory

In developing the argument of the dissertation, the author drew on two general theoretical areas: the idea of a social system and the idea of social action. Building on the idea of social action as a special type of social change in a social system, the author articulated a social action perspective on small farmer agricultural development in Chapter 2; then, in Chapter 4, the author demonstrated how this perspective could be operationalized through the CSA-SFD. Being a relatively general model of the steps that are involved in developing and diffusing SFT to the small farmer in an LDC, however, there is considerable room and need for the construct's further conceptual refinement. Some possible areas for future theoretical investigation are briefly discussed below.

A first area of theoretical inquiry is that of a more "receiver-oriented" approach to the identification of the social system element of objectives within the SSEM of the SFS. As stressed in Chapter 2 and to a lesser extent in Chapter 4, agricultural workers need to identify what the farmer perceives as the relevant objectives and what he sees as the constraints which impede or block the achievement of his objectives. Otherwise, agricultural technicians will develop "SFT" based on their own assumptions as to what the farmer's problems are. In this regard, the author's conceptualization of small farmer objectives may (or may not) be valid from a national development planner's standpoint but does it ade-
quately take into account the priority which the farmer places on his objectives as he defines or perceives them? Have certain objectives been left out which should have been included: housing, health, education, security, low risk...? How would the small farmer rank these in relation to other objectives (e.g., yields)?

A second area of theoretical inquiry is of particular importance in relation to the research analysis of SFS step (B3). The empirical analysis of a SFS would be considerably aided by a more comprehensive taxonomy of the specific variables that should be taken into account within each of the elements of the SSEM. The author had few, if any, guidelines to follow in attempting to analyze the various social system elements in relation to the farmer's decision-making with respect to and operation of the CPS. Hopefully, the SSEM of the SFS elaborated in an exploratory manner in Chapter 2 will provide others interested in this area a useful point of departure for further taxonomic development.

A third area for further theoretical development arises in relation to the general level of abstractness at which the CSA-SFD is formulated. As a general strategy for developing and diffusing SFT to an LDC's small farmers, the CSA-SFD is potentially applicable to a great number and variety of LDCs. However, precisely because it is a general strategy, the CSA-SFD lacks a certain specificity that may be required in certain locales. This suggests that future theoretical elaboration of the CSA-SFD should be directed toward the specification at each action step of alternative prototype strategies and tactics which individual NAREOs could draw upon according to their particular circumstances. For example, what additional steps or substeps might be theoretically specified for developing SFT for a
Multi-CPS and/or a Mixed-CPS as compared to a single plant (or animal) CPS? In what ways may the general strategy need to be modified to suit the particular social system in which the CSA-SFD is being implemented? That is, what modifications in the CSA-SFD are required in order to enhance the possibility of its successful implementation in an African country as contrasted to a Latin American or Asian country?

A fourth area for further theoretical development is that of identifying which variables and hypotheses in the literature on the adoption and diffusion of innovations can be usefully incorporated into one or more of the various steps of the CSA-SFD. One variable which might be examined in this regard is that of the innovation characteristics of a particular Small Farmer Technology (SFT). Rogers (1962:146) has suggested that the characteristics of an innovation, as perceived by actors in a social system, affect its rate of adoption. Such characteristics include: (1) relative advantage (including profitability), (2) compatibility (degree to which an innovation is consistent with existing values and past experiences of the adopters), (3) complexity (degree to which an innovation is relatively difficult to understand and use), (4) divisibility (degree to which an innovation may be tried on a limited basis), and (5) communicability (degree to which the results of an innovation may be diffused to others).

While recognizing the potential relevance to the CSA-SFD of some of the previous research and conceptual frameworks in the adoption and diffusion literature, the author emphasizes that he purposively excluded much of this literature from consideration in this dissertation. While it might be argued that at least some representative items from that literature should have been given greater attention and more widely utilized in developing
the CSA-SFD, it must be remembered that much of the literature on the adoption and diffusion of innovations takes a post facto look at agricultural innovations which have already been adopted. In other words, given that a particular innovation has been adopted by some percent of the farmers in a region, adoption-diffusion studies have generally attempted to determine which variables best predict those farmers who adopted and those who did not. Many of the variables found to explain or predict adoption, however, are often not easily amenable to manipulation by development planners and project implementors---at best they can only be taken into account in designing action programs to increase the adoption of new technology (cf. Adams and Havens, 1966; Röling, 1974). And, as Röling, Ascroft, and Wa Chege (1974) have argued, action programs based on an indiscriminate utilization of the adoption-diffusion perspective have generally resulted in the diffusion of improved technologies to the more progressive farmers rather than to the population of small farmers who are in greatest need of beneficial and workable technological alternatives.

In contrast, in the CSA-SFD as advocated in Chapter 4, the change agent (i.e., the SFDP) does not know in advance precisely who the ultimate adopters will be nor what the technology will be that they will adopt. The SFDP, however, does know that it is generally the small farmer who is most in need of beneficial and workable technological alternatives which are desirable from the farmer's standpoint. Once the SFDP is able to identify the existing problems at the level of the SFS, the project can then proceed to develop through research experiments and research trials a technology that will assist the small farmer in more optimally achieving his objectives. Finally, the CSA-SFD assumes that the way in which the SFDP
involves the small farmer as well as the agri-support system in developing a SFT will be a key, if not determining, factor in the farmer's ultimate decision to adopt or not to adopt a particular technology.

A final area for theoretical consideration is the relevance of the CSA-SFD in view of the growing trend, evidenced historically by the collectivization of agriculture in Russia, China, Cuba, and other countries, toward what may be termed group farming, wherein individual farmers collectively carry out the technical operation of a CPS under the direction of some common authority (e.g., the state, a hired manager, etc.). In view of the fact that the author developed the CSA-SFD with the agricultural subsector of individual small farm holdings in mind, the question must be raised not only as to the applicability of the CSA-SFD to the case of group farming but also and perhaps more importantly as to whether the dissertation may have focused on a disappearing or declining structural form of agriculture (i.e., the individual small farm holding) in the Third World. Ultimately, national governments in the LDCs must decide whether resources are to be directed to developing a viable and productive small farm agricultural sector or whether existing small farm holdings are to be combined into the structural form of group farming. While the latter case would probably require some modification of the CSA-SFD to ensure its applicability, the author takes the position that in either case the basic sociological concepts (e.g., the nine social system elements) in the SSEM as well as the various social processes (e.g., research analysis, legitimation, innovation, etc.) in the CSA-SFD will be relevant in providing a sensitizing framework to assist development planners in approaching the problem of instigating developmental change along the nine dimensions specified in Figure 2.13.
CHAPTER 6. SUMMARY

The Problem and the Objective

National development planners and other concerned parties, particularly in the social sciences, are increasingly recognizing that the subsistence or small farm agricultural sector can play a greater role in the overall process of agricultural and economic development: (1) if productivity on the small farm can be increased; (2) if greater quantities of labor can be intensively employed in the production of agricultural commodities; and (3) if the small farmer's income can be increased sufficiently to alleviate poverty and provide effective demand for nonagricultural goods and services.

The emerging recognition of the importance of developing the small farm agricultural sector is reflected in the increasing attention that is being directed to the development of (1) technologies which are more productive within the context of the small farm and (2) strategies whereby such technologies can be rapidly diffused to the small farmer. At the same time, however, "change agencies in developing countries each work with its own rule-of-thumb approaches to rural development, simply because there is no set of proved strategies which can be replicated" (Röling, 1974:22).

In light of these considerations, the problem of the dissertation was to devise a model or prototype strategy of the steps that are involved in developing and diffusing improved agricultural technology to an LDC's small farmers. Stated in a slightly different manner, the dissertation's overall objective was to devise a strategy which would be of practical utility as a guideline and analytical framework in designing and evaluating action pro-
grams to improve the level of living of small farmers through the development of improved agricultural technology and the diffusion of this technology to the small farmer. A mid-range interpretation of this objective was to approach the stated problem from a sociological as constrained to a purely agronomic or economic approach. At the most specific level, the dissertation objective was to specify a model of a strategy (1) to develop Small Farmer Technology (SFT), i.e., technology that is workable and beneficial within the context of the small farm agricultural operation in an LDC and (2) to diffuse such SFT to an LDC's small farmers. This specific objective was met through four interrelated chapters.

A Social Action Perspective on Small Farmer Agricultural Development

The objective of Chapter 2 was to articulate a social action perspective for approaching the problem of developing a model of a strategy to develop and diffuse SFT to an LDC's small farmers. Specifically, a general social action perspective was presented and then applied to the context of small farm agriculture in the LDCs.

Building on the idea of a social system as a model of social interaction and social organization, the ideas of a subsystem and social system maintenance were introduced. Particular emphasis was placed on the idea of a social system being composed of latency, integration, adaption, and goal attainment functional subsystems. The idea of a social system element was then introduced and nine elements were defined: sentiment, belief, norm, status-role, rank, power, objective, facility, and sanction. These elements were interrelated in what was referred to as a Social System Elements Model (SSEM). Three social system reference points and their corresponding
elements were specified: the social organizational elements (power, rank, status-role), the social psychological elements (norm, belief, sentiment), and the social economic elements (objective, sanction, facility).

The concept of technology was defined as a specific combination of facilities (resources) utilized by an individual or an organization to achieve a defined set of objectives. The element of facility and, relatedly, technology was identified as part of the adaptation subsystem of a social system, while the element of objectives was located in the social system's goal attainment subsystem. Thus, in any social system, the facilities and technology of the adaptation subsystem are the principal means for attaining the ends or objectives of that system's goal attainment subsystem.

Social change was defined as the unplanned alteration in one or more social system elements (Y) which occurs as the result of a change in another element (X) within the same social system. Social development was defined as the purposive instigation of a change in element (X) in social system A with the objective of achieving some planned alteration in one or more elements (Y) in social system A. Finally, social action was defined as a special type of social development or instigated social change in which a first social system or subsystem A (designated as change agent system) purposively instigates a change in element X in a second social system or subsystem B (designated as target system) with the planned objective of altering one or more elements Y in the target system. Four social systems were specified as relevant in social action: the primary target system, the secondary target system, the primary change agent system, and the secondary change agent system.
This social action perspective was then applied to small farm agriculture in the LDCs. Building on such basic concepts as production input factors (e.g., credit), commodity disposition factors (e.g., storage), commodity process system or CPS (i.e., farm firm), and resource allocation system or RAS (i.e., farm family), the CPS was identified as a social system or subsystem embedded within another social system, namely, the RAS. The small farm system (SFS) was then defined as a social system in which the CPS and RAS are interrelated in such a way that three general conditions exist: small size of farm, low level of market interaction, and low or subsistence level of living.

Recognizing the complexity of the SFS, a SSEM of the SFS was presented in which each of the nine social system elements is examined in relation to the small farmer's decision-making with respect to and operation of the CPS (farm firm). Several major assumptions were set forth at the outset of the model. First, the social organizational and social psychological elements enter into, either constraining or facilitating, the small farmer's decision-making with respect to and operation of the CPS. Second, the social economic element of facilities and, relatedly, technology of the adaptation subsystem of the SFS provide the principal means for achieving the objectives or ends of the goal attainment subsystem of the SFS. Third, the social economic element of sanction functions in a way that ensures that facilities are utilized to achieve the objectives of the small farm family. Various qualitative data and in some instances survey data were then presented to illustrate the manner in which each of the nine social system elements can enter into the small farmer's decision-making with respect to and operation of the CPS.
Of the nine elements, particular importance was placed on the specification of nine dimensions along which small farmers might define objectives: (1) nutrition, (2) cash flow, (3) efficiency of utilization of commodity disposition factors, (4) productivity and production, (5) productive potential of the unit of operation, (6) level of on-the-farm employment, (7) efficiency of utilization of production input factors, (8) involvement in political decision-making processes (e.g., cooperatives), and (9) off-the-farm employment generated by the CPS. Each of the nine dimensions was then rewritten in the form of a national policy or small farmer objective, e.g., to increase the nutritional quality of the farm family's diet. It was hypothesized that if small farmers were to specify objectives along any one or more of the nine dimensions and, subsequently, were to achieve the specified objectives, such achievement would constitute a beneficial change in the SFS from the standpoint of national development planning. It was assumed that alteration in the technology currently utilized by the small farmer to operate the CPS is the minimum requisite for a more optimal achievement of the nine small farmer objectives.

With the nine small farmer objectives in mind, it was suggested that considerable research at the SFS level will be required in order to identify what the actual problems are and to develop the kinds of technology that would be beneficial in assisting the farmer to more optimally achieve the specified objectives. The emphasis on the social economic elements of objectives and facilities is not to deny the importance of taking into account the social organizational and social psychological elements when developing new technology for the small farmer. This emphasis, however, does reflect the author's assumption that it is more feasible and benefi-
cial to improve the small farm family's level of living through the utilization of more productive technology than to attempt to solely change either the small farmer's sentiments (e.g., his attitudes) or power (e.g., his land tenure status). Finally, the author defined the concept of Small Farmer Technology (SFT) as a combination of commodity processing facilities (CPF's) that is:

1. **Beneficial** in the sense that the combination of CPF's in question, in comparison with the technology currently utilized by the small farmer, would, if utilized by the small farmer, enable him to more optimally achieve one or more of the nine small farmer objectives; and

2. **Workable** within the context of the CPF's to which the small farmer has access either within the SFS or from sources outside the SFS.

The concept of "small farmer agricultural development" (SFD) was then defined as a more optimal achievement of at least one or more of the nine small farmer objectives. Then "social action for small farmer agricultural development" (SA-SFD) was defined as a type of SFD in which a change agent system (a social system other than the SFS) purposively instigates action to develop SFT and to diffuse that technology to a target system of SFSs. Finally, four social systems were identified as relevant in SA-SFD: (1) the small farm system or SFS (the primary target system), (2) the nationally-based agri-support system or NAS (the secondary target system), (3) the national agricultural research and extension organization or NAREO (primary change agent system), and (4) the international agricultural research center or IARC (secondary change agent system).
Methodology

While Chapter 2 provided a general framework for approaching the problem of developing a model of a strategy to develop and diffuse SFT to an LDC's small farmers, the framework itself was neither a strategy nor a model of a strategy. To develop such a model, the author proceeded on the assumption that a feasible model could be developed by attempting to synthesize a theoretically-based model of social action and an empirically-based model of a "real world" effort to develop and diffuse improved technology to an LDC's small farmers. After reviewing a number of theoretically-based models of instigated social change, the "Construct of Social Action" (Beal et al., 1966) was selected for intensive analysis. On the other hand, the Puebla Project in Mexico was selected as the empirically-based model of a "real world" effort to develop and diffuse improved technology to the small farmer. Chapter 4 or the "Construct of Social Action for Small Farmer Agricultural Development" (CSA-SFD) is the result of the synthesis.

A Construct of Social Action for Small Farmer Agricultural Development

Recognizing that territoriality, size, and time are basic conditions of social action, Chapter 4 systematically discusses each step of the CSA-SFD. The following briefly summarizes the general substantive content of the CSA-SFD without reference to either the "Construct of Social Action" (Beal et al., 1966) or the Puebla Project (CIMMYT, 1969). A Small Farmer Development Project (SFDP) is implemented in terms of (1) a flow of social action which may be broken down by stages, phases, and steps and (2) three
social system levels. To assist in following the discussion, the reader is encouraged to refer to Table 4.1.

**Flow of social action in a SFDP**

There are two overall stages in the CSA-SFD: Initiating sets (Stage I) and Diffusion Sets (Stage II). The former stage occurs prior in time to the latter stage and is primarily concerned with the execution of the phases and steps which are necessary in order that a SFDP may reach the point that a set of research hypotheses have been formulated in regard to the kinds of technology that would be beneficial for small farmers to adopt. The latter stage is then concerned with the execution of the phases and steps which are necessary in testing potentially beneficial technologies at the level of the SFS and subsequently diffusing to other farmers in the SFDP's target area those technologies which have been validated as SFT.

At a more specific level within each of the two stages, there are a number of action phases which are, in general, temporally sequential. During Stage I, there are three phases: convergence of interest (phase A), reconnaissance and legitimation (B), and evaluation (C). The first of these phases, convergence of interest (A), involves those action steps which a NAREO takes to recruit the SFDP staff (A2) and select the project's target area (A3).

After the target area has been selected, the SFDP proceeds to phase B which involves five action steps: delineation of the relevant social systems (B0), legitimation (B1), research analysis of the NAS or nationally-based agri-support system (B2) and SFS (B3), and prior social situation
(B4). Once phase B's actions have provided the SFDP with some understanding of the SFS and the surrounding agri-support subsystems (NASs), the SFDP enters phase C during which the problems of the small farmer are identified on the basis of the data collected at step B3, and hypotheses are formulated as to the kinds of technologies which might assist the small farmer in solving the specified problems. Stated somewhat differently, a decision must be made as to the kinds of research that would most likely lead to the development of technology that would assist the small farmer in more optimally achieving his objectives.

The formulation of a set of research hypotheses at phase C sets the stage for initiating the various action phases and steps subsumed under the Diffusion Sets (Stage II). These are: experimentation (D); evaluation (E) or, more specifically, SFT specification; innovation (F); evaluation (G) or, more specifically, result demonstrations; and large-scale adoption (H).

During the experimentation phase (D), the SFDP carries out the action step of legitimation (D1) for the research experiment (D3) step that will subsequently be carried out at the SFS level. To the extent that the execution of the research experiment step (D3) requires inputs from the NAS, the SFDP must mobilize these inputs from the appropriate NASs at step D2. Finally, the SFDP must carry out the actual research experiment step (D3) at the level of the SFS. On the basis of the data gathered during the research experiment step (D3), the SFDP specifies which technologies qualify as SFT. This specification constitutes the initial evaluation phase (E) of Stage II.

Once one or more SFTs have been specified in phase E, the SFDP is ready to initiate the innovation phase (F). At step Fl, the SFDP carries
out those activities that will serve to legitimize the subsequent research trial step (F3) at the SFS level. Then, at the agri-support system mobilization step (F2), the SFDP ensures that adequate mechanisms have been set up whereby farmers can gain access to any CPFs required for proper utilization of the SFT that will be tested at the research trial step (F3).

Finally, at step (F3), the SFDP carries out those activities which are involved in assisting the farmer to participate in a research trial.

With the results of the research trial step (F3) in hand, the SFDP is ready to implement the second major evaluation phase of Stage II, namely, the result demonstration phase (G). During this phase (G), the SFDP is concerned with assessing whether the research trial step (F3) has been successful in demonstrating that the small farmer does indeed benefit from the SFT in question when he has had the primary responsibility for utilization of that technology within his own SFS. If farmers have been successful, the SFDP is ready to initiate a program of local and regional result demonstrations. The objective of these demonstrations is to provide other farmers an opportunity to see what those farmers who have participated in the project have been able to accomplish and to learn from these farmers how similar results can be obtained on other small farms through adoption of the SFT.

The next to the last phase of the Diffusion Sets is the adoption phase (H). Again, the SFDP is involved in the action step of legitimation (H1), this time with the objective of preparing the way for large-scale adoption (H3) of the SFT throughout the target area. Relatedly, the SFDP continues to mobilize the NASs (H2) to ensure that all the required mechanisms have been set up whereby small farmers can gain timely access to the CPFs neces-
sary for proper utilization of the SFT. Then, to facilitate large-scale adoption (H3) of the SFT, the SFDP ensures that the information which farmers will need to appropriately use the SFT and obtain its requisite inputs is communicated to them.

Finally, during the third evaluation phase (I) of Stage II, the SFDP assesses whether the status of the SFS in the project's target area at the end of step H3 is significantly improved compared to what that system's status was at step B3. Based on this evaluation, the SFDP determines the next steps which need to be taken in order to further developmental change at the SFS level.

**Social system levels in a SFDP**

If we look at the CSA-SFD as a whole, rather than on a step-by-step basis, in effect, looking at the forest rather than each of the individual trees, we see more clearly that a SFDP operates at three different social system levels.

First, at the level of the SFS, the SFDP is basically concerned with five action steps. These steps are represented by the five circles in the right column of Table 4.1. At step A3, the SFDP selects a target area of SFSs. Then, at step B3, the SFDP analyzes the SFS in order to obtain an understanding of what the problems of the SFS are and the data necessary to formulate hypotheses in regard to the kinds of technology that might assist the farmer in solving the problems which are identified. Later, at step D3, the SFDP experimentally tests the formulated hypotheses within the SFS, thereby generating the data necessary to specify which technologies qualify as SFT. Subsequently, at step F3, the SFDP further tests the SFT in a num-
ber of research trials, wherein the participating small farmers assume the principal responsibility for carrying out the necessary practices required for proper utilization of the SFT.

If the action steps at the SFS level are to be successfully accomplished, the SFDP must also work at the agri-support system (NAS) level. Action steps taken by the SFDP at this level are represented by the five circles in the second from the right column in Table 4.1. At step A2, the NAREO in the LDC in which the SFDP is to be implemented, perhaps in conjunction with an international agricultural research center (IARC), must recruit a competent SFDP staff. At least five competencies (technical, economics, scientific, farming, and communication) will be required not only at the research analysis of SFS step (B3) but also at the research analysis of NAS step (B2). Then, as per the specific CPFs required for execution of the research experiment (D3), research trial (F3), and large-scale adoption (H3) steps, the SFDP must develop the mechanisms whereby the farmers can gain access to the CPFs they will require in order to adopt the SFT in question. These mechanisms must be developed within the various NASs during the various mobilization of NAS steps: D2, F2, and H2, respectively.

Finally, the SFDP must work at a third social system level, namely, that of the change agent system which, in effect, is the SFDP staff. This level is represented by the four circles in the third from the right column in Table 4.1. At this level, the NAREO must have a clear understanding of the CSA-SFD as a general "plan of work" for the SFDP. This understanding takes place within the convergence of interest phase (A) and is represented by step Alb. Later, at phase C, the SFDP must specify, on the basis of the data collected at the research analysis of SFS step (B3), what the small
farmer's problems are and formulate hypotheses as to the kinds of technology which would be beneficial in assisting small farmers to solve the specified problems. Then, at phase E, the SFDP must evaluate the research results from the research experiment step (D3) and specify which of the technologies tested at step D3 qualifies as SFT. Once a SFT has proven successful with farmers at the research trial step (F3), the SFDP then seeks to make the SFT and its benefits visible for other farmers to see during the evaluation or result demonstration phase (G). Though not shown at the same level in Table 4.1 as step Alb and phases C, E, and G, the total evaluation and continuation of SFDP phase (I) may also be considered to lie at the SFDP level.

The importance of working at the SFS and NAS levels is reemphasized by the necessity for a continual process of legitimation. If the SFDP is to operate successfully at either the agri-support or small farm system levels, project staff must ensure that the project is adequately legitimized. The importance of the continuing necessity for legitimation is represented by the five circles in the fourth from the right column in Table 4.1.

While the CSA-SFD has been specifically illustrated with reference to the Puebla Project to rapidly develop corn yields, the model is hypothesized to be general enough that it can be utilized to develop SFT with either crop or livestock CPSs. To be sure, not all LDCs will need a strategy to develop and diffuse SFT to increase corn yields, but all LDCs do need a strategy that will assist them to more adequately respond to the problems of the small farmer. The CSA-SFD is proposed as a tool which would be of considerable utility to any NAREO and, relatedly, to any of the
IARCs that seek a more systematic way to effectively respond to the problems of the small farmer in the LDCs.

Discussion and Research Implications

Three general areas of implication for future research were briefly discussed: application, measurement, and theory. While there is an immediate need to put the CSA-SFD to an empirical test, an ideal test would minimally require the implementation of a SFDP in an LDC. The increasing number of Puebla Project-type agricultural technology development and diffusion action programs being implemented in various developing countries provides a potential opportunity for the multi-national testing of the CSA-SFD. Short of an actual test of the model, it was suggested that the CSA-SFD could receive wider exposure and improvement through its utilization as a learning device in agricultural education curricula designed to improve the competency levels of future or current professional agricultural workers.

Second, in relation to evaluation, several research areas meriting further investigation were proposed: (1) conditions to be met, (2) comparative analysis of existing projects, (3) research resource allocation analytical models and evaluation techniques, and (4) social indicators of the small farm agricultural sector. Finally, several possible areas for further conceptual elaboration and refinement of the CSA-SFD and the SSEM were suggested: (1) a more "receiver-oriented" approach to the identification of the social system element of objectives within the SFS, (2) a more comprehensive taxonomy of the specific variables that should be taken into account within each of the nine elements of the SSEM at the research analy-
sis of SFS step (B3), (3) specification of alternative strategies at each step of the CSA-SFD to suit the particular conditions of specific LDCs, and (4) an incorporation into the CSA-SFD of variables and hypotheses from the literature on the adoption and diffusion of innovations.
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This dissertation evolved from my growing interest over the past ten years in the problem of finding ways to more rapidly diffuse improved agricultural technology to small farmers throughout the developing world. This interest was originally sparked in the spring of 1965 at Michigan State University by Dr. Everett M. Rogers' course on "Communication and Change: The Diffusion of Ideas and Information" and has continually been rekindled --no pun intended--by many discussions with my father, Dr. Francis C. Byrnes. Hopefully, those seeking a quickened pace of agricultural development in the Third World will find the dissertation to contain some useful conceptual models which go beyond the work which my father and I earlier published in a 1971 article on agricultural extension and education in the developing countries. This time around, however, circumstances did not afford the luxury of a coauthorship and, accordingly, full responsibility for all of the dissertation's shortcomings must ultimately fall on my own shoulders.

The possibility of developing a synthesis of the "Construct of Social Action" and the agricultural technology development and diffusion strategy of the Puebla Project evolved from a conversation with Dr. Francis C. Byrnes in October, 1974. As one version after another of the synthesis came off the drawing board, Dr. Gerald E. Klonglan, the author's major professor, continually provided the critical feedback which encouraged the author to go back to the drawing board for yet another try to do better. Dr. Klonglan was also of particular assistance in suggesting ways in which I might develop a methodology chapter which explained in greater detail what
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dissertation will provide a valued contribution to the growing number of
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Figure A.1. A construct of social action (Beal and Hobbs, 1969:8-9. Included in this dissertation with the permission of Dr. George M. Beal)
Table B.1. Elements, structural-functional categories, and processes of social systems (adapted from Loomis, 1967:187)

<table>
<thead>
<tr>
<th>Elements</th>
<th>Structural-functional categories</th>
<th>Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Power</td>
<td>Controlling</td>
<td>Decision-making and Its initiation into action</td>
</tr>
<tr>
<td>2. Rank</td>
<td>Ranking</td>
<td>Evaluation of actors and Allocation of status-roles</td>
</tr>
<tr>
<td>3. Status-role</td>
<td>Dividing the functions</td>
<td>Status-role performance</td>
</tr>
<tr>
<td>4. Norm</td>
<td>Norming, standardizing, patterning</td>
<td>Evaluation</td>
</tr>
<tr>
<td>5. Belief</td>
<td>Knowing</td>
<td>Cognitive mapping and validation</td>
</tr>
<tr>
<td>6. Sentiment</td>
<td>Feeling</td>
<td>Tension management and Communication of sentiment</td>
</tr>
<tr>
<td>7. Objective</td>
<td>Achieving</td>
<td>Goal-attaining and Concomitant &quot;latent&quot; activity as process</td>
</tr>
<tr>
<td>8. Sanction</td>
<td>Sanctioning</td>
<td>Application of sanctions</td>
</tr>
<tr>
<td>9. Facility</td>
<td>Facilitating</td>
<td>Utilization of facilities</td>
</tr>
</tbody>
</table>

Comprehensive or Master Processes

1. Communication  4. Institutionalization
2. Boundary Maintenance  5. Socialization