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Appraisal Methodology for Feeder Road Projects

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This paper deals with the measurement of the benefits of feeder road investments in developing countries. It centers on two stages: project identification, and appraisal of specific investment alternatives. A practicable, simplified linear programming model for appraising and comparing investment benefits is proposed; an example is included to illustrate the possibilities of its use. The paper also presents guidelines for carrying out a regional project identification survey and a parallel survey of institutional and sociological factors.

Mr. T. Scudder (consultant) collaborated in the analysis of institutional and sociological factors, and Mr. G. Ablasser in the development of agriculture production models for earlier versions of the paper. Mr. E. Pernia helped to research the paper.

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I. INTRODUCTION

A. Purpose of the Paper

1. In this paper, we intend to present a practical and sound methodology for appraisal of feeder road projects in developing countries. These projects raise special problems because their impact differs in nature from that of major additions to a county's road transportation network. Feeder road benefits are mainly developmental, that is, they result from new traffic generated by the road. Additions to the main transportation network, on the other hand, generate benefits mostly in the form of savings to existing traffic. Other papers have dealt in depth with the latter subject;1 much less literature exists on the subject of feeder roads.2

2. The usual techniques for evaluating feeder roads do not adequately deal with the special characteristics of feeder roads. Moreover, in many cases predictions based on existing techniques have differed widely from the actual results of the investment. For example, growth has been slower than predicted or has failed to occur, and development has been of a different nature than expected. The methodology presented in this paper is designed to improve on the methods now in use.3

B. Definition of a Feeder Road

3. Throughout the paper, we define a feeder road as a road whose benefits stem mostly from new traffic (developmental benefits) rather than from savings to existing road users, and which carries little or no through traffic. Such a road has been called a feeder, rural, branch, tertiary, penetration, farm-to-market, agricultural, service, or village road by other authors. It may have other characteristics, such as low construction standards, short length, low traffic levels, and it may be a dead end road, but these qualities are not essential.

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1/ See Annex I bibliography, section I.
2/ See Annex I bibliography, section II.
3/ Another study on feeder road problems, Systems Analysis of Rural Transport, is currently being prepared for the Bank by META Systems, Inc. of Cambridge, Mass. Their study deals, in particular, with such aspects as the advantages of alternative feeder road grids and the location of agricultural production and markets. (See forthcoming Economics Department Working Paper).
4. The significance of the developmental benefits associated with feeder roads is illustrated by the following demand curve.\(^1\)

**Figure 1: Demand for Travel on a Feeder Road**

Before improvement, transport costs are equal to A and traffic is negligible (OC). After improvement, cost is reduced to B and traffic increases to OD. The developmental benefits, represented by triangle EFG, are more important than savings in transport costs on existing traffic, represented by rectangle BEOA. In an extreme case, transport costs without the road could be A'; no traffic will use the road and no local produce will be marketed until costs are reduced below B'. If a new road lowers costs to B, traffic on the road will be OD and the benefits will be entirely developmental (triangle FB'B).

**C. The Two Major Issues**

5. Among the issues which arise in devising a sound methodology for feeder road appraisals, two are central to the formulation of any specific feeder road investment. The first is pertinent to project identification and scope; the second to project appraisal. The issues are:

i. Which barriers are likely to frustrate or neutralize the development forces set in motion by feeder road investments? That is,

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\(^1\) We use the demand function for transport here only for illustrative purposes. Its shortcomings, especially when dealing with developmental roads, are well known. See item (53) in Annex I (bibliography).
(a) what are the potential barriers?
(b) which of these will be removed or lowered by actions outside the proposed investment?
(c) which will the project need to deal with?
What is the nature of the barriers: economic, political, institutional, or sociological; at what level do they exist: national, regional, or local?

ii. What is the nature of the changes induced by a new or improved feeder road? How do these changes lead to an increase in production? What methodology can best evaluate the changes and increase in production resulting from the project?

6. To deal with the first issue more effectively than the usual methods do, project identification procedures need to be strengthened. More information is needed to identify the other bottlenecks besides poor feeder roads which may hold back rural development, so that project scope can be delineated in a more realistic way. The second issue requires that existing appraisal methodologies consider systematically the manifold effects of a feeder road and that a more general and equally practicable methodology, such as that proposed in this paper, be put into use.

D. Outline of the Paper

7. We have organized the paper around the two major issues. After reviewing the weaknesses of theoretical and operational writings on feeder road appraisals in Chapter II, we explain in Chapter III the necessity of careful project identification, the essence of the first issue. In Chapter IV, we present in detail an appraisal methodology designed to come to grips with the second issue above. Chapter V is a preliminary effort to describe a method for identifying and quantifying institutional and sociological factors to be examined in project identification, part of the first issue. Chapter VI summarizes the paper's conclusions. Annex I is a bibliography on feeder roads and Annex II presents the elements of a quick and inexpensive field survey of institutional and sociological factors.
E. Scope of the Paper

8. We developed the methodology in Chapter IV under the assumption that the main objective of feeder roads investments is to promote regional development in a broad sense. Development is understood in terms not only of per capita income but also of income distribution, employment, health and educational standards, national and political goals, and other diverse aims. For this reason, we will consider feeder roads both in a limited, transport-oriented sense, and in the context of rural development.

9. The methodology we propose in this desk study would need to be tested through application. Admittedly, this would require more data than is commonly available, but it does not represent a theoretical ideal requiring complicated and impractical new procedures. Rather, the paper presents a model which can be implemented in the project preparation stage, if existing data are supplemented by a careful but straightforward survey.

10. The relative complexity of the examples given is meant to illustrate the power of the technique; its flexibility is perhaps its greater virtue. We constructed complex examples to show that the method can handle them. Simpler cases are all the more easily disposed of. The methodology can be simplified as easily as it can be made more complex.

11. The paper deals only with benefits and leaves aside problems arising from cost estimation, such as trade-offs between construction and maintenance costs, technical construction alternatives, and institutional arrangements for constructing and maintaining feeder roads. Likewise, questions concerning possible alternative means of transport are outside the scope of the paper.
II. STATE OF THE ART

1. The following review of the existing techniques for feeder road appraisals, based on an extensive bibliographical survey, is organized around the two main issues raised in the introduction. The first section deals with the identification and scope of projects, and the second with appraisal methods.

A. Project Identification and Scope

2. Theoretical writings stress the necessity of identifying projects through any planning mechanism that may already exist. Projects should be generated either from a sectoral or regional strategy ("macroeconomic" generation), or from local needs incorporated into planning goals ("microeconomic" generation) (1) (4) (6) (40) (64).

3. In very few cases does the appraisal of a project with feeder roads give a direct account of the way in which the project was identified or of any investment alternatives that were analyzed. From inferences, some studies have focused on regional development and have identified the need for feeder roads as part of a development strategy. These studies lead to an investment package rather than a feeder road project (77) (79) (84). In other studies, the focus has been provided by an agricultural development scheme, usually for one crop, and feeder roads are included as a complementary investment (111) (123). In still other projects, the analysis has been limited to the transport sector.

4. In all these cases, a systematic approach for identifying feeder road projects and defining their scope is lacking, because of the increasing acceptance of the idea that feeder roads should be part of regional investment packages. The need for specifying a separate feeder road project does not arise. We believe that past experience with the development of rural regions in poor countries validates the regional approach, but from an operational point of view, regional investment packages are not always satisfactory. A regional plan may not be feasible, for political or technical reasons. Moreover, the belief that a regional plan is the only acceptable approach has been used as an excuse for postponing potentially beneficial projects. The real practical issue, when packages are not possible, is to identify those projects or group of projects which will have the greatest impact on regional development. No systematic approach to this issue exists, either in general or for feeder road projects.

\[1/\] See Annex I, bibliography. The survey refers only to published material. We included consultants' reports only to the extent that we had access to them, the exception being studies on African countries for which a bibliographical survey was available. Bibliographic items will be referred to in the text by their number in the annex listing.
5. One consequence of considering feeder road projects as a component of rural development is to bring attention to institutional and sociological factors. Writers acknowledge that these factors could considerably change the benefits from feeder road investments. At the same time, they accept that feeder roads can counteract the negative effects of some institutional and sociological factors \((79) (84)\). Nevertheless, they have not integrated these factors into a general appraisal framework.

B. Appraisal Methods

6. Benefits of developmental and feeder roads are usually measured by quantifying road user savings. A common technique is to add the savings in vehicle operating costs accruing to the traffic that would have existed without the road, determined by simple extrapolation of past trends, and the value added by the production that has been induced by the road \((46) (112) (113) (114) (130)\). In application, it is not always clear whether the induced production requires investment in sectors outside the appraisal scope.

7. Several studies estimate benefits by measuring differences in income, sometimes using a regional approach. Usually, the region to be affected by the road is defined and independent projections made for expected increases in agriculture or other production. When available, specific development programs in the other sectors may be taken into account \((131) (114)\). Other studies appraise feeder roads as part of an investment package, usually an agricultural development scheme for increasing production of one crop (coffee, tea, cocoa, lumber).

8. Simplified methods have been used when lack of data or other reasons prevent the use of more sophisticated techniques. One study on rural roads in the United States recommends improvement on the basis of daily traffic or, lacking traffic counts, on the basis of very simple indicators like population served, number of schools, etc. \((50)\). Other simple methods use the ratio of cultivated area to road mileage or of population to road mileage as bases for construction decisions \((94)\). A more interesting approach, developed for Turkey \((61)\), could easily be applied to other countries. Each of several variables (population, economy, sanitary facilities, schools and touristic potential) is rated on a point system based on relative importance; the maximum total for these variables is 50. The total is added to another number, based on the proportion of total construction costs to be borne by the road users. The maximum combined value is 100. In this way, different projects can be compared.
C. Follow-up Studies

13. The literature on feeder roads abounds with follow-up studies describing the economic, institutional and sociological changes following feeder road construction (44) (60) (66) (71) (74) (78) (84) (97) (98) (101) (113). Some go into a partial analysis of the mechanisms by which the new or improved roads induced higher levels of output. These studies can point up factors on which appraisal studies should focus, but they provide few practical suggestions about how to appraise such factors.
III. PROJECT IDENTIFICATION AND SCOPE

1. In this chapter, we discuss the first of the issues raised in Chapter I: identification and scope of feeder road projects. This is an important issue for two reasons. First, the relations between feeder roads and the region they serve are more complex than those of other highways. Secondly, experience has shown that feeder roads are in most cases only one of many factors contributing to rural development; their existence is a necessary but not a sufficient condition for its occurrence.

2. We propose that feeder road projects be identified through a process focused explicitly on rural (or regional) development. In practical terms, potential projects in all sectors within the region should be identified simultaneously by the same process. As we will show later, this process does not imply that rural development can only be tackled through investment packages. In many cases, individual project-by-project analysis will be a feasible approach, but the role of each project in promoting development is greatly clarified through the proposed mechanism for project identification.

3. If development plans in the country concerned have clear sectoral and regional content, project identification is by definition part of the sectoral and regional programs. In this case, the process for individual projects starts at pre-feasibility or feasibility level. However, only a handful of developing countries have adequate regional plans. Therefore, we will devote this chapter to the essentials of the identification stage for feeder road projects, in countries where no regional planning is done. Technically speaking, this stage consists in a regional survey.

4. The project identification survey has four tasks:

i. Formulate a regional development strategy, if one has not already been established;

ii. Identify the most important barriers to or factors retarding the attainment of the development objectives;

iii. Determine which of these barriers will remain over the planning period, for economic, political or other reasons;

iv. Based on the previous points, formulate alternative actions (individual projects, investment packages and policy measures).
5. A regional development strategy is indispensable as a general framework for carrying out the other three tasks. Barriers to development cannot be identified unless we know something of the specific development objectives. A detailed strategy is not necessary. General indications of the desired changes in the productive structure (higher proportion of cash crops, less reliance on export-oriented activities) and of social goals (reduction in unemployment, higher educational and health standards) may often be sufficient. Governments often have clear general objectives at a regional level which might serve as a general framework.

6. We emphasize at this point the continuous nature of any planning process. The conclusions of pre-feasibility and feasibility study information may modify the regional goals, and iterations of the planning exercise may be necessary.

7. The second task -- identification of potential retarding factors -- requires a regional survey taking a multidisciplinary approach, since development barriers are institutional and sociological as well as economic. In this chapter, we concentrate on the analysis of mainly economic factors; we will deal with institutional and sociological variables in Chapter V. The separate treatment is purely a matter of presentation.

8. Table 1 gives a general indication of the content of a regional survey. In each domain (resource base, population, infrastructure, etc.) experience has shown certain potential retarding factors to be most common. The survey should establish whether these barriers exist in the region. We do not intend the list to be exhaustive, but to indicate areas of particular concern in rural development, such as population, education, and response to past incentives.

9. The third task -- determination of the barriers which will be present over the relevant time horizon, is perhaps the most difficult from a practical viewpoint. We cannot rely on a system of rules to help us decide which of the barriers revealed by the regional survey will weaken or fall and which the project should try to break down. The exercise is one of qualitative judgment. Knowledge of the political background is also necessary, as political realities may constrain economic action. For example, the government may not wish to challenge tribal organization though the latter may hinder modernization.

1/ We know of no regional survey having this focus. For a general discussion of regional survey methods in use, see Walter Isard (ed.), Methods of Regional Analysis; Cambridge, Mass.: M.I.T. Press, 1960.
<table>
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<th>Domain</th>
<th>Potential barriers to rural development</th>
<th>Potential corrective action</th>
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<tr>
<td>1. Resource base</td>
<td>Extreme scarcity of one or more resources.</td>
<td>Investment to improve the quality of existing resources (fertilizer plants, power plants)</td>
</tr>
<tr>
<td>(minerals, soils, vegetation, energy sources)</td>
<td></td>
<td></td>
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<td>2. Population and Health</td>
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<td></td>
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<td>Migration policies</td>
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<td></td>
<td>Malnutrition</td>
<td>Food production</td>
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<td></td>
<td>Low health standards</td>
<td>Health investments</td>
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<td>3. Educational levels</td>
<td>Illiteracy</td>
<td>Education investments</td>
</tr>
<tr>
<td></td>
<td>Lack of skilled labor</td>
<td>Migration policies</td>
</tr>
<tr>
<td>4. Infrastructure</td>
<td>Lack of infrastructure</td>
<td>Transport projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Irrigation projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power projects</td>
</tr>
<tr>
<td>5. Productive structure</td>
<td>Inadequate and traditional production techniques</td>
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<td>Lack of supporting activities (marketing boards, banks)</td>
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<td>Credit services</td>
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<td>8. Response to past incentives</td>
<td>Lack of response</td>
<td>Export-oriented industries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Institutional changes</td>
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<td></td>
<td></td>
<td>Extension services</td>
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<td>Institutional changes</td>
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<td></td>
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<td>Education investments</td>
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</table>
10. Now that the survey has identified a development strategy and a list of barriers to development which can be dealt with, project formulation can proceed in a systematic way. The elimination of each barrier requires an investment project, a policy action, or both (column 3 in Table 1). If one of these potential projects is the construction of feeder roads, a pre-feasibility study of alternative feeder road investments should follow, to provide a closer look at the feasibility of the project and to provide a ranking of the alternatives according to the contribution to rural development each would make.

11. The result of the identification survey is either a list of individual projects or one or more regional investment packages. The survey will recommend a package rather than a list of separate projects if the benefits are higher for a group of projects taken as a package than for the same projects taken individually. Sequential or unrelated implementation of individual projects is as good a solution as a package, if no extra benefits are expected from their implementation as a group.

12. Institutional constraints may favor the separate project approach. Very few developing countries are prepared to handle investments which require the simultaneous intervention of several ministries. For example, if a region requires a package comprising extension services, storage facilities, and transport, the work will probably be divided into as many projects as there are ministries involved in these three areas. If a Ministry of Public Works exists, it may handle a project covering transport and storage, and the Ministry of Agriculture will direct an extension service project. Although this constraint does not change the nature of the investment process, it increases the risk that parts of the package will be eliminated or postponed. Centralization of the identification stage would lay firm ground for later coordination among the separate ministries charged with project execution.

13. If international lending agencies are expected to provide financing, the institutional characteristics of these agencies may also create constraints. If an agency is better prepared to handle single sectoral projects than packages, a country may prefer to seek funds for the best individual projects as soon as possible, rather than to wait for approval of a multi-sector investment package.

14. Several changes in current practices are implied by the project identification procedure described in this chapter. At present, identification is usually done independently for each sector, although for a few agricultural development schemes, transport requirements have been considered simultaneously. The usual identification missions do not require a great deal of detailed preparation. Three major changes are implied by the foregoing analysis.
i. Project identification surveys concerning feeder roads should focus on rural development and include all sectors concerned (agriculture, industry, marketing, education, etc.). Project identification and feasibility studies should therefore explicitly take on a regional dimension.

ii. With the increase in scope of the identification surveys, preparation alone should require several weeks, and the survey itself will require more than a few weeks. However, since surveys will cover other project areas besides feeder roads, total time spent in project identification may be reduced.

iii. Institutional and sociological factors should be explicitly considered, requiring the involvement of sociologists and political scientists in some stage of the identification survey.
IV. TECHNIQUES FOR PROJECT APPRAISAL

1. This Chapter is addressed to the second major issue raised in Chapter I: the design of an appropriate appraisal technique for feeder road projects. We have divided the subject into three sections. In the first, we propose a technique that complies with most of the requirements for a good method of measuring the benefits from feeder road projects. This technique is illustrated in the second section with an example. In the third section we discuss data requirements and constraints.

   A. The Use of Linear Programming in Appraisals

2. As we propose a technique to appraise the benefits from feeder roads, we should bear in mind the close ties between transport and the local productive structure. The closeness of these ties is clear in a summary of the main effects of feeder road investment, excluding institutional and sociological effects. The direct effect of a feeder road investment is to reduce total transport costs by reducing carriage costs and road time and by making transport service more reliable. The reduction will differ for different users depending on the farm-to-road and farm-to-market distances. This reduction means lower input prices for sectors outside transport, and leads to lower output prices and higher production levels in those sectors. Since most rural transport services use human and animal resources also used in agriculture, resources freed by feeder roads can increase agricultural output. Better year-round access to rural areas facilitates the introduction of new crops and techniques.

3. Existing techniques often neglect analysis of these interrelationships. Often, they work directly with the demand for transport services, as we did for illustrative purposes in Chapter I. Sometimes, they go one step further and state the supply and demand conditions in the regions served by the road (17), but they do not analyze the supply mechanism nor, more importantly, the prices by which transport investments release resources which affect existing supply conditions in other sectors.

4. These shortcomings can be eliminated by using linear programming, a mathematical theory for solving a linear maximization problem with linear constraints. Very generally, a linear programming model consists in the linear function to be maximized, called the objective function, and a series of constraints expressed as linear equations or inequalities. One
objective of measuring benefits from a feeder road project is to find out how much the project increases the local economy's ability to maximize production given local resource constraints. Since the local economy's activity without the project can be expressed as a constrained maximization problem, and activity with the project as another such problem, the programming solutions to the two problems can be compared to show the project's effects.

5. Before proposing a specific programming model, we make five assumptions to simplify both the operational task and the algebra. These assumptions are based on experience with development in rural areas.

i. Demand for the output of the region we are studying is perfectly elastic; therefore output prices can be taken as given.

ii. Likewise, supply of inputs for the region is perfectly elastic and input prices will not be affected by changes in local demand for inputs.

iii. Few crops are farmed (experience indicates three or four crops account for a large proportion of total output), and choice of productive techniques is limited.

iv. The farm year consists of only two seasons.

v. Each farm in the region is affected in the same way by transport improvements.

6. In practice, these conditions will obtain in most rural regions of developing countries; even if they do not strictly obtain, we may assume they do without significantly distorting the model's results. If, in some case, one or more assumptions clearly do not apply, the model can be altered to accommodate the facts. For example, world and national market prices for ruraly produced goods are not likely to be affected by local production levels, but local market prices may be. We can see the effects of local price changes by making a separate study of these price changes and obtaining
a solution for each set of prices. Similarly, while it is very unlikely that the prices of inputs such as fertilizer, machinery, and seeds, will be affected by local demand, should serious price effects be observed, separate solutions can be obtained for different price levels.

7. Additional crops and productive techniques may be introduced as new activities, possibly requiring the introduction of new inputs as well. Variations in productive techniques among areas in the region can be handled by dividing the region into subregions and creating a separate model for each. Institutional and sociological constraints can be translated into resource constraints or new activities, as described in the following chapter. If the area experiences more than two seasons a year, solutions of the model can be obtained for as many seasons as desired.

8. In the programming model we propose for appraising feeder road projects, the objective function is value added. The region's productive structure consists in four productive processes, apart from transport (that is, four crops, each with a single productive technique, or two crops with two techniques each) and uses five resources, including transport services. The model is then described by the following statements.

Maximize the objective function

\[
Z = c_1 x_1 + c_2 x_2 + c_3 x_3 + c_4 x_4 + c_5 x_5
\]

Subject to the restrictions

\[
\begin{align*}
(1) & \quad a_{11} x_1 + a_{12} x_2 + a_{13} x_3 + a_{14} x_4 + a_{15} x_5 \leq B_1 \\
(2) & \quad a_{21} x_1 + a_{22} x_2 + a_{23} x_3 + a_{24} x_4 + a_{25} x_5 \leq B_2 \\
(3) & \quad a_{31} x_1 + a_{32} x_2 + a_{33} x_3 + a_{34} x_4 + a_{35} x_5 \leq B_3 \\
(4) & \quad a_{41} x_1 + a_{42} x_2 + a_{43} x_3 + a_{44} x_4 + a_{45} x_5 \leq B_4 \\
\end{align*}
\]
\[
(6) \quad a_1 X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 - X_5 = 0
\]

\[
(7) \quad X_1 \leq 0, \quad X_2 \geq 0, \quad X_3 \geq 0, \quad X_4 \geq 0, \quad X_5 \geq 0
\]

9. Statement (1) is the objective function; the \( X_i \) are the levels of activity of the four processes \( (X_1, X_2, X_3, X_4) \) and transport \( (X_5) \).

The \( c_i \) indicate the contribution of each activity to value added. Statement (7) rules out negative production in any process. Statements (2) - (5) describe the limitations of resources 1 - 4. The \( b_j \) are the existing amounts of each resource and the \( a_{ij} \) represent the use of each resource in each process. Statement (6) reflects the fact that transport is not part of final demand but an intermediate product. It indicates that the supply of transport services \( (X_5) \) should be equal to the demand for transport by the four other activities \( (a_{51} X_1 + a_{52} X_2 + a_{53} X_3 + a_{54} X_4) \).

This equation reflects the role of transport in the model as both process and input. The dual role played by transport is the key to the model's ability to analyze explicitly the interrelations of transport and the other economic activities.

10. Data from the survey described in Chapter III will give us values for the \( a_{ij} \), the \( c_i \), and the \( b_j \) which describe the economy without the project. The solution of the model yields values for the \( Z \) and the \( X_i \).

The difference in the value of the objective function \( (Z) \) when the model is solved with data describing the situations with and without the project represents the benefits of the project. Since we assume two seasons a year, benefit can be found for every season of the project's lifetime; alternatively, lifetime benefits may be extrapolated from solutions for a few seasons. The model also provides for each resource a value indicating its relative scarcity; these are the shadow prices.
B. An Illustration

11. To illustrate how the model works, we will describe a hypothetical region and estimate the benefits of a range of hypothetical transport projects designed to link the region with the nearest town. We adapt data from a study of primitive agriculture in the highlands of Peru.\(^1\) Our presentation is not intended to demonstrate the exact procedure for applying the model, but rather to illustrate, using available data, the kinds of results the model produces.

12. We first describe the production conditions—input coefficients, output, and resource restrictions—for the economy without the project and two variations. The model solution—maximum output and the inputs required to produce it—is obtained for the initial situations, and for the new production conditions expected to follow from three different transport investments and two investment packages. By comparing the solutions with and without the projects, benefits to each project are calculated; these are combined with rough cost estimates to yield present net worth.

1. Economy With No Project

13. Initially, the economy consists in subsistence agriculture, wheat cultivation, animal husbandry, potato growing, and transport. It is served by a trail passable only by animal or on foot; the nearest market town is 60 kms. away via the trail. The five inputs into the five activities are unskilled labor, cattle land, farm land, animal power, and transport.\(^2\) Table 2 shows input coefficients and output in each process, expressed in terms of unit level of activity in that process; for each input, the amount available is shown. For example, each acre of farm land in subsistence agriculture, when combined with 250 man-hours of labor and 15 animal-hours, will yield 500 lbs. of corn and 300 lbs. of beans, with a combined value added of 1,420 monetary units. In the transport sector, 133 man-hours and the same number of animal-hours can provide 200 ton-kms. of transport service.\(^3\)

\(^1\) J. D. Coffey, "Estimated Costs, Yield and Resource Requirements for Crops and Livestock for the Cuzco Sierra Region of Peru", North Carolina University Agricultural Mission to Peru, Lima, Peru, 1965.

\(^2\) Throughout the illustrations, inputs are assumed homogeneous.

\(^3\) An animal is assumed to be able to carry a half-ton moving at an average speed of 3 km/hr. Thus, in this initial situation, 80 animal-hours are needed to carry one ton of output over the 60-km trail to market, including the empty return trip; an equal number of man-hours is required. This means that 160 animal-hours and man-hours are needed to produce 60 ton-kms. of transport services. Since we have defined the unit level of transport activity to be 200 ton-kms. of transport services, the inputs required are 133 man-hours and 133 animal-hours.
Table 2: Description of Production Conditions: Situation Without Project

<table>
<thead>
<tr>
<th>Input Coefficients</th>
<th>Subsist. Agricul.</th>
<th>Wheat</th>
<th>Livestock</th>
<th>Potatoes</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unskilled labor (man-hours)</td>
<td>250</td>
<td>100</td>
<td>365</td>
<td>250</td>
<td>133</td>
</tr>
<tr>
<td>Cattle land (acres)</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Farm land (acres)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Animal power (animal-hours)</td>
<td>45</td>
<td>40</td>
<td>-</td>
<td>50</td>
<td>133</td>
</tr>
<tr>
<td>Transport (ton-kms)</td>
<td>-</td>
<td>41</td>
<td>120</td>
<td>164</td>
<td>-</td>
</tr>
<tr>
<td>Total Resource Availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,000,000</td>
</tr>
</tbody>
</table>

Corresponding Mathematical Statement

1. Value added (monetary units)
   - Variation B restricts the availability of transport to 250,000 ton-kms. In the initial situation and Variation A, this restriction does not apply. See Statement (9). In all three, demand and supply of transport are required to balance. See Statement (6).
   - Variation A of the initial situation restricts output (value added) outside of subsistence agriculture to one-half of total value added. See Statement (8).
This is sufficient information for a solution of the general model presented in the previous section. The input coefficients are the $a_i$, the value added are the $c_i$, and the resource restrictions the $B_i$. Thus, the model of the initial situation is represented on the following statements.

Maximize

$$Z = 1420X_1 + 2250X_2 + 6400X_3 + 4800X_4 + 2000X_5$$

Subject to the restrictions:

$$250X_1 + 100X_2 + 365X_3 + 250X_4 + 133X_5 \leq 10,000,000$$

$$4X_3 \leq 4,000$$

$$X_1 + X_2 + X_3 + X_4 \leq 30,000$$

$$45X_1 + 40X_2 + 50X_4 + 133X_5 \leq 1,500,000$$

$$41X_2 + 120X_3 + 164X_4 - 200X_5 = 0$$

$$X_1 \geq 0, X_2 \geq 0, X_3 \geq 0, X_4 \geq 0, X_5 \geq 0.$$
<table>
<thead>
<tr>
<th>Total Value Added (000)</th>
<th>Levels of Activity</th>
<th>Input Left Unused</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subsistence agrie.</td>
<td>Wheat</td>
</tr>
<tr>
<td>Solution for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>65,101</td>
<td>-</td>
</tr>
<tr>
<td>Variation A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>53,201</td>
<td>18,733</td>
</tr>
<tr>
<td>Variation B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>53,201</td>
<td>18,733</td>
</tr>
<tr>
<td>With trail improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>107,573</td>
<td>16,181</td>
</tr>
<tr>
<td>With feeder road, alt. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>12,126</td>
<td>13,250</td>
</tr>
<tr>
<td>With feeder road, alt. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>12,126</td>
<td>13,250</td>
</tr>
<tr>
<td>With investment package 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>194,992</td>
<td>31,402</td>
</tr>
<tr>
<td>With investment package 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input shadow prices</td>
<td>330,352</td>
<td>21,784</td>
</tr>
</tbody>
</table>

(a) Not included in this problem.
16. As mentioned before, while input and output prices are assumed constant, shadow prices of inputs are part of the problem solution; these prices, also shown in Table 3, indicate the relative scarcity of the inputs. Those resources not fully utilized -- unskilled labor and farm land -- show a shadow price of zero in the initial situation.

17. To illustrate the effects of two characteristics which may be encountered in rural areas, we have designed two variations of the initial situation. In variation (A), institutional rigidity, such as a traditional land tenure pattern, restricts production outside the subsistence sector to less than half regional value added. This condition is introduced into the model by adding to Statements (1) - (7) the following:

\[(8) \quad 1,200X_1 - 2,250X_2 - 6,400X_3 - 4,800X_4 - 2,000X_5 \leq 0\]

The solution obtained for the new system of equations (Table 3) indicates that the restriction effectively places an upper limit on total value added, which is 18 percent lower than for the original situation. Potato production is half as great, the transport sector is less active, and animal husbandry ceases to exist altogether. However, employment is much higher and a greater proportion of cultivable land is in use; from a social point of view, then, the restriction on non-subsistence agriculture does make sense.

18. In variation (B), the trail to town becomes impassable to man and beast during the rainy season, a restriction represented by setting an upper limit of 250,000 ton-kms. on transport service availability:

\[(9) \quad 41X_1 + 120X_2 + 164X_3 \leq 250,000\]

The solution of variation (B) (Statements (1) - (7) and (9) ) shown in Table 3 indicates that value added is lower than for the initial situation by 11 percent, not as much lower as for variation (A). The transport constraint in (B) shifts resources from potato production to subsistence and wheat, both less transport intensive activities. Unemployment is on about the same level as for variation (A), that is, about 60 percent of initial unemployment.
2. Economy with Project: Three Transport Investments

19. We first propose a trail improvement investment, consisting in bridge construction and drainage installation and resulting in an increase in an animal's carrying speed from 3 to 4 kms. and a reduction in distance-to-market from 60 to 52 kms. The new production conditions following this investment are shown in Table 4; they are the same as for the initial situation except in transport. The solution is in Table 3. Total value added is 20 percent higher than for the economy without the project, due to increased potato production and expanded transport services. Unemployment of labor and land is somewhat lower, but not as much as in variations (A) and (B) of the economy without the project.

20. If, on the other hand, a newly-aligned feeder road is constructed, cutting distance-to-market to 45 km., the economy's structure undergoes considerable change. (See Table 4 for production conditions and Table 3 for solution.) The area is now accessible by truck; truckers join the regional labor force, transporting goods to market in five-ton trucks at an average speed of 15 km. an hour. The trucks are manned by one skilled trucker and two unskilled workers. Animal-power, no longer needed in the transport sector, shifts into subsistence agriculture, permitting more intensive use of land and labor in that sector: farm land becomes a scarce rather than a surplus input; unemployment of unskilled labor decreases; the subsistence sector contributes substantially to value added, and total value added is 30 percent higher than in the economy with improved trail and 70 percent higher than in the economy with no projects. Animal husbandry and potato farming continue to be the most important activities in the cash economy.

21. Even greater shifts in the productive structure occur with the third investment, the most ambitious and expensive. This investment not only cuts the length of the road to 45 km. and introduces trucking, but also opens a previously inaccessible valley, adding 5,000 acres of farm land and 1,000 of cattle land. In the solution, potato-growing and the subsistence sector are less important than in the previous solution; more than half the available farm land is used for wheat. Unemployment is higher than for the previous two investments, but only half of the pre-investment level. Value added is 10 percent higher than that after the less ambitious feeder road project, and 85 percent higher than for the economy with no investment.
<table>
<thead>
<tr>
<th>Input Coefficients</th>
<th>Subsist.</th>
<th>Wheat</th>
<th>Livestock</th>
<th>Potatoes</th>
<th>Trail Impr.</th>
<th>Transport Feeder Road 1</th>
<th>Total Resource Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unskilled labor (man-hours)</td>
<td>250</td>
<td>100</td>
<td>365</td>
<td>250</td>
<td>100</td>
<td>36</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Skilled labor (man-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>25,000</td>
</tr>
<tr>
<td>Cattle land (acres)</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>Farm land (acres)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>30,000</td>
</tr>
<tr>
<td>Animal power (animal-hours)</td>
<td>45</td>
<td>40</td>
<td>-</td>
<td>50</td>
<td>100</td>
<td></td>
<td>1,500,000</td>
</tr>
<tr>
<td>Traction power (truck-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>25,000</td>
</tr>
<tr>
<td>Transport (tons-kms)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trail Impr.</td>
<td></td>
<td></td>
<td>36</td>
<td>104</td>
<td>142</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeder Rd. 1</td>
<td></td>
<td></td>
<td>31</td>
<td>90</td>
<td>123</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>corn</td>
<td>beans</td>
<td>wheat</td>
<td>milk</td>
<td>meat</td>
<td>potatoes</td>
<td>transport</td>
</tr>
<tr>
<td>Quantity (lbs. and ton-kms)</td>
<td>500</td>
<td>300</td>
<td>750</td>
<td>2,000</td>
<td>200</td>
<td>3,000</td>
<td>200</td>
</tr>
<tr>
<td>Value added (monetary units)</td>
<td>1,420</td>
<td>2,250</td>
<td>6,400</td>
<td>4,800</td>
<td>2,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Economy With Project: Two Investment Packages

22. So far, we have assumed investments in only the transport sector, analyzing the increases in regional income and the changes in the productive structure and resource scarcity which they induce. As we indicated in the previous chapter, however, it is important to analyze broader investment alternatives. To complete this example, two different investment packages will be studied.

23. The first package consists in the last feeder road we described, a fairly large rural extension service, and a program to train skilled labor. The extension service introduces modern non-mechanized techniques in all non-subsistence activities, including the use of fertilizers and insecticides but without direct investment in agriculture. We assume a plentiful supply of fertilizers and insecticides, but skilled labor remains in short supply, despite the new training program. (See Table 5).

24. The resulting jump in value added to 195 million units, three times the pre-economy level, should be attributed to the investment package, since it is the result of the three investments combined. Only wheat and potatoes are produced; the transport sector is able to increase its activity because of the larger supply of skilled labor. Animal husbandry ceases, because skilled labor required by the new livestock techniques is all being used in the other, more productive activities. The subsistence sector also ceases to be active, and consequently unemployment increases even more.

25. There is no objective criterion for determining what proportion of the increased value added corresponds to each component in the investment package; the components work together. Because the extension service cannot operate without good access, its effect is intensified by the road investment in a kind of multiplier effect. The number of skilled laborers may have increased because of the training program, or because improved access induced some skilled laborers to move into the region.

26. The second package includes all the components of the first, plus investments to mechanize land preparation and seeding and to train even larger numbers of skilled labor than in the previous package (See Table 5).

The results (Table 3) show a value added nearly twice that of the first package. Since skilled labor is still scarce, there is a limit on the level of transport services, which forces some resources to be used in the subsistence sector. Because of this, unemployment is lower than with the first package.
<table>
<thead>
<tr>
<th>Input Coefficients</th>
<th>Subsistence Agriculture Pkgs. 1 and 2</th>
<th>Activities</th>
<th>Transport Pkgs. 1 and 2</th>
<th>Total Resource Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pkg. 1</td>
<td>Pkg. 2</td>
<td>Pkg. 1</td>
<td>Pkg. 2</td>
</tr>
<tr>
<td>Unskilled labor</td>
<td>115</td>
<td>50</td>
<td>20</td>
<td>400</td>
</tr>
<tr>
<td>(man-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled labor</td>
<td></td>
<td></td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>(man-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cattle land</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>(acres)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm land</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>(acres)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal power</td>
<td>30</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(animal-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traction power</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(truck-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanized power</td>
<td></td>
<td></td>
<td>3½</td>
<td></td>
</tr>
<tr>
<td>(machine-hours)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilisers</td>
<td>150</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(pounds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insecticides</td>
<td>10</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(pounds)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ton-km)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Quantity</td>
<td>corn</td>
<td>beans</td>
<td>wheat</td>
<td>milk</td>
</tr>
<tr>
<td></td>
<td>1,000</td>
<td>600</td>
<td>1,200</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value added /a</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(monetary units)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Package 1</td>
<td>2,000</td>
<td>3,200</td>
<td>14,000</td>
<td>17,000</td>
</tr>
<tr>
<td>Package 2</td>
<td>2,000</td>
<td>3,025</td>
<td>13,500</td>
<td>16,800</td>
</tr>
</tbody>
</table>

Notes: 
(a) Equals price times quantity, minus cost of fertilizers, insecticides, and machines.
4. **Benefit-Cost Analysis**

27. To complete our illustration, we will analyze the feasibility of these investment alternatives. Table 6 shows the benefits, costs and net present worth of each investment alternative. Benefits were estimated to represent the present value of the stream of benefits over the economic lifetime of the project, discounted at the current rate of interest. The initial situation was our basis for comparison. Our rough cost estimates include all items that add to total investment costs (construction expenses, interests on the gestation period, etc.). The fact that net present worth for the two investment packages is greater than the sum of the package components' worth illustrates the advantage of the broader investment approach.

<table>
<thead>
<tr>
<th>Table 6: Investments' Estimated Net Present Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Transport investments</strong></td>
</tr>
<tr>
<td>1. Trail improvement</td>
</tr>
<tr>
<td>2. Feeder road, alt. 1</td>
</tr>
<tr>
<td>3. Feeder road, alt. 2</td>
</tr>
<tr>
<td><strong>B. Investment packages</strong></td>
</tr>
<tr>
<td>1. Package 1</td>
</tr>
<tr>
<td>Feeder road, alt. 2</td>
</tr>
<tr>
<td>Extension services</td>
</tr>
<tr>
<td>Training program</td>
</tr>
<tr>
<td>2. Package 2</td>
</tr>
<tr>
<td>Feeder road, alt. 2</td>
</tr>
<tr>
<td>Extension services</td>
</tr>
<tr>
<td>Training program</td>
</tr>
<tr>
<td>Agriculture (mechanization)</td>
</tr>
</tbody>
</table>
28. The results show that investment package 2 is the best alternative. If the screening process had concentrated only on transport alternatives, feeder road 2 would have been chosen. And, though it is impossible to establish which components cause which benefits, it seems clear that the impact of the feeder road is greater when it is part of a package than when it is an isolated investment.

29. The previous analysis is based on the assumption that the objective function is to maximize value added. In practice, the objective function may be broadened to include social considerations such as unemployment levels. Had unemployment been included in the objective function of the illustration, feeder road 2, which minimizes unemployment, would have the highest priority. The advantage of using this model is that the effect of using alternative objective functions can be easily quantified.

30. To round up the illustration of our appraisal model, we look back over the steps of the procedure we have proposed in this and the last chapters. The regional survey at the pre-investment stage identifies the investment alternatives and ranks them on the basis of rough estimates of costs and benefits. The programming model analyzes the benefits of the alternatives in detail and permits a final investment choice. As we mentioned in the last chapter, if a package of several investments is chosen, the component projects need not be carried out as a package for the benefits to be fully realized; the important thing is that implementation be coordinated and proceed according to a schedule.

C. Data Requirements and Constraints

31. In this section, we discuss in a general way data requirements and constraints for the application of the programming model proposed in the two previous sections. Data problems with respect to the non-economic variables are discussed in Annex II. Those for the identification stage were analyzed in Chapter III.

32. Feeder road appraisals require data at a microregional (district, local) level, practically none of which is usually available. Apart from the problem that political subdivisions on which data collection is based may not coincide with the regional subdivision appropriate to the project, the level of detail of existing regional data may be inadequate. Thus, the problem will be lack of raw data rather than choice or use of existing data. The crucial questions become which data, in what detail, should be generated. The programming model may be used to define which data are likely to most influence the final result. Most of the essential data can be generated through an inexpensive field survey.
33. Although many valuable agricultural studies on productive techniques for important crops are available, appraisers tend to initiate new estimates rather than drawing on existing work. A systematic compilation of this material for the most important crops could help in the application of these models; use of a common reference bank would also promote comparability of results.

34. While specific projects may require special data, four groups of data are basic to all project appraisals.

   i. Production conditions of the activities to be served by the roads (production functions or input-output coefficients for a few productive techniques)

   ii. Input and output prices

   iii. Resource restrictions

   iv. Transport supply conditions (ownership, input use, pricing)

This information should be available for each period (year or season) during the economic lifetime of the project. Exogenous changes in production conditions and changes in the demand structure and in resource availability should also be incorporated. If one of the above is lacking, estimation of benefits is simplified beyond the point of minimum reliability. If exogenous production projections rather than production conditions are used, the problem is transformed into one of cost minimization; lack of knowledge on resource restrictions will generate results that are unrealistic. Even very crude estimates of production and supply conditions will produce better results than exogenous projections or total lack of information.

35. In summary, we need to make a systematic effort to generate basic data inexpensively. Existing techniques, such as simple sampling procedures, and existing information have yet to be used to their greatest potential advantage.
V. INSTITUTIONAL AND SOCIOLOGICAL FACTORS

1. By definition, feeder roads lead away from the main road network, into the rural areas of developing countries. Thus, in dealing with feeder roads, we come face-to-face with the problems of rural development, dominated by institutional and sociological factors. Current development theory recognizes that social and economic institutions and practices can hinder or block development, and that their alteration may be a precondition to rapid development. However, analysis of institutional and sociological factors has yet to be systematically incorporated in project appraisal. This chapter is intended as a first step towards such an analysis.

2. We first briefly describe the institutions and practices of this kind which can influence rural development. Secondly, we indicate ways of assessing their effects on the economic variables, national income or production. Thirdly, we discuss ways of incorporating these effects into a formal regional programming model. In Annex II, we indicate the content of a field survey designed to identify and, where possible, quantify institutional and sociological effects.

A. Types of Institutional and Sociological Factors

3. A feeder road project could be evaluated strictly in terms of the costs and benefits of different construction and maintenance strategies if the following ideal situation were to exist: all politicians and planners on the national, regional, and local levels agree on the type and scale of rural development to which the feeder road system will contribute; the government has established an institutional structure of extension, credit, cooperative and other essential agencies which is adequate for development; the potential of the development area matches the land use system to be introduced; the distribution and density of the human population is favorable; the proposed land use system meets with the approval of the local population and creates no conflict within the farm units; the project has been designed to meet the local people's expectations for the future (it will discourage migration to the cities), and local institutions can be expected to facilitate development efforts.

4. While such a situation is rarely encountered, its description helps to identify possible constraints. If development policy objectives at the local level conflict with development objectives at higher levels (district, provincial and national), higher authorities will encounter very strong general resistance if they attempt to force their policy upon the people. Sufficiently strong local resistance could cause a development program to fail, if, for example, a region striving for economic independence were forced to specialize, an area seeking to bring about greater social equality were forced to focus on purely economic goals, or a village rooted in subsistence farming were forced to expand production for regional marketing.

5. Institutional services for the provision of technical advice, credit and marketing facilities and for upgrading skills may be non-existent or may lack adequate policy, organization, financing and staffing. A rural extension service which is too technically oriented may fail to consider region's institutional and social peculiarities. A marketing system may be excessively costly and unreliable. Farm credit may be unavailable. Areas lacking schools generally also lack the skilled manpower necessary to change traditional agricultural practices. Or, the local educational system may encourage young people to leave the area, creating a manpower shortage rather than raising the educational level in the rural area. Training facilities for essential skills, such as tractor operation and maintenance, along with parts and fuel for transport and cultivation vehicles, may be lacking because of Government inefficiency, in the case of nationally-administered services, or because of poor local co-op management.

6. Development plans may be unrealistic and impractical in view of the unsuitability of the land available or of the poor health of the people. If unrealistic results are demanded, a region may not be physically capable of fulfilling them.

7. Development plans may be opposed or resisted by the local people because they prefer security to income, are suspicious of Government programs whose benefits they do not believe they will share, or wish to avoid repetition of unhappy experiences with past Government programs. Their leaders may oppose the plans in order to retain control. The plans may fail to meet local expectations, once the people have come in contact with the attractions of urban life. Local institutions may be inappropriate: the family-oriented social structure may lead to labor bottlenecks at critical points in the agricultural cycle, and the interest of family heads in having a large number of dependent family members may discourage
income-maximizing behavior. Land tenure systems discourage those who do not own land from becoming involved in development and prevent farms of optimal size from being formed.

B. Measurement of Institutional and Sociological Factors

3. The presence and relative importance of the constraints briefly enumerated above will vary from situation to situation and in the same area at different points in time. It is the task of feasibility surveys to gather information for evaluating their importance, and to weigh the costs of modifying any bottlenecks identified. Because feeder roads' effects occur mostly within the rural, agriculturally oriented areas they serve, most of the constraints should be expressed in terms of agricultural production and income.

9. Theoretically, the effects of these constraints could be measured by comparing the value of the objective function with and without them. In practice, the effect of any single hindrance can be measured only when production is otherwise unhindered, production conditions remain unchanged, and no investments occur. If the removal of a certain restriction is part of a wider development effort (investments and policy measures), then the income or production effects of only the package, not of each component, can be objectively estimated. Similarly, the effect of one constraint cannot be isolated when several are acting simultaneously.

10. Given the present state of the art, some of the constraints described in the previous section are easier to quantify than others.1/ Some can be measured directly, others indirectly. For some, attempts at quantification, apart from being extremely difficult, refer to factors that are to a great extent exogenous to the region, such as conflicts between national and local development objectives, or the lack of realism of national plans. Regional or local action is not likely to change the outcome of these conflicts or inadequacies. Normally, the outcome will be a parameter in the calculations; we will not indicate how these constraints might be quantified.

1/ For the latest attempts in this respect, although at a "macrosocial" level, see Irma Adelman and Cynthia T. Morris, "An Econometric Model of Socio-economic and Political Change in Underdeveloped Countries", Proceedings of the Association for Comparative Economics, December 1967.
11. We give examples of six constraints for which direct measurements are possible, through estimates of income or production levels with and without the constraint. The effect of the lack of an adequate rural extension service could be measured by estimating the effects which the introduction of a good extension service could have on production. For example, certain crops will be grown in a region only if there is an effective extension service. The difference between total traditional output and total production including the new crops is a measure of this constraint. The quality of rural extension services could become one of the most crucial variables for promoting development, as well as the best tool for modifying restrictions such as the unwillingness to shift from consumption cultivation to cash cropping, the lack of leaders or innovators, the lack of interest in agriculture, etc.

12. A similar estimate can be made with respect to credit facilities. A regional survey could indicate that, say, 10 percent of the farmers will plant a new crop if no credit is provided, and 60 percent if it is offered. Production differentials extrapolated from the credit survey information are a measure of this constraint. The effects of the lack of an adequate marketing mechanism could also be analyzed in this way. A good marketing system has two effects: it increases the quantity of goods marketed, and it induces production. Knowledge of the production and market conditions of agriculture should provide a sufficient basis for estimating the production effects of a good marketing system.

13. The analysis can be extended to include constraints arising from subdivision of land holdings and land utilization schemes. For example, the effects, in terms of output, of a social and legal constraint limiting the size of farms to two acres, when the most economic size is 20, or of a tradition that a fixed proportion of available land is set aside for cattle, can be estimated once the agricultural production conditions are known.

14. The same analysis applies to cases in which the introduction of new crops generates labor bottlenecks at critical points in the agricultural cycle. This will occur when traditional agricultural production remains important while a new crop with similar seasonal labor requirements is being cultivated. This situation could be interpreted as an additional labor constraint, whose effect on production could be measured. The cost of farmers' reluctance to shift from consumption cultivation to cash cropping can also be quantified by estimating the difference between income generated

\[1/\text{In the previous chapter, we illustrated one approach to such measurement (see paragraph 17).}\]
by cash crops and that generated by subsistence agriculture. The extent to which farmers are willing to convert to cash crops could be determined through especially designed surveys.

15. The same reasoning could be applied to the lack of social institutions for the mobilization of labor. If farming is traditionally carried out around family units, and the crops that are the best for the region require more labor per farm than family members can provide, the constraint of family size will be reflected in lower farm output. In a programming model, this can be expressed as an additional labor constraint.

16. The rest of the constraints belong to the second group; only indirect estimates of their effects can be made. These include: reduced initiative because of the existing land tenure system; lack or inadequacy of local leaders and innovators; conflict among farm unit members over change; lack of interest in agriculture, and propensity to migrate to the cities. The effect of these constraints may be estimated by assuming that their influence is similar to that of others for which direct measurements are possible. For example, the consequences of poor local leadership or intra-farm conflict could be compared to those of an inadequate rural extension service, because an efficient extension service could, within limits, compensate for poor local leadership and resolve conflicts created by inadequate or incomplete information. The lack of interest in agriculture could be reflected in a constraint on the supply of labor.

17. This quick survey on the quantification of these constraints indicates that, contrary to widespread opinion, institutional and sociological variables can often be quantified and should not be ignored. If feeder road projects are appraised with the help of a programming model similar to that discussed in the previous chapter, and if an adequate regional survey as proposed in Chapter III is carried out, the effect of most institutional and sociological constraints could be directly incorporated in the appraisal. The main institutional and sociological variables discussed are listed in the summary below.
Summary of Institutional and Sociological Factors

Directly Measurable:

1. Quality of extension services
2. Adequacy of credit facilities
3. Adequacy of marketing facilities
4. Flexibility of farm size
5. Flexibility of labor supply
6. Preference for subsistence farming

Indirectly Measurable

1. Degree of farm workers' initiative (proxy: flexibility of labor supply)
2. Quality of local leadership (proxy: quality of extension services)
3. Degree of intra-farm conflict (proxy: quality of extension services)
4. Degree of interest in agriculture (proxy: flexibility of labor supply)
5. Rate of migration to cities (proxy: flexibility of labor supply)

Measurement Impractical (factors exogenous to region)

1. Degree of consensus among national, regional, and local officials about planning goals and pace
2. Reality and practicality of development plans in view of area's natural, human, and financial resources.

18. Social anthropologists and sociologists are imprecise about the cost of a program to remove these constraints, except to say that political constraints will greatly affect the estimates. How much would it cost to overcome the unwillingness of a group of farmers to abandon subsistence production and adopt cash cropping? How long would it take? More work needs to be done before any but rough answers are available.

C. Introduction of Factors into a Programming Model

19. Theoretically, there are two ways of introducing the effects of social and economic institutions and practices into a programming model. The simplest is to express them as additional constraints on resource availability. The restrictions imposed by a land tenure system and by workers' unwillingness to contribute to certain activities, for example, could be accounted for by a reduction in the availability of land and labor, respectively. Alternatively, the programming model could be expanded to include an activity whose purpose is to eliminate one or more constraints.
Some additional output (income or production) will be attributable to the activity; additional inputs will be necessary to carry out the activity. The clearest example of this technique is the introduction of a rural extension service as a separate activity.

20. It is crucial, from a methodological point of view, to choose the appropriate alternative. The choice will depend on the circumstances of each case. If a constraint directly affects an economic resource but its elimination requires new policy rather than new or additional resources, the first and simpler approach seems more appropriate. For example, the effects of land use restrictions which legislation could remove might be represented by a constraint on land availability. If, on the other hand, an institution, practice, or attitude restricts the availability of several economic resources, and if a program to eliminate it is costly, it is best to introduce this program as a separate activity.
VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1. The paper first proposes that feeder roads be defined as roads whose benefits stem mostly from new traffic (developmental benefits) rather than from savings to existing road users, and as roads which carry little or no through traffic. They may have other characteristics, such as low construction standards, short length, and low traffic levels, and they may be dead end roads, but these qualities are not essential.

2. A review of the literature on feeder roads (theoretical writings and appraisal and reappraisal reports) shows that there is no systematic method for identifying feeder road projects nor for defining their scope. Sometimes, these roads are considered part of rural development schemes, but more often they are analyzed in isolation, independently of the development strategy of the region they serve. Their benefits are estimated in most cases by a cost minimization method: output projections are made exogenously, and analysis is reduced to finding the least-cost transport solution. Little analysis is made of the interrelations between feeder roads and other productive activities.

3. The remainder of the paper proposes methods of analysis which systematically identify feeder road projects and appraise benefits in a regional context. For project identification, a regional survey simultaneously identifying potential projects in all sectors should be made. The survey should identify the main factors that retard regional development and propose projects and policy measures to eliminate them. It should also indicate the advantage of investment packages including feeder roads, relative to a series of individual projects.

4. The final stages of project identification should assess the extent to which the characteristics of national and international institutions may constrain the form of the investment. For example, an investment package may emerge as the best of several alternatives. The political situation; the number and relations of government ministries; the capabilities of international financial agencies; any of these may force the division of this package into individual projects.

5. While a great deal more preparation is required for the interdisciplinary surveys we recommend than for the present identification missions, less total work time may be needed for project identification using our method, because a single survey identifies several projects at once.
6. To aid understanding of the interrelations between transport and the rest of the productive structure in feeder road appraisals, we propose that programming techniques be used to measure project benefits. It is a crucial fact that several simplifications increase the programming model's usefulness: the treatment of input and output prices as parameters, the restriction of analysis to a few techniques of production, and the omission of seasonal and locational variations.

7. A brief effort to incorporate institutional and sociological factors in feeder road appraisals shows that these factors can be reduced to a manageable number, and moreover, that it is possible to quantify these factors' effects on the benefits of a feeder road project if a programming model is used in the appraisal. We recommend that identification surveys analyze these factors in some detail.
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Appendix II

GUIDELINES FOR SURVEYING INSTITUTIONAL AND SOCIOLOGICAL CONSTRAINTS

AS THEY RELATE TO FEEDER ROAD PROPOSALS

Introduction

1. Because the survey mission will have to complete its study in a limited period of time (several weeks), a sophisticated research project will not be possible. Team members will have to rely on their own observations, on government and other reports, and on interviews with a wide range of informants in the survey sample. This sample should include the relevant research personnel as well as government officials responsible for planning and implementing change at the national, regional and local level. It should also include local residents, especially those whose cooperation is considered necessary.

2. In selecting local informants, there will rarely be time to choose and interview a statistically representative sample. Local politicians, teachers, and governmental staff (community development and agricultural extension workers) should be able to obtain for the mission lists of progressive farmers, members of cooperative societies, growers of cash crops, owners and users of different size holdings, and other local residents from which a sample for interviewing can be picked. Where they exist, progressive farmers often can provide important information not just on their own operations and problems, but also on the systems of land use of their more conservative neighbors and on the relationship between these systems. Some conservative farmers should also be interviewed, one approach being to select individuals whose farms share a boundary with a progressive farmer.

3. The questionnaire for the interviews should be tailored to the region involved. While the guidelines we propose should prove useful in drawing up its general categories, in the phrasing specific questions there is no substitute for the help of research scientists, extension personnel, and others, who have intimate knowledge of local conditions.

4. Though we stress identification of constraints to rural change, the mission should also look for strengths to build into development plans as well as for ways in which desirable local institutions can be strengthened. If, for example, one or two farmers in each settlement are
trying to follow government advice, their assistance should be taken into consideration in planning extension and other agricultural services. Where a local council is trying to justify its existence to a skeptical population, planners should consider ways of improving its effectiveness as part of the development effort. The council might be given a role in constructing and, particularly, in maintaining the feeder road system. As a provider of jobs and of a road system, the council may gain prestige and effectiveness.

Outline

5. In the following sections, we indicate what kinds of questions need to be answered in evaluating the importance of the constraints discussed in Chapter V. The sections are outlined below for summary purposes.

I. Local Development Objectives May Conflict with Those at Higher Levels (District, Provincial, Regional, National)

II. Development Plans May Be Unrealistic in Terms of the Environment and the Population

III. Technical, Credit, Marketing, and Training Services May Be Inadequate

IV. The Local Educational System May Foster Goals Which Do Not Support, and May Even Undermine, Development

V. Development Plans May Be Unrealistic in Terms of the Social Organization of Rural Society

VI. The Rural Population May Resist Changes Desired by the Development Planner, Because:

A. Systems of Land Allocation Reduce Incentives
B. Subdivision of Land Holdings is Incompatible with New Forms of Land Use
C. New Techniques and Crops Compete with Established Land Use for Labor at Critical Seasons
D. Farm Unit Members Are in Conflict over the Desirability of Suggested Changes

E. Farmers are Unwilling to Shift from Consumption Cultivation to Cash Cropping

VII. The Means of Transport Are Inadequate

VIII. Lack of Interest in Agriculture as a Way of Life is Prevalent

IX. Social Institutions for the Mobilization of Agricultural Labor Are Inadequate
   A. The Farm Unit
   B. Voluntary Self-Help Groups, Work Parties
   C. Hired Labor

X. Local Leaders Are Opposed to Development Plans or Lack Influence as Demonstrators of New Techniques

XI. Local Innovators Do Not Value the Changes Suggested by Government Planners

XII. The Social Organization is Highly Complex

I. Local Development Objectives May Conflict with Those at Higher Levels (District, Provincial, Regional, National)

6. Do national planners and the local population disagree on which objectives are desirable for a given area? Major conflict and lack of cooperation could well interfere with the achievement of national objectives, especially if government agents are not aware that conflicts exist. Where local objectives have been identified by a development committee including local leaders, the mission can identify potential conflicts by meeting with committee members and reading the reports and minutes of their meetings. Where no local planning institution exists, the task is more difficult and requires selective conversations with local leaders and with government and other personnel who are familiar with the people and area. Major conflicts and their potential implications should be pointed out to those responsible for national policy formulation. Local reactions and national decisions should then be evaluated in terms of the likelihood of project success.
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7. Take, for example, a feeder road system which is part of a large project to develop a river basin through construction of a major dam. If the local population believes that its interests are being sacrificed to achieve national objectives, they may oppose the entire undertaking. If we assume that the major project is in fact desirable, the government can reduce if not eliminate anxieties by carefully explaining its aims and procedures to residents, and by taking their interests into consideration in the planning and execution of resettlement and subsequent development. Furthermore, the government may wish to involve representatives of the local population in the planning and implementation of those aspects of the project which directly concern local people.

II. Development Plans May Be Unrealistic in Terms of the Environment and the Population

8. Do proposed changes make sense in terms of climatic, soil, and water conditions? For example, is the annual distribution and reliability of rainfall appropriate in terms of new crops to be introduced?

9. Is there sufficient manpower within the area to accomplish development goals? If not, are there feasible plans to supplement the existing population through immigration of temporary laborers or permanent settlers? Is the local population aware of these plans? If so, are they agreeable? Where areas are over-populated, will the new system of land use absorb more labor or less? If less, are there acceptable options for those who are displaced?

10. What are the implications of present population trends (fertility, mortality and migration) for rural development plans? If the non-migratory population is increasing, can it be absorbed within the proposed development schemes? If not, what alternatives for employment are open to them within the development area or elsewhere?

11. Is the health of the local population good enough to withstand the labor demands of the new system of land use?

12. How does the layout of roads correlate with the present distribution and density of population? Where layout is supposed to redistribute population, will it open up new areas and provide access for potential settlers?
III. Technical, Credit, Marketing, and Training Services

13. In evaluating the effectiveness of institutional services, special attention should be placed on those extension services which will be responsible for introducing new crops, implements, and techniques to the local population. It is also important to assess the degree of coordination among different services and, in particular, whether or not they are offering conflicting advice.

IV. The Local Educational System May Foster Goals Which Do Not Support, and May Even Undermine, Development

14. How do the goals of the school system -- to prepare students for secondary school entrance, for example -- and of the social system relate to development goals? How does the curriculum relate to rural society and rural change? Do students learn to read, write, and calculate well enough to follow written instructions and to carry out simple farm accounting? What proportion of the population by sex and age categories attends and completes school? What types of careers do students expect? What types of careers do graduates and school leavers in fact achieve? What proportion of students remains in the rural area after completing schooling?

15. In attempting to answer such questions, the survey mission will have to rely primarily on interviews with teachers and on examination of the curriculum. The mission may also ask the graduating class to complete a questionnaire on their future goals and their attitudes toward rural society, and, specifically, agriculture.

V. Development Plans May Be Unrealistic in Terms of the Social Organization of Rural Society

16. What is the type, frequency and duration of community activities? Information is needed on the extent to which members of smaller social units, especially the farm unit, actually cooperate for community ends such as road building, lobbying for and construction of schools, and other social services.

17. To what extent do farm unit members cooperate within larger organizations such as corporate kin groups, work parties, and cooperatives to achieve common goals?
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VI. The Rural Population May Resist Changes Desired by the Development Planner Because Systems of Land Allocation Reduce Incentives

18. Are users of land willing to make long term improvements? If land use rights can be revoked at will by another party, as in some land tenure systems, land reform may need to precede development. Similarly, if land litigation is common, freeholders may be unwilling to improve their land until after lands are registered and titles issued. In assessing the system of land allocation, the survey mission should learn who has what types of claims to the land and how these claims affect the incentives of land users. The mission should also examine the extent to which conflicting claims exist, by examining court records and other documents which might reflect the extent of land litigation.

B. Subdivision of Land Holdings Is Incompatible with New Forms of Land Use

19. Development plans should explicitly determine the technically and economically optimum farm size, taking into consideration the farmers' expectations. The survey mission should then compare optimal and actual size of land holdings. Little development may be possible without consolidation; even with consolidation a substantial portion of available farms may fall below the minimal size recommended.

C. New Techniques and Crops Compete with Established Land Use for Labor at Critical Seasons

20. Can the existing labor force handle the demands of the new system? The structure of the local population should be examined and compared with labor needs of the new system. Though accurate census data is often lacking, the information should suffice to determine, approximately, if the area's labor force is deficient. If it is, it is most likely because the population is small and because a significant proportion of the labor force circulates between its district of origin and external places of employment. To augment the labor force, either labor migrants must be willing to return to their rural homes, or a new labor supply must be tapped, or both. Which option or options are selected will depend on the reasons why labor migrants seek external employment and on the comparative
advantage of immigration to labor migrants and settlers from other areas.

21. Are there local conditions such as disease and malnutrition, conflicting demands on time, and attitudes that will interfere with the effective utilization of the existing labor force? If the local population is willing to shift to new crops, labor bottlenecks will be fewer. More likely, a compromise will be arranged which includes crops and techniques from new and old systems. The survey mission should prepare suggestions for such a system. A common example would be a farming population which, though willing to cultivate certain cash crops, is not willing to depend entirely on the market and is apt to favor food crops. If both food and cash crops require planting at the same time of the year, the planting of the cash crops will be delayed with loss in yields.

22. In attempting to assess existing agricultural systems, information should be gathered on the following topics:

(i) Crops grown in order of preference

(ii) Duration of the major operations within the agricultural cycle (land preparation, sowing, weeding, etc.)

(iii) Labor demands for these operations

(iv) Present labor bottlenecks; how new crops and techniques would affect present bottlenecks

Conflicts could be reduced by increasing the supply of certain inputs such as plows, introducing improved techniques, or augmenting the labor force, or by temporarily adopting a less desirable but more convenient cash crop. The solution chosen must of course be acceptable to the farmer in economic and other terms.

23. Do attitudes interfere with effective use of available labor? Some laborers considered underemployed by the economist may be unwilling, at least initially, to allocate more time to agriculture simply because other activities are seen as more desirable. Where an intensive form of land use requiring long hours in fields is proposed, this factor can assume major importance. Also, in some areas, women are not allowed to work in the fields and landowners consider manual labor degrading.
D. Conflicts Among Farm Unit Members Over the Desirability of Suggested Changes

24. The farmer and his wife may have different economic objectives. While the farmer may wish to produce more crops for sale, his wife or wives may be primarily interested in growing enough to feed the household. Accordingly, she may resent her spouse's efforts to channel her labor into cash cropping, especially if she does not directly receive any of the proceeds.

25. Two approaches by the survey mission are suggested to assess present and potential tensions within the farming unit. The first is to examine the present division of labor and attempt to assess how this will be affected by development plans. Will the proposed system of land use increase the labor demands on certain family members, the wife or wives in particular, but not on others? The second approach is to observe the extent to which the families of progressive farmers have shared in the farmers' success. Has the wife benefited through access to labor-saving devices, such as hand- or power-driven machines for processing cereals and other staples, and through more accessible and higher quality water and fuel supply?

26. In most indigenous societies the provision of food, water, and fuel is a relatively arduous, thankless, monotonous, and time consuming task. If the women in the household learn that rural change will improve their lot in these tasks, they are more likely to cooperate by providing both influence and labor. The same applies if some of the cash proceeds of development return to them and their children in the form of clothing, new foods (salt, sugar, protein, etc.), kitchenware, and so on.

27. In talking to farm members, it is important for the survey mission to include women wherever possible although, of course, only if this is acceptable to the farmer himself. All too frequently, the problems and interests of women have been inadvertently left out of efforts to increase rural production.

E. Farmers are Unwilling to Shift from Consumption Cultivation to Cash Cropping

28. Resistance to change is common. It not only affects the implementation of change but may influence the decision to attempt development efforts. In some cases, for the time being at least, it may well be best to use resources in the most receptive areas. In any case, the most acceptable system combines
new and old crops and techniques. Even a compromise system has little chance of success if the farmer cannot try it without jeopardizing his present operations.

29. In trying to assess the area's potential for development, the survey mission should briefly review the recent history of rural change. Significant changes in the economy may well have occurred within the past fifty years following the acceptance of new occupations, new crops, and new techniques. The farmer's attitude may have been influenced by the types of innovation and the consequences of acceptance.

30. If the changes were not successful from the farmer's point of view, he may be loath to attempt further changes, especially if the earlier ones were advocated by the government. If the changes were spurred by population increase, environmental degradation, or other adversities which soon neutralized new benefits, the farmer may see change as a means not for increasing production but only for adapting to adverse conditions. If his present condition is acceptable, he may feel little incentive to try further innovations. Simple innovations, like better yielding plant varieties which do not require fertilizers or other agricultural requisites, may be quite acceptable, while multiple trait innovations are not.

31. Even a brief historical review will give some indication of the farmer's position and how best to influence it. Where positive change has occurred in the recent past and where farmers' expectations are rising, a well-planned and well-implemented program has a reasonable chance for success. It does not in areas where the existing farm system has had high degree of continuity and where the farmer is still primarily satisfied with the old way of life. Resistance may be particularly strong in a high risk environment.

32. The survey mission should also seriously attempt to gain insight into the farmer's present attitudes and expectations. Their assessment requires careful observation as well as the use of a carefully considered questionnaire. The latter should include queries about the farmer's goals and perceived problems. Is he primarily interested in increasing the number of his dependents, in supporting his immediate family on a self-sufficient basis, or in raising his standard of living by increasing his control over land, labor and capital? In the latter case, are his goals largely traditional or do they include the acquisition of consumer goods and other products of an industrializing society? In any case, how much effort, time, and capital are the farmer and his dependents prepared to invest?
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33. Since the answers to such questions may or may not reflect the farmer's actual future behavior, the mission should also try to learn the farmer's background and the history of his farm. Have the farmer's experiences enabled him to observe and participate in life styles different from his own? If so, could certain ideals and behavioral patterns be productively transferred to his own farm? Has the farmer in fact responded to increased awareness of alternatives by applying new ideas to the development of his own resources? The mission may also find it relevant to inquire about the farmer's upbringing (was he, for example, brought up in a progressive or conservative household?); education (number of years, type, and ability to read and write in the national language); wage labor history (number, location, type, and potential relevance of jobs); travel experience; and experience in assuming new modernization roles (participation on loan, school, village improvement, and other local committees; membership in cooperative, religious and political organizations).

34. Concerning the farmer's ability to raise his standard of living, to what extent has the farmer upgraded his farm buildings? Where upgrading has occurred, has the farmer relied primarily on local material and self-help, or has he invested in the purchase of new materials (kiln-dried bricks, cement and lumber, whitewash and paint, door and window frames, metal roofs, etc.) and of skilled expertise (hiring of masons, carpenters, etc.)? To what extent has the farmer upgraded and maintained his farm implements and other movable property (furniture, radios, gramaphones; bicycles and other means of transportation; livestock, through purchase or acceptance of improved breeds)? To what extent has his family benefited from an improved standard of living as reflected in clothes, cooking utensils, payment of school fees, etc.? What is the relationship between the farmer's income and expenditures? If he has savings, in what form do they exist ("buried", postal savings, shares)? If he is in debt, what types of institutions or individuals are his creditors?

VII. The Means of Transport Are Inadequate

35. An inventory of the number and type of vehicles should be made. Their condition should also be assessed, along with the maintenance skills of their users. Finally, the availability throughout the year of service, repair and parts facilities, and fuels within a reasonable distance needs to be considered. (Adequacy of government vehicles should be assessed under III above.)
VIII. Lack of Interest in Agriculture as a Way of Life is Prevalent

36. Much of the information gathered under VI above will indicate whether this constraint is a problem. In general, the survey mission should attempt to inform itself on the following questions.

i. Are farmers, and especially the more progressive members of the community, seeking work outside agriculture?

ii. If they are, is this primarily because land and agricultural opportunities are lacking or because agriculture is little valued?

iii. Where undesirable out-migration is increasing, is there any evidence that certain types of rural development would slow down or reverse present trends? Evidence would include the return of unskilled, semi-skilled, and skilled personnel to the land as new opportunities become available in agriculture and other rural occupations.

iv. If landowners are unwilling to work the land themselves, are they absentee owners or resident managers? If the latter, are they amenable to advice from extension staff; will the available labor force follow instructions? If absentee owners, are they willing to accept innovative managers?

v. What are the possible implications for agricultural development of present trends? Are expectations, for example, rising so fast that target incomes for rural development projects will not be considered satisfactory by the average farmer within a decade? If so, can these incomes be upgraded as expectations rise?
IX. Social Institutions for the Mobilization of Agricultural Labor Are Inadequate

A. The Farm Unit

37. Labor resources should be compared with the labor profile desired under the new system of land use. If there is a major discrepancy, plans should be altered unless other labor resources are available.

B. Voluntary Self-Help Groups, Work Parties

38. Where present, these groups need to be carefully assessed. Will their members be available when needed? Are they willing to practice the standard of husbandry required?

C. Hired Labor

39. The availability, skills and cost of hired labor needs to be considered. If potential laborers are busy in their own gardens when planting help is needed and available only when the farmer can meet his own labor needs, then a modification either in the agricultural system or in government assistance to recruit labor is needed.

X. Local Leaders Are Opposed to Development Plans or Lack Influence as Demonstrators of New Techniques

40. Whom do the people consider to be their leaders and what is the nature and organization of their authority? In some societies, leaders may be individuals who have influence over the population's opinions and actions. In this case, their opposition is apt to be a serious constraint and their support a major benefit, especially if they are willing to demonstrate innovations on their own holdings as well as to encourage others to follow their example. In other societies, the influence of leaders is restricted to specific activities and no single individual or group has the authority or prestige to lead a comprehensive program of agricultural change. In such a case, the extension staff will have to work through a larger number of potential innovators.

41. It is also important to assess the willingness of local leaders to work together toward common community goals. Do they share diverging aims or see each other as threats? In trying to obtain the support of leaders, it is wise to recall that those who have the greatest influence within a community may or may not be those with official positions obtained through
election, inheritance or appointment. In identifying opinion leaders, the mission will have to rely on the selected informants. The survey mission should also examine local political institutions such as rural and village councils and their relevance to the planning and implementation of rural change.

XII. Local Innovators Do Not Value the Changes Suggested by Planners

42. At this point in its survey, the mission should be able to identify the types of changes which have been going on in the area over recent years, and the potential or actual relevance of these changes to rural development. The innovators should be identified and a number of case histories examined. Though they may not be active in agriculture, as opposed to trading and other occupations, this does not necessarily mean that they do not value it. When agriculture is an area of innovation, it may be viewed primarily as a stepping stone to another occupation. Such a situation may or may not adversely affect government plans. When innovators and government planners are working at cross purposes, one stressing an extensive system of cultivation, for example, and the other an intensive one, a compromise system will be needed.

XII. The Social Organization is Highly Complex

43. Where more than one society or land use system exist in the same area, the task of the survey mission is more difficult. From the policy planning point of view, it is important for the mission to know what sections of the population the government wishes to involve in rural change, so that their reactions and degree of involvement under different approaches can be estimated. Furthermore, the implications of the attitudes and behavior of other sections of the population must also be assessed. Where different land use systems are involved, progressive farmers may be held back by factors beyond their control, such as infestation of their fields by insects from the fields of other farmers who are unwilling to carry out pest control measures. Under such circumstances, and when conflicts occur among social strata over resource allocation and land reform, the survey should prepare a range of alternative proposals.