NF

BIBLIOGRAPHIC DATA SHEET

1. CONTROL NUMBER	2. SUBJECT CLASSIFICATION (695)
PN-AAJ-657	DP00-0000-G800

3. TITLE AND SUBTITLE (240)

Study of transport investment and impact on distribution of income in remote areas, phase I final report

4. PERSONAL AUTHORS (100)

5. CORPORATE AUTHORS (101)

Berger (Louis) Int., Inc.

6. DOCUMENT DATE (110)	7. NUMBER OF PAGES (120)	8. ARC NUMBER (170)
1979	449p.	FEA633.Ø687.B496

9. REFERENCE ORGANIZATION (130)

Berger

10. SUPPLEMENTARY NOTES (500)

(Sponsored by SEATAC, Southeast Asian Agency for Regional Transport and Communications Development)

11. ABSTRACT (950)

12. DESCRIPTORS (920)

Agricultural products
Income distribution
Southeast Asia
Indonesia
Surveys
Distribution systems
Transportation
Philippines
Thailand
Investments
Rural areas
Malaysia

13. PROJECT NUMBER (150)

14. CONTRACT NO.(140)

AID/otr-C-1788

15. CONTRACT TYPE (140)

16. TYPE OF DOCUMENT (160)

68

AID 590-7 (10-79)

FEA
633.0687
B496

FINAL REPORT

PN-AAJ-657

PHASE I

STUDY OF TRANSPORT INVESTMENT AND IMPACT ON DISTRIBUTION OF INCOME IN REMOTE AREAS

Sponsored by

SEATAC

SOUTHEAST ASIAN AGENCY FOR REGIONAL TRANSPORT
AND COMMUNICATIONS DEVELOPMENT

Funded by

U.S. A.I.D.

UNITED STATES AGENCY FOR
INTERNATIONAL DEVELOPMENT

Prepared by

LOUIS BERGER INTERNATIONAL, INC.
East Orange, New Jersey U.S.A.

February 1979

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February 28, 1979

Dr. S.H. Simatupang
Acting Director
Southeast Asian Agency for
Regional Transport and
Communications Development (SEATAC)
P.O. Box 1078
Kuala Lumpur, 04-01, Malaysia

Dear Dr. Simatupang:

We are herewith submitting our final report on project RR-2. The report incorporates all the revisions considered necessary after review of the comments on the draft final report. Two sets of computer printouts containing supporting data from the household surveys were supplied to you with the draft. No further computer runs were made. Sixty copies are provided for distribution of ten each to SEATAC, RED, and the four participating countries.

The operations manual has already been submitted to you through Mr. Stonier.

Sincerely yours,

Louis Berger

Louis Berger

LB/kj

THE PRESIDENT'S "E" AWARD — FOR OUTSTANDING CONTRIBUTIONS TO THE EXPORT EXPANSION PROGRAM OF THE UNITED STATES

STUDY OF TRANSPORT INVESTMENT AND IMPACT ON DISTRIBUTION OF INCOME IN REMOTE AREAS

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ACKNOWLEDGMENTS

F O R E W O R D

This final report is submitted in accordance with Article 2.11(c) of the Contract between the Southeast Asian Agency for Regional Transport and Communications Development (SEATAC) and Louis Berger International, Inc., dated March 17, 1977. This contract covers Phase I of SEATAC's Project RR-2, "Study of Transport Investment and Impact on Income Distribution in Remote Areas."

The objectives of Project RR-2 are:

(a) to develop an analytic method through which the role and impact of transport investments on development and income distribution can be predicted and thereby

(b) to provide guidance to SEATAC member countries on the most effective ways in which transport investment can broaden social and economic benefits in rural areas.

The study was designed by SEATAC to be carried out in two phases. Phase I would consist of ex-post examination and analysis of selected projects where relevant investment has already been made, in order to understand the mechanism through which development in remote areas is induced in response to transport improvements. This Final Report presents the findings of the analysis carried out in Phase I.

In Phase II, for which the Terms of Reference are not yet prepared, the findings of Phase I would be applied to the preparation of new projects, and the impact evaluation methodology developed in Phase I would be further refined and tested as these projects were carried out.

This Final Report for Phase I contains six chapters.

CHAPTER 1 provides an overview of the activities carried out in Phase I, including:

- development and refinement of a conceptual model relating transport investment to impacts on income, quality of life, and regional growth potential

- collaboration with Local Study Teams in each participating country to define study projects, determine the availability of data, and identify analytic issues of concern to each country

- development of a field work plan and instruments to obtain the data needed to evaluate transport investment impacts

- participation with Local Study Teams in a workshop to refine the methodology and instruments in order to achieve comparability across study sites while satisfying the particular analytic concerns of each country

- execution, with Local Study Teams, of field work in each participating country

- analysis of the data obtained through field work by Local Study Teams and preparation of this Final Report

CHAPTERS 2-5 present detailed discussions of the findings for each participating country, including:

- description of field study methods and instruments used in each country

- description of transport investments and study areas

- analysis of transport sector change

- analysis of behavioral response

- analysis of impacts on income distribution

- analysis of impacts on quality of life

CHAPTER 6 presents the findings of a comparative analysis of the data from all study sites. This chapter focuses on the following issues:

- differences in transport investment characteristics that may have affected differences in outcomes across study areas

- differences in study area characteristics (situational factors) that may have affected outcomes

- differences in patterns of related investment, transport sector characteristics, price and tax structures, etc. (policy variables) that may have affected outcomes

- conclusions regarding ways in which the benefits of transport investment in remote areas can be broadened to include a larger share of the target area population.

Appendix A contains copies of the survey forms used in field work, as agreed on by all the participating countries. (Forms as modified for use in each particular country are not included.) Appendix B describes the different measures of accessibility and accessibility change developed for this study. Appendix C presents conversion factors used in each country to arrive at quantitative results expressed in the metric system. Appendix D describes the methodology used in this study to assess income distribution impacts.

EXECUTIVE SUMMARY

SEATAC's Project RR-2 is a collaborative research effort by four Southeast Asian countries and a consultant team to develop, test, and refine a model and methodology for transport impact assessment in order to find ways to enhance the economic and social benefits of transport investment in remote areas. Phase I included the development of an impact model, testing of the model with data from four project sites in each of the four participating countries, and comparative analysis of the data from the four sites. In this first phase, an attempt was made to identify the availability of data in the project areas and to develop measurement methods and instruments designed to test the strength or weakness of linkages in a theoretical model of transport investment impacts on income distribution, quality of life, and regional growth in remote areas.

Data concerning four different types of transport investment were collected in seven project areas in four Southeast Asian countries. Over 1,200 household interviews were conducted, as were interviews with village officials, administrators, transporters, traders, and entrepreneurs. The results for each country are discussed in a separate chapter in the body of this report. Conclusions resulting from a preliminary comparative analysis of the findings for each country are summarized below.

- Access change in remote areas is made up of changes in the accessibility of markets to outside centers, changes in the accessibility of villages to markets, and changes in contacts and communications at the village level.

- Access change is generally the result of a combination of public and private investment. Public investment in capital improvements encourages private investment in motorized vehicles. However, some private investment takes place even in the absence of government initiatives.

- Public investment in transport improvement usually generates significant savings in time, comfort, and convenience of travel. If it involves a mode change, it may not reduce transport costs to the consumer. However, the intangible benefits are sufficiently important to induce a substantial increase in transport activity.

- Transport cost savings provide an incentive for investment in transport and commercial activities in the project areas. As a result, the local economy becomes more diversified and more competitive. This process assures the pass-through of a portion of the benefits to producers and consumers in the project area.

- Generally, transport cost savings are not of sufficient magnitude to induce the establishment of agro-processing industries in the study areas. Rather, they facilitate the commercialization of crops over a wider area and the diversification of a subsistence economy. This may, however, help to create conditions favorable to future growth in agro-processing industries.

- Access change makes little difference in the production patterns of subsistence food crops.

- Access change can increase the commercial production of food crops over a subsistence level. For this to occur, however, a wide range of support services seems to be required.

- Access change encourages the production of cash crops in two ways: (1) through direct reduction of transport costs and (2) through increased contacts and communication. Price information is the key determinant of farmer response to new opportunities for cash crop production.

- Market access improvements bring middlemen from outside into the study area.

- Local access improvements increase the circulation of traders in rural areas and draw subsistence farmers into the cash economy.

- With access improvements, a larger share of farmers market some portion of their production, but a smaller share of those marketing transport their crops for sale. In general, the point of sale has moved closer to the farm.

- Personal travel definitely increases in remote areas as a result of access improvement. The major change is in local travel within the study area.

- In the medium term, access change is more likely to encourage migration into a remote area than out of it. This pattern may, however, be reversed in the long term.

- Market access change is clearly linked to increased service provision in the population centers of remote areas.

- Local access improvement may facilitate the delivery of services in rural areas, but this depends on government policies and programs.

- Local access change provides an opportunity for increased utilization of services by remote area residents. Whether or not a change takes place depends primarily on the perceived need for services.

- Communications change has taken place in all the study areas. The relationship between access change and communications change is complex and requires further study.

- Change in cropping patterns is fairly evenly distributed across socioeconomic groups.

- Commercial production of food crops is dependent on a mix of services and inputs to which access may be unevenly distributed by socioeconomic group. Lack of equity in access to services is clearly a constraint on regional production potential.

- There was relatively little movement between socioeconomic groups in the project areas over the study period. The major change was the growth of the nonfarm sector, and this was largely made up of households originating outside the study area.

- Income levels generally have risen, and as a result, the range of income levels has widened. In areas where the income increase is heavily dependent on export crops, there may be a tendency toward greater income stratification. In areas where the increase is largely in commercial food crop production, there may be a tendency toward greater income equity.

- Most project area residents feel that transport change has made a difference in their personal lives. However, far fewer would link this change directly to the study project.

- Economic factors form the dominant dimension in perception of the quality of life by remote area residents, followed by family concerns and access to services.

- Project impacts on the quality of life are generally viewed as positive. However, some negative effects are also perceived by project area residents.

The Phase I findings should be taken as suggestive but not definitive. There are a number of new directions that could be followed in further field research. These include:

- Further refinement and analysis of the existing data base.

- Replication or expansion of the field work in the same project area.

- Replication of part or all of the field work in additional project or control areas.

- Refinement of the instruments and indices.

- More specific studies of research issues raised by the Phase I findings, including:

    - Decision-making processes of small farmers and the role of transport change.

    - Change in employment patterns and urban growth in relation to access change.

    - Patterns of entrepreneurship in response to transport change.

    - The functions of generated traffic.

    - Service provider and client perceptions related to change in service delivery and utilization.

    - Relationship of access change to change in contact and communication.

CHAPTER 1
INTRODUCTION

1

CHAPTER 1

INTRODUCTION

This report presents the findings and conclusions of Phase I of Project RR-2, "Study of Transport Investment and Impact on Income Distribution in Remote Areas," sponsored by the Southeast Asian Agency for Regional Transport and Communications Development (SEATAC) and funded by the United States Agency for International Development (U.S. A.I.D). Project RR-2 is a collaborative research effort by four Southeast Asian countries and a consultant team, designed to develop, test, and refine a methodology for enhancing the economic and social benefits of transport investments in remote areas. Phase I includes the development of an impact model, testing of the model with data from project sites in each of the four participating countries, and comparative analysis of the findings from the four sites.

A. BACKGROUND OF THE STUDY

Public investment in transport and other infrastructure projects has become one of the classic approaches to stimulating national economic development. During the First Development Decade, heavy investments in infrastructure were made to meet national needs for security, alternate access to foreign markets, collection of export products, and distribution of imported goods. Such projects were generally capital intensive and required major investment in equipment that had to be fueled, maintained, and operated by skilled workers. The benefits of transport sector investment accrued largely to the vehicle-owning population and the large-scale entrepreneurs for whom a reduction in transport costs meant a significant saving.

As a corollary to this, the evaluation of infrastructure projects has traditionally been based on measuring such projects' contribution to the national economy, chiefly through the reduction of vehicle user costs. These savings have then been compared to the economic costs of construction and maintenance over the expected life of a project. Until recently, relatively little attention has been paid to the distribution of economic costs and benefits over the population of the country concerned. Further refinements, such as the use of shadow prices for the costs of different types of labor and capital inputs, are just beginning to be introduced in the economic evaluation of projects.

Other, less easily quantified "social" costs and benefits of transport sector investment have occasionally been noted, but they have rarely been taken into account in a systematic manner in project planning and evaluation. This omission has not been too important as long as needed projects could be justified on the basis of user cost savings alone. However, many of the major infrastructure investments have now been made, and priorities in the transport sector have expanded to include projects with relatively low traffic volumes that are justified primarily by the expected value of induced social and economic benefits. The development of a methodology to quantify, evaluate, and predict the magnitude of these induced benefits is urgently needed for transport planning today.

In the Second Development Decade, worldwide interest has turned from the initial problem of stimulating economic activity at the national level to the more complex (and culturally relative) problem of assessing the implications of economic development for changes in human welfare. Specifically, there has been much concern about the effect of development on stratifying a population into distinct groups that receive disproportionate shares of the benefits of change. The economic measure that has been most commonly used as an indicator of this effect is the pattern of income distribution. More qualitative concepts that have been important in the analysis of distributive effects are the dichotomy between urban and rural areas and the distinction between traditional and modern cultural systems.

Apart from concern over the unequal distribution of effects on income, attention has begun to be paid to the secondary consequences of development as they affect the long-term prospects for a better life for the populations of developing countries. These concerns arise out of growing awareness that resources are limited and that nations are increasingly dependent on one another for survival. They include concerns about the world's production of food and other basic commodities to meet the material needs of a growing population, about the environmental consequences of certain development activities, and about the quality of life as lived by people on the margin, expressed principally as concern about access to health care and educational opportunities.

The relevance of infrastructure projects to this more humanistic concept of development is not always obvious. Indeed, it has sometimes seemed that such projects have provided opportunities principally to a small elite, which was thereby enabled to increase its economic advantage over the majority of the population.

The theory that benefits would "trickle down" to the masses has not always worked out in practice. Yet, this question has still to be studied in a systematic fashion and in a way that would identify the factors determining the nature and extent of a "trickle down" effect.

The justification of transport sector projects can no longer rest on economic arguments alone. Such projects must be shown to contribute to an improvement in human welfare in the larger sense, which includes the concept of greater economic equity between groups. Certain other contributions, such as offering a stimulus to food production in deficit areas or providing access to needed services, can also be seen as having a social value above and beyond their estimated economic worth. Similarly, hidden costs, such as those associated with environmental degradation or population concentration, should be taken into account more explicitly in project evaluation.

SEATAC's Project RR-2 represents a first attempt to come to grips with some of these problems in a systematic way. In its initial conception, the project was extremely ambitious, promising to provide the transport planner with a predictive model of distributive impacts that could be used to evaluate alternative transport investment policies. In the course of implementing this initial phase, with due regard to funding limits, time constraints, and the potential of participating countries to sustain the required level of research effort, this ambitious goal has necessarily been cut back considerably. The project as a whole, while it should provide empirical support for reliable guidelines and rules of thumb for project appraisal, will not produce a comprehensive mathematical model for impact prediction.

As noted previously, Phase I of the study, with which this report is concerned, covers the development of a theoretical model of distributive impacts and preliminary testing of this model with data from study sites in the four participating countries: Malaysia, the Philippines, Indonesia, and Thailand. These sites were chosen by the countries concerned to respond to the analytic requirements of the study, which represent transport investments that have been completed during the past ten years, providing a significant change in access to populations in remote areas of the countries. Some countries chose more than one study project, usually in the same mode of transport, in order to provide a basis for comparison. The Phase I research has been a collaborative effort between the Consultants and Local Study Teams in each country to define the objectives of the study, develop appropriate instruments, collect secondary data, and conduct field work. Responsibility for findings and conclusions, however, rests with the Consultants alone.

B. EXECUTION OF THE STUDY

The Work Plan for Phase I consisted of six stages:

1. Project preparation.

2. Review of existing data.

3. Refinement of the proposed methodology.

4. Additional data collection.

5. Analysis of data.

6. Preparation and discussion of a Draft Final Report.

In each of these stages, contributions were expected from the consultant team, the SEATAC staff in Kuala Lumpur, and the Local Study Teams in each of the participating countries.

The project got under way in May 1977 with the arrival of the Project Manager in Kuala Lumpur. The Consultants initiated work on a conceptual model for measuring the impact of transport investments on income distribution, quality of life, and regional growth potential in remote areas. The Local Study Teams made tentative selection of project sites and collected available data on the proposed study areas. The Consultants met with Local Study Team members in each of the participating countries and collected additional data on the national and regional level. Stages 1 and 2 culminated in the preparation of an Inception Report, which was completed in Kuala Lumpur in June 1977 and distributed by SEATAC to the participating countries. Based on the proposed impact model and the data available on the proposed study sites, the Consultants developed a work program and instruments to collect needed additional data. In this stage, it became clear that the emphasis of the study would have to be shifted from the analytic phase to the execution of field research and that substantial additional efforts would be required of the Local Study Teams.

A workshop was held in Kuala Lumpur in early August 1977, in which the Consultants, SEATAC staff, and members of the Local Study Teams participated. During this workshop, the model proposed in the Inception Report was reviewed and modified in accordance with the limitations imposed by the lack of available data and the constraints on potential field work. The selection of study projects and the definition of study areas and impact zones was discussed in some detail. A data collection design was presented, relating the proposed instruments and field work

program to the requirements of the modified impact model. The proposed instruments were then discussed in detail and revised by each Local Study Team, in collaboration with the Consultants, to reflect local and national differences while preserving comparability to the maximum extent possible. Finally, the objectives of the study and the contents of the proposed Operations Manual were discussed by all participants.

The next stage involved the execution of field work in each participating country. Field studies were carried out in August, September, and October 1977. They took from two to three weeks in each country and involved at least two members of the Consultant team, members of the Local Study Team, and locally hired research assistants. Administrative officials in the study areas and citizens who consented to be interviewed also gave generously of their time during this stage of the study.

The data obtained from the field work were partially processed in the field and in SEATAC's office in Kuala Lumpur. They were then forwarded to the Consultants' office in Washington, D.C., for computer processing, analysis, and interpretation. The findings of this stage are presented in this Phase I Final Report.

C. MODIFICATION OF THE MODEL

The Inception Report describes the Consultants' proposed impact model and methodology for measuring key variables and testing the hypothesized linkages between them. The impact model proposed in the Inception Report is shown in Figure 1. While the model does not show all of the many possible interrelationships among the various classes of variables concerned, it is believed to represent the major lines of influence through which transport sector investment can be translated into changes in income distribution, quality of life, and regional growth potential.

A full description of the conceptual model as originally proposed is given in Section II.C of the Inception Report. Briefly, the model begins with three types of "input variables" that are seen as potential stimulants to developmental change: the transport investment under study, other government investment in the study area, and private investment in the study area.

These investments, in combination, produce several immediate impacts in the study area. The most important, from the point of view of this study, is the overall change in accessibility. This change may be made up of several elements,

including change in the cost of travel and transport, in the location of facilities, and in the nature of available transport services. The definition of accessibility change in terms that take all these factors into account and permit comparable measurement across different project sites has been one of the key problems of this study. (See Appendix B)

The model postulates that an accessibility impact can be translated into a change in transport costs that will be reflected in a change in behavior on the part of transporters, shippers, travellers, and service providers. The extent to which cost savings are passed on through these linkages is believed to be of crucial importance to the realization of induced benefits.

There are other, short-term consequences of development projects that may have a direct impact on incomes, quality of life, and regional growth potential. Two classes of short-term impacts were proposed for study by the Consultants: (1) employment impacts (those directly attributable to the study project) and (2) environmental impacts (also limited to direct consequences of the study project). It was hoped that the use of alternate design standards, construction techniques, and maintenance methods for transport projects could be evaluated in the light of these short-term impacts.

The model was then expanded to include a set of second-order behavioral responses to the changes induced by a change in accessibility. Specifically, it was hypothesized that a reduction in transport tariffs for goods would lead to changes in production and consumption patterns; that a reduction in passenger travel costs and an increase in safety, comfort, and convenience would lead to changing patterns of association, migration, and settlement; that changes in service delivery patterns and the cost of travel to the consumer would produce varying patterns of service utilization; and that increased flows of goods, services, and information between points in a network would facilitate communication and enhance opportunities for local participation in development decision making.

Because of the study's emphasis on distributive effects, it was necessary to find ways of establishing the incidence of these costs and benefits by socioeconomic group. There was also a desire to investigate the geographical limits of transport investment impacts and the way in which they vary as a function of accessibility change. The study area population would therefore be stratified in two ways: (1) by socioeconomic status and (2) by location (distance from the study project). Variations in the postulated behavioral responses would be measured

across these groups. Impacts on different groups would then be combined into an overall assessment of impacts on income distribution, quality of life, and regional growth potential.

In addition to the interactions among variables in a specific project setting, the Consultants attempted to identify parameters whose values might vary between project sites in a way that could be related to variations in project impacts. These parameters, or "mediating variables," were divided into two general classes: (1) situational factors and (2) policy constraints. The distinction between these two classes is not entirely clear on theoretical grounds but is of great practical importance for planners. Basically, situational factors represent those conditions that must be taken as "givens" in project planning, while policy constraints represent those conditions that could be changed by governmental action at the national, regional, or local level. The list of suggested mediating variables is shown in Figure 2.

The Inception Report also included a preliminary assessment of the data collected by the Local Study Teams in each country. This assessment was complicated by the fact that, in at least two countries, the final selection of study sites had not been made at the time of the Inception Report. Seven proposed sites were discussed in the report: two bridges in northern Luzon (Philippines), a rural access road in southern Luzon, two rural roads in the northeast region and Thailand, a river system in Sarawak for Malaysia, and an air service and shipping line serving Halmahera Island in Indonesia. The third project in the Philippines and the air service in Indonesia were dropped as being too special to serve the purposes of this study.

The amount and level of detail in the data provided by Local Study Teams prior to the Inception Report varied considerably. In some cases, the Consultants had to supplement these data with national-level statistics in order to make a preliminary assessment of comparability across study sites. In no case was the kind of detailed data needed to establish pre-project income levels and socioeconomic groups available for the proposed study areas. In most cases, pre-project traffic data were also unavailable.

It became clear that in order to achieve the objectives of the study major emphasis would have to be shifted from the analysis of existing data to the field collection of data at the level of detail needed to evaluate distributive impacts. This meant, among other things, that the Consultants would have to

rely almost wholly on respondents' recall of their circumstances and behavior prior to implementation of the study projects, a period of from five to ten years before the present project. Individual household surveys would have to be conducted in each study area and supplemented with whatever could be found out from government administrators, village officials, and private entrepreneurs in the project areas.

It also became clear that, within the limits of funds, time, and Local Study Team participation, it would not be possible to evaluate all of the linkages originally proposed in the conceptual model presented in the Inception Report; certain linkages would have to be assumed and others ignored for the time being. In particular, the following changes were made:

1. Since all the projects under study were constructed using capital-intensive designs and construction techniques, there was essentially no variation in the short-term employment impact generated by project construction in the study areas. In no case was this employment impact of major magnitude from the point of view of the study area population. Short-term construction employment impacts were therefore excluded from the model for the purposes of this study.

2. Because of the lack of detailed data on environmental conditions in the project areas before and after the study projects were implemented, short-term environmental changes were also eliminated from the list of impacts. Secondary environmental impacts resulting from induced development in the project areas, such as deforestation or changes in water supply, were assessed in a qualitative manner and in terms specific to each study site.

3. Because of the lack of pre-project traffic data in most study sites, it was not possible to distinguish normal traffic growth from generated traffic ("Change in Vehicle Use") in present traffic levels. In some cases, where the improvements opened up areas formerly inaccessible to vehicular traffic, all of the present traffic could be regarded as generated traffic. However, even though there is wide variation in population density across the selected study sites, all of the "remote areas" were inhabited prior to the construction of the study projects and at least some communications links existed between them and the outside world. It is therefore quite difficult to determine what part of present traffic levels are due in each case to the project improvement.

4. The behavioral response models for service provision and for communications postulate that a perceived change in transport costs (including improvement in safety, comfort, and convenience factors) creates an incentive to planners to change the level of service provision and communications in the project areas. It was initially proposed to test this model in two stages: (1) by relating actual changes in transport costs to the perception of change by service providers and (2) by relating these perceptions to the measured change in service provision and communication levels. However, the need for concentrating on household surveys in the field work eliminated the possibility of conducting meaningful research on service-provider perceptions. The linkage was therefore assumed for the purposes of this pilot study, and observed changes in transport characteristics were related directly to observed changes in service delivery over the study period.

5. The behavioral response models for changes in production and consumption patterns are based on the assumption that changes in transport tariffs for goods will be reflected in changes in prices paid to the producer for export commodities and in changes in prices paid by the consumer for imported goods. The relationship between these price changes and the observed change in production and consumption behavior can be quite complex. For example, a decrease in the retail price of fertilizer may induce a greater amount of fertilizer consumption (a form of investment), which may then affect production patterns in a variety of ways. Similarly, a rise in producer prices will provide an incentive for production change but will also affect consumption patterns by changing the level of disposable income.

It is possible to measure changes in retail prices for local products and consumer goods over the study period. However, it would be quite difficult to attribute these changes to the transport improvement because of the many other factors affecting price changes that would have to be taken into account. These factors would include local, national, and worldwide inflation; changes in the supply and demand for commodities external to the project area; and government changes in price and tax policies. As a result of these uncertainties, it was decided to assume the retail price linkages and to relate change in transport tariffs directly to changes in production patterns.

On the consumption side, the lack of any pre-project household budget data, and the difficulty of getting even current expenditure data at an adequate level of detail, led the Consultants to alter the response model as related to changes in consumption patterns. A partial substitute for household budget data was found in the acquisition of household assets and investment in farm inputs over the study period.

6. Finally, there was a conceptual problem in defining the benefits of service provision and communications change from the point of view of the study area population. Initially, it was proposed that changes in services delivery and utilization should result in measurable changes in service outcomes, such as higher literacy rates or lower rates of infant mortality. Changes in these outcome measures, however, take a long time to show up in secondary data, and the available statistics are generally not sensitive to short-term or local changes. It was therefore decided to assume that increases in service delivery and service utilization benefit consumers and to treat such changes as direct measures of the impact on quality of life.

Similarly, it was originally proposed that change in communications activity should result in a change in the level of information in the project area and that this change would constitute a benefit in terms of quality of life. However, the resources available for field work did not permit detailed investigation of changes in information levels. Therefore, it was decided to assume that a rise in communications activity is in itself a benefit to the quality of life in remote areas.

Most of these modifications in the conceptual model were made to permit concentrating the available research resources on investigating the linkages of greatest importance to this study, namely those relating to impacts on income distribution. The model as modified for field research is shown in Figure 3. Those linkages that have been tentatively assumed for pilot study should certainly be studied in greater detail in future research programs.

D. SAMPLE DESIGN AND INSTRUMENTATION

The field work plan and proposed instruments were drawn up with these constraints in mind. The modifications made in the model, their relationship to the proposed instruments, and

the implications for Local Study Team participation in field work were all discussed at a workshop held at the SEATAC offices in Kuala Lumpur from August 2 to 5, 1977. Participating in this workshop were SEATAC staff, the Consultant team, and members of the Local Study Teams from each participating country.

The proposed program for field research at each study site was built around the absolute necessity of conducting household surveys on a sample of sufficient size to represent the project area population in order to obtain the data required to evaluate distributive effects. Supplementary data were sought through interviews with administrators and village officials as well as with transporters, traders, and industrial entrepreneurs operating in or near the project areas. Survey instruments for each of these respondent groups were drafted by the Consultants and substantially revised by the Local Study Teams during the workshop sessions. (A copy of the survey instruments as agreed on by all participants is provided in Appendix A.)

For each project under study, a study area and an impact zone were defined in collaboration with the Local Study Teams. (See Figure 4 for a map showing the location of the four study areas.) The impact zone was defined according to certain physical criteria. It included the area within 10 kilometers of the improved transport network, not separated from it by a major physical obstacle (for example, a river or mountain range) and not served by a closer alternate access route to major destinations. The study area was then defined as an aggregate of administrative units containing within it the impact zone.

Approximately 200 household interviews were sought in each project area. A multi-stage, stratified random sampling technique was proposed for selection of the households to be interviewed. In each study area, three sample administrative units were to be selected with population centers at varying distances from the transport improvement. Within each unit, three sample villages were to be selected either at random or purposively to introduce greater refinement in the measurement of accessibility change (determined at the village level). Urban centers were excluded from this process in order to assure an adequate sample size of rural population.

Within each sample village, 20 to 25 household interviews were to be obtained. The village population was to be stratified by farm size, and sample households were to be selected from each stratum in proportion to the district-wide distribution (in order to make the sample population more

representative of the study area as a whole). Landless households were placed in a separate category and interviewed in proportion to their share of village population since no data were available to determine district-wide distribution.

A village-level survey was to be carried out with a responsible official in each of the nine sample villages. Administrative data were to be collected for as many as possible of the administrative units comprising the study area, including , but not limited to, those administrative units selected for the household survey. The administrative survey included forms to be filled out by the chief administrative officer and his associates in the fields of health, education, agriculture, and community development.

Approximately ten transport enterprises serving the study area were to be surveyed. These could be based either within or outside the study area. The sample would be selected to include both large and small transport enterprises and both passenger and freight carriers.

Agricultural processing industries were to be identified at both the village and the district levels. Within each sample village, the village official would be asked to list local enterprises. Administrative officials would be asked to list large-scale processing industries in each district (defined as those having a minimum of five employees). Interviews were to be held with at least one of each type in each sample district.

A similar approach was taken in the commercial survey. Village officials would list the shops serving each village, and interviews were to be held with a purposive sample of up to five shops. Where possible, the sample would be diversified by type of trade. A special effort would be made to find and interview shops carrying agricultural inputs or newspapers and periodicals.

In the sample district centers, an additional five shops were to be interviewed. These shops were expected to be larger and more specialized than those found at the village level. The sample was to include at least one wholesaler supplying goods and services to village shops or traders. The others would be selected to give an approximately representative sample of shop types at the district level.

It was estimated that this field work program could be carried out in each project area by a team of four interviewers, two Local Study Team members, and two members of the Consultant team over a period of two weeks for actual field activity. It

is greatly to the credit of the Local Study Teams that this ambitious schedule was, by and large, successfully carried out in each study area.

E. FIELD METHODS AND CHANGES

After reaching agreement on the general form of the survey instruments to be used in field work, the Consultants met individually with the workshop participants from each country to prepare the specific materials for use in their project areas. In some cases, this required complete translation from the English into national languages (Thai and Indonesian). In every case, of course, interviewers were required to translate the questionnaires into local dialects as they went along.

Other changes included the definition of measurement units in use in each study area,[1] the selection of particular crops and other economic activities most likely to be found there, and the definition of relevant transport modes. Types of land tenure and land use were also locally specific. In addition, each country team was interested in pursuing some specific question with reference to its own study areas. Where feasible, these questions were added to the survey instruments, although the answers do not enter into the comparative analysis.

By the second week in August, field work was underway in Malaysia and the Philippines. The study in Indonesia took place in September and the Thailand study in October. Completed forms were returned to Kuala Lumpur, where the household surveys were coded for computer processing. The analysis of the remaining data was allocated to the Consultant team members who had participated in field work in those particular countries.

Once in the field, it was often necessary to further modify the sample design and instruments in order to take advantage of unexpected opportunities or to cope with unanticipated constraints. A detailed description of the changes made in each project area is given in the country-specific chapters. These changes will naturally affect, but not fundamentally alter, the comparability of data across study sites.

F. ANALYSIS

A flow chart for the analysis is shown in Figure 5. Only the data from the household surveys were deemed to be statistically reliable enough to warrant computer processing. An analytic program was drawn up at the Consultants' home office at the same

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[1] See Appendix C.

time as the survey data were being coded and processed in Kuala Lumpur. It was necessary, of course, to adapt this program to meet the requirements of each data set from each participating country.

Basically, this analytic program used the questionnaire data to develop measures of demographic characteristics, occupational status and land tenure, household income (in cash and in kind), agricultural production, marketing patterns, travel patterns, migration, social participation, service utilization (education, health, extension, and credit), agricultural innovation (use of fertilizer and high-yielding varieties of seeds), and total assets for each household. It also determined changes in income, land tenure, travel patterns, service utilization, production and marketing patterns, and household assets over the study period.

Each household was then assigned to an accessibility group and a socioeconomic group. A number of measures of accessibility and accessibility change were specified for each village surveyed, and the values were then assigned to every household interviewed in that village. The socioeconomic groups were defined in terms of land tenure, agricultural production patterns, income levels, and income sources. Access change measures and socioeconomic status measures were defined in terms that could be applied across all data sets.

Village accessibility measures included the following:

1. Market access: defined as the inverse of travel time from the principal market serving the village to the principal center outside the study area.

2. Village access: defined as the inverse of travel time from the village to the principal market.

3. Trip access: defined as a combination of market access and village access, weighted by the average share of short-distance and long-distance trips in the total sample.

4. Service access: defined in terms of the frequency of visits to a village by extension services, health services, and travelling traders.

5. Household access: defined as a combination of trip access (access "out") and service access (access "in").

Corresponding change measures were also defined to describe the accessibility impact of the transport project for each surveyed community. (See Appendix B for more details.)

Eight socioeconomic groups were defined in order to take into account significant groups in all the study areas. Naturally, in each study area some of these groups were not important and therefore showed up as a relatively small number of cases in the sample. The groups include:

1. Subsistence farmers: defined as farmers with no outside source of income and whose income from cash sales is less than half of total income.

2. Low-income cash-cropping farmers: defined as farmers with no outside source of income and whose income from cash sales is more than half of total farm income but whose total household income is less than U.S. $300.

3. High-income cash-cropping farmers: defined as farmers with no outside source of income, whose income from cash sales is more than half of total farm income, and whose total household income is more than U.S. $300.

4. Food farmers with outside income: defined as farmers who have an outside source of income and whose income from cash sales of farm products is less than half of total farm income.

5. Cash crop farmers with outside income: defined as farmers who have an outside source of income whose income from cash sales of farm products is more than half of total farm income.

6. Landless farm laborers: defined as households without farms whose principal source of income is farm labor.

7. Nonfarm laborers: defined as households without farms whose principal source of income is nonfarm labor.

8. Others: defined as households without farms whose principal source of income is trading, salaried jobs, professional work, pensions, and so on.

Households were classified in groups 1 through 5 if they owned, rented, or sharecropped a piece of land. Household income was calculated using the value of cash sales, the value of domestic consumption, and wage labor income. It should be noted that certain types of outside income, such as salaries, pensions,

support from children, and private business income, were not measured in the survey, although their presence was noted. Hence, the average incomes computed for groups 4 and 5 represent farm income and wage labor income only and undoubtedly underestimate the true average income level for these groups. Similarly, it was not possible to calculate an average income level for group 8 based on survey data. (See Appendix D)

An analysis of the distribution of behavioral change measures by socioeconomic group determined the magnitude of transport investment impacts on income distribution and suggested socioeconomic constraints affecting the achievement of desired developmental change. An analysis of the distribution of behavioral change measures by accessibility group showed the magnitude and geographical distribution of impacts on income levels and quality of life in the project area. Finally, the results of the household survey were combined with other data to identify transport investment impacts on regional growth potential.

The village level and administrative surveys were hand tabulated to provide information on accessibility change, situational factors, and change in service provision and communications. They also provided checks on the sample composition and the reliability of reported data. Finally, these surveys elicited some information on related public and private investment in the study area.

The transporter, commercial, and processing industry survey provided most of the data on change in the transport sector and related investments. They also produced some information on price changes and employment patterns. The analysis of these surveys was combined with the computer processing of household survey data in order to assess the strength of the different linkages postulated in the conceptual model and to determine the magnitude of distributive impacts in each study area.

After the analysis of each country data set was completed, the findings from the six project areas were reviewed and compared. This comparative analysis focused on the variation in investment characteristics, situational factors, and policy constraints across project sites that might be related to variations in the outcome measures (magnitude and distribution of impacts). The findings of this phase of the analysis are presented in Chapter 6, "Summary and Conclusions."

FIGURE I

IMPACT MODEL

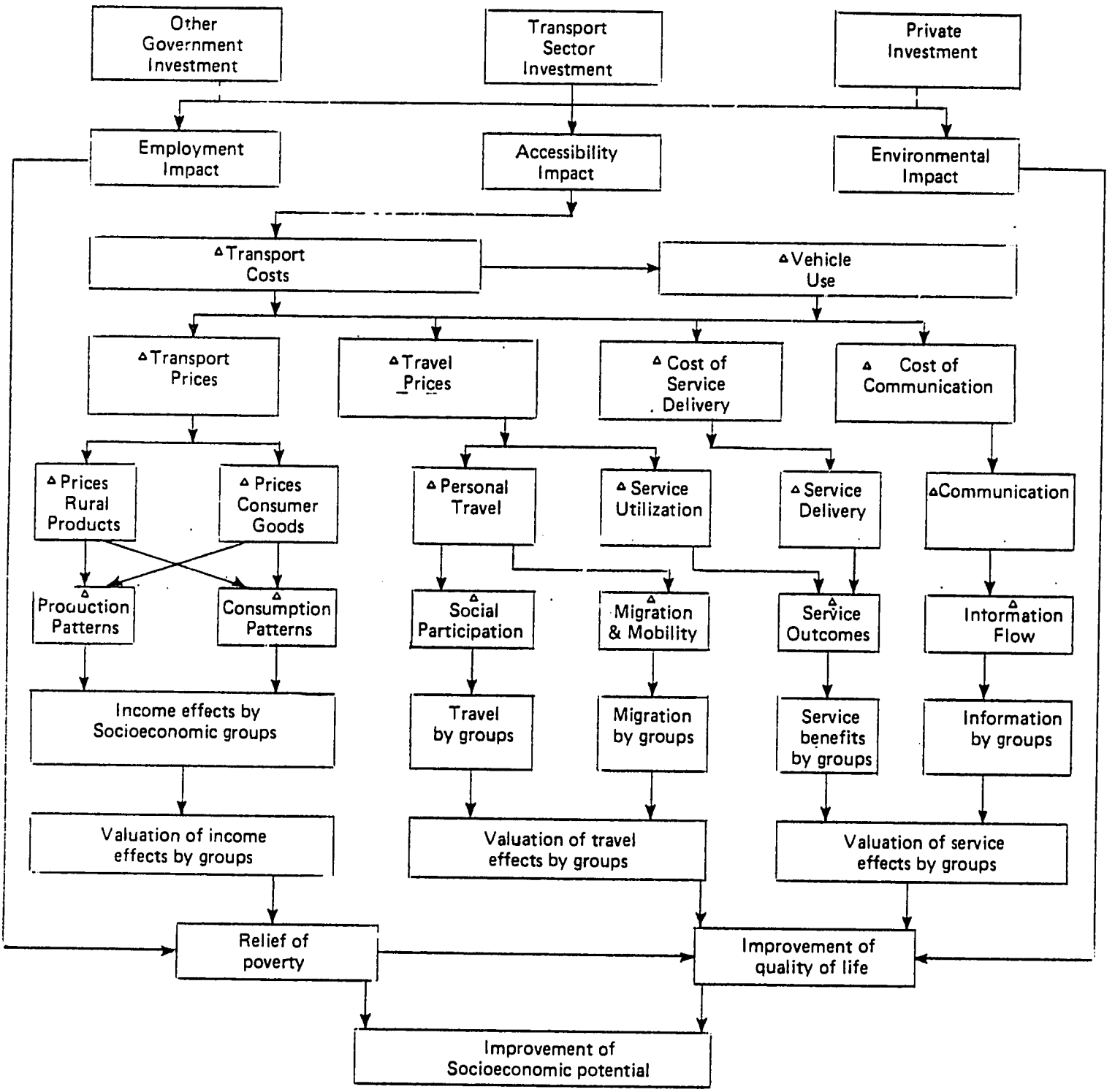


FIGURE 2

MEDIATING VARIABLES

A. SITUATIONAL FACTORS

1. Physical Characteristics
   a. Terrain
   b. Soils and Geomorphology
   c. Hydrology
   d. Climate and Rainfall
   e. Vegetation

2. Population Characteristics
   a. Size and growth rates
   b. Density
   c. Age/Sex structures
   d. Socioeconomic groups
   e. Ethnicity
   f. Religion
   g. Nationality

B. SOCIOECONOMIC STRUCTURES
(Policy Variables)

1. Economic Structure
   a. Land tenure
   b. Land use
   c. Investment in rural industries
   d. Patterns of employment
   e. Structure of transport service sector
   f. Pricing/marketing/storage systems
   g. Credit systems
   h. Tax policies and effects

2. Social Structures
   a. Settlement patterns
   b. Patterns of association
   c. Formal organizations
   d. Educational levels
   e. Health levels
   f. Social control mechanisms
   g. Information levels
   h. Participation in planning

FIGURE 3

MODIFIED IMPACT MODEL

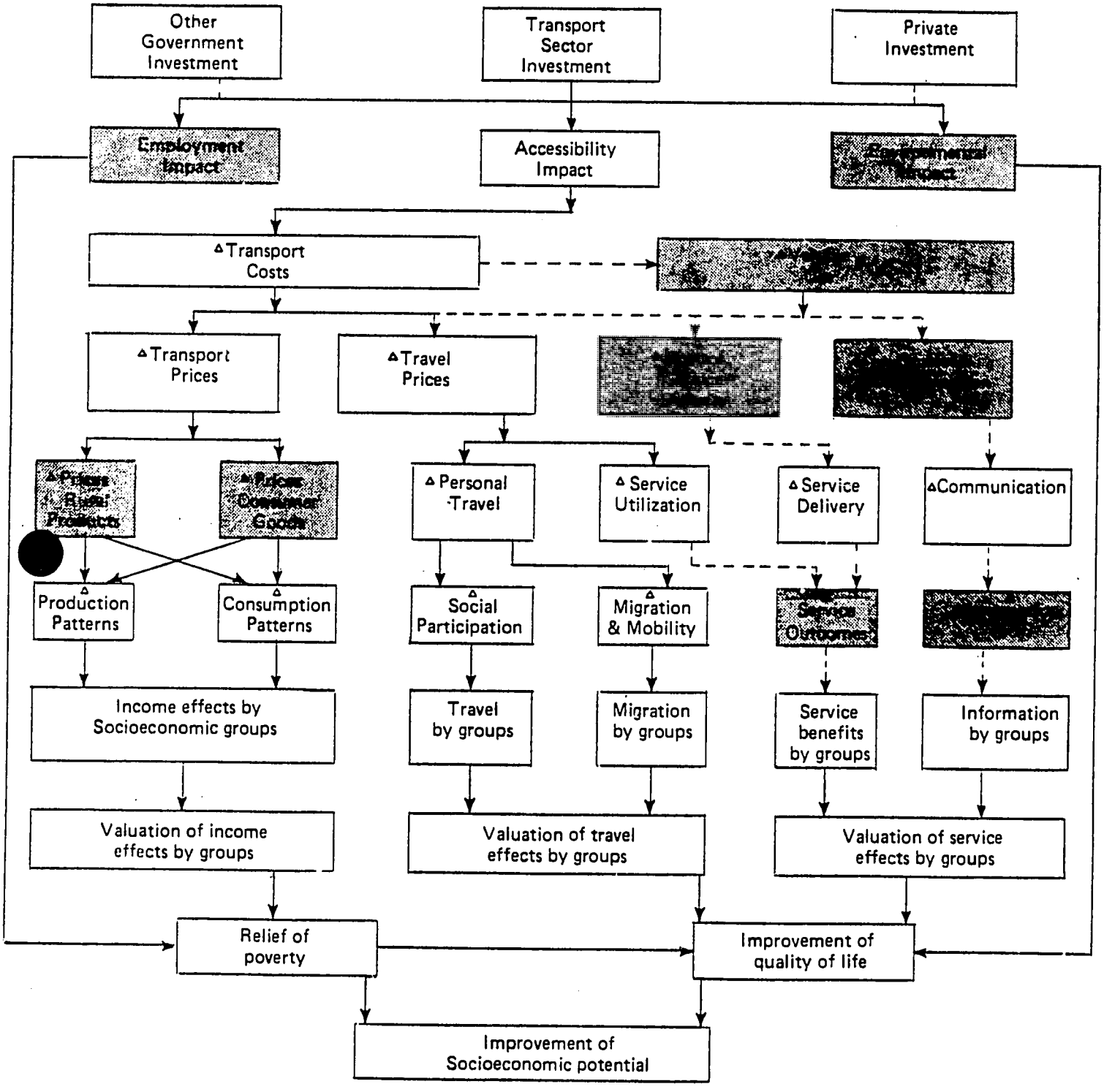
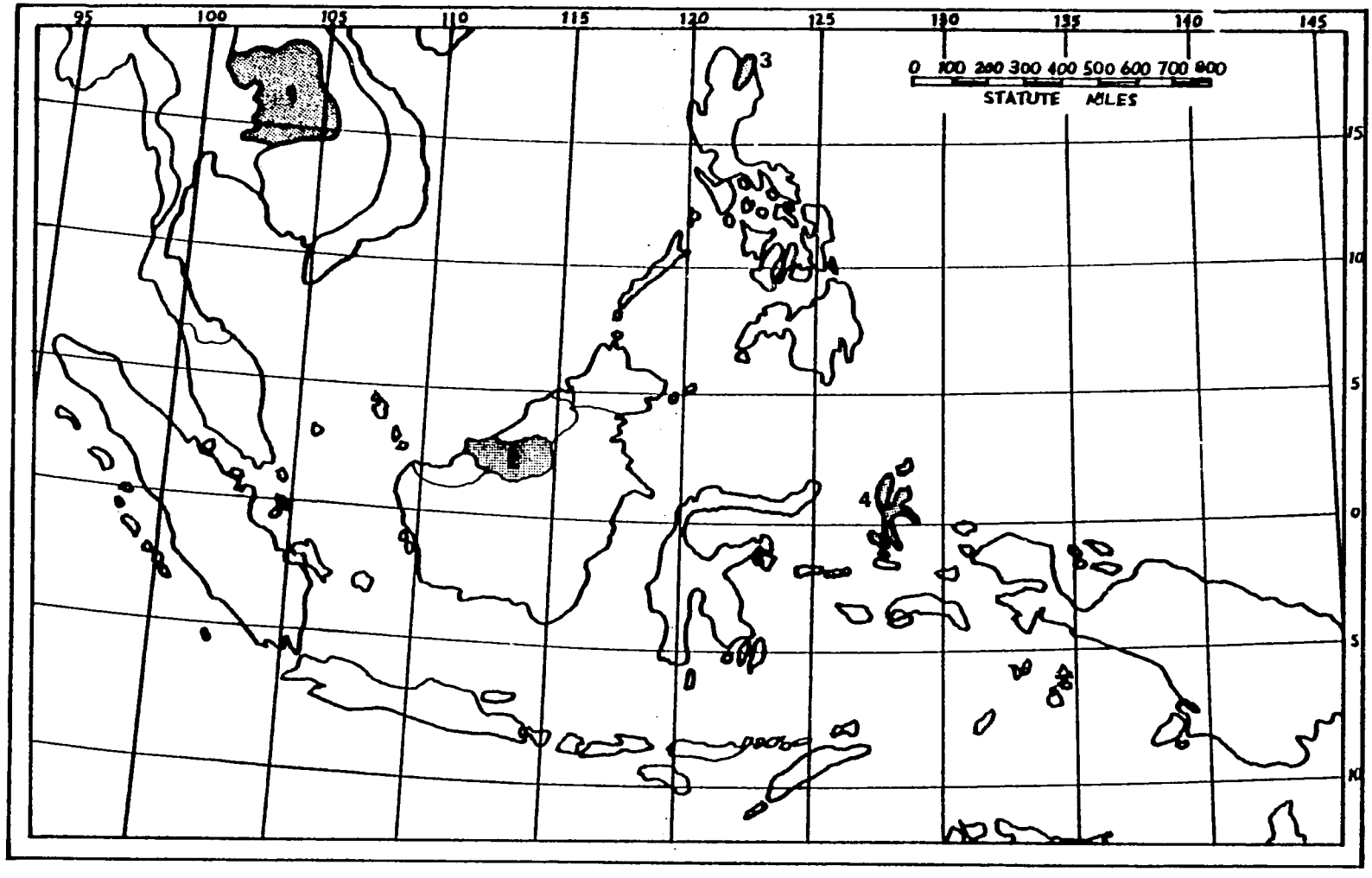


FIGURE 4

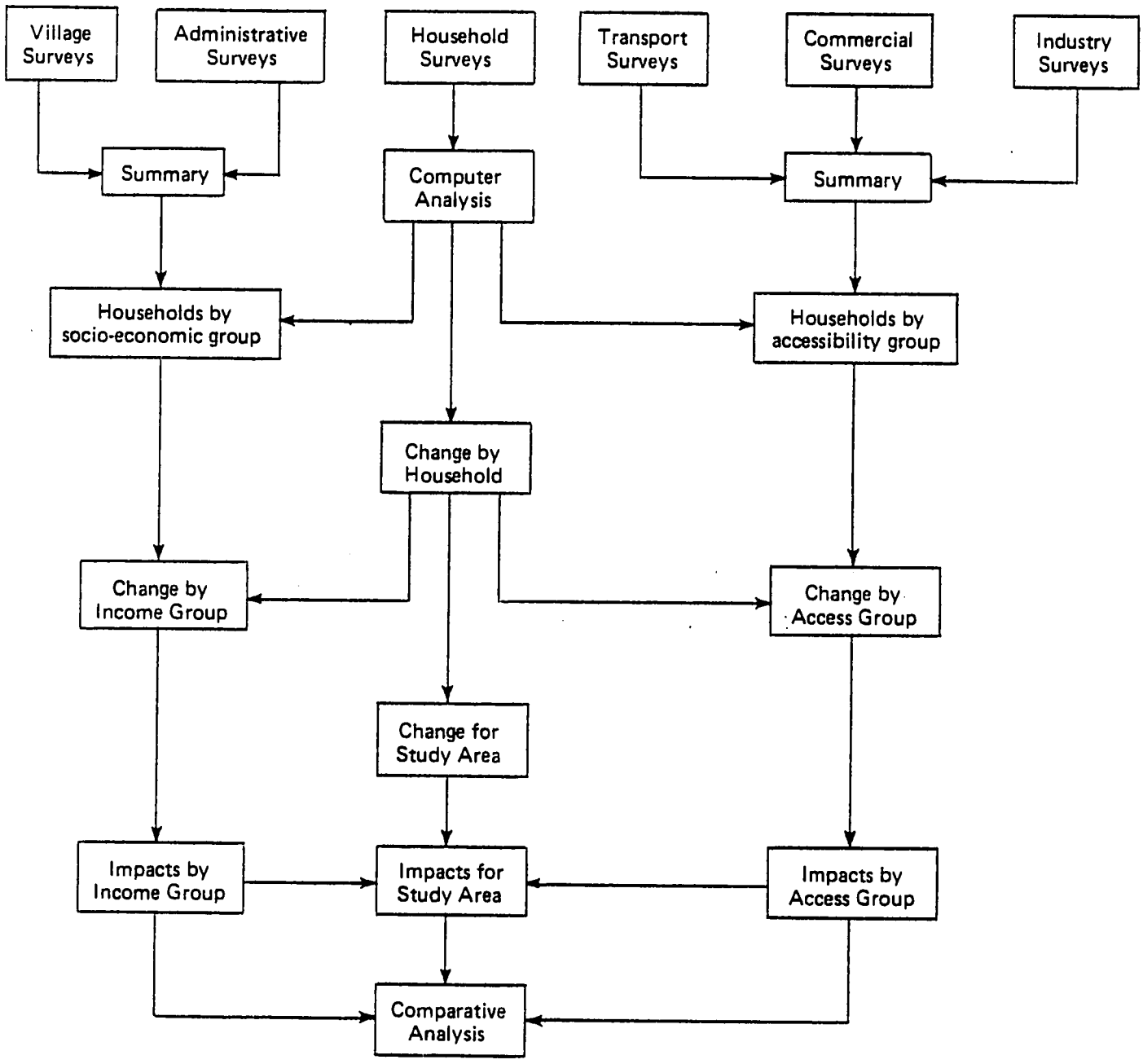
STUDY AREA LOCATION MAP



1 Northeast Thailand
2 Sarawak Third Division, Malaysia
3 Region II, Northern Luzon, Philippines
4 Halmahera Island, Indonesia

FIGURE 5

SEATAC ANALYSIS FLOW CHART



CHAPTER 2
MALAYSIA

2

CHAPTER 2

Malaysia is a composite country, consisting of the part of the Malay Peninsula formerly known as Malaya or the Federated Malay States (West Malaysia), and two formerly British territories on the north coast of Borneo: Sarawak and Sabah (East Malaysia). The administrative area selected for the study project in Malaysia is the state of Sarawak. This state contains a population of approximately 1,150,000 in a land area of 125,000 square kilometers.

The government agency most directly involved in planning and executing the study was the State Planning Unit of Sarawak, under the coordination of the Economic Planning Unit for all Malaysia. Local Study Team members included, in addition, representatives of the Departments of Education, Health, Agriculture, Forestry, Public Works, and Lands and Surveys. The Sarawak Museum provided invaluable guidance and assistance in carrying out the study, as did state and local officials in the communities concerned.

A. SAMPLE DESIGN AND FIELD METHODS

A.1. Definition of the Project Area and Impact Zone

A.1.a. Project Area. The originally proposed project area was the Ranjang River basin in central Sarawak. The study area was initially defined to include the Third, Sixth, and Seventh Divisions of Sarawak, coextensive with the drainage basin of the Rajang. This was an area of well over 50,000 square kilometers, containing 288,000 inhabitants and the state's second largest city (Sibu, population 65,000). The transport improvement to be studied consisted of the introduction of (privately owned) express boat service, small public investments in river port improvements, and government investments in boats for mobile service delivery in this remote area.

It soon became apparent to Local Study Team members and the Consultants that the proposed study area was far too large to permit an adequate analysis of transportation impact within the time and funds available for the study. In a meeting with the Local Study Team and representatives of the Economic Planning Unit held at SEATAC, it was agreed to limit the study area to the Upper Rajang basin, outside the influence area of Sibu (see Figure 6). This choice also eliminated the problem of analyzing intermodal competition from the growing road network, which so far extends only through the Lower Rajang basin.

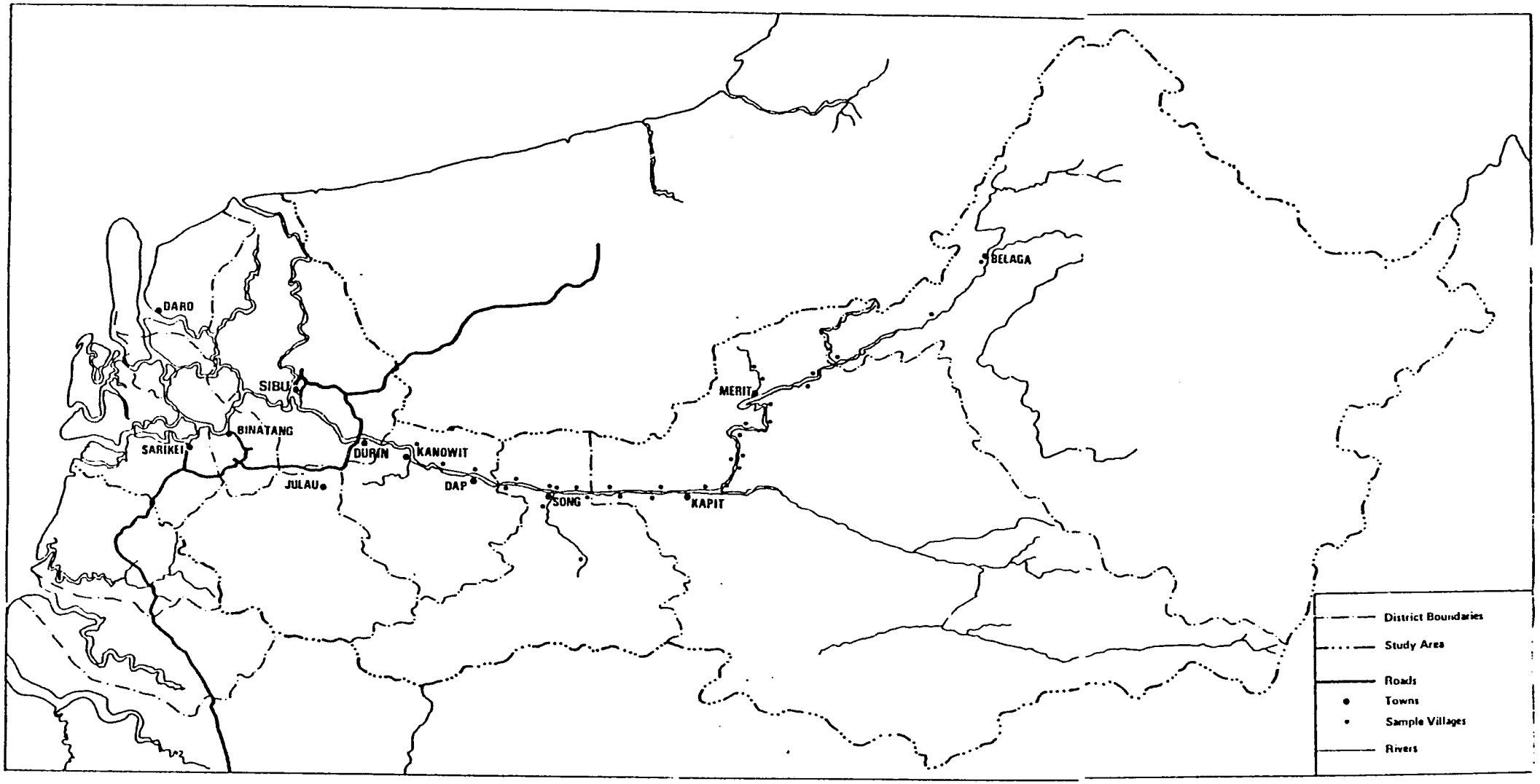
At one point it was still hoped that the coastal district of Matu Daro, West of Sibu, could be included in the study. However, further planning showed that a choice would have to be made between excluding Matu Daro or excluding the more remote region above Kapit (Belaga District). Reluctantly, it was decided at the workshop to restrict the field work to the upper Rajang basin.

Four districts comprised the project area as administratively defined: Kanowit, Song, Kapit, and Belaga (see Figure 6). The four district capital towns, by the same names, are located along the Rajang River and are served almost exclusively by river transport. Except for the small urban zones there are no roads. Regular and emergency air service link Kapit and Belaga to Sibu.

A.1.b. Impact Zone. For the purpose of selecting sample communities within the project area, an impact zone was defined running 10 kilometers on either side of the main river. The area

FIGURE 6

MALAYSIA AREA MAP



along two tributaries was added to the sample fram. These were the Sungai Katibas (joining the Rajang at Song) and the Sungai Merit (joining the Rajang at Merit above the Pelagus Rapids). The impact zone defined for field study purposed was arbitrarily terminated above Belaga Town and below Kanowit. Using this definition, the field survey was divided into two parts : from Kapit to Belaga (called the "upper stretch") and from Kapit to Kanowit (called the "lower stretch").

A.2. Selection of Sample Units

A.2.a. Districts. Since only four administrative districts were included in the final definition of the study area, all of these were covered in the field surveys.

A.2.b. Communities. Communities in the impact zone were enumerated using maps prepared by the anti-malaria campaign workers in 1973. A large town might include several communities, identified by economic function and ethnicity: e.g., Chinese shophouses, Malay kampong, Government quarters, etc. Outside the major centers, communities were either longhouses (belonging to varying ethnic groups), Chinese farming communities, or institutions such as schools, missions, or military posts. Institutional communities were excluded from the sample frame since they were not made up of households.[1]

The sample villages were selected using a clustered random sampling technique designed to spread the interviewing load fairly evenly over the study period, taking into account travel time between communities. Approximately one in three communities within the impact zone was selected above Kapit; about one in six, on the average, below Kapit. This is a dense sample for communities within the impact zone (within 10 kilometers of the main river), but it is sparse in relation to the total number of communities in the study area (approximately 4%).

The sample was about evenly distributed between the Belaga-Kapit stretch of the river (16 communities) and the Kapit-Kanowit stretch (15 communities). The Seventh Division capital of Kapit was excluded from the survey as being an "urban place" (population over 3,000). However, the district capitals of Belaga and Song were included in the survey.

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[1]This is not to say that river transport improvement has had little impact on institutional communities. Such impacts might well be the subject of separate study in the future.

Of the 31 sample communities, by far the largest was the Chinese settlement at Song, containing about 200 households and a population of slightly more than 1,000. Excluding this group, the sample communities varied in size from 5 to 70 households (less than 500 population) with an average size of 27 households, or less than 150 population. The median size was 23 households, indicating a larger number of communities on the lower end of the scale.

A.2.c. Households. Household interviews were conducted in 21 of the surveyed communities, including all of the Malay, Chinese, and non-Iban indigenous communities. A simple random sampling technique was used to select households for interviews. Households were actually enumerated by the survey team unless a reliable secondary source was available. (Some sample communities had already been enumerated for the Agricultural Census.)

From 3 to 15 households were selected for interviews in each community, to give, on the average, a 15% sample of households. A wife or (in one instance) a grown son was interviewed when the head of a selected household was not available. If no knowledgeable household member could be interviewed, substitutions were made using immediately adjacent households. For protocol reasons it was decided to interview the longhouse headman (T.R.) in every case. Thus, T.R.s are somewhat over-represented in the sample.

A comparison of the ethnic origin of households interviewed with the ethnic distribution of the population of the four districts in 1970 is shown below:

	Population (1970)		Sample Households	
Malay	1,248	2%	6	4%
Chinese	8,809	11%	24	17%
Iban	58,705	76%	90	64%
Other indigenous	7,724	10%	22	15%
Others[1]	896	1%		
Total	76,382	100%	142	100%

[1]Including 200 Melanaus in Kanowit District.

This distribution shows that minority groups are somewhat over-represented in the sample as compared to the Iban majority.

A.3. Comparison of Sample Characteristics to Population Characteristics

During the two-week survey, 143 household interviews were obtained. Of these, two were discarded as unusable after field editing. The total sample size reflected in the analysis is therefore 141.

Unfortunately there are very few data available on the study area population with which to compare the sample household characteristics. Some information on demographic characteristics is available from the 1970 census. No income study has been made in the project area, and accurate figures on the production of principal crops are difficult to obtain. Farm size distribution is virtually unknown and changes every year with the patterns of shifting cultivation.

A.3.a. Distribution by Age and Sex. The survey respondents were grouped into four age categories: under 25 (7%), 25 to 44 (51%), 45 to 64 (38%), and 65 and over (4%). This distribution is somewhat skewed toward the older end of the range when compared to the census data for adults in Sarawak, which showed the following breakdown: population age 20 to 25 (18%), 25 to 44 (49%), 45 to 64 (27%), and 65 and over (6%). Thus, interviewing heads of household, who tend to be older than the average adult, may tend to create a conservative bias in the survey results. Of the household heads, 92% were male, whereas 50% of the adult population is male. (Females were counted as household heads only if no spouse was present.)

A.3.b. Farm Size Distribution. In the sample, 130 of the 141 respondents (92%) were farm operators and 127 of these (98%) were owner-operators. (The remaining 2% were sharecroppers.) The average owner-operated farm size reported in the data is 7.5 hectares (18.5 acres). Two owner-operators were also land renters, and five were sharecropping additional land. These numbers are too small to make the average amount of land rented or sharecropped a meaningful figure. The values range from 0.1 acre (for pepper) to 40 acres (for a rubber plantation).

An estimate of farm size distribution was made using ranges of less than 3 hectares, 3 to 6 hectares, 6 to 9 hectares, 9 to 12 hectares, and more than 12 hectares. The corresponding sample distribution is:

Less than 3 hectares:	34	(26%)
3 to 6 hectares:	40	(31%)
6 to 9 hectares:	23	(18%)
9 to 12 hectares:	14	(11%)
More than 12 hectares:	19	(14%)

This distribution shows that the majority of farms are less than 6 hectares in size, and over one-fourth are less than 3 hectares. On the other end of the spectrum are a number of large farms, mainly rubber plantations, ranging from 20 to 60 hectares in size.

A.3.c. Production of Principal Crops. Fourteen crops found in study area were measured in the sample. Table 2.1 shows the number of respondents presently engaged in the production of each crop, the average area cultivated, average production, and estimated average yields. The Study Team data provide the following yield estimates for comparison: irrigated rice, 11.7 piculs per acre; rainfed rice (hill padi), 4.3 piculs per acre; black pepper, 58.4 piculs per acre; mature rubber, 8 piculs per acre.

It is clear from Table 2.1 that the average production reported by respondents is substantially below the yields estimated by administrative officials. This discrepancy could be due to a number of causes: (1) overestimation of cultivated area by respondents; (2) under-reporting of production by respondents; (3) loss of crops due to bad weather, insect and animal pests, etc.; (4) a significant share of area planted but not yet in production; (5) crops planted but not harvested due to lack of price incentives; and (6) overoptimism on the part of administrative officials. In the case of pepper, for example, a combination of under-reporting and acreage planted but not yet producing probably accounts for the low yield estimates. In the case of rubber, the principal cause is lack of tapping, with immature plantings of high-yielding varieties as a secondary cause of low average yields.

A.3.d. Household Size and Household Income. The average household size found in this survey is 6.3 persons. This figure excludes children away from home (unless they are in school) but includes other adult household members besides the nuclear family. The average family size, counting all children but excluding other household members, is 6.9 people. Twenty-four, or 17% of all respondents, represented households where no spouse was present (usually deceased).

The average value calculated for household income was M$1658.1 (U.S. $690), corresponding to M$263.2 (U.S. $110) per capita. This income comprises the value of cash sales of farm products (mean value M$1128.1) plus the value of domestic consumption (mean value M$485.6). To this is added, where appropriate, income gained by wage labor (mean value M$46.1); the landlord's share of the value of production is subtracted

TABLE 2.1

PRODUCTION OF PRINCIPAL CROPS
1976-77 Crop Year

Crop	Producers		Average Area Planted (acres)	Average Production (piculs)	Yield	
	No.	%			Piculs/acre	Kg/ha
Irrigated rice	48	37%	2.1	17.4	8.29	1244
Rainfed rice	100	77%	3.9	7.4	1.90	285
Maize	72	55%	1.4	0.6	0.43	65
Cassava	38	29%	1.0	0.3	0.30	45
Coconuts	12	9%	0.5	0.0	0.00	0
Sago	20	15%	0.9	0.1	0.11	17
Fish ponds	5	4%	0.6	0.0	0.00	0
Vegetables	23	18%	0.3	0.1	0.33	50
Fruits	68	52%	1.5	0.4	0.26	40
Pepper	57	44%	0.9	7.1	7.89	1183
HYV rubber	56	43%	7.3	0.4	0.05	8
Local rubber	97	75%	7.0	1.0	0.14	21
Cocoa	3	2%	2.3	0.0	0.00	0
Coffee	12	9%	5.1	0.0	0.00	0
	(130)					

Source: Household Survey

out for sharecroppers. Income estimates were not obtained for households without farms unless their principal income source was wage labor.

The major generators of cash income were pepper, rubber, fruit, forest prducts (fish, game, rattan, illepenuts), pigs, and rice. Sales of maize, coconuts, vegetables, eggs and poultry, and firewood and craft products contributed slightly to cash income. Cassava and sago were produced exclusively for home consumption, and coffee and cocoa plantings were generally too young to provide a harvest.

The presence of other income sources was noted in the survey, although their value was not always determined. The number of respondents with different income sources is shown below:

	Number	%
Crop sales only	39	28%
Seasonal farm labor	14	10%
Sale of fish or forest products	47	33%
Sale of craft products	4	3%
Nonfarm labor	6	4%
Salary	8	6%
Pension	3	2%
Support from children	18	13%
Private business	7	5%

Less than 30% of all households are economically sustained solely by a farm enterprise. Fishing, hunting, and gathering are the major supplementary activities. Wage labor (farm and nonfarm) and remittances from children provide income for many of the remaining families. Salaries, pensions, and private businesses, though relatively few in number, probably account for a larger share of the cash in circulation.

A.4. Sample Design for Other Surveys

A.4.a. Traffic. A traffic survey was carried out over a seven-day period at Kapit, covering all river traffic landing at the main wharf and market area. The Kapit location was chosen because virtually all river traffic stops there before proceeding

up or down river. It is also the major transfer point for goods and passengers in the study area.

A survey period of one week was selected in order to measure all types of trips in the project area on weekends and weekdays. The survey was conducted during the week of August 13-20 while the household survey was being carried out on the Kapit-Belaga stretch.

The survey was designed to cover 100% of arrivals and departures of all river craft between 6:30 A.M. and 7:00 P.M. at the principal landing in Kapit. Landings at this point on the river represent approximately 95% of goods traffic to and from Kapit and 85% of the passenger traffic. In practice, there were times when too many boats arrived for the survey team to handle. The volume of traffic missed was estimated at 2% - 5% of total traffic. In addition, an estimated 8% of total traffic is believed to arrive earlier in the morning or later at night than the survey. Therefore, the sample represents approximately 84% of all freight traffic and 75% of all passenger traffic to and from Kapit during the survey week, including 100% of all express and motor launch traffic. The sample included 375 canoes, boats, and ships, carrying 4,623 passengers as well as goods.

Since this survey is used to represent a yearly traffic flow and it did not take place during a peak travel period, it was assumed that the data represent slightly less-than- average weekly traffic, or 2% of the annual flows. This assumption implies an average annual volume of 20,600 craft arrivals and departures and 310,000 passenger trips into and out of Kapit.

A.4.b. Transporters. Transporters serving the project areas from Sibu were identified by using the Sibu telephone book. The largest express transporter was identified and interviewed in Sibu. He provided the names of additional transporters based in Kapit. All transporters based in Kapit and in each of the other towns sampled in the project area were subsequently interviewed.

The sample consisted of five interviews in Kapit, two in Belaga, one in Kanowit, and one in Song, for a total of nine based in the project area, in addition to the transporter based in Sibu.

A.4.c Commercial. The commercial survey sample was designed to cover 100% of village shops in villages surveyed and approximately five shops in each market center. The market centers were Belaga, Merit, Kapit, Song, Dap, and Kanowit

In each market center except Dap, shops were enumerated and categorized by type. The principal categories were general store (dry goods and sundries), urban shop (more specialized dry goods or services), wholesale/retail (large diversified business with links to village shops), tailor and clothing, and restaurants. A stratified sample was selected using these categories and allocating between them according to the number of shops in each category. (Restaurants were omitted from most samples, but one was included in Belaga to provide some data on tourism).

The sample size varied inversely with the total number of shops, from 5% in Kapit to 50% in Merit (two out of four shops) and 100% in the villages. The total sample covered 39 out of an estimated 253 project area shops for an average 15% sampling rate.

A.4.d. Primary Processing. Very few primary processing enterprises were found in the project area. Those found included rice mills, rubber smokehouses, and sawmills. Interviews were conducted at 44% of the rice mills encountered (7 out of 16). Those not interviewed were usually those where the owner was not present. When more than one rice mill was found in a community, one interview was normally obtained. Two out of ten rubber smokehouses were interviewed for a 20% sample, and one out of three sawmills was surveyed.

Cold storage, which might be viewed as a type of primary processing, was usually found in association with a shop or other commercial enterprise. Of the commercial sample, 13% provided cold storage facilities, as did one of the transporters in Kapit. Cold storage was also often found together with a rice mill since both could be operated on a single generator.

A.5. Instrument Modification

The survey forms presented in Appendix A were modified during the workshop in Kuala Lumpur and subsequently in the field to make them more appropriate to the Malaysian situation. The most important changes were those made in the household survey instrument. They included the following:

1. The study period was defined as the ten years from 1966 to 1976, i.e., going back to the time before express boat service was introduced. Farm enterprise data were collected for the 1976-1977 growing season.

2. Principal crops were defined to include those most likely to be found in the project area, such as, padi (irrigated and rainfed), rubber, pepper, maize, cassava, fruits,

and vegetables. The final instrument included crops such as coconuts and sago, which, while of minor importance in the study area, were expected to be significant if the study was extended to Matu-Daro District.

3. Farm organizations were defined to include production cooperatives and Saberkas (4-H) groups but to exclude organizations whose chief purpose was to promote moral uplifting of villagers.

4. Credit institutions were defined to include government subsidy schemes to promote the cultivation of cash crops such as rubber, pepper, and irrigated rice.

5. Because informal credit is commonly used in the project area for purposes other than farm investment, a question was added to determine if credit obtained was actually used to support agricultural activities.

6. Because valuable antiques, especially large Chinese jars, are owned by many households as a form of savings, they were added to the list of potential household assets.

The list of village industries and community facilities used in the village survey was modified to represent the range of likely responses in the project area (for example, rice mill, rubber smokehouse, wharf or jetty, sports fields). Potential transport modes to market were defined as: canoe or longboat (non-motorized), motor boat (outboard), motor launch, and express boat. In addition, the village survey instrument was modified to include a question concerning visits made to villages by missionaries and changes in this pattern over the last ten years.

The transporter, commercial, and agro-processing industry surveys were used substantially without change.

A traffic survey instrument was drawn up in the field. Origin-destination zones were defined in terms of reaches of the river; major boat types and commodity types were defined and coded. One line was used to enter relevant data for each craft arriving and departing. Due to time and staff constraints, it was not possible to conduct extended interviews with passengers. A copy of the traffic survey instrument and instructions to interviewers is included in Appendix A.

A.6. Field Methods

The field work was carried out entirely within a period of three weeks in August. The consultants went first to

Kuching, where they met with field team members at the Sarawak Museum. The Museum staff kindly provided two interviewers for one week each to help in carrying out the field surveys. The Consultants and field team members proceeded to Sibu, where introductory meetings were held with RASCOM (the military command responsible for security in the project area), representatives of the Departments of Agriculture and Forestry, and transporters based in Sibu.

The first field team then proceeded to Kapit by express boat. After meeting with the Division Resident and obtaining permission to proceed to Belaga, the team visited various division and district offices to obtain administrative data. Commercial enterprises in the town were inventoried and a sample drawn for interviewing. A training session was also held in Kapit for the three interviewers who would be conducting the household survey.

In Kapit, the field team decided that it would be possible to conduct a traffic survey during the first week. Two interviewers who had completed secondary schooling were found through the local labor officer, and arrangements were made to pay them out of State Planning Unit funds. Supervision was provided by the Division Office of Lands and Surveys, which also duplicated the survey instrument. Police cooperation was also obtained. Training was provided by having the interviewers fill out two sample interviews under the supervision of the Consultants before the field team departed for Belaga.

Sixteen villages were surveyed during the first week, and 83 household interviews were obtained. After a brief break in Kapit and an exchange of personnel, the second survey team proceeded to cover the 100 kilometer Kapit-Kanowit stretch. Fifteen communities were covered during the second week, and 59 household interviews were obtained. In addition, administrative data and commercial interviews were collected in the district centers of Belaga, Kapit, Song, and Kanowit.

Approximately one in three household interviews was conducted under the Consultants' direct supervision. The percentage is considerably higher for the transporter, commercial, and agro-processing industry surveys. Interview schedules were spot checked but not completely edited in the field. Additional editing was done as part of the coding process that was carried out by SEATAC staff in Kuala Lumpur. Finally, the coded data were subjected to a consistency check through the use of a computer edit program developed in the Consultants' home office.

B. CHARACTERISTICS OF THE STUDY AREA

In discussing the transportation impact model presented in the Consultants' Inception Report, it was argued that the relative strength of particular causal linkages would depend in part on situational factors. These factors are assumed to be more or less constant within each of the project areas under study. Situational factors are classified into four groups: physical characteristics, population characteristics, economic structures, and social structures. This section presents a qualitative assessment of situational factors in the Malaysian project area, including a summary of household characteristics as determined by the sample survey.

B.1. Physical Characteristics

The Rajang River drains a basin of over 50,000 square kilometers, or about 40% of the land area of Sarawak. It flows westward out of the mountains dividing East Malaysia from Kalimantan (Indonesia) and empties into the South China Sea. Above Kapit the river flows swiftly with a strong current, dropping through a vertical distance of several hundred feet as it carves a chasm in the landscape. The water level may vary greatly in a single day, depending upon rainfall in the mountains.

The river washes down rocks and gravel, forming swirling rapids and treacherous shoals at low water. Particularly well known are the Pelagus Rapids above the point where the Balleh River meets the Rajang. The Pelagus Rapids have long posed a major obstacle to river navigation. Only recently, with the introduction of steel-hulled express boats driven by twin engines, has it been possible to provide reasonably regular transport service to the people living above the rapids.

Below the rapids the river flows more slowly, widening and deepening as it takes in the flow of numerous tributaries. From Kapit to Kanowit, the river flows through a narrow valley capable of sustaining settled agriculture. At Kanowit the valley widens and the river becomes a major artery, flowing on to Sibu at the head of the Rajang delta. Oceangoing ships can come up the river as far as Sibu, and flat-bottomed motor launches can traverse the river comfortably as far up as Kapit (and some distance on the Balleh).

The area along the upper reaches of the river is heavily forested. It is characterized by steep slopes and broken, hilly terrain. Where the vegetation has been cut back, there is often a serious problem of erosion, particularly along the river banks. The sedimentary soils near the river are porous and unstable. Forest products such as fish, game, and wild fruits and nuts exist

in relative abundance, while the cultivation of cash crops is difficult and relatively unrewarding.

Below the rapids there is a narrow belt of cultivable land on either side of the river. Although steep slopes and bank erosion are still major constraints to agricultural development in this area, cash crops have been introduced with considerable success. Much of the cultivable land has been cleared in recent years, with a corresponding reduction in forest cover. Although the area cultivated in any given year is still a small percentage of the total, more and more of the land is covered by second growth, which gives a greatly reduced yield of forest products.

The climate is appropriate to a tropical rain forest zone, with two seasons only slightly differentiated by average temperature and rainfall. Sudden, heavy showers occur intermittently throughout the year. Average annual rainfall at Sibu is 125 inches (3,200 mm), and precipitation increases as one moves up the river toward the mountains. Situated only 2° North of the equator, the Rajang River basin has a nearly constant temperature range of 70°-90° F (21°-32° C); slightly warmer in the lowlands around Sibu, slightly cooler in the highlands above Belaga.

B.2. Population Characteristics

The Rajang River basin is sparsely populated in general (5.7 persons per square kilometer was the estimated average density for the Third, Sixth, and Seventh Divisions in 1975), and much of the existing population is concentrated in the delta. The 1970 population, land area, and density for each district in the study area are given below.

	Population (1970)	Area (km2)	Density
Belaga	7,342	19,404	0.4
Kapit	30,438	15,415	2.0
Song	13,635	3,390	4.0
Kanowit	25,937	2,228	11.6
Total	77,352	40,437	1.9

As of 1970, only two towns in the study area, Kanowit and Kapit, had populations exceeding 1,500. By the time of this study, Song Town had grown to well over 1,500 people and Belaga had become a town of perhaps 1,000 persons (including students and military personnel). The total estimated town population in

the four administrative centers of the study area is now 7,500, or about 10% of the study area total (which was estimated at 78,500 in 1975).

A comparison of Local Study Team estimates of 1975 population with the census data for 1970 indicates that the study area as a whole has experienced extremely low population growth, at an average annual rate of 0.3% per year. This rate may be due to significant migration out of the study area, but it appears more likely that it is the result of undercounting births and new arrivals. Data from the Consultants' village survey indicate that the actual population growth rate was closer to 2.2% per year in the impact zone. Even this percentage is considerably less than the average growth rate for the state of Sarawak, which was 2.7% per year during the 1960-1970 period.

Census data indicate that in the decade 1960-1970, the rate of population growth in the study area was 2.6% per year, only slightly under the statewide average. Kanowit District grew at the relatively high rate of 3.3% per year, attributable to the immigration of farmers in search of new lands in the Sibu delta. Kapit District also grew faster than the average, at an annual rate of 2.9%. Song and Belaga Districts, however, with annual rates of 1.7% and 1.1%, respectively, grew considerably more slowly than the project area and national averages.

Although detailed data are not available for 1970-1975, it is expected that the expansion of Kanowit has slowed somewhat, with migration now moving into Song District. Kapit is probably still growing at a rate that exceeds the average, and Belaga's growth pattern is probably unchanged. (It is likely, however, that the population of Belaga District is significantly underenumerated in all censuses.) The current population growth rate for the study area as a whole is probably still less than the statewide average, on the order of 2.4% per year.

B.3. Economic Structure and Investment Patterns

Agriculture and forest products are the two basic economic sectors in the rural areas of the Rajang basin. Fishing has recently become important. Mining is presently negligible, although there is a possibility of future coal mining activity near Merit.

Manufacturing activity is dominated by sawmills, although other local processing industries and light consumer goods producers have expanded into the project area. Small commercial enterprises combined with trading are the most frequently found economic units in the study area.

Transport activities are currently centered on the Rajang River, which is the traditional link between the study area and the outside world, although a road to Sibu and a proposed road link to the north may provide more access to the rest of the Sarawak in the future.

A detailed discussion of each sector is given below.

B.3.a. Agriculture and Livestock

1) Major products and their value

The principal cash crops and livestock produced in the study area are: rubber, pepper, rice, fruit, and vegetables. Food crops include maize, cassava, sago, and coconuts as well as rice, fruit, and vegetables. Coffee and cocoa are cash crops produced in negligible amounts. The total value to farmers of production of these products is shown in Table 2.2, along with the change in quantity and unit value between 1966 and 1975, in constant prices.

TABLE 2.2

FARMGATE VALUE OF PRINCIPAL CASH PRODUCTS IN 1966 AND 1976

Crop	Amount Produced[a]			Unit Value[b] at Farmgate			Total Value[b] (M$000)		
	1966	1976	% change per year	1966	1976	% change per year	1966	1976	% change per year
Rubber	39.6	37.2	-0.6%	1,016	862	-1.7%	40	32	-2.2%
Pepper	66.0	666	25.9%	2,654	2,688	+0.1%	175	1,790	26.0%
Padi (hill)	3,119	3,868	22 %	370	400	0.8%	1,154	1,547	3.0%
(irrigated)	-	1,390	n.a.	370	400	0.8%	-	556	n.a.
Total Padi	3,119	5,258	5.4%	370	400	0.8%	1,154	2,103	6.2%
Maize and other food crops	289	296	0.2%	517	588	1.3%	149	174	1.5%
Total	3,513.6	6,257.2	5.9%	-	-	-	1,518	2,488	5.1%

a From household survey for 1976-1977 and change from district statistics.
b In 1976 prices per metric ton (consumer price index 1976=1.39 x 1966); 16.8 pikuls=1 ton. Prices given in Malaysian dollars.

This table indicates a decline in production of rubber, which was due to the decline in unit price to the farmer. It also shows the major increase in production of pepper that occurred in the study area during the ten-year project period.

Rubber presently accounts for only 1.3% of total cash value to the farmer, compared to 2.6% in 1966, and pepper now accounts for 72%, although it was one-tenth as significant ten years ago.

Rice should be considered differently from the other products. It is more of a local-consumption product and is not exported, but it is traded locally. Vegetables and pigs are more urban-consumption products, primarily produced as cash crops near the larger towns and cities.

2) Marketing structure and prices

The marketing of agriculture and livestock products must be considered in terms of perishable and non-perishable products. Most of the agricultural cash crops (such as rubber and pepper) are non-perishable.

These non-perishable cash crops pass through three types of dealers: first-rank dealers (exporters), second-rank dealers in major towns, and third-rank dealers in rural areas. In some cases, even more middlemen are involved in the trade.

Exporters buy almost exclusively from other dealers, although they frequently have close ties with second-rank dealers. Second-rank dealers buy pepper or rubber mainly from other dealers and from farmers who bring their crops to market centers. They sell primarily to exporters, although they may themselves export if their scale of operations becomes sufficiently large.

The third-rank dealers mainly purchase directly from farmers and sell to the second-rank dealers. These rural dealers frequently combine trading in export crops with operating small shops that trade consumer goods with farmers in exchange for rubber and pepper. Itinerant traders in motor launches also ply the river, acting as third-rank dealers.

The combination small shopkeeper-trader has traditionally been a role for Chinese families that establish themselves near villages or longhouses in Sarawak. Recently this role has also been taken up by members of the indigenous elite, who are encouraged to develop trading links with second-rank dealers in market centers such as Kapit.

The price structure at each level in the marketing structure is related closely to export prices, which are monitored every day by dealers and farmers with radios even in the most rural areas. Dealers offer the farmer a price that is a certain amount below the export price. The difference corresponds to a relatively stable dealer's margin plus transport costs. Competition between groups of traders keeps the dealers' margins low. The actual amount a farmer will receive normally includes a

discount for the weight of the bag, dirt, and stones. This can be as much as 10%. Money-lending practices also affect the price paid to the farmer when he deals with a local shopkeeper-trader. There is generally no control of product quality and no incentive for the farmer to produce better quality products.

3) Farm structure

The main impetus to rubber planting in Sarawak has been derived from the subsidy schemes that have been in operation since the 1950s, although limited planting with traditional techniques and without fertilizers is still taking place in some rural areas.

There are no longer any large rubber plantations operated as economic units in the study area, although former plantations in Kanowit District still exist and the land has been parceled out to renters.

To date, most rubber trees have been traditionally planted kampong rubber, and high-yielding varieties are found in only scattered sites in the study area. The majority of the mature rubber trees are not presently tapped because of the relatively low prices now prevailing. However, almost all villages produce some rubber for minimum cash income needs.

Pepper is grown on flat land near the river or on terraced hillsides in well-drained areas of good soils. It is grown mostly by smallholder farmers and is a major cash crop downstream from the project area. It has recently been introduced in the project area. In the past, mainly Chinese farmers planted pepper, but recently, Iban and other indigenous groups have begun to grow it.

Pepper is both a labor-intensive and a fertilizer-intensive crop. Its maintenance needs make it a relatively sensitive crop requiring major changes from traditional agricultural techniques. Relatively high prices and a subsidy scheme make this change attractive to the more progressive farmers.

Other cash crops such as coffee, cocoa, and fruits have been introduced into the project area under the Agricultural Diversification Program, but these crops have not yet been adopted by farmers in any significant number. Tobacco is grown for home consumption only.

Vegetables as a cash crop and pig raising are also found occasionally in the study area. Vegetables are sent each morning to the urban centers by motor launch or by road (where available) Farmers either accompany their produce or arrange with the transporter to act as their agent. In the towns, farmers can sell

their own produce or sell through retailers and wholesalers. Wholesalers have regular suppliers, but when there is a shortage, farmers will sell to the highest bidder. Pig marketing operates in a similar manner near urban centers, with the principal buyers being wholesale slaughterers.

The predominant inland farm type consists of farms featuring a high acreage of hill padi and kampong rubber from which small average gross income is generated. These farms are found in the upstream areas, and subsistence shifting cultivation prevails with negligible cash income.

The midland farm type consists of both hill and swamp padi; the relative portion of swamp padi increases with access to the river's edge. Cash crops such as rubber and pepper are important cash earners, and river transport is available to support them. An appreciable gross income of M$400 is obtainable on these farms, although net disposable income is only 10% of the gross because the rest is required for farm inputs and subsistence. (Fishing and hunting are important sidelines that are not included in these income estimates.)

The intensive farm type is found only in the vicinity of large urban areas such as Sibu, where large pepper, commercial poultry, and pig farms, fish ponds, and large vegetable gardens are found. Average income is substantial, ranging from M$2,000 to M$10,000, and so is the net disposable income. There are very few of these farms in the study area.

Another type of farm is found at an irrigated rice scheme covering 200 acres at Nanga Merit in the project area. This scheme is located in a large flat area near the confluence of two rivers, one of the very few upriver locations suitable for irrigation. The farmers in this scheme each have a plot of less than an acre (double cropping rice or alternating rice and maize or cassava) in addition to their hill farms. Farmers from several villages participate in this scheme, as there is help in clearing the land and credit is available for seeds and fertilizer. When present technical problems with the pumps are solved, the area should generate a substantial rice surplus.

As agriculture in the study area is dominated by small holders, farms are not highly mechanized. Hand machines such as power tillers, motor sprayers, and motorized weed cutters are found occasionally, however, particularly on the Merit scheme lands. In areas where commercial pig and poultry farms exist, manufactured materials such as cement, wire fences, and pipes are used. The limited numbers of tractors and heavy machinery found in Sarawak are owned and used by a few large estates, the Department of Agriculture, or quasi-governmental bodies, mostly outside of the study area. No privately owned heavy machinery was identified in the study area survey.

B.3.b. Fishing, Hunting, and Gathering

1) Major products and their value

Fish and game, which are now exported to Singapore and other countries, have recently become major cash products in the study area. Other gathered products, such as fruits (including rambutans, durian, bananas, langsat, and mata kuching) and nuts (especially illepenuts) offer substantial income when they are in season. The major gathered product in terms of volume is rattan, of which several types are found in the study area. Firewood is also gathered and sold near towns.

A variety of fish can now be purchased in the study area. These fish vary in market price in Kapit from M$0.50 to M$5.70 per kati (about 600 grams), which shows a wide range of values. Only the highest-priced species are exported. The average purchase price is approximately M$1.50 per kati in Kapit (slightly over U.S. $1 per kilogram).

Wild boar and deer meat are the principal game exports. They are purchased for export in Kapit at a relatively stable price. Deer meat is valued at M$2.40-M$2.80 per kati, wild boar is half that price. Game prices to the producers have risen 130% since 1974.

Fruit and nut prices vary considerably from season to season and year to year, particularly for durian, which is not an annual fruit. An estimated total value was derived from an estimated average price of M$0.50 per kati.

Rattan has a range of prices, depending on the type. The two most common types are the one that is used for tying log rafts and is sold principally to the logging companies and the one that is used for furniture making and is sold in Sibu. The price varies from M$8-M$18 per bundle in Kapit. This represents the latest stage of rising prices as rattan becomes scarcer and demand remains steady.

The total value of fish, game, and gathered products from the study area is shown in the following table:

Product	1976 - 1977 Amount Produced[1] 1966	1976	% Annual Change	Average Price to Producer[2] (M$)	Total Value to Producer[3] (M$000) 1966	1976	% Annual Change
	(Tons)				(Tons)		
Fish	197	255	2.6%	1.20/kati	397	514	2.6%
Deer and wild boar meat	98	133	3.1%	1.95/kati	321	436	3.1%
Fruits and nuts	102	127	2.2%	0.66/kati	113	141	2.2%
Rattan and forest products	2,340	1,779	-2.7%	9.00/bundle	421	320	-2.7%
Total	2,737	2,294	-1.8%	-	1,252	1,411	+1.2%

[1] Estimate from household surveys.

[2] Estimates from commercial surveys and blue book.

[3] 1680 katis per ton, 20 bundles per ton of rattan.

2) Marketing and Price Structure

The marketing structure is very similar for the fish and game markets. Hunters and fishermen from villages along the river collect the fish and game and bring it to small shopkeeper-traders who are strategically located along the river, and have "cold stores," which are large refrigerators usually mounted on floating jetties. The shopkeeper-traders purchase the fish or game and store it for 1-3 days; when they have a large enough volume, they send it to wholesalers in Kapit. (Of these cold stores, 90% are located upriver from Kapit.) Each shopkeeper-trader has an agreement with a specific wholesaler, and frequently both own part interest in an express boat service that provides the transport link between them. There are presently three wholesalers operating in the study area in competition for export of fish and game. This competition keeps the retail and wholesale margins in close relation to costs.

The price of fish varies considerably from upstream to downstream, and only a small part of this variation is the result of transport costs. The major part of the price differential is due to the high spoilage rate under the present system, which reaches 50% or more from Belaga to Kapit. (Without the cold stores, the spoilage would be too high to serve the export trade.) Sample prices are given for a high-quality species of fish in the following table. Other fish and game prices show similar differentials.

A Sample Price Structure for Export Fish in Study Area

(M$ per kati)

Producer price (whole fish)			Wholesale price (cleaned fish)[1]
Longhouse	Belaga	Kapit	Kapit
3.00	3.30	4.50	5.20

Note: The transport cost from Belaga to Kapit by express is approximately M$1-M$8 per pikul, or M$0.01-M$0.08 per kati, depending on volume transported.

[1] Approximately 1/16 of original weight is lost in cleaning

Fruits and nuts are mainly gathered from forest trees and sold or consumed either locally, in the urban centers of the study area, or in Sibu. These items are considered windfall income by most area residents, although many trees, such as durian, are identified with a particular owner who makes certain they are not cut down during land clearing. A large durian tree can give its owner an income of several hundred Malaysian dollars when it bears fruit if it is marketed in time. The situation is similar for illepenuts. In these cases, the owner usually arranges to gather the fruit, transport it, and sell it in an urban area such as Kapit or Sibu.

Rattan is collected by the villagers and sold by the piece to small shopkeeper-traders in most cases. The shopkeeper-traders accumulate the rattan and tie it into bundles of 100 until they have enough to sell or transport to a market center. The price differences reflect principally transport costs and trader margins, as shown in the following table. Transport costs are $2-$3 per bundle, depending on volume, from village to Kapit.

Purchase Price per Bundle of 100

Rattan Type	Village Shop	Kapit	Sales Price Kapit
Furniture	M$8.50	M$15.00	M$18.00
Log tying	M$3.20	M$ 6.00	M$ 8.00

B.3.c. Wood Products

1) Type and total value of products

The major industry in the project area is logging and sawmill operation. Most (80%-90%) of the trees cut down are exported as logs, and the rest are sawn in three sawmills located in the study area. Most of the sawn wood is also exported, but some is sold locally.

Some of the wood produced in the study area is sent to wood-processing plants downstream in the Rajang basin. There are five moulding factories, a woodchip factory, a plywood factory, and twenty-five more sawmills in the basin outside of the study area.

Log production and exports from the study area rose to a peak in 1970, declined sharply in 1972, and have fluctuated near 40% of its 1970 output for the last three to four years. Sawn lumber reached a new high in 1975 after reaching a low point in 1970; however, exports of sawn lumber have not regained their high 1970 level in total tonnage. Their value in 1975 (M$380 per ton) was second only to the 1973 peak year, when the average price per ton jumped to M$505.

Wood production in the Sibu region including the study area in 1975 amounted to 286,000 hopper tons of logs and 1,686 cubic tons of sawn lumber that were valued at M$23.4 million and M$0.64 million, respectively, in 1975. Recent data suggest an increase in this value for 1977. About 25% of this value is paid to the government as a royalty, in addition to timber concession fees. The gross value of sawmill sales represents 70% of the value of manufacturing sales and also of salaries and wages in the Third Division.

2) Industry structure and employment

An interview with Song Logging Company, largest in the study area, has provided some data on local industry structure. This logging company operates three logging concessions and two sawmills, one at Ng. Bawai on the Balleh River just north of Kapit, and one at Song. (It formerly operated in the Belaga area, but moved down to Ng. Bawai when its timber concession became depleted.) The company estimates that its present concession at Ng. Bawai will last 10-15 more years. It is now in its fourth year.

The Ng. Bawai operation produces an average of 20 tons per day of sawn lumber from 40 tons of logs. However, it saws only those logs with hollow centers that are not export quality (20% of total logs). Of the sawmill output, 10% is exported.

The remaining 90% is sold in Sarawak: 20% locally, 50% downriver (mostly in Sibu), and 30% in Kuching. Log exports mainly go to Japan and China.

The Song Logging Company is owned by shareholders in Sibu who bought out a former European company. The Ng. Bawai operation employs about 400 persons, with 100 at the sawmill and 300 in logging operations. Three-quarters of the employees, mostly skilled workers, come from the Sibu area; the remaining quarter comes from near Kapit; of these, one-fifth have Form 3 education, and the remainder have little or no education.

In the logging operations, the company encourages individual responsibility by requiring each chain saw operator to supply his saw and a crew of helpers. They are paid by the ton. The sawmill employees are hired directly.

3) Salary structure

Based on data from Song Logging, the salary scales and average pay are as follows:

Position	Salary Rate	Paid by	Average Monthly Earnings	Number in Song Logging
Chain sawman	M$3.50/ton	company	M$1,000	30
Barker	M$0.60/ton	chain sawman	M$ 200	100
Tractor driver	M$5 /ton	company	M$2,000	20
Assistant driver	M$1.50/ton	chief driver	M$ 200-300	60
Lorry driver	M$5.50/ton	company	M$2,000	15
Assistant driver	M$1.50/ton	chief driver	M$ 200-300	45
Mechanic	-	company	M$ 500	15
Surveyor	-	company	M$1,200	2
Camp supervisor	-	company	M$ 600	2

These figures indicate that Song Logging was paying $160,000 per month in salaries for its logging operations at

Ng. Bawai alone. Combined with the sawmill operation, the total Song Logging payroll is over M$200,000. This suggests a gross value of at least M$500,000 in wages and salaries for the industry as a whole, which represents a major contribution to the economy of the study area (assuming Song Logging represents 40% of timber industry employment in the study area).

B.3.d. Manufacturing and Primary Processing

1) Type and total value

There is very limited economic activity in manufacturing other than sawmills in the study area, excluding Sibu. Rural activities are limited to small-scale agriculture-based processing operations except for one local furniture-making company in Kapit. These processing operations include small rice mills and rubber smokehouses.

Fifty-two percent of the communities surveyed had rice mills that are run with small gasoline engines. Another 16% were served by a floating rice mill on a barge that travels the relatively calm stretch of river between Song and Kapit. Only 23% (7) of the communities had rice mills 10 years ago.

There are 10 rubber smokehouses in the surveyed communities (including 4 on a former rubber estate, 1 in a Chinese farming community, 1 in Song and 1 in Belaga). Those on the lower stretches are more than 10 years old, whereas those on the upper reaches have been built since 1967.

The total value of rice milling and smokehouse operations is difficult to define because they are basically services. Their charges for services in sample villages indicate a total value added of M$8,000 per year for 20 rice mills[1] and M$200,000 per year for 10 smokehouses.[2]

2) Industry structure and pricing

Both rice mills and smokehouses operate primarily as services in the study area. This means that virtually no purchases of the processed product are made, and little effort is made by operators to become traders as well.

Rice mills are mostly owned by small shopkeepers and are run with a gasoline engine that is also connected to a cold store in many cases. The charge of M$2 per pikul is not designed to

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1 Rice: average 4 pikuls per week x 50 weeks x M$2/pikul = M$400/year x 20.

2 Rubber: average 100 pikuls per month x 50 weeks x M$4/pikul = M$20,000/year x 10.

make a profit but is set as a competitive price to draw customers to the shop (according to several owners interviewed).

Frequently the fee is taken as a portion of the rice milled (6 katis per pikul of padi plus the bran). The bran and milled rice then become a secondary product for the rice mill owner to sell. Sometimes the bran is used by the owner for chicken or pig feed.

Smokehouses are run on a strictly monetary basis because they process rubber mainly for large or medium size traders in the towns. A direct charge of M$4 per pikul provides an adequate operating margin.

B.3.e. Commercial Activity

1) Type and total value

Commercial activity takes a number of forms in the study area. In the towns or market centers, there are a variety of specialty shops selling imported goods (wholesale and retail), services (predominantly restaurants and tailor shops), and trading enterprises for the marketing of export products. In the villages, there are small shops (often run by Chinese families) that serve as both trading posts and retail sales outlets. Smaller market centers may be composed of several of these village-type shops as well before the center is large enough to support more specialized shops.

Also in the larger towns, such as Kapit, several business families were found to be active in several different types of commercial and other activities at the same time. Large wholesale import and trading businesses tend to branch out into transport, cold stores, and other sidelines, such as building construction, where opportunities are perceived.

The number of each type of shop in the sample survey is shown in Table 2.3.

TABLE 2.3

TYPES OF SHOPS IN COMMERCIAL SURVEY MARKET CENTERS

Type	Belaga	Merit	Kapit	Song	Kanowit	Village Shops	Total Number	Total Sales (000)
Village Shop	-	2	-	-	-	16	18	222
Urban Shop	4	-	4	4	3	-	15	584
Wholesale/ Retail Shop	-	-	1	-	1	-	2	1,500
Tailor Shop	1	-	1	1	-	-	3	10
Restaurant	1	-	-	-	-	-	1	20
Total Sample	6	2	6	5	4	16	39	2,336
Total Shops	20	4	111	36	66	16	253	15,573
% Sample	30%	50%	5%	14%	8%	100%	15%	(15%)

These 39 shops represent total sales of M$2,336,000. Since they were selected in rough proportion to their portion of total shops, it is assumed that they represent 15% of total sales volume in the study area. This implies a total annual sales volume of M$15,573,000 in the study area for the commercial sector.

2) Market structure and pricing

The structure of the trading activities has been described above under agricultural activities. Rubber, rattan, and pepper are the predominant traded goods.

The retail sales structure is essentially the reverse of the trading structure. The village shops order through the larger market center wholesale/retail businesses. These larger businesses dominate the commercial sector (representing 64% of total sales in the sample). The village shops range from very small part-time operations in someone's home (M$300 per year sales) to well-stocked trading posts (M$66,000 per year sales) The smaller the shop, the more dependent it is on the supplier in the market center. The larger shops tend to be separate structures that are Chinese owned and managed, while the smaller shops are owned and run by longhouse residents.

The Consultants detected a shift from the complete dominance of Chinese families in commercial activities to some participation by other groups in the study area. The small village shops

that were found in some cases to be owned and managed by a person from the village (frequently from the village headman's family) had in two cases been purchased from a Chinese businessman. In most cases, the shop manager had an arrangement with a supplier in the town (usually Chinese) for the ordering of goods for the village store, and this arrangement usually included extension of credit.

As shown in the following table, virtually all of the village shops, and two-thirds of the urban shops, traded commodities in addition to supplying retail goods. Of the village shops, 22% had cold stores and 11% had rice mills as supplementary activities. All newspapers and most agricultural inputs were sold by urban shops; the wholesale/retail shops were an entrepreneurial base for many activities in addition to strictly commercial activities. These businesses also had close ties to exporters of commodities from upstream traders. Tailor shops and restaurants were specialized (although some large village shops were observed with a coffee shop sideline).

Pricing of retail items in the study area appears to follow a standard mark-up over shops in the market centers. Shop owners claim that recent competition has reduced their margins in recent years. A summary of business activities is shown in Table 2.4

TABLE 2.4

SUMMARY OF BUSINESS ACTIVITIES IN SAMPLE

Business Type	Number of Shops	Trading	Cold Store	Rice Mill	Smokehouse	Transport	Other	Number Selling Fertilizer or Pesticides	Number Selling Newspapers
Village shop	18	17	4	2	1	-	-	2	-
Urban shop	15	10	-	-	-	1	-	5	6
Wholesale/ retail	2	2	1	-	-	1	2	2	-
Tailor or clothing	3	-	-	-	-	-	-	-	-
Restaurant	1	-	-	-	-	-	-	-	-
Total	39	29	5	2	1	2	2	9	6

B.3.f. Transporters

1) Type and total number

Virtually the only form of transport in the Rajang River basin is river transport. Some road vehicle transport takes place within towns, but it is limited since a road system has not been developed in the basin. There is also regular air service by small plane between Sibu and Kapit and occasionally to an airstrip downstream from Belaga.

River traffic consists of wooden canoes, long boats, motorized long boats, motor launches, and express boats. Prior to express boats, the motor launches played the major transport role for goods and passengers for the stretch between Kapit and Sibu. These launches are relatively slow (two days per trip) and frequently the captain-owner functions as a mobile trader. A few transport companies own two or more motor launches.

Upstream of Kapit and the rapids, the major form of goods transport is the motorized long boat. These are owned by traders, shop owners, or groups of longhouse residents. In addition, individually owned motorized long boats are often used by groups from a longhouse for market trips or occasionally as a taxi service from the major market centers.

Statistics on water transport vehicles are not systematically collected because of the wide dispersion of ownership. The Marine Department collected the following statistics on larger boats and ships in the private sector.

Number of Privately Owned Vessels Operating in the Rajang River Basin 1965-1975

Year	Number of Vessels	Express	River Launch	Coastal Ship[1]
1965	90	-	50	40
1970	120	4	71	45
1975	80	8	55	17

Note: Express boats are narrower and have more horsepower capacity than the motor launches. They also have steel hulls and can sustain higher speeds. About 20 express boats were registered in 1977.

[1] Below Sibu.

Source: Marine Department.

The number of vessels peaked in 1970, which was two years after express service was introduced in 1968. The decline in coastal ships registered in the basin reflects a dip in the amount of timber exports, which has subsequently increased. Some of the decline in motor launches is attributable to this timber industry decline, but much of it is due to competition with the express boats, which have become a dominant factor in the transport market, particularly for passengers. (In 1977 there were 26 express boats identified on the Rajang upstream of Sibu.)

2) Market structure and pricing

Two kinds of express service between Kapit and Sibu are regularly scheduled. There are three larger (50-70 passengers) more powerful (550-1050 horsepower) boats and three smaller (40-50 passenger or 350 horsepower) boats per day. The larger ones are faster (4½ hours from Sibu to Kapit versus 6 hours for the smaller express boats). The passenger tariff is less for the slower boats, as shown below:

Transport Pricing on the Rajang River (M$)

	Kapit-Sibu			Sibu-Durin	Kapit-Belaga
	Express		Motor		
	Fast	Slow	Launch	Express	Express
Passenger					
Total price	7.50	5.50	3.00	4.50	10.00
Price per/km	.085	.063	.034	.081	.096
Freight					
Price per pikul		$3-5	$1-2	$1.25-2.50	$6-8
Price per/kg	$.046-.076		$.015-.030	$.019-.038	$.091-.121
Price per ton/km	$.520-.860		$.170-.340	$.341-.690	$.875-1.16

Source: Transporter interviews.

The price of a ten-hour trip by motor launch from Kapit to Sibu is M$3.00. Freight charges on the express are M$3-M$5 per pikul or less depending on distance and product. Motor launches charge 30%-40% less for the same routes.

Eight transport companies (representing 40% of the area's transport companies) interviewed in the study area supplied the following services:

Route	Number of Vessels Express	Number of Vessels Motor Launch	Number of Companies	% of Total Companies
Kapit-Sibu	2	4	2	20%
Kapit-Belaga	10	-	3	100%
Belaga-Long Jawe	2	1	2	67%
Kapit-Bah[2]	1	-	1	100%
Kanowit-Sibu[3]	1	1	1	100%
Song-Sibu[3]	-	2	1	100%
Ng. Sebatu-Kapit[3]	1	-	1	100%
Total	17	8	8[1]	40%

[1] Three companies have two routes apiece.

[2] Competes with Kapit-Belaga boats making intermediate stops.

[3] Competes with Sibu-Kapit boats making intermediate stops.

All except one company interviewed are owned by several shareholders (over 80 in one case). These shareowners are frequently groups of businessmen from the area who have joined together to ensure transport for their supplies. Frequently, the express boats are owned and run by Chinese merchants, but in several cases, Iban shareholders were also involved.

3) Traffic surveyed

In order to evaluate the flows of river traffic in the project area, traffic surveys were carried out for one week at Kapit. Kapit was chosen as the principal transfer and secondary distribution point on the river. This survey entailed interviewing about 80% of the total traffic, including 100% of the express traffic arriving or leaving Kapit. This amounted to 375 boats, 4598 passengers, and 383,966 pikuls (23,229 metric tons) of freight.

The origin and destination of boats interviewed are shown in the following table. All types of boats were included in the survey, from one-man canoes to motor launches and express boats. Vessels calling at Kapit more than once during the survey week were counted once for each trip.

Zone of Origin or Destination	Boat Trips		Passengers		Freight	
	Number	% of Total	Number	% of Total	Amount (kg)	% of Total
Sibu	85	11.3	981	21.3	63,442	16.5
Kanowit	0	0	196	4.3	150	0.1
Song	3	.4	376	8.2	1,852	0.5
Kapit	428	57.1	1,297	28.2	84,067	21.9
Merit-Bah Area	26	3.5	217	4.8	19,179	5.0
Belaga	20	2.6	226	4.9	39,433	10.3
Above Belaga	2	.3	0	0	0	0.0
Lower Balleh	179	23.9	1,280	27.8	141,413	36.8
Upper Balleh	7	.9	25	.5	34,430	8.9
Total	750	100.0%	4,598	100.0%	383,966	100.0%

The types of freight carried, in order of importance, were:

1. Building materials
2. Imported food
3. Petroleum products
4. Rubber
5. Fertilizer
6. Pepper
7. Rattan
8. Fish
9. Animal meat
10. Household goods
11. Marketed food
12. Padi rice

The largest flows occurred for building material (42.3% of total weight shipped - mostly lumber from the sawmill on the Balleh River), imported food(27.8% - mostly from Sibu or Kapit), petroleum products (11.8 %), and rubber (9.4%).

Most of the passengers on the Kapit-Sibu express run are not those making the trip from Kapit to Sibu, which amount to only 12% of the passengers carried. Instead, they are making shorter trips, usually between market centers. As shown below, a brief survey of origin-destination flows on two express boats in August 1977 shows that the Sibu-Kanowit trip is the most travelled.

Origin-Destination Distribution of Passengers on the Kapit-Sibu Express Boat (both directions)

Origin-Destination Pair	Percent of Total Trips
Kapit-Song	16%
Kapit-Kanowit	5%
Kapit-Sibu	12%
Song-Sibu	15%
Kanowit-Sibu	40%
Kanowit-Durin (road intersection)	4%
Durin-Sibu	3%
Sibu-Local	1%
Durin-Kapit	4%
Total	100%

Source: Consultants' surveys August 11 and 21, 1977.

B.4. Social Structures

B.4.a. Settlement Patterns

The indigenous tribes of the Rajang River basin practice slash-and-burn agriculture, supplemented by hunting, fishing, and gathering of forest products for food and domestic craft activities. Recently, some of them have begun to produce cash crops. However, their major source of cash income has traditionally been the sale of craft and forest products.

Within the last two hundred years, the Rajang Valley has been gradually occupied by the Iban people, or Sea Dayaks, moving northward and eastward out of Sarawak's Second Division. The Iban, more organized and more acculturated than the smaller tribes of the Rajang basin, pushed them back toward the mountains and up the tributary rivers while they occupied the main river valley. In principle, the Iban territory now stops at the border between Kapit and Belaga districts, which crosses the Rajang between Merit and Bah (see Figure 6).

The indigenous people, Iban and others, live in longhouses, which are structures consisting of a row of apartments belonging to individual households, fronted by a common covered porch area and often by a further extension of the porch or boardwalk beyond the roof. Longhouses are invariably located close to a river, which provides both the community water supply and the principal means of transport. Each longhouse is legally

entitled to cultivate surrounding lands within a certain area reserved to it under native customary rights. Legal claim to the land can be laid only after clearing.

Within the longhouse, each household functions as an economic unit. Fields are individually cultivated, and food preparation is carried on in the individual apartments. The public porch is used for socializing and public meetings. The uncovered porch area is used primarily for access to the longhouse and for drying crops and clothes.

Considerable variation can be observed within a single longhouse in the economic status of the individual household units. Individual households own the construction materials used in their particular dwelling units, including tin roofs in some cases. Some households are deeply involved in the cash economy, possessing a wide variety of manufactured household goods, while others have few household items that could not be locally constructed.

Nevertheless, the social structure of the indigenous communities seems designed to mitigate the extremes of economic differences. Informal barter, or simple sharing, accounts for the survival of those who are not economically self-sufficient. Old people and children, although primarily the responsibility of their immediate families, are cared for by the community if necessary, often through "adoption" into other households.

In addition to the indigenous population, the study area contains a significant share of families of Chinese and Malay origin. The Chinese households are of two principal types, farmers and traders. The Chinese farming families live in single-family houses surrounded by fields but more or less grouped together into "Chinese farming communities" with their own social, political, and religious organization. Because of legal restrictions on land ownership, many Chinese must rent or sharecrop land belonging to the natives. The Chinese farmers are very much in the cash economy and their agricultural innovations have had a certain demonstration effect on indigenous farming practices.

The traditional role of the Chinese in Malaysia has been that of the trader, skilled craftsman, or professional. This pattern is repeated in the towns of the study area, even the very small towns such as Dap or Merit. Market towns begin with construction of a "Chinese shophouse community," consisting of blocks of five or six ground-floor shops with residential units above or behind them. The Chinese commercial community is closely knit in the project area and has major ties to wholesale buyers and sellers based in Sibu.

In addition to the town dwellers, there are a certain number of Chinese traders who live in individual households located close to--but not in--the longhouse communities of the upper Rajang. These traders collect agricultural products (principally rubber) and distribute consumer goods (cloth, small tools, tinned food) through a shop. In addition, they may operate a rice mill or cold storage facility. Such traders usually have commercial and/or family ties to larger dealers based in the major market towns.

Finally, there are the Malay communities. In the project area, these are found only in the administrative centers and their principal area of economic activity is government service. Malays are housed in separate quarters (kampongs) and are distinguished from the other communities of the project area by legal status, language, and religion. The kampongs in the project area are generally of recent construction, consisting of modern single-family houses with small gardens, improved public paths, and sometimes electricity.

Market buildings are found only in the district centers. The market building in Song was constructed during the project period. A community meeting house has been constructed in Belaga. Out of the 31 communities surveyed, 6 (20%), including Belaga and Song, have playing fields, almost all of which are associated with a school.

About 50% of all surveyed communities have jetties, floating or fixed, and about 30% have constructed plankwalks to replace the notched logs usually leading up the river bank to the longhouses. Practically all of this construction took place during the project period. However, at least some of these projects were undertaken to replace older construction that had been worn down, subject to rotting or damaged by storms and by waves from high-powered boats on the river. A few communities have given up building jetties and plankwalks since they have seen their efforts so often destroyed.

About half of all surveyed communities have a permanent water supply. Twelve of these (40% of the total) are gravity-feed pipeline systems built under government initiative, which serve the entire community. The remaining 3 (10%) are Chinese communities that have privately owned pumped water supplies for individual households. Electricity exists in the district centers, and generators are often owned by rural traders, especially those who operate rice mills or cold stores. Chinese farming families may also have generators, but it is rare to find electricity in a longhouse.

Churches, temples, and mosques exist only in the Malay and Chinese communities, with two exceptions: the Roman Catholic mission at Song and a Christian chapel associated with one longhouse. Although no systematic attempt was made to determine the religion of each community, the survey covered approximately 10% Christian, 10% Muslim, and 10% Buddhist communities, with the rest mixed or pagan. Often the practice of more than one religion was evident within a single longhouse. In one case, religious differences were cited as the cause of a longhouse split.

B.4.b. Migration

The village sample indicates that only about half of the communities in the impact zone experienced any migration of households during the ten-year study period. Of the surveyed communities, 25% had households moving in, 15% had households moving out, and 15% had movement both in and out. There was relatively little variation in the direction of migration by ethnic group, although migration (both in and out) was more common in the Chinese and Malay communities than in the indigenous ones.

A total of 95 households out of 1,050 in the sample communities, or a little less than 10%, moved during the study period. These moves were about evenly divided between households moving in (49) and households moving out (46). Such moves were often made in groups, several households transferring together from one longhouse or town to another. About 60% of the moves were made between communities in the study area and communities outside the study area, principally located in the neighboring districts of Sibu and Julau. About 25% were short-distance moves (within the same district), and 15% were medium-distance moves (between different districts in the study area).

About half of the long-distance moves into the study area are accounted for by Chinese families moving into the two towns studied (Song and Belaga). Almost all of the long-distance moves out of the study area are accounted for by households moving out of the Malay kampong and the Chinese rubber estate. If these moves are excluded, the pattern of indigenous migration shown a preponderance of short-distance moves and a distinctly larger movement into the study area than out of it. (See Tables 2.5 and 2.6.)

TABLE 2.5

MIGRATION (ALL COMMUNITIES)

Moves	In	Out	Total
Within district	10	13	23
Between districts	9	5	14
Outside study area	30	28	58
Total	49	46	95

TABLE 2.6

MIGRATION (INDIGENOUS)

Moves	In	Out	Total
Within district	10	13	23
Between districts	9	5	14
Outside study area	15	2	17
Total	34	20	54

B.4.c Occupational Structures

Data for all of Sarawak indicate that 67% of the employed population is active in the primary sector (including agriculture, forestry, fishing, and mining); only 9% is in the secondary sector (crafts, industries, transport, and communications); and 16% works in the tertiary sector (sales, services, and government). More specific data on occupational structures in the project area are not available. From observation, it would appear that the population outside the four major towns is almost exclusively active in the primary sector, with the exception of a few traders. The town population (about 8% of the total), in contrast, is very heavily involved in the tertiary sector.

Virtually all industry in the project area is extractive (wood processing) or directly derivative from agriculture (rice milling, rubber smoking). A few skilled and unskilled workers residing in urban areas are active in transport and communications. While there is little specialization in secondary sector activities outside the towns, local crafts and cottage industries as well as local transport and communications contribute substantially to the economic well-being of the indigenous communities.

The principal forms of wage labor are rubber tapping (usually on a share basis), work in timber camps or sawmills, "coolie" work (loading and unloading cargo boats, distributing goods within the towns), and service to shopkeepers or government agencies. The paramilitary role of "border scout" carries good pay and prestige. But opportunities to earn cash are relatively scarce in the study area, and many young people now leave the area temporarily or permanently to seek paid employment elsewhere.

B.4.d. Education

A general literacy rate of 38% is claimed for Sarawak as a whole, based on the population ten years of age and over at the time of 1970 census. This rate varies significantly by sex and ethnicity, as indicated in the following table:

Literacy Rates (1970)

	Males	Females	All
Malay	57%	30%	43%
Chinese	66%	49%	58%
Iban	30%	12%	21%
Other indigenous	36%	19%	29%
All groups	49%	28%	38%

Primary and secondary school enrollment has expanded during the study period in the project area, as shown in the following table:

Change in Enrollments

District	1967	1976	Average Annual Growth	Population Growth[1]
Belaga	884	1,980	8.4%	1.1%
Kapit	3,686	6,000[2]	5.0%	2.9%
Song	1,344	2,602	6.8%	1.7%
Kanowit	4,221	4,645	1.0%	3.3%
Total	10,135	15,227	4.2%	2.6%

[1] 1960-1970 annual growth rate, based on census data.

[2] Estimated by Consultants based on 1975 enrollment and 1967-1975 growth rate.

There are at present approximately 100 primary schools in the study area and 4 secondary schools, 1 located in each of the district centers. There are no institutions of higher education in the project area. About 20% of the primary schools are privately operated, usually by the Chinese communities or by missions, but most of these receive government aid and conform to official curriculum requirements. Secondary schools in the project area are all government operated.

Maps showing the location of primary schools in Song, Kapit, and Belaga districts indicate that a conscious attempt has been made to spread the schools around geographically. Schools are always located near rivers for ease of access and frequently are found at the confluence of two or more streams.

The available data permit the calculation of only a couple of rough indicators of the level of educational service provision by district:

	Belaga	Kapit	Song	Kanowit	Study Area	State of Sarawak
Schools (1976)						
Per 1,000 pop. (1970)	1.8	1.2	1.3	1.5	1.4	1.4
Enrollment (1976)						
per 1,000 pop. (1970)	278	198	191	182	200	241

Although it would appear that Belaga District is distinctly better served than the others, this result is more probably attributable to undercounting of the Belaga District population in the 1970 census. If this is true, then educational services appear to be spread quite evenly over the project area. Enrollments, however, are low relative to the statewide average.

Unfortunately, it is not possible to determine changes in the numbers of schools and teachers in each district over the study period, as the data for Song, Kapit, and Belaga were combined into a single district prior to 1970, while data for Kanowit were combined with those for Julau, outside the study area.

In the village surveys, primary schools were found in or near 25% of the sample communities. The Chinese and Malay communities were 100% served by schools, whereas the indigenous communities were only 10% covered. All of the schools were more than five years old, confirming the fact that recent school construction has been moving away from the main river. In the indigenous communities without schools, many children made long trips daily or weekly in order to attend schools located some distance away.

B.4.e. Health Services

The only hospital in the study area is at Kapit, with a capacity of 100 beds. This hospital was constructed during the study period to replace a privately operated hospital of the same size. There are seven additional clinics or static dispensaries: two in Belaga District, two in Kapit District, one in Song District, and two (one private) in Kanowit District. In addition, there are approximately eight other points of health care service delivery (sub-dispensaries, health sub-centers, etc.) and ten travelling dispensary units. Of these, only one static dispensary, but all of the lesser centers and all but one of the travelling dispensaries, were introduced during the study period. A Flying Doctor service enables medical personnel from the hospital at Kapit to reach out-lying communities in a case of emergency.

According to administrative data, there are 3 doctors in the study area, all based in Kapit, as are the 13 registered nurses. There are three trained midwives in Belaga, six in Kapit, two in Song and two in Kanowit. In addition, there are 24 paramedical personnel (hospital attendants, etc.) in Kapit District. Ten years ago there were only six trained nurses at the privately owned hospital in Kapit and only four midwives for the entire study area.

These data give the following crude indicators of health service delivery in the project area:

	Belaga	Kapit	Song	Kanowit	Study Area	State of Sarawak
Fixed facilities per 1,000 pop. (1970)	0.56	0.20	0.15	0.16	0.21	0.07
Travelling units per 1,000 pop. (1970)	0.28	0.13	0.22	0.04	0.13	0.04
Medical personnel per 1,000 pop. (1970)	0.42	1.52	0.15	0.08	0.69	2.23

These figures indicate that the study area is relatively quite well served in terms of medical facilities but under-served, in comparison to the State of Sarawak as a whole, in terms of medical personnel. Within the project area, medical personnel are excessively concentrated in Kapit, undoubtedly because of the presence there of the region's only hospital.

The relatively low levels of health service delivery in Kanowit District probably reflect its proximity to Sibu. The survey showed that many residents of Kanowit District travel regularly to Sibu for medical care.

It would be difficult to overestimate the impact that the travelling dispensaries had on health practices and health care in the more remote parts of the study area over the study period. Data collected in informal interviews with health service providers indicate that a travelling dispensary unit can visit up to five longhouses and schools a day, depending on community size and distances to be covered. This means that all the longhouses that are accessible by motorized craft could be reached by a travelling dispensary on at least a monthly basis. In fact, those longhouses that receive regular service are visited more frequently than that, while others are infrequently served because of the difficulties of access and the high cost of fuel for long trips.

Of the villages surveyed in the study, 80% receive visits from a travelling dispensary, compared to less than 50% ten years ago. Such visits are now also more frequent--on the order of once a week rather than twice a year characteristic of ten years ago. However, communities near the newly created district centers and growth centers such as Merit and Dap have experienced a decrease in service delivery visits, since they are now expected to go to the permanent facilities in the nearby towns for service. The travelling dispensaries are supposed to serve only communities without access to fixed medical facilities.

The general picture is one of services gradually being extended out into the more remote communities. However, services in general have not yet reached longhouses located on streams that are impassable to outboard engines. The single exception is the anti-malaria campaign, which claims nearly 100% coverage in the study districts.

B.4.f. Community Development

During the past ten years, substantial efforts have been made to improve the standard of living in the communities of the Rajang River basin by providing financial support for a variety of community development projects. Local labor can be enlisted to complete the construction of government schools, with the government providing materials, design standards and specifications, and construction supervision. In the impact zone defined for this study, most such schools were completed more than ten years ago.

The principal source of community development funds is now the annual allocation for "minor rural projects." Such projects may include the construction of concrete paths or wooden bridges, floating jetties or plankwalks, water supply systems, sports fields, latrines, and so on. Communities wishing to embark on such a project submit a request for funds to the appropriate administrative officer. Usually the government provides either money to purchase needed materials, such as

cement, pipes, or nails, or the materials themselves. The villagers are expected to contribute their labor and certain types of materials (planks, posts, rattan) that are locally available. Allocations range from M$500 to M$5,000 (U.S. $200-U.S.$2,000) per project.

Administrative data from the three districts reporting (this information was not provided by Kapit District) show an impressive number of projects completed in each year of the study period. The number of projects reported annually increased from 6 to 13 in Belaga, 2 to 29 in Song, and 25 to 100 in Kanowit over the study period. Detailed lists provided by Song and Belaga districts show the following patterns of village participation in community development projects:

	Song		Belaga	
No projects	47	38%	10	(23%)
One project	57	45%	20	(46%)
Two projects	17	14%	10	(23%)
Three or more projects	4	3%	3	(8%)
Total	125	(100%)	43	(100%)

The above figures refer to longhouse participation only. Schools and urban communities also benefit: ten projects for six schools in Belaga, ten projects for eight schools in Song, three projects for each of the two Malay kampongs in these districts, two for Belaga town, one for Song town, and two serving the Roman Catholic mission at Song were implemented over the project period.

In the village survey, most of the sample communities (80%) had participated in some kind of community development project. Below Kapit this participation was almost universal, the only exception being one longhouse that moved to the banks of the Rajang less than three years ago. Above Kapit, the projects were largely confined to construction of jetties, plankwalks, and piped water supply. Community participation in the construction of schools and of boats for the coming Independence Day regatta was also mentioned. With the exception of the schools, these projects were all quite recent (since 1970).

Below Kapit, there was a greater variety of projects, a larger number of projects per community, and a longer history of project participation. Seven communities had built a piped water supply, eight built jetties or plankwalks, and three had

built bridges or footpaths to facilitate land (pedestrian or bicycle) transport. Pit latrines, another popular project, were found in three communities.

In addition, community projects in agriculture (pepper, vegetables, and fish ponds) were cited in three cases. These were organized by Saberkas, the national equivalent of a 4-H movement. Three communities (Chinese and Malay) mentioned past participation in school construction.

Occasionally a community will assess each household for a contribution to a project not sponsored by the government. This type of local initiative, however, appeared to be relatively rare (3 cases out of about 50 projects mentioned). It is probably most prevalent in the Chinese communities, which are less likely to be viewed as eligible for government aid.

Cooperatives are active in Kanowit District but are mostly located in the Sibu delta, outside the impact zone for this project. As of 1975, there were 17 registered cooperatives in Kanowit District, of which only 14 were functioning. Seven were trading associations, one was a cooperative rice mill, and nine were credit cooperatives; some of the trading and processing cooperatives also made loans to members. All of the cooperatives, except three trading associations, were started in 1960-1965 (prior to the study period).

Song District had four credit cooperatives and one trading association in 1975. Two of the credit cooperatives were not functioning. There was only one cooperative in Belaga District, which functioned principally as a trading association. All of these cooperatives were organized during the latter half of the study period (1970-1975).

B.4.g. Communications

Post offices have been established in the four administrative centers since before the project period began. There are no other postal agencies in Belaga and Song Districts. Two additional agencies were opened in Kapit District in 1974. New agencies have been added steadily since 1972 in Kanowit District at the rate of about one per year.

The only postal vehicles and mobile post services are provided in Sibu and Sarikei. Mail for the Rajang River valley travels on the express boat; therefore, the service is considerably faster, more frequent, and more regular than it was ten years ago. Mail can be delivered directly to longhouses located on the express routes by special arrangement with boat drivers.

The volume of mail handled by the four district post offices increased over the project period as shown in the following table:

	1965	1975	Average Annual Increase
Kanowit	117,631	413,224	25%
Song	13,429	89,443	53%
Kapit	150,532	295,622	9%
Belaga	15,370	66,461	30%
Study area	296,962	864,750	19%
State of Sarawak	21,962,475[a]	45,856,372	18%

[a] Data for 1969.

The relatively low rate of increase for Kapit can be attributed to the siphoning off of administrative functions to Song and Belaga when these towns became district centers in 1973. Overall, the rate of increase of mail communication in the project area is close to the national average.

Telephone service exists only in Kapit, Song, and Kanowit and has been present in these three towns for over ten years. The number of telephones has doubled in Song and Kanowit and tripled in Kapit over the project period:

	1965	1975	Average Annual Increase
Kapit	50	143	9
Song	18	38	2
Kanowit	32	69	4

Average daily circulation of newspapers in 1975 was 273 in Kanowit, 100 in Song, 543 in Kapit, and 12 in Belaga. Of these, 72% are Chinese newspapers, 24% are English, and 4% Malay. All newspapers are delivered by the express boats to distributors in the towns. No data are available on newspaper circulation prior to the study period.

The number of radio and television licenses issued annually in the project area declined over the study period.[1] The number appears to have peaked in 1966 in all four districts and declined steadily thereafter. Assuming the figures for 1965 represent the total then existing in each district, and the rest represent new acquisitions, the growth of radio and television is as follows:

[1] Many radios, however, are operated without licenses.

	1965	1975	Average Annual Increase
Kanowit	1,062	6,864	55%
Song	210	1,446	59%
Kapit	543	3,425	53%
Belaga	95	607	54%
Study area	1,910	12,342	55%
State of Sarawak	51,402	90,118	8%

The village survey showed that 30 out of 31 communities now have a radio and are aware of changes in crop prices regulated by government. This is true even of communities that cannot be reached by motor boat. About half of the surveyed communities had radios and got prices from them ten years ago.

Other sources of agricultural information now include newspapers (eight cases, or 26%), traders (four cases, or 13%), and agricultural extension staff (three cases, or 10%). Commodity buyers in Song and Kapit (but not Belaga) can also get current Sibu unofficial prices by phone.

Ten years ago, newspapers were information sources in only three communities (10% - all Chinese). Traders were the main source of price information in seven cases (23%). Eight communities (26%) said they had no source of agricultural information ten years ago. All but one of these are located above Kapit; the single exception is the longhouse that only recently moved to the banks of the Rajang.

From these data it is possible to derive a few crude indicators of communications levels in the project area as compared to the rest of Sarawak:

	Belaga	Kapit	Song	Kanowit	Study Area	State of Sarawak
Annual Volume of mail/pop.	9.3	9.8	6.6	16.2	11.3	47.0
Radios and Televisions per 1,000 pop.	85.3	113.3	106.3	268.7	161.4	92.3
Telephones per 1,000 pop.	-	4.7	2.8	2.7	3.3	24.4
Newspapers per 1,000 pop.	1.7	18.0	7.4	10.7	12.1	95.5

Note: Communications measures are for 1975; population figures are for 1970.

The overwhelming importance of radios as a means of communication in the project area is evident from this table. There is at least one radio for every ten persons in the study area, and the ratio for radios exceeds the national average, whereas those for mail, telephones, and newspapers are far below the national averages for these services.

Finally, the Malaysia Information Service maintains mobile units based in Song and Kanowit to bring civic information and activities to the villages. Eight of the surveyed villages (26% of total) reported being visited by the information service. All of these were located on the Kapit-Kanowit stretch of the river, and they constituted more than half of the communities surveyed on this stretch. Information service visits are still infrequent (average twice a year), but they provide valuable information about government activities in which the communities can participate.

C. TRANSPORT SECTOR CHANGE AND COMPLEMENTARY INVESTMENTS

C.1. Study Project Characteristics

The study project in the case of Malaysia was defined as private investments in express boats serving the area upstream of Sibu on the Rajang River, and the investment during the same period, 1968-1977, by government services in mobile service boats to serve the same area. These investments are described below.

C.1.a. Express Boat Service. The express boat service was inaugurated in 1968 with a Sibu-Kapit run. It has since expanded to include service between Kapit and Belaga and between Belaga and Long Jawe. Several shorter passenger and freight express routes have been created ending at Kanowit, Ng. Sebatu, and Bah (one boat each). This represents a total of 17 express boats of various sizes (smaller ones operate farther up river) but all with steel hulls, twin inboard engines, and high speed (greater than 20 knots). The various boat sizes and related investment costs are shown below:

EXPRESS BOAT INVESTMENT

Boat Size		Investment Period				1977 Average Cost	Total Investment
Horse-power	Passen-gers	1968-1970	1971-1973	1974-1977	Total	(M$)	(M$)
500-1100	50-70	2	(1)	(1)	4	150,000	600,000
350	40-50	(2)	(3)	4 (+1)	10	80,000	800,000
160-220	30-40	-	-	4	4	50,000	200,000
70-150	20-30	-	-	7 (+1)	8	30,000	240,000
Total		4	4	18	26		M$1,840,000

( ) = estimated boats for non-interviewed companies.

It appears from these data that 70% of the boats (amounting to 50% of total investment) were purchased in the last four years. This investment was largely in the smaller express boats to be used upstream of Kapit. Investment in the larger boats has declined, probably because of recent government proposals to limit the allowable size of express boats.

The express service is a scheduled service between Sibu and Kapit and between Kapit and Belaga. There are four departures per day from Sibu and Kapit. This schedule was an innovation over the previous transport services supplied by motor launches, which were unscheduled.

The time saved by the express over the motor launch (4½ versus 10 hours from Kapit to Sibu) is a major factor in its success, particularly when combined with its relatively high frequency of service and a certain flexibility for intermediate stops. These factors allow the express to improve significantly on motor launch service but at a higher cost.

The higher cost of operating the express boat is reflected in its higher prices to the user. The basic charge from Sibu to Kapit for a passenger is M$7.50 for the fastest express. This amount is two and one half times the motor launch cost, as shown in the previous section. Freight price differences between express and motor launch are similarly large.

At the start of the express service in 1968, the price differential was even larger (M$6.20 to M$1.00). Nevertheless, there was still a large demand for the express service, which was very profitable. Other transporters then entered the express market by buying express boats, and a period of stiff competition ensued. After one to two years of this competition and an associated price war, the express transporters grouped together and organized a rotation system to go with a scheduled service. Nevertheless, the results of competition are seen in the relatively slow price increase that has taken place since 1968 compared to motor launch prices.

Passenger Price 1968-1977 - Sibu-Kapit Trip

	1968 (M$)	1977	Total Increase	Average Annual Increase
Express (fast)	6.00	7.50	25%	2.5%
Motor Launch	1.00	3.00	200%	13%

The motor launch price rise reflects the major increase in fuel prices as well as general inflation (39% increase in the retail price index from 1966-1976). The express price rise is only a small fraction of the general price increase.

The relative decline in profitability on the Sibu-Kapit run has led at least one major transport company to shift its emphasis to the upstream stretch east of Kapit. The price per passenger-kilometer is higher on this stretch, although the risk of losses is also higher because of the rapids. This shift is reflected in recent boat investments.

C.1.b. Government Boat Investment. Investment in boats as service vehicles for various government agencies has been significant in the last ten years. The number of travelling dispensaries has more than doubled, and agricultural extension and community development agents are much more mobile, as indicated in the responses to the village surveys. In addition, the forestry department lands and surveys, education, information service, and JKR all have boats for their services at the Kapit district center (see following table).

RIVERINE MOBILE UNITS SERVING DISTRICTS - 1977

	Dispensary		Infor.	Government Vehicles		
	1976	1966	Unit.	Speedboats,	Longboats,	O/B engines
Kanowit	1	-	1	-	3	
Song	2	1	1	-	3	
Kapit	4	2	1	3	31	69
Belaga	2	1	-	1	8	23
Total	9	4	3	4	45	94

Source: Administrative Surveys

The only yearly investment data were obtained in Belaga. From this, it appears that the government boats in use now were all built in the last four years. (Four were acquired in 1976.) This reflects the short life of a longboat on the upper river. Of the engines purchased, almost 70% were acquired in the last four years. This figure probably understates earlier investments, as older engines have been scrapped.

BOATS AND MOTORS ACQUIRED BY PERIOD (BELAGA)

	1968-1970	1971-1973	1974-1976
Number Boats	-	-	9
%	-	-	100%
Number Motors	2	5	16
%	10%	22%	68%

Nonetheless, it is clear that more vehicles have been made available to government services in the project area in the last ten years. It is estimated that the number of boats has approximately doubled. This implies an additional investment in 25 boats for an estimated cost of M$100,000 (25 x M$4,000 average cost) over the study period. This investment is only 6% of the private investment in express boats during this period.

C.1.c. Effect of study project on accessibility, transport flows, and transport prices

1) Effect on Accessibility

Five indices of accessibility change were constructed for the project area using various forms of weighted average time savings. The indices are called:

1. Market Accessibility Change
2. Village Accessibility Change
3. Travel Accessibility Change
4. Service Accessibility Change
5. Household Accessibility Change

Market accessibility relates each market center to major centers outside the study area. Village accessibility relates each village to the nearest market town. Travel accessibility is a combination of village and market accessibility weighted by the number of trips to each destination. Service accessibility is a combined index of visits by the various types of services to the villages. Household accessibility is an average of travel accessibility and service accessibility for each village.

The three basic accessibility measures and changes are given below for the five market areas and as an average for the 31 villages for which data were available. (See Appendix B for further discussion of the different types of accessibility measures used in this study.)

MEAN VALUE OF ACCESS CHANGE MEASURES
BY MARKET TOWN - MALAYSIA

Town	Market Access	Market Access Change	Mean Village Access	Mean Village Access Change	Mean Service Access	Mean Service Access Change
Belaga	0.091	0.694	0.625	0.000	1.000	0.928
Merit	0.125	0.733	0.368	0.189	0.639	0.432
Kapit	0.200	0.583	0.162	0.230	0.725	0.248
Song	0.333	0.571	0.529	0.286	0.679	0.580
Kanowit	1.000	0.645	0.555	0.000	0.500	0.167
Sample Mean	0.265	0.637	0.389	0.181	0.694	0.405

Market access increases from town to town going downstream. The change in market access is large throughout the study area and slightly higher above the rapids. Village accessibility change (from village to market center) shows the greatest increase in the center of the study area due to the improvement provided by the express. Service access is high throughout the project area and the greatest change has come with the decentralization of services from Kapit to Belaga, Song and Merit.

2) Effect on Transport Flows

The major change in transport flows as a result of the study project is a significant shift in passenger traffic from motor launches and motorized longboats to express boats. Express boats now carry approximately 75%-80% of the passenger traffic on the Sibu-Kapit route. At the same time, the number of passengers carried by motor launches has declined to an estimated 60% of its 1965 level.

On the other hand, the express boats have had a more limited impact on freight flows. They carry only 15% of the traffic into or out of Kapit. Express boats are major carriers for perishable goods such as fresh fish and game, of which they carry virtually all the region's production for export. The same is true for the more perishable fruits, such as durian.

The increase in passengers travelling in the study area by express has not been caused so much by the rural area residents as by traders and government employees who are making more frequent trips than before. The introduction of the higher-priced express has created more opportunity to travel for those who can afford it or who depend on travel for their work (such as traders).

In certain cases, such as villages above or near the rapids, the express represents a decrease in transport costs and therefore a savings for longhouse residents who travel. Otherwise, longhouse residents benefit only indirectly through association with regional growth linked to transport.

3) Effect on Prices

The study project has not significantly changed transport tariffs in the study area except for adding a higher-priced option with benefits deriving from speed, safety, comfort and convenience. The express is not competitive with motor launch service for slow-moving freight hauls on the navigable portions of the river. Passenger transport tariffs have risen dramatically over the study period, principally owing to the rise in fuel costs. In this situation the express offers certain economies of scale and its prices are more competitive now than formerly with the cost of personal travel by motorized longboat.

C.2. Other changes in transport sector

Several changes in the transport sector have accompanied the investments in boats described above, although they are not closely linked to the express service. These include construction of jetties, decline in motor launches, new road construction, and air service changes.

The construction of jetties is a major project for most small villages or longhouses. This activity is related to the express service in both a positive and a negative manner. On the one hand, the express will stop more readily at a jetty than at the river bank, which encourages villages to build jetties. On the other hand, wave action from passing express boats damages jetties and shortens their life, requiring villages to repair or rebuild them and incur extra expense.

The total number of boats owned by the transport companies interviewed in the study area (40% of total) increased from 16 to 26 over the study period, but the number of motor launches owned declined from 16 to 9. Most of this decrease is due to the competition from express boats, although the majority of freight still travels by motor launch between Sibu and Kapit.

Small boat ownership in the study area appears to have stayed essentially the same over the last ten years despite an increase in population and income. All sample communities have at least one outboard engine (although some are not in working order), compared with 80% ten years ago. The number of outboards has increased in 60% of the communities, decreased in 30%,

and stayed the same in 10%. The villages with a decrease are mainly just above the rapids, where the express has brought a major increase in safety and a decrease in cost compared to privately-owned motorized longboats. There is now one outboard for every five families, compared to one for every six families ten years ago.

Non-motorized boats were said to have increased in 34% of the villages, decreased in 33%, and stayed the same in 33%. These boats were said to have a shorter life (two years) now that they are battered by express boat waves.

Other transport sector changes affecting the study area include the construction of a road from Sibu to Kuching (the capital of Sarawak). This road now provides a significant transfer point at Durin where passengers from upriver can leave the express and board a bus for Kuching. In the past, it was necessary to take a longer trip by coastal steamer up the coast from the Rajang River mouth.

Air travel has increased slightly as there is regular biweekly service from Sibu to Kapit and less frequent service to the landing field south of Belaga. This service is expensive and appears not to be competitive with river transport. A flying doctor medical service is based from Kapit, which has increased the speed of medical care for serious accidents or illnesses.

C.3. Related Investments

C.3.a. Agriculture and Livestock. There is an active agricultural extension service in the study area that provides subsidies for certain crops and selects participants for subsidy schemes. The principal subsidy schemes in the project area are for rubber planting (RPS) and paddy planting (APPS). However, there are others in support of fruit trees, coffee, maize, groundnuts, and pepper. In these schemes an extension agent inspects each site to ensure that it has the right soils, slope, and drainage and is readily accessible. After clearing, the Department of Agriculture will provide subsidies in the form of seeds, cuttings or seedlings, and fertilizer as an incentive to planting. Continued provision of these inputs depends on whether the plot is adequately maintained.

Most subsidy schemes are available only to a few farmers. They are intended to act as demonstration farms that will encourage imitation by other farmers who would buy their own inputs. No detailed data are available on participation in subsidy schemes. The participation rate appears to be higher in downstream areas and lower in the upstream areas, where extension services are less active and have lower budgets.

C.3.b. Fishing, Hunting, and Gathering. There have been substantial investments in floating cold stores since 1970 in the upstream areas of the Rajang and some on the Balleh and other tributaries to support the fish and game export business. Other trade in forest products has not required any investment.

The upriver cold stores are two to three cubic meters that are run by gasoline motors. These motors are also used for running rice mills in 90% of the cases. In addition, the jetty that supports the cold store is used as a landing stage for the shop-keeper-trader. Thus, the actual investment for the cold store alone is less than the M$3,500-M$4,000 investment for the jetty, rice mill, and cold store together. If M$1,500 is the allocated investment for the cold store, then the 20 to 25 cold stores on the river represents an investment of M$30,000-M$37,500 in the study area, in addition to more expensive cold store facilities in Kapit and Sibu. Total investment in cold stores since 1970 has probably been M$100-M$150,000.

As far as the study team could determine, there are no subsidies associated with hunting, fishing, and gathering activities. About 30% of the study area population participates in fishing, hunting or gathering for commercial purposes.

C.3.c. Wood products. Song Logging investment at Ng. Bawai was estimated to have M$2-M$3 million in sawmill equipment, M$10 million in trucks and tractors, and M$4 million in inventories of spare parts for this equipment. This totals M$16-M$17 million. Assuming that Song Logging represents 40% of total wood industry investment in the study area, this indicates a total investment level of M$40-M$45 million in this industry. Assuming that the number of jobs is a direct function of investment, logging and sawmill operations employ about 1,000 persons in the study area. Of these (mostly unskilled workers), 25% are recruited from villages in the study area, the remainder coming from Sibu.

C.3.d. Manufacturing and Primary Processing. Investment in either rice mills or smokehouses is small (M$500-M$1,000). Total investment in these operations only amounts to between M$15,000 and M$30,000 in the study area. Total employment is insignificant (30-50 jobs) and is limited to family members.

C.3.e. Commercial Activity. Investment in commercial enterprises during the project period was significant, particularly in the upstream stretch above Kapit, which has experienced expanded commercial activity principally in the last six years following the introduction of express service upstream. As shown in the following table, the number of village shops in the sample grew by 400% over the project period, urban shops grew by 25%, and all shops together grew by 130% over the ten-year period. Additional investment was made as existing shops expanded their inventory.

Investment in the shop structures has been estimated by the Consultants as roughly equal to two year sales, and investment in inventory is estimated at one-third of annual sales for new shops and one-twelfth of annual sales for pre-project shops. This amounts to approximately M$3,200,000 in the ten-year period.

The number of new jobs created by this investment was approximately 60 in the survey sample. Assuming that the sample represents 15% of employment in the study area, an estimated increase in study area employment of approximately 400 jobs results.

SUMMARY OF SAMPLE CHANGES 1966-1976

Business Type	Number of Shops			Employment		Annual Sales (000 M$)	
	Total	Pre-project	New	Total	Average	Total	Average
Village Shop	18	3	15	39	1.6	222	12
Urban Shop	15	12	3	44	2.9	584	39
Wholesale/ Retail	2	1	1	21	10.5	1,500	750
Tailor or Clothing	3	1	2	4	1.3	10	3
Restaurant	1	-	1	2	2.0	20[1]	20[1]
Total	39	17	22	110	2.9	2,236	60

[1]Estimated by Consultants.

D. BEHAVIORAL RESPONSES TO TRANSPORT SECTOR CHANGE

This section examines changes in behavior over the project period, which may be at least partly attributed to the impact of the study project. Behavioral change is examined in seven areas: production, consumption, travel, migration, service utilization, social participation, and communications. The analysis is based primarily on the household survey data.

D.1. Production Changes

D.1.a. Change in Cropping Patterns. Eleven respondents (8% of the sample) had no farm either now or before the study project. Twenty more (14%) had begun farming during the study period. There were no respondents who had stopped farming during the study period. Of those who were farming before and after, 65% have more cultivated area now than before, 25% have less, and 10% have kept the same over the study period. In general, there seems to have been a slight movement in the direction of more farms and expanding cultivated area.

The only crop that was introduced into the study area during the project period was cocoa. Even coffee was present ten years ago, though in very small amounts. Pepper, fruits, irrigated rice, and high-yielding rubber are the crops that have made the greatest percentage gains over the study period. Table 2.7 shows the number and percentage of farm respondents who have increased or decreased the area devoted to each crop.

Production patterns for rainfed rice have remained relatively stable. A substantial number of producers have decreased their acreage in rainfed rice, mostly as a result of a shift to irrigated rice. Almost three-quarters of all irrigated rice producers started or expanded their acreage of this crop during the project period (see Table 2.8).

Cultivation of other subsistence crops (maize, cassava, and sago) has also remained basically stable with a slight overall increase reflecting the addition of new farms. A significant number of former maize producers have abandoned this crop, again because of a shift into irrigated rice. Cultivation of coconuts, vegetables, and fish ponds has increased on the average, but there has also been a relatively high abandonment rate for the latter two.

TABLE 2.7

CHANGE IN PRODUCTION PATTERNS BY CROP
OVER THE STUDY PERIOD
(Number and Percentage of Farm Households)

Crop	Started		Increased		No Change		Decreased		Stopped	
	No.	%	No.	%	No.	%	No.	%	No.	%
Irrigated rice	33	25%	4	3%	6	5%	5	4%	2	2%
Rainfed rice	16	12%	13	10%	38	29%	33	25%	5	4%
Maize	15	11%	6	5%	35	27%	16	12%	1	1%
Cassava	6	5%	5	4%	22	17%	5	4%	-	-
Coconut	7	5%	-	-	5	4%	-	-	-	-
Sago	8	6%	1	1%	10	8%	1	1%	-	-
Fish (ponds)	4	3%	-	-	1	1%	-	-	2	2%
Vegetables	13	10%	-	-	8	6%	2	2%	5	4%
Fruits	30	23%	12	9%	26	20%	-	-	2	2%
Pepper	48	37%	5	4%	3	2%	1	1%	1	1%
HYV rubber	38	29%	1	17.	16	12%	1	1%	1	1%
Local rubber	20	15%	8	6%	65	50%	4	3%	4	3%
Cocoa	3	2%	-	-	-	-	-	-	-	-
Coffee	9	7%	2	2%	1	1%	-	-	-	-
All crops	20	15%	72	55%	10	8%	28	22%	0	0%

Source: Household Survey

TABLE 2.8

PERCENTAGE OF PRODUCERS MAKING CULTIVATION CHANGES

Crop	Started or Increased		No Change		Decreased or Stopped		Total Producers
	No.	%	No.	%	No.	%	No.
Irrigated rice	37	74%	6	12%	7	14%	50
Rainfed rice	29	28%	38	36%	38	36%	105
Maize	21	29%	35	48%	17	23%	73
Cassava	11	29%	22	58%	5	13%	38
Coconut	7	56%	5	42%	0	0%	12
go	9	45%	10	50%	1	5%	20
Fish (ponds)	4	57%	1	14%	2	29%	7
Vegetables	13	46%	8	29%	7	25%	28
Fruits	42	60%	26	37%	2	3%	70
Pepper	53	91%	3	5%	2	3%	58
HYV rubber	39	68%	16	28%	2	4%	57
Local rubber	28	28%	65	64%	8	8%	101
Cocoa	3	100%	0	0%	0	0%	3
Coffee	11	92%	1	8%	0	0%	12

Source: Household Survey

Fruits are grown as both food and cash crops, and their cultivation increased significantly over the project period. Prior to the introduction of the express boat service, fruits were not a viable cash crop in the project area. Much of the increase can therefore be attributed directly to the transport improvement.

Pepper has had the highest growth rate of all, with over 90% of pepper producers starting or expanding their pepper plantations during the project period. Part of the incentive has been a highly favorable price structure, but the increase can also be attributed to transport change in two ways: (1) highly perishable pepper seedlings are brought into the project area by express boat and (2) the agricultural extension service, using its own boats, has brought the knowledge and inputs needed to enable project area farmers to participate in government schemes to promote pepper planting. Since pepper is a relatively high-technology crop and inputs are difficult to obtain except through government channels, this intervention has been crucial to the growth of pepper production in the project area.

Area planted in rubber has also expanded, with most of the growth attributable to planting of high-yielding varieties. Local rubber is the most stable of crops, with 65% of producers showing no change over the project period. Much of the mature rubber has not been tapped for several years owing to an unfavorable price structure. The increasing use of high-yielding varieties may be partly attributable to extension efforts and subsidy schemes, but the actual production change from year to year appears to be most responsive to price changes.

Cocoa and coffee are new to the project area, although one respondent had coffee planted before the study project. Despite promotion by the extension service, these crops have been adopted by relatively few farmers. The Consultants data are not sufficient to determine the reasons why some promotions succeed and others fail to achieve their objectives. In any case there does not seem to be a clear relationship between these differences and transport sector change.

D.1.b. Change in Marketing Patterns. By far the most important cash crop in the project area is rubber, with 55% of all farmers currently selling this crop. Pepper is the most rapidly growing cash crop, now sold by 29% of all farmers. Third in importance are fruits and forest products, each sold by 18% of all farmers. Other cash crops include fish (12%), maize (9%), rice (8%), vegetables (5%), and coffee (3%). As previously noted, cocoa has been introduced as a cash crop only recently and has not yet matured to the point of producing for sale.

More than half the producers of irrigated rice have sold some of their production. In contrast, only 3?% of rainfed rice producers have ever sold any rice (see Table 2.9). The pattern of rice commercialization fluctuates over time, reflecting the size of the annual harvest and changing household consumption requirements.

In general the commercialization of rice seems to have been declining over the project period. Respondents attributed the drop to declining soil fertility and the introduction of new insect pestsin the area, resulting in lower crop yields and harvests that are now sufficient only to meet family needs. Data on increasing imports of rice into the study area support this conclusion. This effect can be attributed to the combination of slash-and-burn agriculture with legal restrictions on access to land, which forces farmers to recycle their plots at shorter intervals, decreasing soil fertility and increasing erosion problems.

The pattern of maize commercialization is similar to that for rainfed rice. Only the surplus production is sold, and fewer than 40% of maize producers have ever sold this crop. More producers sold maize in the past than are selling it now. This may be partly due to declining fertility, but is also because of a substantial decline in maize cultivation over the project period (cf. Table 2.7).

Other food crops, such as cassava, sago, and coconuts, have been sold in the past but are less frequently sold now, and more than half of all producers have never sold these crops. Since prices for these food crops are relatively low in relation to volume, it is probable that producers have shifted into more lucrative income - generating activities as markets open up for perishable products such as fish, game, and fruit. Vegetables are more widely commercialized than other food crops, but the pattern of declining commercialization persisted over the projected period.

Fish, fruits, and forest products are generally gathered crops rather than cultivated crops. About 50% of those who produce fish and fruits do so for domestic consumption only. It appears that forest products are more often commercialized, but this may well be the result of under-reporting of domestic consumption in the sample. In fact, almost every family makes some use of forest products in its daily life. The principal forest products sold for cash include rattan, game, wild fruits and nuts, and firewood.

The marketing of fish and fruit appears relatively stable, with about the same number of producers entering the market over

TABLE 2.9

PERCENTAGE OF PRODUCERS MAKING MARKETING CHANGES

Crop	Producers	Never Sold		Sold Before Not Now		Sold Now Not Before		Sold Now and Before	
	No.	No.	%	No.	%	No.	%	No.	%
Irrigated rice	50	23	46%	15	30%	6	12%	6	12%
Rainfed rice	105	71	68%	24	22%	5	5%	5	5%
Maize	73	46	63%	15	21%	6	8%	6	8%
Cassava	38	29	76%	5	13%	4	11%	0	-
Coconut	12	6	50%	4	33%	0	-	2	17%
Sago	20	12	60%	7	35%	1	5%	0	-
Fish[1]	47	24	51%	8	17%	9	19%	6	13%
Vegetables	28	13	46%	9	32%	4	14%	2	8%
Fruits	70	34	49%	12	17%	12	17%	12	17%
Pepper	58	13	22%	7	12%	21	36%	17	29%
Rubber	110	14	13%	25	23%	16	14%	55	50%
Cocoa	3	3	100%	0	-	0	-	0	-
Coffee	12	3	25%	6	50%	1	8%	2	17%
Forest prods.	47	8	17%	16	34%	5	11%	18	38%

[1] Includes both fish ponds and river fishing.

Source: Household Survey

the project period as leaving it. (This apparent stability may mask a geographical shift upstream, as resources have become depleted in the more accessible areas and transport improvements have overcome the barriers to access in more remote areas.) Marketing of forest products distinctly declined over the project period, due to depletion of forest resources within an economically feasible distance of the market.

Pepper, rubber, cocoa, and coffee are cash crops only. Producers who report no sales are those whose plants are still too young to produce a crop -- 100% of cocoa producers, 25% of coffee producers, 22% of pepper producers, and only 5% of rubber producers. Rubber is the most stable of cash crops, having been sold by 50% of producers both before and after the project. However, commercialization (tapping) of rubber experienced a net decline over the project period, attributed by respondents to unfavorable prices.

Pepper sales have grown most rapidly, with 66% of all producers currently selling and 22% more just coming into commercial production. A total of 36% of all producers entered the market during the project period. A few had pepper gardens in the past that failed, probably because of inadequate maintenance and lack of needed inputs.

About 25% of all coffee planters are currently producing for sale. Cocoa is still too new to be on the market. These crops are not yet sufficiently widespread to have a major impact on income patterns.

Rubber, pepper, coffee, and cocoa all require a certain amount of processing before sale. Drying and sorting of pepper, coffee, and cocoa is done by each producing household. Latex is converted into rubber sheets using a mangle, which may be the property of an individual household or of a whole community. Smoking of rubber sheets is usually done by the trader, who purchases them from the producer. In processed form, these crops are non-perishable; thus, their commercialization is not significantly affected by transport change.

Of producers who sold crops both before and after the study project, 68% made no change in the point of sale for each crop, 24% sold crops closer to the farm after the study project and 8% sold crops farther away from the farm after the project. The transport improvement seems to have had the effect of encouraging traders to establish their shops closer to the farm gate rather than permitting farmers to go further afield in search of better prices. To the extent that this is true, of course, the traders are realizing the benefits of transport improvements. In fact, because of competition, the practical

effect has been to extend the geographical range within which crop commercialization is economically feasible for traders.

Crops transported for sale by farmers show an interesting pattern of mode change over the project period:

Mode	Now		Past	
	No.	%	No.	%
Hand carried	36	28%	20	20%
Bicycle	2	2%	2	2%
Canoe	58	45%	61	61%
Motor boat	2	32%	23	23%
Express	9	7%	0	0%
All farmers	130	100%	100	100%

The percentage of farmers who hand carry crops to the point of sale has risen, while the proportion of those using non-motorized boats has declined. Use of motorized longboats has increased somewhat, while the express service now carries a small share of all crops transported for sale. The evidence seems to confirm the view that transport improvements, so far, have benefited mostly traders as far as crop marketing patterns are concerned.

D.1.c. Farm Enterprise Changes. Use of fertilizer was studied for four crops: rubber, rice, pepper, and vegetables. Use of high-yielding varieties was studied for rice (irrigated versus rainfed) and rubber. Only 14% of rubber producers report using fertilizer; 21% of rice producers do so; 64% of pepper producers use fertilizer; and 15% of vegetable producers do so. About 8% of all rubber producers have all or most of their farms in high-yielding varieties; another 28% have about half and half; and the remaining 64% have little or no high-yielding rubber. For rice, about 9% of producers have all their rice land in irrigated rice, another 7% are cultivating approximately the same amounts of irrigated and rainfed rice, and the remaining 84% have little or no irrigated rice.

Of those respondents now using fertilizer for rubber, 80% used more fertilizer ten years ago (when it was given out as part of the rubber subsidy scheme). Many more respondents reported using fertilizer when it was available at no cost through the rubber scheme, but abandoning it afterward. About 10% of those using it now use the same amount as before, and 10% use more than before.

Of those now using fertilizer on rice, 71% were not using it before the study project. The same amount as before is being used by 17% and 8% are using more now than before. Only 4% (one case) of those using fertilizer for rice have used less over the project period.

Of respondents using fertilizer on pepper, 68% did not have the crop at the start of the study period. Another 10% are using more fertilizer now than before. The remaining 22% are using the same amount as before. No respondents report decreasing the amount of fertilizer used on pepper.

The amounts of fertilizer used on vegetables did not change over the project period.

Nearly 60% of all the producers of high-yielding rubber have had this crop for more than ten years. Over 30% planted high-yielding rubber between five and ten years ago, and only 10% have planted it in the last five years. The pattern is reversed for irrigated rice; over half of the producers started irrigated rice during the last five years, about 30% started during the preceding five years, and 18% were planting irrigated rice before the study project began.

About 20% of respondents who were farming in the study area both before and after the project reported shifting the site of their farm operations to make it more accessible to markets. An increase in the production of crops for sale was reported by 60% and 66% reported adding new crops during the study period. About 22% experienced an increase in livestock inventories, while only 6% added storage facilities to their enterprise. Irrigation improvements, including the planting of irrigated rice and drainage ditching for pepper plants, were reported by 12%.

The overall picture of farm enterprise change seems to be closely associated with subsidy schemes, both through direct participation and through diffusion. Very few farm enterprise changes have been made that were not originally suggested by the government. Response to government initiatives is, however, conditioned by prices and other factors, such as the availability of inputs and the amount of labor required. Transport change has had a short-term impact by making it feasible to commercialize local products such as fish, fruit, and game, but these resources (except fruit) are rapidly depleted. Commercial production of perishable crops such as vegetables, livestock, and dairy products has not been greatly stimulated by the transport improvement in the project area.

D.2. Consumption Changes

The Consultants collected relatively little data on changes in consumption patterns, since this kind of information is difficult to reconstruct with confidence through respondent recall. The major data source was the change in household assets over the study period.

Table 2.10 shows the percentage of respondents owning various types of household assets and the length of time they have been owned. Radios and sewing machines are the most common household assets (owned by about half of all households), with zinc roofs and outboard engines following closely behind (owned by about a third of all households). Shotguns, chain saws, and pesticide sprayers are also found in a smaller proportion of households.

Bicycles were found only in urban communities and on the former rubber estate. A fair proportion (about 15%) of indigenous households in the impact zone benefited from gravity-feed water supply installations, but generator-powered water pumps were found only in Chinese farming and urban communities. Generators also provided household electricity and power to operate rice mills in two cases. The only households benefiting from a public power supply were those in the Malay kampong.

Electricity, rice mills, and shotguns were generally acquired prior to the project period. The acquisition of zinc roofs, rubber mangles, and sewing machines began well before the project period and continued throughout it at a relatively stable pace. The items that have shown really rapid growth since the transport investment include radios, bicycles, outboard engines, sprayers, and chain saws. Of these, all but the outboard engines have grown exponentially, with the major part of the increase coming in the last five years.

In contrast, the acquisition of outboard engines followed a parabolic pattern, peaking in the period just after the transport investment was made. The recent decline in the acquisition and operation of outboards (as well as in their maintenance and repair) is attributed by respondents first to the current high cost of fuel and second to the greater convenience, reliability, and economies of scale offered by competing transport options such as the express boats.

It is difficult to attribute any change in the pattern of ownership of household assets to increased prosperity resulting from transport investments, except perhaps for radios and bicycles. (The acquisition of bicycles is almost certainly related to the paving of urban streets and the construction of bridges and footpaths, types of transport investment made during the study period

TABLE 2.10

CHANGE IN HOUSEHOLD ASSETS

Type	Owners		Length of Time					
	No.	% of Respondents	Less than 5 Years		5 to 10 Years		More than 10 Years	
Zinc roof	50	35%	18	36%	20	40%	12	24%
Radio	63	45%	36	57%	20	32%	7	11%
Bicycle	13	9%	7	54%	4	31%	2	15%
Motorcycle	1	1%	1	100%	0	-	0	-
Outboard engine	43	30%	18	42%	21	49%	4	9%
Rubber mangle	4	3%	1	25%	1	25%	2	50%
Sprayer	14	10%	10	71%	3	21%	1	7%
Chain saw	13	9%	12	92%	1	8%	0	-
Rice mill	2	1%	0	-	0	-	2	100%
Other farm machinery	2	1%	1	50%	0	-	1	50%
Gun	21	15%	0	-	2	10%	19	90%
Sewing or weaving equip.	73	52%	16	22%	32	44%	25	34%
Electricity	8	6%	0	-	1	12%	7	88%
Gravity feed water supply	18	13%	14	78%	4	22%	0	-
Pumped water supply	9	6%	3	33%	6	67%	0	-

Source: Household Survey

that were not considered in this study.) Chain saw ownership is most closely related to the opportunities for wage labor in the timber camps, which are not particularly sensitive to transport change. The striking growth in ownership of pesticide sprayers is directly attributable to the introduction of government schemes in support of commercial agriculture. On the whole, it does not seem that the transport investments under study have made any striking difference in the patterns of household consumption as measured by capital assets.

D.3. Travel

Of the entire population covered by the sample (household heads, spouses, and other household members), the average annual number of trips per capita was 2.2 to the district center, 0.3 to Sibu, and less than 0.1 to Kuching or beyond. (District center trip data exclude residents of Song and Belaga, who live in the district center.) In other words, the typical impact zone resident visits the district center twice yearly, three out of ten residents travel to Sibu once in a year, and less than 10% of the population makes a longer trip in any given year.
About 13% of all household heads did not even visit the district center during the past year, while 28% of their spouses did not make such a trip, and in 36% of all households, no other household member visited the district center.

The average annual trips to different destinations for household heads and spouses are shown in Table 2.11. This table shows that household heads are consistently the most frequent travelers to all destinations. The frequency of travel by spouses approaches that of household heads in inverse proportion to the length of the trip. Over all destinations, spouses travel approximately half as often as household heads, and other household members (mostly children) travel very little in proportion to these two.

Change in travel patterns over the study period is shown in Table 2.12. The most striking increase is in the frequency of trips to the district center; over half of the sample population goes there more frequently now than before. The number of annual trips declined for 14%, and 17% have kept up the same number of trips. Of the 14% that never visited the district center prior to the study project, only 1% did so during the study period.

Trips to Sibu have also increased, but this affects a smaller segment of the population. Over 40% of the population has never been to Sibu, and only 1% started traveling to Sibu since the study project began. Of those who were traveling to Sibu prior to the project period, slightly less than half are now traveling there more often, while 20% are going less often, and the remaining 33% have maintained the same frequency.

TABLE 2.11

AVERAGE ANNUAL TRIPS BY TRAVELER AND DESTINATION

	Head	Spouse
District center	16.6	9.9
Sibu	2.5	1.1
Kuching or beyond	0.3	0.1

TABLE 2.12

CHANGE IN TRIPS BY DESTINATION - ALL TRAVELERS

	More Now than Before	Less Now than Before	Same Now as Before	Same Now, More Before	None Now, None Before
District center	53%	16%	17%	1%	13%
Sibu	27%	12%	19%	1%	41%
Kuching or beyond	3%	3%	11%	2%	81%

CHANGE IN TRIPS BY TRAVELER - ALL DESTINATIONS

	More Now than Before	Less Now than Before	Same Now as Before	Same Now, More Before	None Now, None Before
Heads	33%	14%	16%	1%	36%
Spouses	21%	11%	16%	2%	50%
Others	28%	6%	16%	1%	50%

Source: Household Survey

There has been relatively little change over the project period in travel to Kuching or points farther away. Over 80% of the impact zone population has never traveled this far. Of the remainder, more than half show no change in travel patterns, while the number who have increased their long-distance travel over the study period approximately offsets the number who have decreased it. This implies that long-distance travel is too sporadic and infrequent among the sample population for a significant change to be brought about by a transport improvement such as the study project.

All household members have experienced a slight increase in travel, though the increase is most marked for household heads and least marked for spouses. (The increased mobility of "other household members" may be partly accounted for by children attending school in the district centers.) Still, only a very small share of those who never traveled prior to the study period have begun traveling since the project began. The conclusion is inescapable that transport sector change has benefited primarily those who were already traveling prior to the project and has not induced significant change in travel patterns among the previously non-mobile population.

D.4. Migration

About 60% of all respondents have never moved from their community of origin. Of those who have moved, about 70% moved prior to the project period, while 18% moved between five and ten years ago, and only 12% moved during the last five years. Thus, only 10% of the sample households moved during the project period. (Of course, the sampling procedure excluded households that had moved out of the sample communities during the project period.)

More than half of the moves were made from outside the project area. Many of these moves represent commercial entrepreneurs and government workers coming into the project area in response to new opportunities for employment. Others, however, represent groups of households moving from one longhouse to another, both within and across project area boundaries. Of the moves, 30% were made between districts in the project area and only about 15% were within the same district.

Reasons for moving were varied: about 45% moved for commercial or government employment, 20% to find better land, 18% left to live in their spouse's community, 9% moved to buy land, and 8% moved with their parents when young. Moves made for commercial or government employment or to buy land took place predominantly during the first five years of the study period and originated primarily outside of the study area.

moves made for other reasons show no particular responsiveness to transport sector change. (An apparent decline in the number of respondents moving with their parents is actually an artifact of the sampling process.)

D.5. Service Utilization

Changes in service delivery patterns associated with transport sector change over the study period are discussed in Section B.4 above. The present section concerns changes in the utilization of services by households over the project period. Four types of services are considered: education, health, agricultural extension, and credit.

D.5.a. Education. The household survey shows a very sharp difference in levels of educational attainment between parents and children in the project area. Less than 20% of household heads (usually male) could be considered fully literate (completed four years of primary schooling), and less than 10% of their spouses meet this criterion. In contrast, nearly 61% of their children have an acceptable level of educational attainment (completed four years of primary schooling or the number of years corresponding to their age). 63% of children living away from home (including grown children) meet this standard, while the proportion falls to 60% for children at home. This variation is not significant.

The sample shows evidence of a considerable improvement in the relative position of women over the project period. The percentage of literate adult males is more than twice that of literate adult females, while the percentage of literate male children (67%) is about one and a quarter times of literate female children (53%). The disproportion is less marked for children away from home (61% of females and 65% of males have acceptable levels of education) than for children at home (only 51% of females, though 68% of males, have acceptable levels of education). 28% of all female children and 17% of all male children of school age or above have no education at all.

Among other adults present in the sample households, nearly 60% had no education and 6% had inadequate levels (less than four years of primary schooling). Still, the proportion of literate other adults (34%) is higher than that for household heads and spouses. This is probably attributable to the younger average age of these household members compared to that of household heads and spouses. (A total of 31% of other household members were between the ages of 15 and 25, while only 7% of household heads and 11% of spouses were in this age group.)

Of children over six years old living at home, 59% were in school, 29% worked on the family farm, 3% had non-farm jobs, and 9% were unemployed. (Children away from home attending school were counted as children at home for this purpose.) Of those living away from, 42% worked on farms, 20% had non-farm rural jobs, (such as working in a timber camp), 25% had non-farm urban jobs, and 13% were unemployed (including housewives).

Children presently in school were divided between those who had adequate (72%) and inadequate (28%) levels of achievement for their ages. Only half (50%) of children working on farms had an adequate basic education. More than adequate educational levels were highly associated with non-farm jobs and, among children living away from home, with urban residence.

Among other adults living in sample households, 87% worked on the family farm, 2% had non-farm jobs, and 11% had no employment. About a third of these (in each employment category) had adequate or more than adequate levels of education. The increasing numbers of literate young adults living at home, including children, indicates a potential for more rapid rates of change in regional production patterns in the future.

D.5.b Health. Every household in the sample reported making at least one visit per capita for health care during the past year. Nearly 75% of the sample households reported between one and five health care visits per capita, while 16% made between five and ten visits and 11% made more than ten visits per capita. Health care was available at a distance of less than 1 kilometer to 37% of households (through the visits of traveling dispensaries to longhouses), and within 5 kilometers for 58% of households (including those living in market towns). Of the households, 24% were between 5 kilometers and 10 kilometers from a health care delivery point, and 18% had to travel 10 kilometers or more to obtain health care.

The frequency of annual visits for health care definitely increases in inverse proportion to the amount of travel required. Health care services are within a kilometer of 33% of those making one to five visits per capita, 45% of those making from five to ten visits, and 67% of those making more than ten visits. More frequent visits (five to ten per capita) remain high for distances up to 10 kilometers, but they drop off sharply thereafter. More than ten visits per capita are rarely made away from the village, with the exception of three Chinese households in the lower part of the study area seeking specialized medical care in Sibu.

Of all households 57% make more visits for health care now than they did ten years ago, 25% have experienced no change, and 20% make fewer visits now. The percentage of respondents making more visits now declines with increasing distance to the health care delivery point. Those whose pattern is unchanged over the study period are predominantly those for whom health care is more than 10 kilometers away, although a fair share of unchanged patterns is also found among those who have health care available within 1 kilometer. A decline in health care utilization is found principally among those for whom health care facilities are either within 1 kilometer or between 5 kilometers and 10 kilometers away.

The two major reasons given for making more use of health care now were greater incidence of illness (45%) and greater availability of services (40%). There are no objective data with which to test the perception of more illness now, but it seems to be related to life cycle patterns, that is, present household heads are likely to be experiencing more responsibility for dealing with sickness (aged parents, more children) than they were ten years ago. The perception may also be partly due to the dissemination of medical information by health care personnel, calling attention to treatable diseases that were previously considered part of the natural condition of life.

Among those who make fewer visits now, less sickness is the most common reason (48%). This is attributed by 20% of respondents to the preventive care provided by the available services, but life cycle reasons account for most of the answers. Of the respondents making fewer visits, 14% now claim they can no longer afford medical services, and one respondent makes fewer visits now because the traveling dispensary no longer comes to his longhouse and he must travel farther for medical care now than before.

Another way of looking at the change in health care utilization over the project period is to analyze changes in the conditions under which children are born. Table 2.13 shows the number of percentage of children included in the sample population by age group and place of birth. Of the nearly 500 children represented by the sample population, 56% were born at home in the traditional manner, 18% were born at home with a midwife attending, 17% were born at health care centers, and 8% were born in hospitals.

The percentage of children born at home has shown a steady decline over time, from 100% 25 years ago to 66% today. The intervention of midwives in home births rose steadily until the last five years, when it showed a sharp decline. As a result, the percentage of traditional home births rose during the same period. The decline of midwife attendance at home births may be related to the rapid growth of health centers as places for giving birth during the second half of the project period. The percentage of children born in hospitals remains small and declined slightly over the project period.

TABLE 2.13

CHANGE IN PLACE OF CHILDBIRTH

	Home - Traditional		Home - Midwife		Health Center		Hospital	
	No.	%	No.	%	No.	%	No.	%
Present Age of Child								
Under 5 years	48	52%	13	14%	24	26%	7	8%
5 to 10 years	52	45%	28	25%	22	19%	13	11%
10 to 15 years	52	48%	22	20%	22	20%	13	12%
15 to 25 years	64	61%	16	15%	17	16%	8	8%
Over 25 years	58	87%	9	13%	0	-	0	-

It would seem that effects of transport on health care in childbirth took place in two stages. During the first half of the project period (five to ten years ago), improved mobility resulted in midwives attending home delivery in significantly more cases than before. In the second half of the project period, construction of fixed facilities increased the opportunity to deliver children away from home but had the effect of withdrawing re-

sources from services delivered in the home. Thus, for those for whom access to fixed facilities presents a major barrier to health care utilization, the net effect has been negative in the long run.

D.5.c. Extension. Of the presently farming households, 32% report that their farms were never visited by the agricultural extension service during the past year. One visit during the past year was reported by 14% and 54% said they were visited two or more times. A total of 56% of respondents reported that agricultural meetings were held in their communities. Where such meetings were held, 83% of household heads reported regular attendance and 17% reported occasional attendance.

Of those respondents farming both now and prior to the study project, 43% reported receiving more visits from the agricultural extension service now than they did two years ago. The frequency of extension visits has not changed for 40% of farming households, and 17% have never been visited by the agricultural extension service. These data generally support the contention that agricultural service delivery has been significantly increased as a result of transport improvement.

D.5.d. Credit. Credit programs or subsidy schemes were participated in by 33% of farming respondents during the past year. Of those who did not receive subsidies, about half applied but were turned down and the other half never applied.

In addition to subsidy schemes, respondents occasionally borrowed from local merchants (13%) and relatives (2%). Credit obtained from local merchants was used for farm investments in only 32% of cases, but funds borrowed from relatives were used for farm investments 67% of the time.

Of all respondents,63% claim that they have never borrowed money for farm use. Of those who have borrowed, 33% began borrowing before the study project, 27% began borrowing during the first five years of the study period, and 40% began borrowing during the last five years. The first source of credit was the subsidy scheme in 73% of cases, local merchants in 18% of cases, relatives in 4% of cases, a private money lender in one case, and a combination of sources in two cases.

The data indicate a steady growth in credit use, largely associated with the penetration of subsidy schemes into the project area, over the project period. Other forms of credit use are relatively unaffected by transport improvements. There is still no commercial bank in the project area. The data also indicate a greater willingness to make use of credit in the form of subsidy schemes than the available resources can supply. It is possible

that the use of informal credit sources is significantly under-reported in the sample.

D.6. Social Participation

Changes in patterns of social participation were studied by looking at participation in farm organizations and attendance at agricultural training programs. While these changes do not begin to cover the range of possible consequences associated with transport improvement, they may be indicative of change in regional growth potential to the extent that it depends on agricultural productivity. Within the framework of this study, it was not possible to examine in detail changes in affiliation and attendance for religious groups, political clubs, ethnic associations, and other types of social organizations found in the project area.

In fact, the Consultants found that farm organizations were practically nonexistent in the study area. A total of 92% of household heads and 98% of their spouses have never belonged to such an organization. Those who do participate all date their activity as beginning between five and ten years ago, in other words, from the first years of the project period, when farming organizations began to appear in Kanowit District.

During the past year, 75% of farming households did not attend an agricultural training course. One course was attended by a member of 25% of households, and one household reported attendance at two or more courses. Since these courses are held at Agricultural Training Centers located some distance from the participants' farms, transport might be considered a major barrier to such participation. However, the data indicate that attendance at agricultural training courses is unchanged over the project period for 96% of households, while it is more frequent now than before for only 1% of households and is less frequent for 3% of households. Clearly, transport improvement has not provided a significant incentive for change in social participation of this type.

D.7. Communications

Relatively little data have been gathered to indicate the extent of communications change in the project area at the household level. Aggregate data on communications change at the district level are discussed in Section B.3.g. The two pieces of information obtainable from the household survey that may be used as proxies for communications change are literacy and radio ownership.

The survey does not give a direct measure of change in literacy levels over the project period. It does, however, permit an analysis of present literacy levels by age group. Upon combining

data for household heads, spouses, and other household members, it appears that 15% of adults in the project area could be considered as literate. The rate is 50% in the under-25 age group, 14% in the group from 25 to 44, 6% in the 45 to 64 age group, and 33% (3 of 9 cases) of those over 65. Combining data for all children over 6, both at home and away from home, shows that the average rate of adequate education is 65% for those under 10, 58% for those between 10 and 20, and 55% for those over 20. These data clearly show a sharp increase in literacy for those educated during the project period (presently aged up to 25 years).

Radio ownership expanded considerably over the project period, from 5% of households prior to the project to 45% today. The impact of this change on communications is considerably greater than these data seem to indicate, for radio broadcasts are listened to by friends, relatives, and neighbors as well as by those owning radios. One or two radios in a longhouse are sufficient to change the level and type of communications reaching almost every family in that longhouse. This "spread effect" is somewhat reduced in communities consisting of separate single-family homes, but even here the social norms are such that most people can hear radio broadcasts if they so desire. (Also, such communities are more likely to have radios in almost every household.)

Written means of communication, including mail and newspapers, are available in the market towns and farming communities but not, generally speaking, in the longhouses. Posters, films, and other government information services do reach the longhouses occasionally; for example, visual messages concerning public health precautions were displayed in several of the longhouses the Consultants visited. Oral communication is still the most common method, however, and carries the credibility of a traditional mode when used to convey government messages to the longhouse population. An interesting point to pursue in future extensions of this study would be the degree to which information on specific points of interest to the government has been successfully disseminated among the project area population.

E. IMPACTS ON INCOME DISTRIBUTION

This section examines the socioeconomic composition of the project area population as revealed by the household surveys and describes the characteristics of different socioeconomic groups. Changes in the socioeconomic composition of the population over the project period are then determined. Finally, the incidence of income-related impacts of the transport investment is analyzed by socioeconomic group.

E.1. Composition of Socioeconomic Groups

Of the household survey sample, 31% were classified as subsistence farmers (that is, farmers whose cash sales of farm products are no more than half the total value of farm production and who have no outside source of income). The average household income found for this group was M$825.7, or about U.S.$344. The average household size was 6.2, very close to the sample mean. The corresponding per capita income was M$155.9, or about U.S.$65. The typical subsistence farmer owned slightly over 6 hectares. In no case did subsistence farmers rent or sharecrop land, nor did they have wage labor income.

Low-income cash cropping farmers were defined as those with a household income of under U.S.$300 who nevertheless derived more than half of their income from cash sales of crops and who had no other source of income than the farm. Only 8% of the sample fell into this category. The average household income for this group was M$416.2, or about U.S.$173. The average household size of 6.6 is well above the sample mean, leading to a very low per capita income of M$65.9, or U.S. $27.46. These farmers own significantly smaller amounts of land (4.8 hectares on the average) and cultivate even less (2.7 hectares). They do not rent or sharecrop land nor do they earn outside income.

The category of "high income farmers," that is, cash cropping farmers with household incomes over U.S.$300, accounted for 26% of the sample. The mean value of household income for this group is M$2680.3, or about U.S.$1118. Even with a relatively high average household size of 6.5, this group generates a per capita income of M$485.3, or U.S.$202.21. A large amount of land is owned (9.5 hectares on the average) and partly cultivated (7.3 hectares). Renting, sharecropping, and wage labor income are not found in this group.

Respondents who have farms but who also have outside income sources, and who sell less than half of the value of their farm produce, made up 9% of the sample. The average farm income

reported for this group is M$1,345.3, or about U.S.$560. The average household size is 6.3, corresponding to a per capita income of M$239.4, or about U.S.$100 from the farm. The amount of land owned is relatively large (9.1 hectares on the average) and is mostly cultivated (8.4 hectares). One case (8% of this group) was a sharecropper rather than a landowner; he was producing pepper on land rented for a small share of the production per vine. No wage labor income was found in this group; outside income was from such sources as trading, government jobs, and private business.

Cash cropping farmers with non-farm income sources made up 14% of the sample. Their average farm income was even greater than that of the preceding group: M$3,168.4, or about U.S.$1,320 per household. This group also had the largest household size (7.0), resulting in a per capita farm income of M$387.4 (U.S.$161.42). It had the largest average farm size (11.9 hectares) and the largest share of area cultivated (11.4 hectares). Two households (10%) were sharecropping land in addition (in one case) to owning land. Wage labor did not provide income for any of these households.

Farm laborers (4% of the sample) had the smallest average household size (4.2) and slightly under average household incomes (M$1,187.6, or about U.S.$495), resulting in a per capita income very close to the sample mean (M$261.8, or U.S. $109). Of these respondents, 60% owned some land (1.1 hectare on the average) and 80% were sharecroppers (including rubber tappers). None of them received cash wages for his labor; all were paid in crops.

Non-farm laborers also constituted 4% of the sample. Their average household size was 5.2, more than for farm laborers but still well under the sample mean. Wage income was reported for 60% of these households averaging M$1,300 (U.S.$542) per household, or M$162.5 (U.S.$68) per capita. Given that these respondents had no farms to produce food for their own consumption, their standard of living is very close to that of the average subsistence farmer.

Finally, 4% of the sample consists of respondents with no farms but with sources of income such as trading or industry. The average household size for this group (6.0) differs only slightly from the sample mean. No income data are available from our survey for this group.

E.2. Characteristics of Socioeconomic Groups

E.2.a. Demographic Characteristics. The most striking difference among socioeconomic groups with respect to age is that non-farm laborers are disproportionately frequent in the youngest age groups (15 to 25) and that both cash cropping farmers

with non-farm income and non-farm households with other sources of income are disproportionately represented in the oldest age groups (over 65). Subsistence farmers tend to be younger, on the average, than cash cropping farmers, suggesting that the addition of cash crops to the farm enterprise is usually undertaken after production to meet household needs is assured by skill and experience. On the other hand, low-income farmers and food farmers with non-farm income are more prevalent in the older age group (45-65) than are the high-income farmers and cash croppers with non-farm income, indicating that innovation in income-generating agricultural activities is more likely to take place among young farmers (age 25 to 45).

All farmers with no outside source of income are more likely to have inadequate levels of education than are those with other income sources. Surprisingly, food farmers with other income sources and landless laborers have among the highest rates of illiteracy, though the former are more likely to have had at least some exposure to education. Non-farm laborers and those with other non-farm income have at least a little education and represent a higher than average proportion of literates. High-income cash cropping farmers with non-farm income divided between those with no education (about the same proportion as for the total sample) and those with more than adequate education. These data suggest that exposure to education is related more to non-farm employment than it is to successful farming in the project area.

E.2.b. Travel Patterns. Trips to the district center are made most frequently by households whose principal source of income is non-farm. This includes food farmers with non-farm income, non-farm laborers, and other non-farm workers. Cash cropping farmers with non-farm income and farm laborers are the next most frequent travelers to the district center, while farmers who do not have outside income travel less frequently and low-income farmers travel least of all.

There is relatively little variation among socioeconomic groups in the propensity to travel over longer distances. Non-farm laborers and cash cropping farmers with non-farm income are most likely to have visited the regional center, Sibu, while subsistence farmers and low-income farmers are least likely to have done so. High-income farmers and, for reasons probably relating to ethnicity, landless laborers are most likely to have traveled farther away, while subsistence farmers, low-income farmers, and non-farm urban households are least likely to have done so.

E.2.c. Sources of Income. Of all subsistence farmers, 34% have additional cash income from fishing, hunting, and gathering forest products. About 11% have income from seasonal farm work,

and 2% earn money (one case) from the sale of craft products. Low-income cash-cropping farmers have outside income only from fishing, hunting, and gathering (58% of this group); high-income farmers are also active in this area (46%) as well as in seasonal farm labor (16%) and sale of craft products (3% -- one case).

Farmers with non-farm income naturally show a greater diversity of income sources. Those who sell less than half of their farm produce are most likely to have salaries (46%) or support from children (31%), but they may also have income from non-farm labor (8% -- one case), a pension (8% -- one case), or private business (8% -- one case). In addition, such households often have other income sources in the agricultural sector: fishing, hunting, and gathering (31%) or sale of crafts (8% -- one case).

Cash cropping farmers with other income sources have the greatest diversity of all groups. 65% receive support from children, 20% have income from a private business, 20% have income from non-farm labor, 15% from fishing, hunting and gathering, 5% (one case) from crafts, 5% (one case) from a salary, and 10% from pensions.

Among respondents without farms, few income sources are found other than the principal occupation. One case (20%) of landless farm laborers has income from fishing, hunting, and gathering. One case (20%) of non-farm laborers receives support from children. Of those with other non-farm sources, one case (20%) reports the source of income as a salaried job and 80% as a private business.

E.2.d. Tenure class. Among subsistence farmers, 98% are owner-operators only and 2% (one case) is both an owner-operator and a farm laborer. Owner-operators only comprise 92% of low-income cash cropping farmers and 89% of high-income cash cropping farmers. One low-income farmer is a renter (sharecropper) and so are two high-income farmers. In addition, one high-income farmer combines the roles of owner-operator and landlord, while another combines those of owner-operator and renter.

Those with non-farm income sources are also predominantly owner-operators: 92% in the case of food farmers and 90% in the case of cash cropping farmers. One case in each class is a renter, and one cash cropping farmer is also a landlord. Farm laborers may be owners (40%) or sharecroppers (60%). Non-farm laborers and other non-farm households, by definition, have no farms.

E.2.e. Production Patterns. Table 2.14 shows the percentage of farmers in each socioeconomic group who produce each crop considered in this study. Rainfed rice is the most common crop, produced by nearly all farmers without outside income and by a substantial share of farmers with outside income. It is most likely to be produced by subsistence farmers and least likely to be produced by farm laborers. In contrast, irrigated rice is least likely to be produced by subsistence or low income farmers and most likely to be produced by farm laborers.

Maize, cassava, coconuts, and sago are produced by all socioeconomic groups except farm laborers. Maize is planted by over half of all households with no non-farm source of income but by less than half of those with non-farm income. Low-income farmers and cash cropping farmers with non-farm income are least likely to have other food crops, subsistence farmers are in the middle range, and high-income farmers and food farmers with non-farm income are most likely to have other food crops in addition to rice. Fish pond production is limited to the latter group.

Vegetables and fruits are generally cultivated by all socioeconomic groups. Low-income farmers do not have vegetables and have the lowest percentage of fruit producers. Farm laborers, on the other hand, do not produce fruits and have the lowest percentage of vegetable producers. In the other groups, vegetable production is fairly constant at 15% - 25% of households. Fruit production is more common among high-income households (71%) than in the other groups (around 50%).

Local rubber is the only cash crop cultivated by farm laborers (that is, rubber tappers). After rice, rubber is the most common crop in all income groups. Many producers have both local and high-yielding varieties. Use of high-yielding rubber affects about 50% of all farm households except for low-income households, where the share drops to 25%.

Pepper is popular in all farming groups, with participation ranging from 36% (subsistence farmers) to 55% (high-income farmers and cash croppers with non-farm income). The data suggest that pepper cultivation may be partly a function of cash income, including non-farm income but excluding domestic consumption. Cocoa and coffee are cultivated exclusively by high-income farmers and those with non-farm income sources.

E.2.f. Marketing Patterns. Table 2.15 shows the percentage of producers in each group who sell some of their production by crop. Rice is only infrequently commercialized, by about 10% of producers. Subsistence farmers are less likely than others to sell rice, and low-income farmers and farm laborers do not do so at all. (Low-income households selling rice are really paying for a storage service, since they must buy it back in times of shortage.)

TABLE 2. 14

PRODUCTION PATTERNS BY FARMING GROUP
(PERCENTAGE OF HOUSEHOLDS PLANTING EACH CROP)

Crop	Socioeconomic Group					
	1	2	3	4	5	6
Irrigated rice	27	25	41	38	50	60
Rainfed rice	91	75	84	69	45	40
Maize	64	67	59	46	30	0
Cassava	34	8	38	38	15	0
Coconuts	5	0	14	23	10	0
Sago	11	8	27	8	15	0
Fish ponds	0	0	11	8	0	0
Vegetables	23	0	19	15	15	20
Fruits	48	25	71	54	50	0
Pepper	36	42	55	38	55	0
Rubber	41	25	49	54	50	0
Local rubber	77	58	92	54	70	20
Cocoa	0	0	3	15	0	0
Coffee	0	0	22	15	10	0

Key:
1 = Subsistence farmers
2 = Low-income cash cropping farmers
3 = High-income cash cropping farmers
4 = Food farmers with nonfarm income
5 = Cash cropping farmers with non-farm income
6 = Farm laborers

Source: Household Survey

TABLE 2.15

MARKETING PATTERNS BY FARMING GROUP
(PERCENTAGE OF PRODUCERS SELLING EACH CROP)

Crop	Socioeconomic Group					
	1	2	3	4	5	6
Irrigated rice	8	0	13	0	0	0
Rainfed rice	3	11	10	11	11	0
Maize	4	13	14	25	17	b
Cassava	0	0	0	0	0	b
Coconuts	0	b	20	50	0	b
Sago	0	0	0	0	0	b
Vegetables	80	b	71	100	67	100
Fruits	29	67	73	43	60	b
Pepper	44	60	75	20	82	b
Rubber	45	60	80	40	50	0
Coffee	b	b	25	50	50	b
Cocoa	b	b	0	0	b	b
Fish [a]	18	0	38	31	0	0
Forest products [a]	14	42	54	15	25	20
Craft products [a]	7	0	5	0	10	20

a Percent of all households
b No production

Source: Household Survey

Maize is marketed only slightly more often than rice across all producer groups. Cassava and sago are not sold, but coconuts are sold by a few high-income farmers and food farmers with non-farm income. Vegetables are sold by nearly all producers, while fruits are more often sold by cash cropping farmers (60% - 75%) than by food farmers (30% - 40%).

Pepper, rubber, coffee, and cocoa are cash crops only. Producers who do not sell are those whose crops failed to yield a harvest in the past year, usually because they are too young, but sometimes (as in the case of rubber) because the value of the harvest will not justify the labor cost. Rubber tapping in the past year was carried out by only 40% to 60% of potential producers in each socioeconomic group.

Pepper marketing reflects a time differential in participation in pepper planting. 75% of producers in the high-income group and 82% of those in the cash cropping/non-farm income group are marketing pepper now. 60% of low-income pepper planters and 45% of those classified as subsistence farmers are producing for the market, while food farmers with non-farm income have only recently added pepper to their crop mix (only 20% marketing now).

Coffee was first planted by farmers with non-farm income and 50% of these are producing for the market now. High-income farmers also have coffee and 25% are able to market some production. Cocoa is too young to produce and only farmers with non-farm income have planted it so far.

Commercialization of both fish and forest products is highest among the high-income farmers. Food farmers with non-farm income are equally likely to sell fish, and low-income farmers are almost equally likely to sell forest products. Subsistence farmers less often sell either type of product. Forest products are also sold by 15% - 25% of farmers with non-farm income and farm laborers. Sale of craft products is relatively infrequent but it contributes to income for subsistence farmers and farm laborers.

E.2.g. Agricultural Service Delivery and Social Participation. Participation in agricultural organizations is reported by 12% of subsistence farmers, 11% of high-income cash cropping farmers, 8% (one case) of food farmers with non-farm income, and 20% (one case) of farm laborers. Low-income farmers and other groups report no participation. Participation by spouses includes one case each from the groups of subsistence farmers, high-income farmers, and farm laborers.

The agricultural extension service has never visited 45% of subsistence farmers. This proportion drops to 27% for low-income farmers and food farmers with non-farm income and to 18% for high-income farmers. However, 39% of cash cropping farmers with non-farm income have never been visited by the extension service. These figures suggest that non-farm income is, to some extent, used as a substitute for the assistance normally privided by the extension service. This may be true not only with regard to financial assistance and inputs but also with reference to knowledge gained through the channels of communication opened up by a non-farm income source.

When it comes to visiting farms more than once in a year, high-income cash cropping farmers and farms operated by laborers (that is, belonging to landlords) are by far the most frequently visited. All of laborer-operated enterprises and almost three-quarters of high-income farms were visited more than once during the past year, while less than half of the remaining farms were visited this often. Cash cropping farmers with non-farm income were least likely to receive more than one visit (39% of cases).

On the other hand, agricultural training courses are most frequently attended by cash cropping farmers with non-farm income (33%). High-income farmers (29%) and subsistence farmers (26%) are the next most likely to attend, while food farmers with non-farm income have a relatively low rate of participation (18%) and none of the low-income farmers participated in training courses during the past year. Only one household attended more than one course during the past year; this household was in the high-income farming group.

When agricultural meetings are held in the community, 100% of high-income farmers and 100% of food farmers with non-farm income report regular attendance. The share drops to 71% for both subsistence farmers and cash cropping farmers with non-farm income and to 50% for low-income farmers. It seems as though the subjects of agricultural meetings are perceived as being relevant primarily to those in the cash economy, and in particular to those who can expect continued help from the agricultural extension service.

Use of credit (participation in subsidy schemes) is most common among cash cropping farmers with non-farm income (42%). Subsistence farmers (39%) and high-income farmers (33%) also participate. Food farmers with non-farm income (27%) and

farm laborers (20%) are less likely to make use of credit, and low-income farmers have not participated at all.

E.3. Change in Composition of Socioeconomic Groups

It was not possible to reconstruct, with any degree of confidence, the household income levels of ten years ago. Therefore, the Consultants do not have detailed data on the actual change in income levels and income distribution occuring over the project period. Instead, changes in the socioeconomic structure of the project area population and project impact on income distribution will be inferred by looking at qualitative changes in the characteristics defining socioeconomic status and the incidence of behavioral change by socioeconomic groups.

E.3.a. Change in Land Tenure. Out of the entire sample, 82% of households were landholders both before and after the project; 11% did not have land either before or after the project. Only 6% of landholders did not have land before, while only 1% has gone from landholding to a landless condition. The small amount of change in landholdings is well within the range that could be accounted for by life-cycle changes, and this seems to be the explanation in most cases.

E.3.b. Change in Sources of Income. Of all subsistence farmers surveyed, 80% had no other source of income than their farms either now or before the project. The remaining 20% had other income both now and before. Thus, this socioeconomic group has experienced no change over the project period. The same appears to be true of all the other groups.

With respect to non-farm income (excluding income from farm labor, fishing, hunting and gathering, and sale of craft products), 66% of the sample had none either before or after the project and another 16% have such income now but did not have it ten years ago. Of those who had such income in the past, 52% have experienced no change and 48% (9% of the entire sample) report fewer non-farm income sources now than in the past.

The first three socioeconomic groups by definition have no non-farm income now. However, 11% of the subsistence farmers and of the high-income farmers had such income in the past. Low-income farmers have never had such income.

The two groups of farmers with non-farm income are basically split between those whose income sources have not changed over the project period (46% of food farmers, 25% of cash cropping farmers) and those who have such income now but did not ten years ago (54% of food farmers, 65% of cash cropping farmers). The remaining 10% of cash cropping farmers have fewer sources now than ten years ago.

Farm laborers have no non-farm income now; 20% (one case) had such income in the past. Of non-farm laborers (a relatively young group), 40% had no non-farm income ten years ago. Only 20% of other non-farm householders reported a change in non-farm income sources over the project period. In total, about 15% of the sample households acquired a non-farm income source over the study period.

E.4. Distribution of Income Impacts by Socioeconomic Group

The distribution of income impacts will be assessed by examining the incidence of changes in production patterns, marketing patterns, and agricultural innovation (use of fertilizer and high-yielding varieties) by socioeconomic group. The degree to which these impacts are attributable to the transport improvement will be determined by examining the relationship between different types of access change and change in income-related behavior.

E.4.a. Change in Production Patterns. Of subsistence farmers, 48% have expanded their cultivated area over the project period, while 20% have not changed their area, 23% have less cultivated area now than before, and 9% began farming during the project period. In contrast, 50% of low-income cash cropping farmers and 73% of high-income cash cropping farmers expanded their cultivated area over the project period. However, 25% of low-income farmers and 19% of high-income farmers decreased the area cultivated. In each case, only 8% stayed the same over the project period.

Among the farmers with non-farm income, 69% of food farmers but only 45% of cash cropping farmers increased the area cultivated. In addition, 8% of food farmers (one case) and 10% of cash croppers began farming during the study period. The area cultivated by a substantial share (15% of food farmers and 25% of cash croppers) remained the same over the project period, while relatively few (8% of food farmers and 15% of cash croppers) decreased the area cultivated.

Among farm laborers, 20% (one case) began farming during the study period, 20% (one case) expanded the area under cultivation, and 60% worked on less land than before. Non-farm laborers and other non-farm households showed no change over the project period.

Change in area cultivated by crop was correlated with selected measures of access change and socioeconomic change. The results are shown in Tables 95 and 96 (see Appendix volume) In general, the correlations with access change are extremely low. The only significant findings are the following:

1. Increased hill padi production is positively associated with improved village access to markets.

2. Increased maize production is positively associated with village access and is even more strongly associated with improved access between market towns and centers outside the project area.

3. Change in cassava (tapioca) production is positively associated with both village and market access change.

4. Increase in the area devoted to fish ponds is relatively associated with village access improvement.

5. Increase in the area devoted to fruit trees is positively associated with market access improvement.

6. Change in pepper planting is positively associated with household access change.

7. Planting of high-yielding rubber is negatively associated with village access change but positively associated with market access change.

8. Cocoa planting is positively associated with all three types of access change.

9. Coffee planting is positively associated with an improvement in market access.

None of these correlations exceed .25 in magnitude, so the perceived relationships are extremely weak.

As alternate socioeconomic determinants of change in crop production, four indicators were tested: household income, cash income, and age and education of household head. Generally, these indicators yielded equally low correlations. The following findings are statistically significant:

1. Increased production of irrigated rice is positively related to both household income and cash income (.31 in each case) and somewhat less strongly related to age.

2. Increased production of hill padi is positively associated with education, but the correlation is weak (.11).

3. Increased maize production is negatively associated with age, but the correlation is again weak (-.11).

4. Increased coconut production is positively associated with total income (.31) and cash income (.33) and to a lesser extent with age (.14).

5. Change in sago production is negatively associated with age, but the correlation is weak (-.11).

6. Increased area devoted to fruit trees is positively, but weakly, associated with household income (.11).

7. Planting of high-yielding rubber is positively related (.20) to the levels of household income.

8. Expansion of local rubber plantings is positively related to household income (.24) and somewhat less strongly to cash income (.15). It is also related to education of the household head (.13).

9. Coffee planting is positively related (.22) to household income and positively, but weakly (.11), related to cash income.

Despite the weakness of these relationships, they suggest some hypotheses that might merit further study in the project area or elsewhere.

1) Rice. Traditional rice production can perhaps be stimulated by improving village access to markets and household needs. Socioeconomic structures are not a major constraint on this effect. In contrast, irrigated rice production (involving a higher perceived risk) depends more on income levels and is little affected by access change.

2) Other food crops. Both maize and cassava production appear to be somewhat responsive to access change and relatively unrelated to socioeconomic status. Coconuts and sago are unresponsive to access change but are, surprisingly, sensitive to socioeconomic characteristics. Vegetable (and fish pond) production change is not significantly associated with either access change or socioeconomic status, but cultivation of fruits is responsive to market access change and is slightly sensitive to income levels.

3) Cash crops. Pepper cultivation is only slightly responsive to access change and bears no relation to socioeconomic status. Given the high value/low volume characteristics of the pepper crop, it makes sense that household access (one component of which is access to services) makes more difference than village or market access. Income appears to be a significant determinant of the propensity to expand area planted in rubber, while access change has contradictory effects (for high-yielding varieties only). Cocoa appears to be responsive to access change but not to socioeconomic variables, while the reverse is true for coffee. Since coffee planting began before

the project period and cocoa is quite new in the project area, this suggests that access change may provide an initial impetus to production change, which is then sorted out by income groups over the long run.

E.4.b. Change in Marketing Patterns. A similar study was made of the relationship between access change measures and change in the point of sales of crops. The following conclusions can be drawn from this study:

Sales of rice move further away from the farm as village access is improved (.20), but closer to the farm as market access is improved (-.12). A similar pattern holds true for maize commercialization. Sales of cassava and sago show no significant relation to village access change but move closer to the farm with improved market access.

Fish sales are made further from the point of production with improved household access (.16). Forest products appear not to be affected, while sales of fruits and nuts move closer to the farm with improved market access (-.26). Vegetables show a slight positive movement away from the farm with household access change (.11) and a stronger movement toward the farm with market access change (-.19).

Sales of pepper move slightly further from the farm with improved village access (.14). Rubber sales show a rather strong tendency to move further from the farm with improved household access (.22), a somewhat weaker association with village access (.18), and a negative association with market access (-12). Coffee commercialization is closer to the farm as a result of improved market access (-.17).

Taking non-significant findings into account, improved village access is almost always associated with movement of sales away from the farm, while improved market access is universally associated with movement toward the farm. Improvement in household access (including travel and access to services) has mixed effects, but generally tends to move sales of all but the least valued products (cassava, sago) further from the farm.

E.4.c. Farm Enterprise Changes. Two types of farm enterprise change are studied in this section: fertilizer use and planting of high-yielding varieties of rubber and irrigated rice. The relationship of these behavioral changes to access change is first examined, then the distribution of impacts by socioeconomic group is discussed.

1) Fertilizer use. For rubber, 78% of producers report using fertilizer now. Of these, 53% are using more now than before the study project, 27% are using the same amount, and 20% are using less. Of producers who never used fertilizer, 60% are in the lowest range of accessibility change (using the household access measure), 25% are in the next lowest range, and 15% are in the middle range. Where accessibility change has been greatest, all households use fertilizer on rubber.

The greatest percentage (69%) of farmers increasing their fertilizer use is found in the second-lowest accessibility change group; 29% are in the middle group, and 2% are in the lowest group. Unchanged fertilizer use over the project period is associated with medium to high levels of access change, and decreasing fertilizer use is most frequently found (83%) in the highest access change groups.

These findings seem to illustrate a two-step process where access change stimulates initial behavioral change but in the long run tends to counteract it. The findings are probably more closely related to age of rubber plantings, for it is far more common to fertilize young, growing trees than to use fertilizer on mature trees. This pattern is also related to subsidy schemes that provide fertilizer at no cost for a limited period.

A similar pattern is found for fertilizer use on rice. Households that do not use fertilizer are in the lowest access change ranges. Most of those increasing their fertilizer use over the project period (69%) are in the second-lowest range and the remainder are in the middle range. Those whose fertilizer use stayed the same are predominantly in the middle and upper-middle range, while a high proportion (89%) of those decreasing fertilizer use is found in the two highest access change groups.

The pattern for pepper and vegetables is only slightly different. Of those who plant pepper but do not use fertilizer, 36% are in the two lowest ranges, 45% are in the middle range, and 18% are in the highest range of accessibility change. Of those who increased fertilizer use, 78% are in the middle range and the rest are in the lower-middle range. Those who stayed the same are predominantly in the middle to upper-middle ranges, and those who decreased their fertilizer use are mostly (82%) in the highest access change group.

Fertilizer use on vegetables is very similar. About a third of all producers do not use fertilizer, and these are mostly (94%) in the middle and lower-middle access change groups. Of those who increased fertilizer use over the project period,80% are in the middle range and the rest are evenly distributed on each side. Of those who kept the same use, 85% are in the upper-middle and upper groups, and 82% of those who decreased fertilizer use are in the highest access range.

The conclusions that can be drawn from these data are, first, that access change is positively associated with fertilizer use, and second, that increasing amounts of access change seem to be negatively associated with increases in the quantity of fertilizer used (per crop unit) over the project period.

Fertilizer use also shows distinct patterns of distribution by socioeconomic group. For rubber, those producers who do not use fertilizer are predominantly (89%) subsistence farmers and low-income farmers. All farmers with non-farm income have a history of fertilizer use. Of producers in the subsistence group, 88% do not use fertilizer; the remaining 12% have decreased their fertilizer use over the project period.

Low-income farmers who use fertilizer on rubber (33% of producers) are most apt (83%) to have increased their fertilizer use over the project period. Only 17% (one case) shows a decrease in fertilizer use. High-income rubber producers are predominantly (86%) in the group that has experienced no change in fertilizer use. Use by food farmers with non-farm income either stayed the same (69%) or decreased (31%), while cash croppers with non-farm income consistently decreased their fertilizer use (100%).

For rice, the pattern is similar: 91% of subsistence producers and 50% of low-income producers use no fertilizer on rice, but all other producers use some fertilizer during the study period. High-income farmers are predominantly (89%) in the category of "no change." Food farmers with non-farm income are divided between those who have stayed the same (60%) and decreased (38%), while cash cropping farmers with non-farm income universally used less fertilizer than before (100%)

The pattern is more varied for pepper and vegetables. Still, there was a tendency for subsistence farmers not to fertilize or to decrease their fertilizer use over the project period. Most low-income farmers also do not use fertilizer, but those who do started during the project period. High-income farmers are divided between those who do not use fertilizer, those who have increased its use, and those who have

stayed the same. Food farmers with non-farm income are predominantly in the "no change" category, but for both crops a substantial share of producers has also increased fertilizer use over the project period. Cash cropping farmers with non-farm income are predominantly in the category of those who have decreased fertilizer use over the project period.

2) Use of high-yielding varieties. Planting of high-yielding rubber is relatively little related to the study project since more than half of the producers planted high-yielding varieties more than ten years ago. For those who introduced high-yielding varieties during the study period, 80% were in areas that experienced lesser degrees of accessibility change and none was in the group that had the greatest access change.

During the study period, 82% of irrigated rice producers began cultivating irrigated rice. Again, most of these (79%) were in the areas that had least accessibility change, and the rest were in the middle range. The conclusion seems inevitable that adoption of high-yielding varieties in the project area is very little related to the transport investment under study (although it may well be related to previous access changes).

The use of high-yielding varieties of rubber is found in all farming groups. High-income farmers and cash crop farmers with non-farm income are most likely to have planted high-yielding varieties (about 68% in each case). Subsistence farmers and food farmers with non-farm income are considerably less likely to have high-yielding rubber (about 38%) in each case), and low-income farmers are least likely to have it (25%). All farmers with no outside source of income show about the same propensity to plant high-yielding varieties (around 50%), while farmers with non-farm income are less likely to do so (38% for cash cropping farmers and 20% for food farmers).

Planting of irrigated rice is most common among farmers with non-farm income (23% to 33%), less common among high-income farmers (16%), and least frequent among low income and subsistence farmers (8% and 5% respectively). With few exceptions, all of the irrigated rice in the study area was planted during the study period. The exceptions are among high-income farmers (33% of those planting irrigated rice) and cash cropping farmers with non-farm income (20%--one case).

F. IMPACTS ON THE QUALITY OF LIFE

The relationship between access and quality of life can also be examined by looking at the variation in socioeconomic structures between areas with different degrees of accessibility at the present time. In this section, the composition of the sample by accessibility groups is defined, the characteristics of these groups are described, and the perceived relationship between transport change and change in quality of life in the project area are discussed.

F.1. Composition by Accessibility Groups

Households were assigned by market town to six accessibility groups. These groups, starting at the furthest point up river, represent increasing levels of access at present and decreasing levels of accessibility change over the project period. One market area (#5 - Dap) had too few responses to be treated as a separate group, so they have been added to the next nearest market town (#6 - Kanowit) for this analysis. The distribution of the sample by market town is the following: Belaga 14%, Merit 32%, Kapit 25%, Song 18%, and Kanowit 11%.

Mean household size varies little by access groups from the sample mean of 6.2, except for Kanowit, where it is significantly higher (7.2). The average household income is highest in Belaga (M$2,561.2, or U.S.$1,493). In the intervening areas, it drops to about half this level (M$1,392.2, or U.S. $580 around Merit; M$ 1,211.2, or U.S. $504 near Kapit; and M$1,101.7, or U.S. $459 in Song).

The results for Belaga should not be considered typical for the district, as about half of the sample for this area consisted of commercial households in Belaga Town. On a per capita basis, the income levels in Belaga (M$440.4, or U.S.$184) more closely approximate those of Kanowit (M$381.9, or U.S.$159). Per capita income in the other market areas is around U.S. $100 (M$ 249, or U.S.$104 in Merit; M$259, or U.S.$108 in Kapit; and M$209, or U.S. $87 in Song).

Sales of perishable products account for a share of cash income in all of the market areas except Kanowit. They contribute to income for 45% of households in Belaga, 26, near Merit, 48% around Kapit, and 32% in Song District. For households selling perishable products, this income source accounts for about half of their cash income in Belaga, Merit, and Kapit, and for four-tenths of their cash income in Song.

Farm labor income contributes to household income only in Song District and in only three cases there (12%). The average amount of land cultivated is smallest in Song (3.6 hectares); is near the sample mean in Kapit and Merit (5.8 hectares), and is considerably higher in Kanowit (9.7 hectares) and Belaga (10.8 hectares).

F.2. Characteristics of Accessibility Groups

F.2.a. Demographic Characteristics. Residents of Belaga are disproportionately likely to be either very young or very old; residents of Kanowit are disproportionately likely to be either middle aged (45 to 64) or old. Households in the other market areas are more likely to be concentrated in the middle age groups. Around Merit, the average age is somewhat younger than for the whole sample, while the ages prevalent in the other two areas are very close to the sample distribution.

With regard to education, Belaga household heads are least likely to have none and are disproportionately likely to have more than a primary education. In Song and Kanowit, fewer than the average share have no education and more than the average have more than adequate levels. In Merit and Kapit, however, the highest proportion (78%) of household heads has no education and the lowest share (2% to 3%) has more than four years. Belaga and Song have relatively high percentages of household heads with some exposure to education but not enough to assume literacy (less than Primary 4). In Merit and Kapit, the proportion of household heads who have completed a basic education is slightly above the share for the whole sample.

F.2.b. Travel Patterns. The propensity to make short-distance trips (to the district center) varies only slightly from a high of 9.9 annual trips per capita in Song to a low of 7.1 annual trips per capita in Belaga. The exception is Merit, where the average number of annual trips per capita to the district center (Kapit) is only 2.7. This result is undoubtedly due to the difficulty of travel between Merit and Kapit, which require running the river rapids.

Trips to Sibu are noticeably less frequent with increasing distance. Residents of the Kanowit area travel to Sibu 3.2 times per year on the average, while those in Song average 1.1 trip per year, in Kapit 0.7, around Merit only 0.3, and in Belaga 0.6. The slight rise in frequency of trips to Sibu from Belaga can be attributed to the high proportion of commercial households in this sub-sample.

Long-distance trips are about equally likely to be made by members of any access group. A curious anomaly is the relatively high proportion of long-distance trips among the population of the Merit area, perhaps associated with the somewhat younger average age of this sub-sample.

F.2.c. Income Sources. Fishing, hunting, and gathering are the most common sources of income other than crop sales in the market areas of Belaga (45%), Merit (41%), and Kapit (43%). However, they provide income to only 12% of households in Song and 7% (one case) in the Kanowit area. The decreasing importance of fishing, hunting, and gathering as one moves downriver reflects

the fact that the readily collected resources of the more accessible areas have been partly depleted while those in the area opened up by the express service are still available for exploitation.

Other sources of income in the Belaga area include private business (25% of households), farm labor (5%-one case), non-farm labor (5%-one case), and pensions (5%-one case). Around Merit a relatively small share of households receives income from seasonal farm labor (4%), sale of craft products (4%), non-farm labor (4%), salaries (6%), support from children (6%), and private business (2%-one case). In the Kapit area, farm labor becomes a significant income source (23% of households) and contributions are also made by craft sales (3%-one case), salaries (3%-one case) and support from children (9%).

Sources of income are more diversified in Song, where 28% of households receive support from children, 16% receive salaries, 12% are engaged in non-farm labor, 8% earn money in farm labor, and 4% (one case) receive income from the sale of craft products. Support from children is important for 33% of households in the Kanowit area, while pensions contribute to 13%, farm labor to 7% (one case), and private business to 7% (one case). The increasing importance of support from children as one moves downriver suggests that the economy is now reaping the rewards of previous investment in access change, as children who have received education have gone off to find urban jobs from which they remit a portion of their earnings to households in the study area.

F.2.d. Production Patterns. Out of all producers of irrigated rice, 40% are found in the Merit area (where there is a major government scheme to promote this crop). There are no producers in Belaga, but some exist in all the other market areas. Irrigated rice producers include 41% of households in Merit, 31% in Kapit, 24% in Song, and 80% in the Kanowit area (where suitable land is more plentiful). Production of rainfed rice is common in all the access groups except Kanowit.

Maize and cassava are produced in all market areas but by a consistently smaller share of families. (See Table 2.16 for details.) Sago production is fairly common in Belaga and Kapit areas, less so around Merit and Song, and is not common in Kanowit. Fish ponds are infrequently fround but are most common in Kanowit area.

Production of vegetables is nearly constant at about 15% of households across all access groups, except for Kanowit, where this crop is twice as common. Fruits are produced by a substantial share (35% to 65%) of households in all access groups, but their popularity peaks around Kapit. This distribution may be related to the role of Kapit as the major

TABLE 2.16

PRODUCTION PATTERNS BY ACCESS GROUP
(PERCENTAGE OF HOUSEHOLDS PLANTING EACH CROP)

Market	Belaga	Merit	Kapit	Song	Kanowit
Crop					
Irrigated rice	0	41	31	24	80
Rainfed rice	55	96	97	44	0
Maize	40	72	63	28	13
Cassava	15	37	43	8	7
Coconuts	10	11	9	8	0
Sago	25	9	23	12	0
Fish ponds	0	2	6	0	13
Vegetables	15	13	14	16	33
Fruits	35	41	66	48	47
Pepper	30	43	43	20	73
HYU rubber	55	43	40	24	33
Local rubber	45	76	80	64	47
Cocoa	5	4	0	0	0
Coffee	20	9	3	12	0

Source: Household Survey

origin of export shipments from the study area, as fruit constitutes an important and highly perishable export crop.

Pepper production is widely diffused throughout the project area. It contributes to income for 73% of households in Kanowit but only 20% in Song. After that, it shows a fairly consistent pattern, with a slight decline in participation between Merit and Belaga.

Rubber is also found throughout the project area. Use of high-yielding varieties is more common as one moves upriver, perhaps reflecting more recent plantations. Cultivation of local rubber is most common around Kapit (again, perhaps, because it is the major shipment center for export crops) and is distributed in an approximately normal curve along the axis of accessibility.

Cocoa and coffee are new cash crops whose greatest impact has been in the areas above the rapids. Cocoa is not found at all below the rapids, and only 25% of coffee producers are found there. A somewhat higher share of coffee producers is found in Belaga and in Kanowit than in other areas.

F.2.e. Marketing Patterns. Table 2.17 shows the percentage of producers selling some of their crops in each access group. Irrigated rice is sold only by producers in the Merit area. Rainfed rice is sold by a small share of producers all along the upper stretch of the river but is not sold at all below Kapit. Maize is likewise sold by a small share of producers (around 10%) on the upper reaches of the river. (The 50% of producers selling maize in Kanowit represent only one case.)

Coconuts are a cash crop in Kapit and Song districts but not above the rapids. Cassava and sago are, of course, not sold by anyone. Vegetables and fruits are cash crops throughout the project area, with little systematic variation by access group.

The percentage of producers selling pepper clearly decreases as one moves upriver. This is directly related to the relative age of plantings, since pepper is not a food crop in this area. The percentage of producers selling rubber is relatively stable at around 60% except for in the Belaga District, where the percentage drops to 20%. This may be explained by the relatively high opportunity cost of rubber tapping in Belaga, where fishing, hunting, and gathering is still a relatively remunerative alternate activity. All cocoa and most coffee plantings are too young to be producing for sale, although the coffee in Kanowit District and a little in Belaga District is mature enough to be sold.

TABLE 2.17

MARKETING PATTERNS BY ACCESS GROUP
(PERCENTAGE OF PRODUCERS SELLING EACH CROP)

	Belaga	Merit	Kapit	Song	Kanowit
Irrigated rice	b	16	0	0	0
Rainfed rice	9	7	9	0	b
Maize	13	12	9	0	50
Cassava	0	0	0	0	0
Coconuts	0	0	33	50	b
Sago	0	0	0	0	b
Vegetables	67	100	80	75	60
Fruits	71	42	48	67	57
Pepper	33	55	53	80	90
Rubber	20	65	55	65	60
Coffee	25	0	0	100	b
Cocoa	0	0	b	b	b
Fish[a]	25	15	11	20	0
Forest products[a]	45	33	37	4	7
Craft products[a]	5	4	9	8	0

a Percentage of all households.
b No production.

Source: Household Survey

Sale of river fish is generally of increasing importance as one moves upriver. (The higher rate for Song includes fish pond production as well as river fish.) The same is true for forest products, which contribute cash income in only about 5% of households below Kapit but in 35% to 45% of households further upstream. Craft product sales are relatively constant over the project area at between 5% and 10% of households.

F.2.f. Service Delivery and Social Participation. Membership in agricultural organizations is not found at all in Belaga and was not reported by any households in Kanowit District. Totals of 11% of respondents in the Merit area, 14% around Kapit, and 4% in Song report belonging to such a group. Only one spouse in each of these three areas participated in an agricultural organization.

Attendance at agricultural training courses was most common near Kapit (that is, in the area closestto the regional Agricultural Training Center). Of sample households in the Kapit area, 20% had participated during the last year. The percentage of participants drops to 13% around Merit and to 5% around Belaga, going upriver, and to 16% in Song District going downriver. In Kanowit, with ready access to Sibu, 73% of households had participated during the past year.

Farms in Belaga District were least likely to be visited by the extension service; 70% of farm households reported that they had never been visited. Only 16% of farm households in Merit have never received visits from the extension service, while 43% in Kapit and 45% in Song have never been visited. Only 7% of farm households in Kanowit have escaped the attention of the extension service.

Frequent visits (more than once a year) occur most often in Merit (72%), Kanowit (60%), and Kapit (53%). Only 35% of households in Song District and 15% of households in Belaga are visited by the extension service more than once a year.

Regular attendance at agricultural meetings in the community is most common in Merit (54%), followed by Kanowit (47%) and Song (40%). Only 26% of households in the Kapit area and 10% in Belaga report regular attendance at agricultural meetings.

The highest rate of participation in subsidy schemes is also found near Merit (40% of farm households). Kapit (34%) and Song (30%) also have high participation rates, while Kanowit (27%)and Belaga (15%) have a smaller share of participants. It is possible that the rate of participation in subsidy schemes is

inversely related to the perceived availability of alternate sources of capital, a hypothesis that would be supported by the observed geographical distribution. It does not appear to be directly related to accessibility.

F.3. Perceived Effects of Transport Sector Change

Household survey respondents were asked two open-ended questions in order to determine their own perceptions of change in the quality of life over the project period. These were:

1. "Has improved transport changed your life in any important way over the past ten years? If so, how?"

2. "Do you think that life in general is better than it was ten years ago? In what way?"

F.3.a. Effect of Transport Change. Of the respondents, 96% felt that improved transport had made a difference in their personal lives during the past ten years. Of these, 65% felt that there had been a general improvement due to transport change; 17% felt that transport change had made life worse than it was before; and 17% felt that it had had both positive and negative effects. Among the benefits were lower transport cost (mentioned by 37% of respondents), improvements in convenience, comfort, and saftey of travel (69%), and access to service in emergencies (11%). Among the negative effects, damage caused by high waves from the express boats was cited 22% of respondents, and increased transport cost by 11%.

In the village survey, village officials were asked to consider whether the study had brought any improvements to the village and whether the study project had created any problems for the village. Almost all (90%), including two of the four communities not located on the banks of the Rajang, felt that the study project has brought some improvement. A large majority (77%) felt that the study project had also created problems for the villages.

Following are the responses concerning the effect of transport change; the number of such responses is given in parantheses.

The types of improvement mentioned show significant differences between the two parts of the study area. Above Kapit, economic factors seem preponderant. The express makes it possible to bring in pepper plants (2) and to ship out fish and rattan (2). The cost of personal travel is cheaper (11) and travel time is reduced (3). Better prices can be obtained for local products and consumer goods by traveling to Kapit (1). The more regular and more frequent express service adds a convenience factor (8). The safe and reliable express service is particularly valuable in medical emergencies (3).

The more frequent services now provided by traveling dispensaries are highly valued in the remote communities (3), and those communities now served by a nearby sub-health center regret the consequent decline in dispensary visits (3). More frequent visits of agricultural extension staff and consequent opportunity to participate in government schemes is also seen as an advantage (2).

Below Kapit, the study project had a more minor impact. The express is faster than other transport modes (4), but it is also more expensive and consequently is less frequently used (3). The principal advantage of speed is in providing access to health care in medical emergencies (5).

In this area also, the frequent visits of travelling dispensaries have led to better health (4). The visits of agricultural staff have promoted local participation in government schemes (2). The development of motor transport on the tributary streams has provided more regular access to markets on the main river for local products and consumer goods, so that farmers no longer have to ensure their own food supply before producing cash crops (1). The influx of businessmen, government agents, and tourists into the region, largely due to the express service, has contributed to the expansion of economic activity in the towns (1).

Problems created by the study project were not very different in the two parts of the project area. About half of the communities complain about the damage to jetties and plankwalks caused by large waves from the express. The waves also knock about and sometimes break the small wooden boats belonging to individual households (19). The express waves are also perceived as a primary cause of soil erosion on the river banks, resulting in the loss of crops (usually fruit trees) planted near the river (14).

Capsizing presents a hazard to human life, particularly when the boat occupants are children (2). Large waves also endanger women and children who are washing clothes, drawing water, or bathing by the river bank (5). A concern for the safety of travel on the express was mentioned by some respondents who have observed frequent overloading and a tendency to allow insufficient time for loading and unloading at stops (2).

In general, the express service has improved the economic bargaining position of primary producers, as shown by the laments of businessmen over price "inflation" and the decline of profit margins (1). By placing a premium on the collection of jungle products (rattan, nuts and fruits, fish, game) for sale, the service has contributed to a decline in the supply of such products for local consumption. Villagers must now forage further away to meet their needs, taking time from the production of food and cash crops (1). Small entrepreneurs have been gradually squeezed

out of the long-distance transport market, sometimes becoming shareowners and/or engine drivers for the express companies (1).

F.e.b. Life Satisfaction. Of the household survey respondents 51% felt that life is better now than it was ten years ago; 25% feel that it is worse now: and 21% feel that it is better in some ways and worse in others, but basically unchanged (2% did not reply to this question). Those who felt that life is better now cite also positive changes: higher income (54%), higher prices for goods sold (43%), more government support (39%), better transport (37%), improved family situation (15%), and increased job opportunities (11%). Those who feel that life is worse now than before mention: higher prices for goods purchased (51%), worsened family situation (34%), decline of hunting , fishing , and gathering as a source of income (29%), and soil deterioration (14%).

Over the entire sample, 29% mention higher income, 20% more government support, 23% higher prices for goods sold, 16% higher prices for goods bought, 22% improved transport, 6% increased job opportunity, 9% decline of hunting,fishing, and gathering, 6% soil deterioration, and 21% life cycle changes as factors related to change in the quality of life. The predominance of economic factors in the perception of quality of life by respondents is evident in this list. Transport change is directly or indirectly related to all of these factors except for life cycle changes. Thus, it brings both positive and negative effects into the lives of project area residents.

CHAPTER 3
THE PHILIPPINES

3

CHAPTER 3

PHILIPPINES

The Philippines is composed of two large islands, Luzon and Mindanao, and hundreds of islands lying south of Luzon and north of Mindanao generally described as the Visayas. The administrative area selected for this study includes parts of three provinces in the northeast part of Luzon, namely Cagayan, Isabela, and Kalinga-Apayao, which are three of the six provinces designated as Region II by the National Economic Development Aurthority (NEDA).

The government agency most directly involved in planning and executing the study was NEDA; financial and logistic support was provided by the Department of Public Works, Transport and Communications. NEDA's Region II field office for the Cagayan Valley region, located in Tuguegarao, Cagayan Province, was specifically delegated the responsibility for carrying out the field studies.

A. SAMPLE DESIGN AND FIELD METHODS

A.1. Definition of the Project Study Area and Impact Zone

The transport investment projects to be studied were the Buntun Bridge crossing the Cagayan River between Solana and Tuguegarao and the Gamu Bridge crossing the same river near Gamu, Isabela. The study period for the former was defined as ten years: for the latter it was five years. The study area was defined as all of the municipalities west of the Cagayan River for which these two new bridges provide an important increase in accessibility to the rest of Luzon. It was determined that this should include in Isabela eight municipalities--Quezon, Mallig, Quirino, Gamu, Roxas, Burgos, San Manuel, and Aurora; in Cagayan five minicipalities-Solana, Piat, Tuao, Enrile, Santo Nino; and in Kalinga-Apayao two municipalities-Tabuk and Rizal.

In selecting sample communities within the study area for village household surveys, an impact zone was defined as running approximately ten kilometers on either side of the principal roads leading from these municipalities to the bridges.

The field survey was divided into two parts: a study of those communities impacted by the Buntun Bridge and those impacted by the Gamu Bridge.

A.2. Selection of Sample Units

Three municipalities in each study area were selected. The basic criterion for selection in each study area was the distance from the project site. The municipality adjacent to the project site and a municipality at the furthest distance from the project were selected in both study areas. A third pair was selected at a distance somewhat between the project site and the most distant municipality. Within these parameters, the NEDA field staff, in cooperation with local census offices, selected specific municipalities that they thought would be most representative of the total study area and where surveys could be conducted with reasonable speed and facility.

The study team had at its disposal the 1971 Agricultural Census for the three provinces, which gave the land tenure and size of land holding distribution for all of the municipalities. It was decided that these statistics would be used as a guide in selecting sample villages.

Within each of the selected municipalities, the Consultants chose three villages that, in the view of the local census officials and NEDA staff, most clearly represented the municipality as a whole. A municipality such as Piat, where there is a relatively large proportion of large land holdings and where plantation sugar is just now being planted, was considered unrepresentative. Furthermore, an attempt was made to

select the three villages in each municipality at varying distances from the nearest road but within the ten kilometer constraint mentioned above. Villages sampled, however, were grouped as closely together as possible to make the logistics of survey work somewhat easier. No less than 60 farm households were surveyed in each municipality, with approximately 20 in each village.

The sample was distributed over the following four land-holding classifications in proportion to the frequencies shown in the Agricultural Census for the sample municipalities: less than 1 hectare (9%), 1 hectare to 2.9 hectares (59%), 3 hectares to 4.9 hectares (23%), and more than 5 hectares (9%). A total of 375 farm household interviews were conducted out of a total universe in the six municipalities of 13,415 farm households, giving approximately a 3% sample. The actual sample corresponds very closely to the distribution of farm size given in the Agricultural Census, as shown in Table 3.1.

The Consultants were advised that non-farming households represented a very small percentage of total households in these municipalities. It was not possible, however, to obtain an actual enumeration of these families and, therefore, little effort was made in the survey to interview such households. In fact, three were interviewed.

Although there are considerable numbers of landless farm laborers in the study area, they were underrepresented in the sample as there was little information on the size of the universe and no enumeration from which sample households could be selected.

A.3. Execution of the Surveys

The survey instruments were prepared in final form at the NEDA regional office with the assistance of professionals in that office. A group of about a dozen high school students, without prior survey training, were hired specifically to carry out these surveys. They received two days instruction in the office followed by a day of field testing under the supervision of selected NEDA staff and one of the Consultants. Thereafter, the twelve enumerators were divided into three groups, each under the supervision of either the Consultants or a professional from the NEDA staff, with each team going into one village per day.

It was possible for each team to complete the approximately 20 household interviews, plus the village survey questionaire, in one day. Each day the survey teams would move into a different municipality. The village (barangay) chief was alerted in advance of the team's arrival. In some cases, a census officer had already identified a large part of the sample households to be interviewed; these household heads were called in by the chief for interviews.

TABLE 3.1

NUMBER OF FARMS BY SIZE AND MUNICIPALITY
1971

Municipality	Total Number of Farms	SIZE OF FARM										
		Under 1.0 Hectare	%	1.0 and Under 3.0 Hectares	%	3.0 and Under 5.0 Hectares	%	5.0 and Under 10.0 Hectares	10.0 and Under 25.0 Hectares	25.0 and Under 50.0 Hectares	50.0 Hectares and Over	Total % >5 Hectares
Gamu	1,225	150	12	758	62	209	17	81	23	3	1	9
Mallig	1,423	31	2	940	66	411	29	30	7	0	4	23
Roxas	2,287	87	4	1,472	64	587	26	93	47	1	-	6
Solana	3,443	360	10	1,853	55	837	25	326	54	9	4	10
Sto. Niño	2,181	263	12	1,350	62	358	16	156	47	4	3	9
Tabuk	2,856	288	10	1,738	61	498	17.5	232	71	2	27	11.5
Project Area	13,415	1,179	9	8,111	60	2,000	22	1,225				9

Source: 1971 Census of Agriculture, Vol 1.

More frequently, however, the enumerators went from house to house, each with a list prepared by the census officer or the barangay chief of households that they were to survey.

In quite a large number of cases, either there was no responsible adult to interview at the time of the visit, or it was determined that the size of landholding that had been presumed for the household was incorrect. Therefore, it was the professional supervisor's responsibility to check the enumerators' progress during the day and to adjust the sample of households to be interviewed so that a representative sample would be obtained. The supervisors, moreover, would circulate among the enumerators during the day to see how well they were conducting the interviews and, in fact, conducted some of the interviews themselves. At the end of each day, the supervisors would review the questionnaires for errors and discuss deficiencies with the enumerators. The questionnaires were subsequently coded at SEATAC, Kuala Lumpur, by SEATAC and consultant staff.

A.4. Other Surveys

The administrative, agro-industry, commercial, and transporter surveys were conducted by a separate team. During the surveys, from two to five professionals, including one of the Consultants, carried out these surveys. Administrative surveys were conducted in all of the study area municipalities. This was accomplished by scheduling visits to each of the municipal centers and having the mayors convene a meeting of all necessary officials. The administrative survey instruments were then distributed and explained to the persons attending this meeting and left with them to be completed and returned at a later date. This method was adopted because it would not have been possible to rapidly complete the survey instruments, involving inputs from many different officials, in the time that the survey teams could allow for each visit.

The other surveys were conducted by the professional enumerators visiting establishments. All of the agro-industry establishments in municipal centers were interviewed. All transporters operating more than one bus or truck were also interviewed. Some of these interviews were conducted in urban centers near but outside the study area where the establishments were located. Thirty-two commercial enterprises were interviewed, having been selected at random from the six municipalities where the village and household questionnaires were conducted.

The survey was conducted in mid-August, with approximately one week taken in each study area.

A.5. Instrument Modification

The survey forms presented in Appendix A were modified during the workshop in Kuala Lumpur and subsequently in the field to make them more applicable to the Philippine situation. With the exception of the household questionnaire, this work was largely a matter of substituting the appropriate terminology. For the household questionnaire, a household was defined as including all persons living in the present household plus all children who might be living elsewhere but who have not formed their own household. For description of travel patterns, there were three categories: The poblacion (municipal market center), the provincial capital, and Manila. Crops and livestock appropriate to the study areas were used. As vehicle types, the jeepney and motorized tricycles were added. (The jeepney is a jeep with a pickup truck type chassis that is adapted to carrying 10 to 15 passengers and is often used as a light 3/4 ton cargo vehicle as well.)

B. CHARACTERISTICS OF THE STUDY AREA

B.1. Physical Characteristics

The study area is located in the Cagayan Valley and includes parts of three provinces comprising this valley, namely Kalinga-Apayao, Isabela, and Cagayan Provinces. The Cagayan River basin is about one million hectares in size, representing the country's largest area of contiguous fertile lowlands. Bounded on three sides by mountain ranges and to the north by the sea, much of these agricultural lands have remained unused because of weak infrastructure and the region's physical isolation from the more developed areas in Luzon. The study areas lay to the west of the Cagayan River and to the east of the mountain ranges (see Figure 7). While including some low deforested hills, the predominant terrain is flat and does not rise more than 300 meters above sea level.

There are still substantial uncultivated areas that have soils suitable for agriculture. Most of the agricultural soils are naturally fertile, and most crops can be grown seasonally without modern techniques of planting. Little natural vegetation remains in the study area.

Heavy seasonal rainfall is adequate for single cropping of palay (unshelled or paddy rice). Rainfall starts in July/August and is continuous through December with either October or November as the peak of the rainy season. Average annual rainfall is in the range of 1,500 millimeters to 2,000 millimeters and the number of rainy days is between 100 and 150. The area is drained principally by the very large Cagayan River and its tributaries. There are no lakes in the study area.

B.2. Population Characteristics

The study areas comprise a population of nearly 300,000 people, of whom approximately 168,000 are in the Buntun Bridge area and 125,000 are in the Gamu Bridge area. The largest municipality, Solana, has a population of approximately 40,000 and the smallest, Quezon, has approximately 8,000.

The population growth rate is 3.4% per year for the study area municipalities in Isabella Province (Gamu Bridge) over the last five years. This compares with an average annual growth rate for the last five years for the whole province of 2.7%. However, from 1960-1970, the province had an annual population growth rate of 3.9%. It is reasonable to expect that in the study area as well the rate of population growth is declining, partly in response to the greater education in and use of birth control methods.

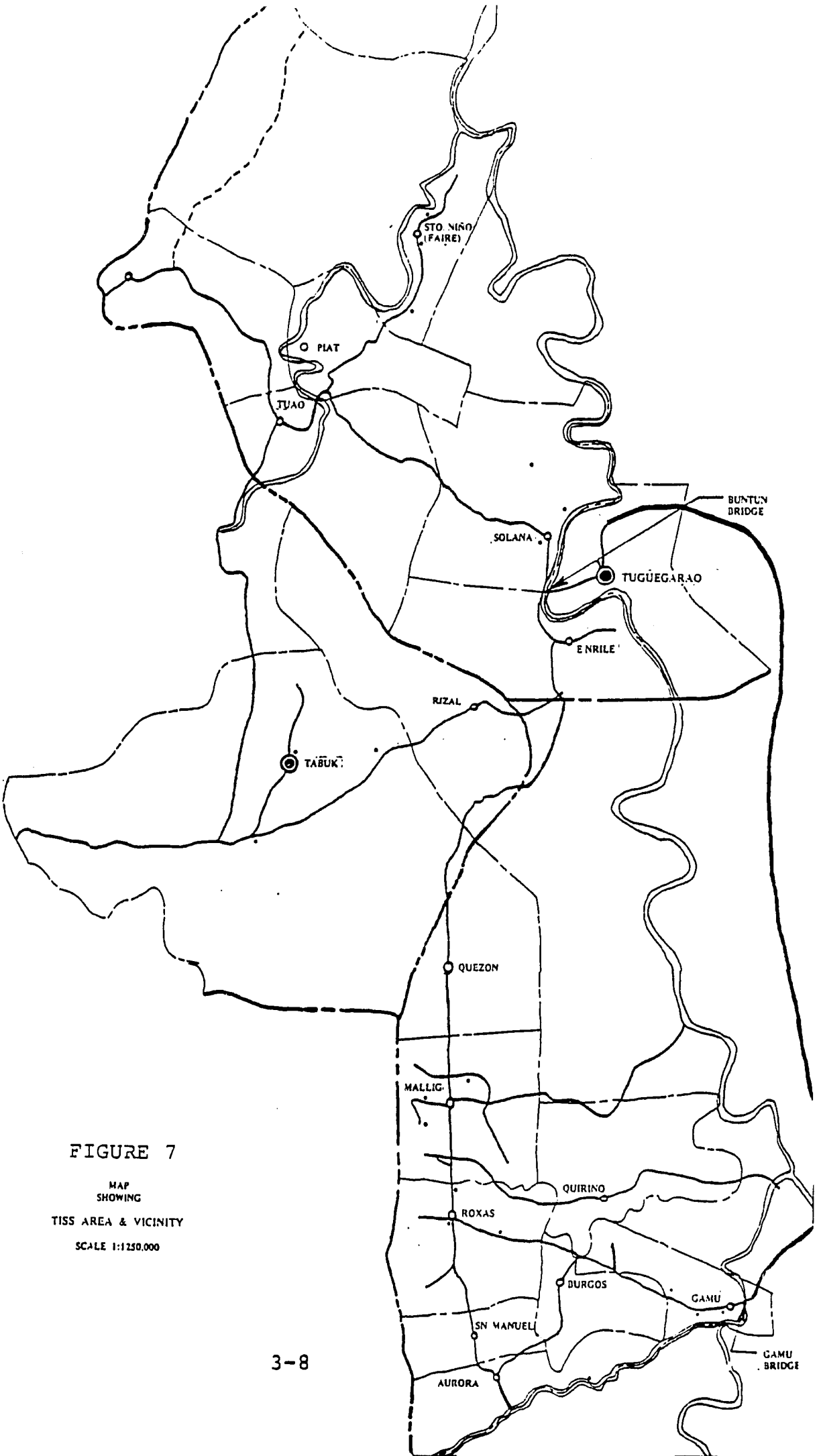

FIGURE 7

MAP
SHOWING

TISS AREA & VICINITY

SCALE 1:1250,000

In the study area municipalities of Cagayan Province (Buntun Bridge), the apparent growth rate for the past five years is 2.3%.

Both provinces have experienced net in-migration. In Isabella in the period 1960-1970, net migration accounted for approximately 14% of population growth.

Sample population densitities per square kilometer for 1975 include: Gamu 59, Roxas 115, and Mallig 52. National population density in 1975 is estimated to have been about 2.2 times higher than that indicated for Cagayan and Isabela provinces.

The percent of urban population in the study area municipalities was approximately 14%. However, four of the municipalities in the study area, Enrile, Tabuk (provincial capital), Gamu, and Roxas had urban populations of greater than 20%. Nonetheless, only two of the municipal centers in the study area could be considered as having significant urban characteristics: Tabuk (provincial capital) and Roxas.

Distribution by sex is approximately equal. Approximately one-third of the population is younger than ten years and about 5% are over the age of 60. The predominant ethnic group are the Ilocanos, the second most important group being the Ibanags. Ethnicity in the study area has no great influence on development patterns.

Information in the remainder of this section was drawn from the sample household interviews conducted in 18 villages in 6 municipalities of the project impact area.

B.2.a. Demographic Characteristics. The mean average household size is 6.7 persons. In the six municipalities surveyed, the average ranged between 6.3 and 7.3 persons, not a great deal of variance. Of the household heads interviewed, 54% were between the ages of 25 and 44 and 42% were between 44 and 64 years. Educational levels of household heads were distributed approximately equally between the categories of four years or less, five to six years, and more than six years of education. The distribution between municipalities varied somewhat. In Solana and Sto. Nino, the percentage of heads of households interviewed in the 44-64 category was slightly greater than in the bracket 25-44 years. In Gamu and Mallig, the category 25-44 years represented 62% and 70%, respectively, of the sample. Roxas and Tabuk were representative of the mean average of the total sample. The lowest percentages of household heads having more than four years of education are found in Solana and Sto. Nino, in other words, in the municipalities where the age group sampled was the

TABLE 3.2

DISTRIBUTION OF SOCIOECONOMIC GROUPS BY TENURE CLASS

Socioeconomic Group	No Farm (0)	Own-Oper (1)	Landlord (2)	Shr-Rent (3)	Own-Lab (4)	Rent-Lab (5)	Own-Llrd (6)	Own-shr (7)	Llrd-Shr (8)
Subsistence farmers	1	72	0	82	8	19	0	18	0
Low-income farmers	0	1	1	2	0	1	0	0	0
High-income farmers	1	35	0	16	2	0	0	1	0
Food farm/Non-farm income	1	27	0	24	6	5	0	4	0
Cash farm/Non-farm income	0	8	4	5	4	2	1	5	0
Total	3	143	5	129	20	27	1	28	0

eldest. The Tabuk sample showed the highest percentage of educated heads of households, with approximately 40% in the four to six year category and 40% having greater than six years of education.

The age distribution of head of household spouses was somewhat younger, 58% being between the ages of 25 and 44 and 33% between 44 and 64 years. Approximately two-thirds of these had more than four years education, but only 25% had more than six years. Therefore, spouses have somewhat less formal education than the heads of household but not dramatically so.

B.2.b. Land Tenure, Occupation, and Income. The predominant forms of land tenure are private ownership with the owner operating his farm (191 cases) and the sharecropper or renter of land (156 cases).[1] Of the owner-operators, 28 also sharecropped and 20 worked as laborers on other people's land. Of the sharecroppers and renters, only 28 indicated that they worked for cash on other than their own sharecropper plots. The number of farmers who worked for cash on other than their own plots may be understated because it does not include work that may have been paid for in kind or the exchange of labor services between farmers.

Land tenure patterns have not changed significantly over the past ten years. Of the 362 households responding to the question on changes in land tenure, 297 reported no change; a large number of remainder were new households. The agricultural land reform program of the Philippines has not yet been implemented in the study area. At present, demarcation of sharecropper land is being made in anticipation of transferring the larger, greater than seven hectare farms presently being sharecropped to private small farmer ownership. Land reform measures, however, have been implemented in other parts of the Philippines where sharecropping and large land holdings were more prevalent and the need for land reform therefore more urgent.

Total household income averaged 6,400 pesos (U.S. $875), of which about half is in cash sales and half in equivalent value of production consumed in kind on the farm. It is quite possible, however, that the proportion of cash sales to consumption on the farm has been understated. Per capita income is about 1,100 pesos (U.S. $150). For most farmers, cash sales are predominantly from palay. Only 110 households reported income from other than farming activities, and these were fairly evenly spread between the categories of non-farm labor, salaries, aid from children, and private business. Concerning cash sales other than rice, only 26 households reported sales of maize, 17 sell tobacco, and 54 sell livestock.

Household income distribution by socioeconomic group is shown in Table 3.3. Subsistence farmers (those whose value of cash sales is less than half the value of their total production)

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1 See Table 3.2, sum of columns 1,4,7 and columns 3 and 5 respectively

TABLE 3.3

HOUSEHOLD INCOME DISTRIBUTION BY SOCIOECONOMIC GROUP

(Income in Pesos, 1977)

Socioeconomic Group	Low Income	High Income	Median Income	Number
Subsistence farmers	5.0	73,920.0	2,904.0	202
Low-income farmers	0.0	1,716.0	847.0	6
High-income farmers	2,420.0	63,888.0	10,961.5	55
Food farmer with non-farm income	80.0	36,000.0	2,518.0	67
Cash farmer with non-farm income	0.0	42,989.0	5,946.1	29

Source: Household Survey

clearly predominate, representing 56% of the sample. When the food (subsistence) farms that also have non-farm income are added to the subsistence farm group, the total is 269, or about 75% of the total sample. Farms that sell more than half of their production, that is, high-income farmers and farmers with cash farms and non-farm incomes, total 84, or 23% of the sample. Other socioeconomic group categories are insignificant.

Land cultivated by subsistence farmers averages only 1 hectare, whereas the average for high-income farmers is approximately 2 hectares. Farm income per capita by socioeconomic group is as follows: subsistence farmers 702 pesos (U.S. $95), subsistence farmers with non-farm income 640 pesos (U.S. $88), high-income farmers 2,290 pesos (U.S. $315), and cash (commercial) farmers with non-farm income 2,455 pesos (U.S. $335). For only 30% of the subsistence farmers is the education of the household head more than six years, whereas for the high-income and cash farmers, half of the heads of households have more than six years of education.

Table 3.4 shows there are substantial variations between the six municipalities studied in terms of cash income, household income, and income per capita. The three municipalities in Isabella Province have significantly higher income values than two of the municipalities in the Buntun Bridge study area. The area of land cultivated in these municipalities is somewhat higher than the average, particularly in Mallig and Gamu, but this alone does not explain the differences. Crop patterns are essentially similar: most of the cash income is from rice, except in Gamu, where nine of the total sample of 17 tobacco farms are located. (Tobacco's high-income return per hectare would tend to explain why Gamu has higher average income.)

In Tabuk, Roxas, and Mallig, irrigation and the use of fertilizer with high-yielding varieties of seed are very significant. Thus, farms in these municipalities generally obtain higher productivity. Solana and Gamu have the least irrigated farming. In Solana and Sto. Nino, age of household heads was significantly higher and formal education levels significantly lower than in other municipalities, which correlates well with their lower incomes.

Of the two municipalities adjacent to the bridge sites, Gamu is among the highest household income municipalities whereas Solana is among the lowest. Of the two municipalities farthest from the bridge sites, Sto. Nino is among the lowest in income, but Mallig is in the high income group. Income level is therefore not a function of distance from project sites.

TABLE 3.4

MEAN VALUES OF AREA CULTIVATED AND INCOMES FOR SAMPLED VILLAGES IN SIX MUNICIPALITIES

	Area Cultivated (Ha)	Total Income From Farming (Pesos)	Of Which Cash Income (Pesos)	Total Income Per Capita (Pesos)
Solana	1.2	1994	3498	631
Tabuk	1.3	3650	5318	1025
Sto. Nino	0.9	1219	2711	441
Gamu	1.4	4203	7718	1404
Roxas	1.1	4210	9007	1349
Mallig	1.5	6140	10053	1603

Source: Project RR-2 Household Survey, 1977

B.3. Economic Structure and Investment Patterns

B.3.a. Agriculture and Livestock. The study areas are major palay areas, producing substantial amounts of surplus for food deficit areas of the Philippines. Next in importance is corn, for which a surplus is also produced but for regional consumption. Substantial amounts of these products are consumed on the farm or locally; production is for humans, but some corn is fed to animals. The only other significant cash crop has been tobacco and only in certain municipalities of Isabella Province. Sugar is now being planted over substantial acreage in the Buntun Bridge/Cagayan study area but on large landholdings.

In the period 1960-1971, the hectarage planted to these temporary crops did not change substantially for either province. Production patterns over the last ten years have changed little, based on the study sample households (see Table 3.5).

Predominant farm size in both provinces is between 1 and 3 hectares. In Isabella, farms less than 5 hectares comprise 86.6% of all farms and 57% of total farm area. In Cagayan, small farms comprise 91.3% of all farms and 47.6% of total farm area. Therefore, while both study areas are characterized by small farms, there are still some substantially large landholdings that are potential targets of the government's land reform program.

Although there is a preponderance of owner-operator farms, part ownership and tenancy are still very significant in the study area, as shown in Table 3.6. Only 37% (99) of the subsistence farmers (including those with non-farm income) own and operate their own farms, whereas 51% of the high-income farmers (including those with non-farm income) own and operate their own land (see Table 3.6). The most frequent method of tenant payment is to give the owner 30% of the farm production. Tenure agreements are largely informal.

Palay ranks first in value of production of all crops in the study areas. In Isabella and Cagayan provinces, average production with irrigation is 47 and 30 cavans (1 cavan of palay = 44 kilograms), respectively; the figures without irrigation are 31 cavans and 25 cavans, respectively. In 1971 about 40% of Isabella's area planted to palay and 20% of Cagayan's were irrigated. In the studied municipalities, the percentages were: Roxas 60%, Mallig 80%, Gamu 20%, Tabuk 60%, Solana 40%, and Sto. Nino 57%. Irrigation was used by 40% of the farm households in the sample.

TABLE 3.5

FREQUENCY DISTRIBUTIONS OF CHANGES IN PRODUCTION PATTERNS
(Number of Households)

Crop	None Now, None Before	Some Now, None Before	None Now, Some Before	Same Now As Before	More Now Than Before	Less Now Than Before
Palay	28	53	1	266	18	9
Maize	264	22	5	82	2	0
Vegetable	323	7	0	44	0	1
Peanuts	364	3	0	8	0	0
Mongo Beans	364	0	1	8	2	0
Tobacco	355	7	1	10	0	2
Coffee	371	0	0	2	1	1

TABLE 3.6

NUMBER OF FARMS BY TENURE OF OPERATOR AND BY MUNICIPALITY

1971

		TENURE OF FARM OPERATOR									
		OWNER		TENANT[b]						OTHER	
Municipality	Total Number of Farms	Full-Owner	Part-Owner[a]	Total All Types	Cash	Share of Produce	Fixed Amount of Produce	Rent Free	Others	Manager	Other Forms of Tenure
Gamu	1,225	506	266	423	18	336	14	-	55	1	29
Mallig	1,423	368	85	970	5	953	12	-	-	-	-
Roxas	2,287	750	328	1,198	10	874	67	221	26	1	10
Solana	3,443	608	1,168	1,598	6	980	591	9	12	1	68
Sto. Nino	2,181	1,045	566	561	1	560	-	-	-	-	9
Tabuk	2,856	1,600	274	802	-	593	59	100	50	2	178

[a]Farm operators whose holdings are partly owned and partly rented from others.

[b]Farm operators who rent or lease from others the land they operate. The rent may take the general forms shown in the subheads.

Source: 1971 Census of Agriculture, Vol 1, Table 6A

Yields for unirrigated corn were also higher in Isabella, at 16 cavans per hectare compared to 11 cavans per hectare in Cagayan. The average annual farm household per capita income in 1971 was correspondingly higher for Isabella (440 pesos) than for Cagayan (253 pesos). Total value of palay and corn production was as follows:

	Palay[1]	Corn[1]	Total Farm[1]	Palay and Corn / Total Farm
	(Millions)			
Cagayan	55.9	9.6	80 (U.S. $10.9)	82%
Isabella	123.4	25.9	187 (U.S. $25.6)	80%

[1] Cash and cash equivalent of consumption on farm

The survey showed that there is a very wide range in the price of good rice land in the barrios: from 15,000 pesos to 3,400 pesos in Cagayan Province and from 12,000 pesos to 1,000 pesos in Isabella. There was such irregular distribution within these ranges that it is impossible to draw any correlations from the sample. However, given the relatively low per capita farm household incomes, valuations above 5,000 pesos (given in seven of the villages surveyed) must be considered suspect. There was, however, general consistency in responses showing that the price of land had increased substantially during the study period and that this gain was considered a major source of wealth. It appears that this increase is in part the consequence of increasing productivity from use of better seeds, fertilizers, and irrigation and improved accessibility, but the Consultants do not have data to further document the distribution of land value changes or their causes.

B.3.b. Fishing, Hunting, and Gathering. There are no fishing, livestock, or forestry products of commercial significance in the study areas. The carabao, however, is still the predominant work animal, numbering about 100,000 in Cagayan and 125,000 in Isabella, for an average of about two per farm.

B.3.c. Manufacturing and Primary Processing. Firms are almost exclusively in business to mill palay and corn. There was only one enterprise surveyed that employed more than ten regular employees.

There are rice mills in all but four of the villages surveyed. Five of the villages had a single mill and eight had more than one. These mills are small, family-operated enterprises that usually provide only a milling service rather than purchase palay for commercial sale outside the village. All of the larger commercial mills in the study area were surveyed; the information therefrom is presented below. The first sugar mill in the study area will begin in 1978 in Cagayan, as discussed in more detail below.

Some of these enterprises have been in the study area more than ten years and have grown, others are newly established, while still others closed over the study period. The closings, most pronounced in Tabuk, can be largely attributed to improved transport. Whereas several firms had a monopoly in purchasing and milling before transport improvements, merchants from outside the study area now compete very effectively in the market. Although this has reduced the value added within the study areas, the price paid to farmers is somewhat higher. These merchants have certain competitive advantages that the local enterprises lack. Moreover, with better transport, the importance of reducing the product weight through processing at source has decreased.

Paricularly notable in Cagayan is the move of some milling enterprises into the study area from Tuguegarao. These moves were made so that the mills would be closer to the farmers and the costs of operations in a large town would be reduced.

The only primary processing industries in the study area are rice mills, a few of which also mill corn. All seven of the mills in the project area that commercialize rice and corn were surveyed: Solana (3), Tabu (2), and Aurora (2). In addition, three mills that do not sell rice but that provide a milling service were interviewed in Mallig. In Tabuk, an interview was held with a proprietor of a milling enterprise that had closed.

Of the seven enterprises, three were owned by persons resident outside the province in which they were located. Four of the enterprises opened within the last four years. The number of permanent paid employees ranged from 2 to 14, with most having less than 5. Their rate of throughput ranged from 15-400 cavans a day, with most mills operating 6 to 8 hours a day for up to 8 or 9 months a year. At peak periods, the mills operate on a 12 hour schedule, thus considerably increasing their capacity. Those mills that have sufficient covered storage can also increase their capacity by extending the number of operating months. There seems to be ample opportunity for expanding capacity in this manner without

introducing additional equipment. Only one enterprise closed down in another location to move to its present location. Four of the enterprises transport more than 50% of their raw material from the farmer to their mills in their own vehicles. Some of them make no extra charge for this service, and others charge one or two centavos per kilo. The service area of the mills is either the municipality in which they are located or in a municipality in the immediate vicinity, with hauls from farm to mill generally less than 40 kilometers.

The two mills in Mallig, which do not buy and sell products but simply provide a milling service for which they charge, are a type of enterprise found throughout the study area in many barrios. They typically are run as family businesses with no full-time paid employees; operate on quite a small scale; do not have their own transport vehicles; and charge approximately ten centavos per kilo for milling services.

The closed-down enterprise in Tabuk is interesting because it represents a change that has occurred in that municipality over the past ten years and is typical of three or four other mills that have closed down. The enterprise in question operated from 1953 to 1973 and was producing an average of 150 cavans per day (medium to large scale) with a maximum capacity double that. It had a huge warehouse capacity of 40,000 cavans and operated a fleet of trucks to bring in the products. The proprietor, when asked why he and several other firms had closed, explained that since the opening of the bridge, it was no longer profitable for them to operate in the municipality. The outside merchants could come in and pay somewhat better prices than they could for the farmers' product, and because they could make their own selling arrangements in the metropolitan areas to the south, they could still make a good profit.

Of approximately 2 million cavans of palay produced annually in the study area in 1971, it appears that only about 250,000 cavans pass through the seven major mills in the study area. Assuming that local consumption in the study area is 0.4 kg./capita, or 1 million cavans per year, and that these major mills produce for consumption outside the study area, there must have been in the order of 750,000 cavans of palay grown in the study area and shipped unmilled to other parts of the Philippines. This has probably risen to over 1 million cavans today.

The operation of the Cagayan Sugar Corporation (CASUCO) was to start January 1978 in Piat. It will have a milling capacity of 4,000 tons of sugar cane and be capable of producing 250 tons of refined and semi-refined sugar per day. The Philippine National Bank is financing the project at 500 million pesos ($70 million) and will handle marketing.

To achieve full capacity, about 12,000 hectares will be planted to sugar cane on private plantations in Solana, Tuao, Piat, and Enrile municipalities. In 1977, about 5,200 hectares were planted; the full acreage is to be accomplished by 1979.

It is estimated that CASUCO will employ 700 people for its factory operations and that the plantations will generate employment for up to 180,000 daily laborers. Most of these employees would be hired from local municipalities.

CASUCO now has 80 ten-ton trucks for hauling cane, 15 for transport of refined sugar, and 10 for transport of bulk sugar. The truck requirement for cane will be at least 300 units, but CASUCO expects to lease additional trucks from private truckers.

The existing road from the Buntun Bridge to the refinery is already paved for about 20 kilometers; the remaining 10 kilometers to the refinery are being improved. The refinery will clearly be a major traffic generator on local roads as well as the bridge and could not have been undertaken without the bridge.

B.3.d. Commercial and Trading Activities. Commercial activities fall largely into three categories:

1) Buyers of agricultural produce

2) Sellers of miscellaneous consumption goods

3) Sellers of investment goods, farm inputs, and construction materials

There has been a shift with improved transport to selling farm produce to licensed and sometimes unlicensed merchants whose bases of operations are outside the study area, frequently as far away as Manila. This is true for all three main cash farm products: palay, corn, and tobacco.

As for consumption goods, these items are sold mostly in Sari-Sari stores, whose line of merchandise has not changed substantially over the past ten years, the major sale items being packaged food. The number of these stores has approximately doubled in the past ten years. In 11 out of the 17 villages studied, there is now one such store for a population of 150-300. To the extent other items are becoming important, it seems that they are being sold in main trading centers or by itinerant traders. Thus, it is possible with better transport for more traders to come into the study area, and they can afford to offer a larger variety of goods and better prices than small shops. All but three of the villages surveyed reported that

traders visited much more frequently than before the projects. Moreover, families that have disposable incomes to purchase new categories of consumer goods, such as motor vehicles, refrigerators, and gas ranges, are also those that can and do now make occasional trips to large commercial centers.

Local merchants appear to be doing better in the sale of seeds, fertilizer, insecticides, hardware, and building materials. These products are fairly standardized, and the farmer is unlikely to be able to make product differentiation between what is available locally and in the larger towns. Building materials, because of their bulk, cannot be carried back from town by the farmer as easily as consumer goods and require an added transport charge. The local merchants seem to be able to provide good service for small lot purchasers.

Prices of insecticides and fertilizers are government controlled. Various manufacturers are out competing for new business, particularly as farmers move into irrigated agriculture. These manufacturers set up local demonstration plots and appoint local agents. They also know that, through government subsidized programs, farmers are gaining the ability to purchase their products.

B.3.e. Transport Activities. Most of the commercial firms interviewed had increased the number of vehicles they operate. A few of these are now operating trucks for long-haul transport that are larger than they could operate before the project. However, most local truckers have to be content with local services as they cannot compete with truckers supplying services throughout Luzon. The latter can operate larger vehicles and get much higher year-round utilization from them. This very sizeable influx of trucking from outside the study area is most remarkable. A good level of service is provided. There appears to be a consequent reduction in existing commercial warehousing capacity utilized in the study area.

As for passenger service, there is now long-distance service by large buses from the study area to major towns outside the study area, where previously only service by small bus and jeepney was available. Large buses would not use the small ferry boats. These long-haul trips are served mainly by firms based outside the study areas. The village surveys show that in all districts except Tabuk (a provincial capital) and Solana and Gamu (districts adjacent to the project sites), round-trips to provincial capitals that used to require two days are now accomplished in one. This was frequently cited as a major benefit of the projects.

Travel time savings between the study area and the provincial capitols has been substantial from replacement of ferries by bridges. For example, traveling from Sto. Nino to Tuguegaroa, which used to take up to 8 hours, now is

reduced to 2-3 hours. Trips between Solana and Tuguegaroa that used to require 2 hours are now made in 15 minutes.

Minibuses, jeepneys, and motor tricycles provide local service and are locally owned. They are highly competitive, and the number of vehicles has increases substantially since the projects were completed.

It is reasonably clear that jeepneys and motorized tricycles are providing the bulk of the passenger services within a single municipality and between adjacent municipalities where distances travelled are 15 kilometers or less. On longer hauls between municipalities, or to points outside the study area, buses are important. This segregation of the passenger transit market has become more apparent in the Isabela study area than in the Cagayan one.

For example, in the vicinity of Tabuk, stations 3339 and 3341 show 1500-2000 jeepneys per day, and in the vicinity of Roxas, Station 329 shows 1050 jeepneys per day. However, on the Tabuk-Buntun Road, 16 kilometers out of town, jeepneys drop to about 200 per day compared to 75 for buses. Since the buses have about three times the capacity of jeepneys, the two vehicle types can be assumed to be sharing passenger trips approximately equally. On the Roxas-Gamu Road, jeepneys and buses are 80 and 116, respectively, with total bus capacity and use greatly exceeding jeepneys.

B.4. Social Structures

B.4.a. Settlement Patterns. Each municipality is composed of a number of barnagays. One or more of these barangays is designated as the poblacion, or urban center, of the municipality. These poblacions are physically easily identifiable and contain clusters of houses, the town hall, major churches, community facilities, and commercial and agro-processing enterprises. The streets in the poblacion have usually been improved and occasionally are paved.

In this heavily Catholic country, churches represent the most frequently found public buildings and are often the most substantial structures in each barangay. Most of the barnagays are linked to the municipal center by some form of motorable road, which may vary from a major national or provincial road to local dry-weather barangay roads. The farmers' houses are normally located on the plots that they farm and are made of locally available materials with the frequent addition of a tin rather than a thatch roof. Each of the barangays has a barangay captain. The municipality itself is governed by a mayor and municipal council. Municipal officials normally include a treasurer, judge, and police chief. These people have offices in the town hall, which often houses various officers of national service agencies as well.

Central electrical systems (cooperatives) which have been installed recently, are found in only two municipalities of the study area, namely Solana and Tabuk. It would have been very difficult to transport the equipment needed to construct the generating facilities without the project study bridges. Moreover, it would be difficult to transport the fuel oil required to operate these facilities without the bridges. Central electricity distribution, however, is largely confined to the municipal centers. The cooperative power plant in Solana also supplies electricity to some areas of neighboring municipalities. Lighting in the study area is predominantly through the use of kerosene lamps. A small number of households have electric generators frequently associated with some other economic activity enterprise located adjacent to the home.

B.4.b. Occupational Structures. The study area, and more particularly, the impact area, is composed largely of farmers. These farmers, of whom approximately half are owner-operators and the remaining half tenant or renters, with relatively small numbers being a mixture of both, account for most of the employment. There is little recorded cash income from employment as farm labor, as there are few large-scale agricultural enterprises. The services represent the second largest employment group; herein, the largest number would be associated with the educational institutions. There are, of course, employees of the national government agencies and the few employed by the municipal governments. The commercial, agro-industrial and transport establishments located in the study area are small and largely family-run. Only the largest would have full-time employees. However, the agro-industrial establishments do tend to hire seasonal labor. In aggregate, however, the numbers are very small. The transport enterprises in the study area have their vehicles garaged at the home of the enterprise owner or driver.

B.4.c. Education. Almost all of the elementary schools are public schools, whereas a substantial number of the secondary schools are private. The private schools are publicly certified but are usually operated by a religious order. This reflects the history of Catholic missionary work in the Philippines, with schools often being formed as a principal service agency of the Mission. In fact, for the study area as a whole, private secondary schools educate more students than public schools; however, the number of public schools is rapidly being expanded. Although there are now secondary schools in most municipalities, there is frequently more than one secondary school in the larger towns and provincial capitals, such as Roxas and Tabuk, which draw their students from the adjacent municipalities. Therefore, the number of secondary school places in a particular

municipality does not indicate the total availability of secondary school places to children of that municipality.

The distribution of student population by levels in the whole of Region II is as follows: elementary 79%, secondary 16%, tertiary 5%. These percentages imply that there is a considerable narrowing of the educational pyramid between elementary and secondary schools.

The rate of retention of students from grades 2-6 based on data for 1972-1977 in Gamu shows 82% for grade 2, about 90% for each of grades 3-5, and 100% for grade 6. The decreasing retention of pupils in schools is caused by many factors. Because these are agricultural communities, as soon as children can be of help on the farm, they are asked to do farm work, while others have sent their older children for employment as household helpers.

The quality of elementary education is also a problem. For example, in Gamu the textbook ratio is only one book for every four pupils. In the local high school, the ratio is one book for every two pupils. There is also a great lack of teacher materials, guides, and manuals. Curriculum content often covers too many subjects without obtaining depth in any. Teacher/pupil ratios are also high. In Gamu elementary schools, the teacher ratio for grades 1-6 ranges from 1:31 to 1:38. In the local (barangay) high school, the ratio is 1:48. Laboratory equipment and school library audio visual aids are frequently lacking. The barangay high school is one that is financially locally supported. There are also national high schools that are financed by the national government.

The number of students in secondary schools over the past ten years has increased by an average of 30% in the study area municipalities.[1] Particularly significant are increases in public education institution enrollments. However, it is still a constraint on educational development, as only about one out of three graduates of elementary grade 6 can be placed in the first year of high school. However, none of the study area municipalities appears to be without a high school, and at least half have more than one high school, the typical pattern being one private and one public.

B.4.d. Health Services. The leading causes of morbidity in the study area are influenza, bronchitis, and gastro-enteritis. Malaria and pneumonia rank fourth and fifth. Pneumonia, however, is the leading cause of mortality. In 1975, a study of malnutrition was undertaken in Isabella. A total 35,100 children ages 0-17 months were examined and weighed in 33 municipalities; of these, 17.5% were found to be of normal weight, while 81% were found to be underweight, which is a sure indication that

[1] Particularly significant increases are as follows: Sto. Nino 100%, Solana 33%, Tuao 68%, Tabuk 50%, Mallig 23%, and Roxas 80%.

they were malnourished. Of the underweight children, about 60% were found to be seriously malnourished.

There are hospitals in six of the municipalities in the study area: Tuao, Piat, Roxas, Tabuk, Solana and Rizal. The number of beds available has doubled in the last ten years in Piat, Roxas and Tabuk. The total number of beds available now in the study area is about 240. In addition, there are also about 20 small private clinics, some of which provide a few beds. In the study area, there are now 33 rural health centers and an additional 15 other health delivery facilities (particularly family planning centers and mobile health units), a net increase of ten units in the study period. Ten of the municipalities report having doctors resident in the municipality. The total number of doctors in the study area is 49, compared to 30 in the earlier period. Registered nurses are resident in all municipalities, with the municipalities of Tuao, Piat, Roxas, Aurora and Tabuk being the best serviced. Their number rose from 45 to 84 in the study period. All of the municipalities had midwives in residence; their numbers also increased from 40 to 63. There are also a large number of health practitioners called "hilots" who provide a type of para-medical service. The principal change over the past ten years is that most of the "hilots" have received some medical training and certification. These are the health practitioners that one would normally find at the barangay level, whereas the other practitioners would most normally be found in the municipal center.

Potable drinking water is found generally through the study area. The most normal practice is for a household to have its own well; these are predominantly hand pumped but in many cases are artesian. In fact, more than half of the households surveyed had private wells. Communal wells and piped water systems are the exception. There is an appreciation of the need for personal sanitation, and sealed privies are more frequently found than pit privies.

C. TRANSPORT SECTOR CHANGE AND COMPLEMENTARY INVESTMENTS

C.1. Study Project Characteristics

The study projects were two major bridges, the Buntun Bridge, which is approximately 1,200 meters long in Cagayan Province and was opened in 1968, and the Gamu Bridge in Isabella Province, approximately 500 meters in length, opened in 1971. Both of these bridges replaced small ferries. They provided the first year-round uncongested access between municipalities to the west of the Cagayan River and the provincial capitals and major trading towns of Isabella and Cagayan provinces. The projects also linked these muncipalities with the new Philippine Friendship Highway running from these provinces to Manila.

C.1.a. The Road Network Serving the Study Area. The Buntun Bridge is located on the outskirts of the provincial capital of Tugegarao. Just west of the bridge, the road divides, with one fork going north and serving the municipalities of Solana, Tuao, Piat, and Sto. Nino, and the other fork going south to serve Enrile, Rizal, and Tabuk. The northerly road is paved for the first 20 kilometers from the bridge; 10 of these kilometers have been paved since the construction of the bridge. The next 14 kilometers reaching the junction of the main road with the spur to Tuao is a good graveled road. The 5 kilometer spur to Tuao is graveled, but travelers must take a small ferry to enter the municipal center. This ferry carries only light vehicles. The total waiting and crossing time averages 20 minutes. Trucks serving Tuao must park on the east bank of the river, a branch of the main Cagayan River, and receive or discharge cargo there. Cargo reaches the east bank mainly by small boat; some arrive by small cargo vehicles such as jeepneys crossing on the ferry.

The municipal center of Piat is also about 4 kilometers off the national road; this spur is paved. Both Piat and Tuao are about 40 kilometers from the bridge site. However, Piat is more accessible because it does not have the aforementioned ferry constraint. The new sugar refinery mentioned earlier is located on the national road in the municipality of Piat.

The distance from Piat to Sto. Nino is about 16 kilometers from the Piat spur turn off. It is a provincial road, graveled but in poor condition, and portions have not been properly engineered. It has two temporary wooden bridges, and 2 kilometers adjacent to the municipal center of Sto. Nino are paved.

The road section from the bridge site to the Piat spur is flat. The section beyond to Sto. Nino has flat to rolling terrain.

Travel time between the bridge site and Sto. Nino for passenger vehicles not making stops is approximately one hour at an average running speed of approximately 55 kilometers per hour. Normal travel time for buses and trucks is closer to two hours.

The southern spur leading to Tabuk, the provincial capital of Kalinga-Apayao, is approximately 65 kilometers 17 kilometers of which are paved. The first 45 kilometers are over flat terrain. The road then climbs over a range of hills to gain access to the valley where Tabuk is situated; the terrain, therefore, becomes hilly. Total travel time to Tabuk for non-stop passenger vehicles is about 1½ hours at speeds averaging 40 to 45 kilometers per hour or up to 2½ hours for normal passenger and commodity transport.

There is only one main road leading west from the Gamu Bridge and serving this entire study area. The first approximately 25 kilometers to Roxas is a wide road that was once well graveled but has now deteriorated in most places to standards appropriate for an earth road. Although the terrain is flat, the road becomes very difficult to use during or immediately after heavy rains. These 25 kilometers are scheduled for reconstruction and paving shortly; they certainly carry a volume of traffic sufficient to warrant this kind of improvement. At Roxas, the road joins the north-south road linking the municipalities of Quezon, Mallig, San Manuel, and Aurora. This heavily traveled gravel road is over flat terrain and is in somewhat better condition than the Roxas-Gamu section. There have been no significant improvements to these principal roads serving the study area since 1971. A secondary road turns south off the Gamu-Roxas road through Burgos to Aurora. This road is in poor condition and is not heavily used. Truck traffic and passenger vehicles to and from Aurora find it more efficient to take the somewhat longer route via Roxas because Roxas is a principal generator of passenger traffic. Travel time between Roxas and the bridge site varies with the condition of the road but averages about one hour for an average of 25 kilometers an hour. Speeds on the Mallig-Aurora road average about 40-45 kilometers per hour.

C.1.b. Philippine-Japanese Friendship Highway. Prior to the construction of the bridges, the principal national road running north-south and connecting Tuguegarao, Cagayan, and Ilagan with southern Luzon and Manila was largely a graveled

road in poor condition with many temporary bridges and some ferry crossings. Travel from Tuguegarao to Manila often took several days, especially in the rainy season.

Beginning in the early 1970s, the Japanese Government agreed to finance the reconstruction of this entire road to high-standard asphalt. Completion of the road to Tuguegarao was accomplished in 1976. This new road has made it possible and attractive for merchants and truckers from all parts of Luzon to serve the study areas.

It was not possible to segregate the impact of this major road investment from the project bridges in the study. In retrospect, it would have been better to have picked study projects that were not affected by a second major transportation investment so that a purer case for impact of bridges could be made. It is probable, however, that the impact of this road investment on economic activity in the study area was somewhat greater than that of the bridges, although the bridges are clearly associated with this road improvement and have helped bring the benefits of the road improvement to the study areas. For personal transport, the impact of the new national road is less significant for the study areas than was the construction of the bridges. The construction of the bridges made it possible to travel easily in one day between the study area and the provincial capitals and major trading centers adjacent to but outside the study area. Although passenger trips can now be made from Tuguegarao to Manila in approximately 12 hours or less, the frequency of household trips to and from southern Luzon is less than one per year.

C.2. Investment in Fleet

There has clearly been a substantial increase in motor vehicle ownership in the study area since the bridges were built. Of the 15 project area villages reporting vehicle ownership, ownership has increased from 52 to 171 vehicles. The largest increase is the number of motorcycles, about 1/3 of all vehicles. A large number of the vehicles, especially jeepneys and motor tricycles, are used in public passenger transport. It was not possible to obtain vehicle registration statistics for the study area for the past ten years.

In the Gamu Bridge study area, there are five firms owning and operating buses: two in Gamu, two in Roxas, and one in San Manuel.[1] These are small operators owning and operating between one and three buses ranging in size from 22 to 54 passenger capacity. Only two of the enterprises were operating buses before the project, one with less and one with more buses.

Of the six commercial trucking companies, two each are

[1] Nelson Liner, Lintao Express, Larry Vic, Velasco, and

located in Mallig, Roxas, and Aurora. The ones in Aurora are owned and operated by rice mills. Three of the transport enterprises did not exist before construction of the bridge. Trucks with six to nine tons capacity are typical. Trucking capacity is highly utilized during and immediately after the palay harvesting season, but thereafter the trucks remain idle for many months of the year.

Passenger buses, however, are only slightly subject to seasonality, with some peaking at the palay harvest season and at the beginning and end of school holidays. However, the average running distance of a 100 kilometers per vehicle per day shows a relatively low utilization rate. This stems, in large part, from a scheduling problem. Travelers normally want to begin their trips early in the day so that they can transact their business and return before dark the same day. Therefore, bus operators with more than one vehicle tend to schedule all trips to begin, say, between 6 A.M. and 9 A.M. These vehicles generally make their return trip in the early to middle afternoon. Although the buses could make a mid-morning return trip and a second out-bound trip in the early afternoon, there does not appear to be a demand at these times of day. Jeepney operators achieve greater efficiency as their trip lengths are generally shorter and hourly peaking is not as significant.

In the Buntun Bridge study area there are seven passenger transport enterprises; three additional enterprises serve the study area but are located in Tuguegarao. Only two of these enterprises were in business before completion of the bridge. Twenty-one buses, ranging from 25 to 58 passenger capacity, are garaged or operating in the study area. In addition, three relatively large jeepney operators with five or more vehicles are serving the area.

Only three truck operators exist in the study area, with most service being provided by four firms based in Tuguegarao and other truckers coming from more distant points in the Philippines. One of the local truckers is a rice miller and the other two have three trucks each of eight to ten ton capacity. Two of the enterprises did not operate trucks before the project, and the third has increased from one to three vehicles. In Tuguegarao, enterprises with a total fleet of 23 ranging from 6 to 18 ton capacity serve the project area. The number of vehicles owned by these enterprises has not changed substantially. These enterprises report that whereas their trucks were only able to complete three round trips weekly between Tuguegarao and the project study area before the bridge, they now do approximately one such trip per day at speeds averaging between 25 and 50 kilometers per hour.

TABLE 3.7

TRAFFIC CENSUS

Prov./City - Cagayan KM. No. 498.5 Sta. No. 1112

LOCATION - TUGUEGARAO CENTRAL SCHOOL - BUNTUN SECTION

CAGAYAN - APAYAO ROAD

Year	Type of Vehicle							Measured Traffic Vol.	Expansion Factor	AADT
	Pass. Cars	Jeep-neys	Buses	Light Trucks	Heavy Trucks	Trucks Comb.				
1963	4	3	-	-	8	-	-	15	1.676	27
1964	8	7	4	-	18	-	-	37	1.687	62
1965	6	23	3	-	18	1	-	51	1.638	84
1966	8	-	-	-	13	-	-	21	1.638	34
1967	3	9	-	-	9	-	-	21	1.712	35
1968	6	8	9	-	82	-	-	105	1.723	181
1969	32	147	18	-	92	3	-	292	1.762	514
1970	139	191	47	-	156	9	-	542	1.769	959

Note: Traffic counts stopped in 1970; resumed only in 1976.

Source: DPH - Manila.

C.3. Changes in Transport Flows and Transport Prices

C.3.a. Changes in Transport Flows.

1) Buntun Bridge

Traffic counts taken at the bridge up through 1970 clearly show the impact of the bridge opening in 1968, when traffic jumped five-fold, largely because of trucks. By 1970, traffic (AADT) was recorded at 959, compared to 35 in 1967. Jeepneys exceed trucks in 1969 and 1970, and in 1970 passenger cars became significant, accounting for 25% of traffic. (See Table 3.7)

In 1976, traffic counts were resumed at the junction of the N-S feeder road a few kilometers west of the bridge (Station 1114). These counts proved a reasonable approximation of bridge traffic. The AADT in 1976 was 1,437, a 50% increase in six years. The distribution was 38% passenger cars, 37% jeepneys, 9% buses, and 16% trucks. All categories of vehicles showed increases, with passenger vehicles gaining most dramatically.

2) Gamu Bridge

A pre-bridge traffic count shows 125 AADT on the Gamu-Roxas Road and 146 vehicles on the road to the Gamu ferry (40% to 50% commercial). For 1975, a traffic count on the Roxas-Gamu Road recorded an AADT of 446, of which 168 was through traffic (using the bridge). This figure understates bridge traffic, however, as it does not include traffic with origin/destination in Gamu itself. The poor condition of the Gamu-Roxas Road has, however, contributed to lowering potential traffic on the bridge. This road, which will soon be paved, has been allowed to deteriorate to the point where passage after rains is hazardous.

Traffic on the feeder road running north and south of the important commercial town Roxas is considerably higher, on the order of 1,500 vehicles per day rising to 4,400 in the municipality of Roxas itself. Although the Consultants do not have origin and destination information, some of the traffic north of Roxas, Mallig, and Quezon municipalities is unquestionably using the Buntun Bridge for entrance and exit to the study area during bad weather.

C.3.b. Effect on Transport Prices

Passenger transport prices are government fixed and controlled at about 8 centavos (U.S.$0.011) per kilometer for jeepneys and about 4 centavos (U.S.$0.005) per kilometer

for buses. According to the transporters interviewed, these prices have about doubled since 1971. The DPWTC estimates that vehicle running costs have almost tripled in this period.[1]

Buses normally charge an additional peso for each cavan of palay carried by a passenger; jeepneys charge up to 4 pesos, irrespective of distance.

By performing the following calculations, the amount of household income spent on passenger transport can be roughly estimated. An average household makes approximately 70 trips to the provincial capital per year. If one assumes that the average distance of these trips is 35 kilometers and is made at an average cost per trip of 6 centavos per kilometer, 70 round trips would equal 6 centavos x 35 kilometers x 140 trips, or approximately 300 pesos per year. The Consultants have also found that the frequency of trips to municipal centers is about double that to provincial capitals. Assuming an average distance for these one-way trips of 5 kilometers at an 8 centavos per kilometer rate, one can estimate the cost at 8 centavos x 5 kilometers x 300 trips, or a total of 120 pesos. This may be a slight exaggeration, as some of these trips are not made by motor vehicle. If households are spending approximately 400 pesos per annum on public transport, however, this represents a major portion of household cash disposable income in the study area.

Because of the marketing system for the principal commodities, palay and rice, it was not possible to obtain reliable goods transport prices. The traders come into the study area and pay farmers a price for palay that includes transport cost. The rice miller either ships rice on his own vehicles or sells the rice to a rice dealer, again at a price which includes transport. One trucker and the Casuco refinery estimated their costs at 30 centavos per ton/kilometer.

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[1] Light vehicle tunning cost (taxes included) approximately 13 centavos/veh/km in 1971 and 33 centavos/veh/km in 1977. For trucks the respective values were 29 centavos in 1971 and 83 centavos in 1977. These are DPWTC values for operating on paved, flat, tangent roads in good condition with no capacity constraints.

D. BEHAVIORAL RESPONSE TO TRANSPORTATION SECTOR CHANGE

This section examines changes in behavior over the project period that may be at least partly attributable to the impact of the study project. Behavioral changes were examined in several areas: production, consumption, travel, service utilization, social participation, and communications. The analysis is based very largely on the household survey data.

D.1. Production Changes

D.1.a. Change in Cropping Patterns. The general conclusion that can be reached from the sample survey is that the area cultivated and the cropping patterns changed relatively little over the study period. For the major crop, palay, 266 respondents, or 72%, reported that they were cultivating about the same area as before. Only 28 reported that they had not cultivated rice before and are not presently cultivating it; 53 reported that they are cultivating some now but did not before. A substantial number of these can be assumed to be new farms. Only 18 indicated that they were cultivating more rice land than before; 9 reported cultivating less than before.

The second most frequently cultivated crop is maize, for which 106 farms reported cultivation. However, again, the majority of these (82 respondents) said they were planting about the same areas as before, and most of the remainder had begun planting corn during the study period.

The third most frequently reported crop is vegetables, for which the response pattern was similar. Of 52 cultivators, 44 reported they were cultivating about the same area as before, and 7 indicated they were cultivating vegetables for the first time. However, neither maize nor vegetables is an important cash crop.

Although only 17 tobacco farmers were surveyed, 7 of these were new planters; the remaining 10 reported planting about the same area as before.

No new crops were introduced in the study area, with one very recent exception. A major sugar mill has now been sited in Piat, and sugar cane has been planted for the first time in this municipality and adjacent ones; the mill began operations in 1978 (see discussion in Section B, Agro-Industries). Sugar cane is being planted largely as

a plantation type crop on large estates. Because these estates are not planted with rice or corn, they will not be subject to the Land Reform Act. Although the acreage planted to sugar will increase to approximately 12,000 hectares, this gain is not likely to be reflected in small farm cropping pattern changes. However, the sites chosen for farm household samples did not include the municipality of Piat, where some small farmers may begin to grow sugar cane. The survey showed only one new sugar cane farmer. The main significance of the sugar cane cultivation will be to generate a major source of new cash labor employment in the area, possibly drawing off labor now engaged in small farming. Considering the size of the mill and the traffic that it will generate both for transport of sugar and industry inputs, it is certain that it could not and would not have been sited in the study area if there still existed a small ferry instead of the new Buntun Bridge.

D.1.b. Change in Marketing Patterns. Palay is by far by the most important cash crop in the study area. About 60%, or 220 farms, reported selling palay. The number of farms selling the crop, however, appears to be declining somewhat, since 85 farms reported that they were selling before but not now, compared to only 29 that reported sales now but not before. Further, 28 farms reported that they did not now or before sell palay. Only one-third of the farms growing maize reported cash sales; this has changed little over the study period. All tobacco farmers, of course, sell their crops for cash. Other crops are mainly grown for on-farm consumption.

The majority of farmers either sell their product at the farm gate, at roadside, or in a village within a few kilometers of the farm. Motor vehicles were cited in 140 responses to the question concerning the mode of transport the farmer used to transport his crop in the past. This probably means that less than 140 of the farm households interviewed actually used a motor vehicle, because if a farmer used more than one type of motor vehicle, there would be a reply for each type of vehicle used. By contrast, the mode of transport now used showed a frequency of 237 for motor vehicles. The most dramatic increases were in use of motorcycles, buses, and jeepneys. The most significant decrease was in the use of the bullock cart. There was also a modest increase in use of trucks. However, this understates the importance of trucks in commodity transport because most trucking is in the hands of merchants. The farmer will deliver his product to the trucker/merchant, who is the point of sale; the farmer does not actually travel on the truck to a larger market place. (See Table 3.8.)

TABLE 3.8

CHANGE IN TRANSPORT MODE

Transport Mode	None Now, None Before	Both Now And Before	Now, Not Before	Before, Not Now
Hand Carried	327	20	7	8
Bicycle	345	3	8	6
Motorcycle	337	6	19	0
Bullock Cart	291	27	4	40
Bus	303	33	23	3
Lorry	294	49	18	1
Jeepney	263	44	45	10
None	69	253	21	19

In fact, the information on point of sale shows that the frequency with which farmers themselves transport their produce for sale has decreased slightly. The predominant response to the question on changing point of sale, however, is that the farmer is using the same point of sale as before. Of farmers responding, 31 said that they were selling their products closer to the farm and only 12 noted that they are selling palay at a more distant point. The major change in commercialization patterns is that farmers now have greater opportunities to sell their product directly to the merchant, who will market the crop in the food deficit areas of the country directly; farmers had to sell to local merchants or millers more frequently because fewer merchant/truckers would come into the study area owing to transportation difficulties on the road from southern Luzon to the study area and a lack of a good river crossing facility.

D.1.c. Farm Enterprise Changes. There has been a significant increase in the use of fertilizers for palay, with 248 farms reporting fertilizer use now; of these, 192 report that they were not using fertilizer before. Of the farmers that were using fertilizer before, 39 reported using less now and 10 more. Only three farmers reported using fertilizer on maize.

High-yielding varieties of seed are very widely used for palay in the study area. A total of 250 farmers reported using higher-yielding varieties, and of these, 186 used this type of seed for their entire cultivated area. Of the 250 farmers using high-yielding varieties, 217 indicated that the use began within the last five years. Therefore, a very significant change has taken place in the use of both fertilizers and high-yielding variety seeds for the palay crop in the study area. Corresponding improvements have not been followed in maize. This can, in part, be accounted for by the fact that the government extension services have made a major effort, called Masangana 99, at improving the yields for palay. The corresponding program to increase yields for maize is only just beginning in the study area.

Statistics on irrigation acreage for the study area show that in certain municipalities, particularly Tabuk, Roxas, and Mallig, use of irrigation is becoming widespread. Its use and value is also beginning to be significant in Tabuk, where a major irrigation project is now being installed using waters captured and impounded in pipes from the neighboring mountain watersheds. Irrigation immediately makes possible double or triple cropping with consequent tremendous improvements in acreage yield. The survey showed that 147 farms, or 40%, are now using irrigation, although, as indicated above, the distribution of these farms is concentrated in certain municipalities.

The use of small farm tractors is now seen frequently in the study area, particularly in Roxas. The farmer walks behind these tractors to cultivate palay.

Of farmers responding, 114 indicated that they had increased the number of livestock on their farms and 100 responded that they had added or increased facilities for storing palay.

The irrigation facilities that are having the most impact are major infrastructure projects being installed and managed by NIA (National Irrigation Authority). It is reasonable to presume that the national government would not have undertaken such large projects and investments if it were not assured of good access to the study area for the inputs required to establish the irrigation works and for marketing the production if the bridges were not built.

D.2. Consumption Changes

Table 3.9 shows the change in selected household assets of the farm households surveyed. More than half the households have a private water supply, radio, and housing with tin roofs. There have been significant increases over the last five and ten years in ownership of these assets. One-third of the households have sewing or weaving equipment. Only 20% of the households own bicycles. Motorcycles appear in 20 households, with 13 owning the vehicle less than five years. Ownership of other types of machinery, largely small tractors, has also increased rather dramatically in the last five and ten years. Electricity is available in only 23 households. On the whole, it does not seem that the transport investments under study have made a striking difference in the patterns of household consumption as measured by these assets.

D.3. Travel

The previous discussion of the changes in the transport service, that is, the increases in jeepneys and buses, and the change in traffic statistics clearly indicate that there is a great deal more personal travel now than before. Accessibility to the provincial capitals of Tuguegara and Cagayan and to Ilagan, a principal commercial center in Isabela, are clearly related to the project improvements. Round trips between the project area and these cities can now be done easily in a single day with sufficient time to transact business, whereas before the projects, this was normally an overnight trip. Travel to Manila, although not a frequent destination yet, has also increased because of both the installation of the projects and the major improvement of the Japanese Friendship Highway. Local

TABLE 3.9

CHANGE IN HOUSEHOLD ASSETS

	Ownership		Years Owning		
	Yes	No	0-5 Yrs.	5-10 Yrs.	10+ Yrs.
Tin Roof	178	179	44	40	81
Radui	254	106	103	80	54
Bicycle	61	300	22	14	19
Motorchcle	17	342	13	3	3
Other Vehicle	8	350	3	3	1
Rice Mill	2	356	2	0	1
Other Michinery	59	299	35	13	7
Sew & Weaving	121	238	35	20	52
Electricity	23	332	17	2	2
Private Water	179	147	38	37	77
Public Water	27	1	2	2	9

travel within the study area has also dramatically increased, as evidenced by the increasing number of jeepneys and jeepney trips. However, these local trips are not related to the bridge improvement projects, except insofar as the vehicle owners can now get fuel, parts, and service much more easily than before.

The responses to travel frequency questions of the household survey do not confirm the above conclusions. Respondents as a group did not report a significant increase in motorized travel although this clearly has occurred. The explanation may lie in the survey sample design since non-farm families account for the largest number of trips. Moreover, the survey question did not ask for specific number of trips only whether more, less of the same number were being made compared with the earlier period. Therefore the information obtained was quite impressive.

Household heads are consistently the most frequent travelers to all destinations; however, frequency of travel by spouses is about 80% of the frequency by household heads. Children attending secondary schools are also significant users of transport. Again, these trips are mainly local trips, as there is now a substantial distribution of high schools throughout the study area.

D.4. Service Utilization

Four types of services are considered: education, health, agricultural extension, and credit. This section concerns itself with the utilization of services by households over the project period and with the mode of transport used by service providers.

D.4.a. Education. The household survey shows a very sharp difference in levels of educational attainment between parents and children in the project area. Thirty-two percent of heads of households and 35% of their spouses have completed less than four years of primary schooling and therefore cannot be considered literate. By contrast, only 16% of their children fall into this category. Heads of households and their spouses having more than six years education are 35% and 25%, respectively; 59% of their children are in this category. Of the total 1,483 children, 345 were living away from home. Of these children, 63% had more than six years education. These statistics confirm that more children are going to school now than before and staying in school beyond the first six years of primary education. They also reflect the fact that secondary education is being increasingly offered in the municipality of household residents and, therefore, children can remain available to assist on the farm without forfeiting better educational opportunity at the secondary level.

The number of children with no education, though relatively small (107), is equally divided between boys and girls. However, for children who have gone or are going to school, a greater percentage of boys are getting primary education. Approximately equal numbers of boys and girls have attended or are attending secondary schools. One can conclude that girls are somewhat disadvantaged in getting a primary education, but once they have succeeded in completing a primary education, they appear to have a somewhat greater probability of gaining entrance into secondary schools than boys.

D.4.b. Health. Most of the households in the sample reported making between one and five visits per capita for health care during the past year. Health care was available at a distance of less than 4 kilometers to 43% of the households, at 5 kilometers to 10 kilometers for 19% of the households and at greater than 10 kilometers for 38% of the households. The frequency of annual visits for health care showed no significant relationship to distance from health care delivery point. Of course, between the range of one and five visits per year, there may have been variations that were not enumerated in the household questionnaire. The frequency of visits was reported not to have substantially changed for 135 households. A surprisingly large number (96) reported that they made fewer visits, and only 65 reported more frequent visits. The explanation for lower frequency of visits may be that the general health of the households has improved or that the health care at each visit has improved enough that less frequent visits are necessary. Another explanation may lie in the manner in which the question was asked: the household was asked about frequency of visits to health care centers or clinics for treatment in the past year. In fact, a number of health care practitioners who are not working in fixed locations, such as may be the case for midwives and is certainly the case for the trained "hilots," has distorted the meaningfulness of this question. Moreover, there are more mobile health units than before and respondents may not have included these visits in their replies.

D.4.c. Agricultural Extension. Of the presently farming households, about half report that their farms were never visited by the agricultural extension service during the past year, while 19% said they were visited once, and 32% indicated they were visited two or more times. Of the sample, 33% reported that visits were more frequent now than before, and no households reported less frequent visits than before. These data generally support the contention that agricultural services have been significantly increased. However, most of the farmers reporting more visits now than before also reported that they had at least one visit from agricultural extension agents before. This suggests that the increased service delivery is to a select group of farmers.

Most agricultural extension agents used to come to villages on foot. Today this is rarely the case unless the agent lives in the village, which was true in only two of the municipalities in the study area. Motor vehicles are now the prevalent means of transport for the agricultural extension officer. However, these agents are normally resident in the study area, so their increased mobility cannot be directly related to the project improvement. It appears that there is about one agent for 200-400 farm families.

D.4.d. Credit. About 55% of respondents indicated that they were obtaining credit from a formal banking agency or institution. Out of 188 respondents who were doing so, 176 indicated that this practice began since 1972. This is a significant change. Most of those who have not borrowed have never applied for credit. The most frequent reason respondents cited for not applying for credit was that their level of production was too small or that they were afraid to obtain credit. Eighty-five respondents indicated that they obtained credit from relatives. Private money lenders, local merchants, and middlemen are used by 65 of the respondents. Only 61 respondents indicated that they never borrowed from anyone.

D.5. Social Participation

Of heads of households, 153 reported participating in farm organizations; 100 spouses indicated participation in such groups. Participation for both heads of households and spouses generally began from five to ten years ago. The study period coincides with the period over which the government actively encouraged the formation and participation of farmers and their wives in various types of farm organizations devoted to increasing productivity.

D.6. Communications

From the household survey, it was learned that literacy has increased, as has radio ownership. All municipal centers now are accessible by telegraph. Newspapers are not sold in any of the municipalities and are obtained only when travelers go to provincial capitals or other major urban centers outside the study area. Readership of newspapers is therefore very low. There are post offices in all the municipalities, and many of them have instituted mobile delivery service within the last five years. No data were obtained concerning the change in volume of mail.

E. IMPACTS ON INCOME DISTRIBUTION

E.1. Composition of Socioeconomic Groups

The significant socioeconomic groups in the study area and distribution of these groups by household income and tenure class has been presented in Section B.

E.1.a. Travel Patterns. Travel patterns of the surveyed households are shown below. As one may expect, the frequency of travel is greatest to the municipal center, with trips to the provincial capital less frequent but still significant. Trips beyond the provincial capital, normally to Manila or other parts of southern Luzon, are relatively infrequent, as are trips for health care.

TRAVEL PATTERNS

	Mean Annual Av. Trips	
	Per Capita	Per Household
To municipal center	22	150
To provincial capital	11	70
Beyond provincial capital	0.6	4
For health care	2	13

Trips to the municipal center and to the provincial capital are made most frequently by households whose principal source of income is non-farm. This includes food farmers with non-farm income and cash farmers with non-farm income. The difference in trip frequency between subsistence farmers and high-income farmers is not significant; however, as a group, their frequencies are lower than the previously mentioned socioeconomic categories.

E.1.b. Sources of Income. The only socioeconomic group that reported significant non-farm income was the food farmer/non-farm income category. Other sources of income were primarily non-farm income, children, and private businesses. About 15% of the subsistence farmers reported income from fishing and other activities, such as selling firewood and charcoal.

E.1.c. Production Patterns. For all four significant socioeconomic groups, rice cropping is the most significant production activity. About 25% of the subsistence farmers reported growing maize, as did a similar percentage of cash and high-income farmers. Other production crops are insignificant.

E.1.d. Marketing Patterns. Rice is sold by 71% of rice growers. The farmers who do not sell rice are all in the subsistence category. Of 103 maize growers reporting, only 26 sell their maize, 17 of these being subsistence farmers and 9 cash farmers. Only 4 out of 52 vegetable growers sell this crop. All tobacco growers, of course, sell their crop. But only 4 out of 17 farmers are classified as subsistence farmers.

E.1.f. Education. In only 30% of the subsistence farms is the education of the head of household more than six years: for the high income and cash farmers, however, half the head of households have more than six years of education. Of subsistence farmers, 38% have less than four years education, compared to 25% of high income farmers. Therefore, there is some correlation between better education and higher income.

E.1.g. Agricultural Service Delivery and Social Participation.

Subsistence farmers and food farmers with non-farm income have consistently lower frequencies of participation in social groups, agricultural service delivery systems, and use of credit. Therefore, they are discussed as one socioeconomic group in this section. Household heads were asked if they were a member of any farmers club or association and how long they had been a member. Household spouses were asked if they were a member of any farm women's club or association. Households were also asked whether the agricultural extension service regularly schedules meetings in the community to discuss problems, programs and issues with the farmers and, if yes, how frequently they attended. Two additional questions were asked: 1) How frequently was the farm visited by an agricultural extension agent in the last year? and 2) Has the farmer obtained credit from a formal credit agency for his farming operations in the past year or two? The distribution by socioeconomic group to these questions is given in Table 3.10.

E.2. Income-Related Impacts of Transportation Investment

There have not been significant changes in the types of crops grown in the study area since the transportation investment. (See Table 3.4) The study area is still basically monoculture in palay. All of the evidence cited above indicates that the major changes in production have come from productivity improvements stemming from a combination of irrigation, the use of high-yielding seed varieties, improved delivery of agricultural extension services and greater participation in agricultural organizations, an increase in use of fertilizer, and a greater number of buyers for the palay. Cash farmers are clearly the ones benefiting the most from these changes; the cash farmer who has non-farm income runs second. The subsistence farmer, whether he has some non-farm income or not, is participating relatively little in these changes.

TABLE 3.10

PERCENTAGE YES RESPONSES FOR AGRICULTURAL SERVICE DELIVERY AND PARTICIPATION IN FARMERS ASSOCIATIONS

	Subsistence	High Income	Cash with Non-farm Income
HH Membership	38	60	33
Spouse Membership	22	55	25
Agri. Training once	13	18	10
More than once	20	30	50
Regular Attendance Agri. Ext. Service Meetings	23	40	42
Agri. Ext. Visits - once	19	22	8
More than once	26	43	39
Borrowed	44	87	73

The changes most directly related to the transport investment stem from the fact that farmers have good access now to the major palay markets in southern Luzon and that merchant/truckers from outside the study area are actively competing both between themselves and with local rice mills to purchase the crop. As a consequence of this competition, the farmer is able to get a somewhat better price for his product and need not transport his product to a market town some distance away.

The irrigation systems that have been put in place would certainly not have been launched on the present scale if the bridge investments had not been made, because these investments require transport of substantial physical inputs and presume availability of fertilizers and seeds, which can only be assured through greater accessibility. Furthermore, with the increase in production already experienced and with the additional increments anticipated from ongoing irrigation projects, the small ferry boats would have presented real transport marketing bottlenecks.

A major new project such as the sugar mill would not have been carried out had the Buntun Bridge not been built. Although the additional income from this project has not yet begun, it is most likely that it will provide a substantial new source of cash income for farm labor, which is likely to be drawn from the subsistence farm sector in the future.

Additional agricultural extension activity and participati in agricultural groups might have occurred without the projects since the agents of change are located in the municipalities themselves. However, the ability to increase productivity through improved seeds, fertilizer, and irrigation certainly must have spurred the agricultural extension services to increase their resource inputs into the study areas where a good return can now be gained.

There is no clear indication that municipalities adjacent to the project sites have benefited more or less than studied communities at greater distances from the project site. This is probably because other factors, such as irrigation, seed, and fertilizer, are much more critical than the distance from the project site in determining impact, given that a reasonably extensive local road network exists throughout the study area to funnel traffic across the bridges. Moreover, the actual distances in travel time between the provincial capitals and the most distant of the communities in the study area does not exceed 65 kilometers or two hours travel time, which makes a round trip in one day very feasible. Since most of the palay

production is trucked over 800 kilometers to markets in southern Luzon, the incremental hour or so that a trucker must take to reach the more distant communities from the bridges is inconsequential in terms of percentage of total trip time.

F. IMPACTS ON THE QUALITY OF LIFE

Households were asked questions about the overall transport impact and the quality of life today. Most respondents perceive the improvement in transport in terms of more convenient, fast, and reliable personal transport service. Since they do not transport their production to market at any great distance from the farm, most respondents did not directly relate the bridge improvements to improving the marketing of their products. The negative perceived effects were that transport had gotten more expensive. Of course, this has nothing directly to do with the subject investments but is, rather, a reflection of inflationary trends. Respondents who said that their quality of life was better now than before most frequently cited more government support, higher incomes, and better and faster transport.

CHAPTER 4
INDONESIA

4

CHAPTER 4

INDONESIA

Indonesia is an archipelago nation comprising about 13,000 islands strung out over 5,000 kilometers on both sides of the equator, with a 1978 population estimated at 140 million. The Indonesians regard the entire area as their nation--the Indonesian name for fatherland is tanah ayer, which literally translated is "land water." The center of the nation is the island of Java, which contains 65% of the population and has the highest levels of population density and income.

A. SAMPLE DESIGN AND FIELD METHODS

A.1. Definition of Project Area and Impact Zone

A.1.a. Project Area. The Government of Indonesia selected Maluku Utara, the northern region of Maluku Province, as the project area. The region is divided into two districts, or kabupatens: Maluku Utara and Halmahera Tengah.[1] This area was selected because the Government wished to measure the impact of the Perentis (Pioneer) Sea Fleet, which began operations in 1973. The Pioneer Sea Fleet links 11 port towns in the region to Ambon, the provincial capital located in the central Malukus, and to Menado, a major deep-water port at the eastern tip of the north arm of Sulawesi Island. In addition, subsidized air service is provided by Merpati Nusantara Airlines, which links Ternate, the capital of Maluku Utara, with Ambon, Menado (Sulawesi), and Sorong (Irian Jaya). Within the region, there is twice weekly air service from Ternate to Galela in northeast Halmahera Island.

A.1.b. Impact Zone. In the initial planning, the impact zone was defined as all of Halmahera Island, but the definition was later extended to include Bacan Island and southern Morotai. Ternate was excluded because of its status as a major seaport and airport for the region. This definition has been retained, although it became apparent during the survey that the limited nature of the service provided by the Pioneer Sea Fleet would make it impossible to use the fleet alone as a measure of transport change.

Original plans called for the survey to be limited to a small sample of kecamatans on Halmahera Island, the largest island in the province. In practice, the staff provided by the Government of Indonesia for the conduct of the survey permitted substantial expansion of this plan. Ten of the fourteen kecamatans on Halmahera Island were surve[illegible] and two other island kecamatans were added. Bacan was added at the request of the Bupati (District Director) for Maluku Utara, and Morotai Selatan, the

[1] The administrative divisions in Indonesia, in descending order, are: propinsi (province), kabupaten (district), kecamatan (sub-district), and desa (village). Regions are used for statistical purposes but are not administrative units.

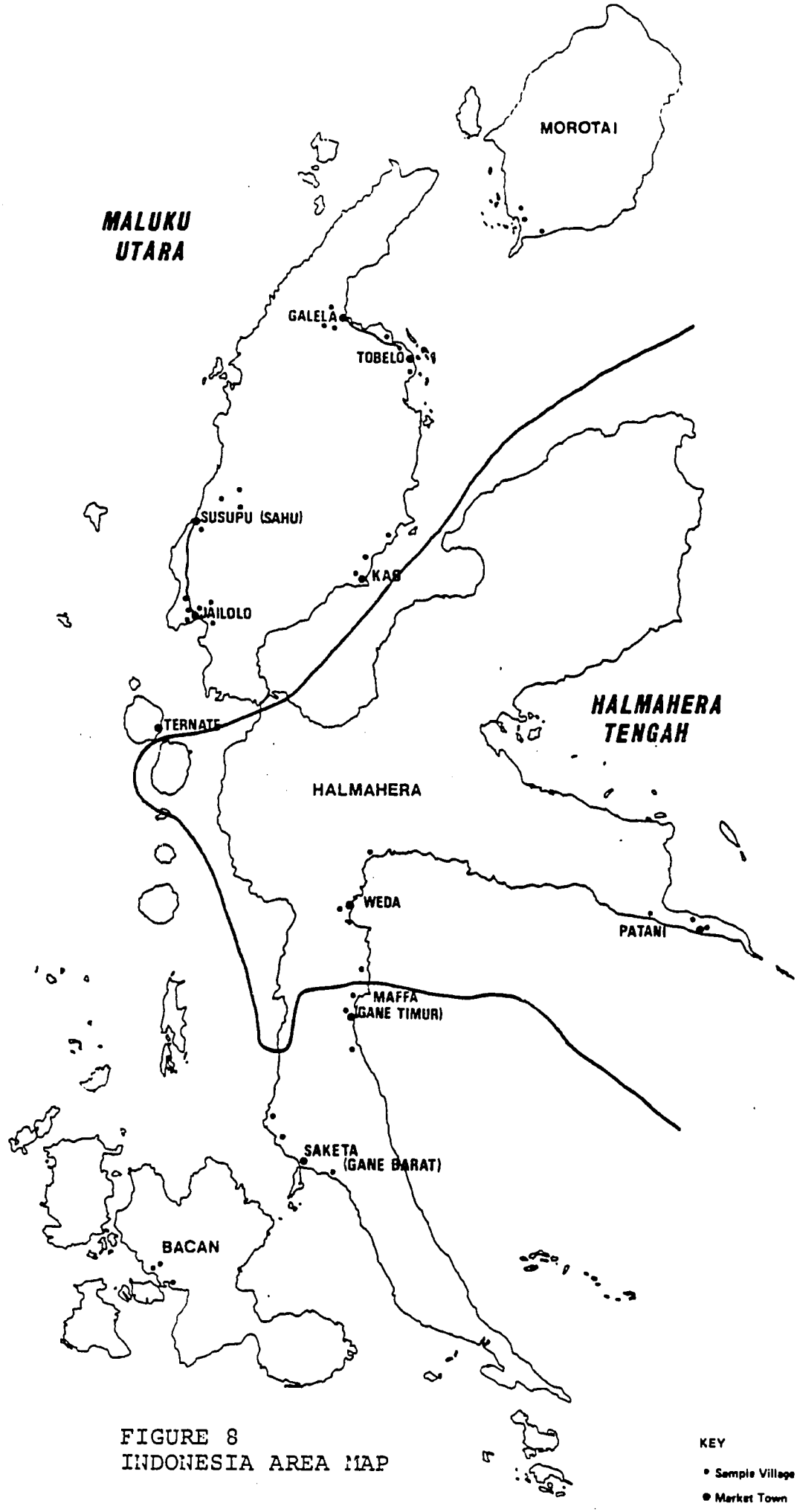

FIGURE 8
INDONESIA AREA MAP

southern half of the island of Morotai, was added when it was learned that a number of kecamatans in the original sample had either no or very limited service from the Pioneer Sea Fleet. In total, the completed survey included 11 kecamatans, 38 desas, 370 households, and 86 other interviews.

The impact zone was defined as all villages in each of the kecamatans surveyed, regardless of the distance from the kecamatan capital. This was because most villages are either on the coast or have road access to the kecamatan capital and because the infrequent nature of shipping service (typically once a month) would justify a long trip from the village.

A.2. Selection of Sample Units

A.2.a. Kecamatans. With the staff available, the kecamatans selected were intended to provide the maximum coverage of Halmahera Island that time and the substantial distances involved would permit.

A.2.b. Communities. Within each kecamatan, a minimum of three villages was surveyed. The Government had initially selected the villages immediately adjacent to the kecamatan capitals to minimize the travel times involved. However, during the course of the survey, this pattern was changed, and an effort was made to select one village in or near the capital and two others at varying distances from it.

In some instances, when two desas were contiguous with each other, they were treated as a unit for selecting a household sample. In such instances, the household sample was spread over the contiguous villages. An example is the village of Lelilef, which is in fact two villages almost identical in size - one Islamic and one Christian - with separate headmen. (It was one village thirty years ago.) In Lelilef, a sample of five households was taken from each village. As a result, four villages were covered in four kecamatans by the survey, and in Jailolo, five villages were covered.

Thirty-eight villages, fifteen in the south and twenty-three in the north, were surveyed. Compared to the northern group, southern villages are much more remote, are economically less well developed, and are more sparsely populated, having nine persons per square kilometer, compared to the north's eighteen.

Of the 38 villages, 26 are either on the coast or within a kilometer of it, including all 15 of the southern villages. Of the remaining 12, 6 are within walking distance of the coast. The village furthest inland is Tobobo in Sahu, which is 14 kilometers from the sea.

Of the villages, 20 (7 in the south and 13 in the north) of the villages are within easy walking distance (4 kilometers or less) of the kecamatan capital, which with rare exceptions, is the nearest market town. The remainder are from 5 to 20 kilometers from the capital. For the latter, transportation in the south is by water and in the north by water or road.

A.2.c. Households. A random sample of households was taken within the villages using lists of voters prepared in May 1977. These lists included all adults in the village except Government officials and policemen. The families of the latter, however, were included in the list and were included in the sample selection. If the head of the selected household was not available, an alternate was chosen by seeking the next higher, then the next lower. In practice, few substitutions were made.

In most of the villages surveyed, the Kepala Desa (village headman) had been informed in advance of the team's visit and had made sure that villagers were available for the survey. In the few instances where this had not happened and where it became apparent that it would be necessary to go through a number of alternates to find someone available in the village, the headman was asked to send for the individual originally selected. This action was taken to avoid biasing the sample by excluding household heads who were away from the village working on their farm.

A. 3. Comparison of Sample Characteristics to Population Characteristics

A.3.a. Household Size. There were 364 households in the survey sample. The sample shows a mean family size of 5.9 persons and a mean household of 5.9. This compares with a mean household size of 6.2 in the village surveys and 5.9 for Maluku Province in 1971. In the sample, 93% of the household heads are married, compared to 92% for the rural population of the province.

A.3.b. Education. In the sample 52 % of the population over 10 has achieved an education of four years or more and thus are presumed to be literate. This compares to literacy rates of 79% for persons over ten years of age in Maluku Province and 61% in Indonesia as a whole.

Comparative household income data for the province and the study area are not available. (A survey has been completed, but the data were not published at the time of this study.)

A.3.c. Farm Size. The following table compares the percentage of various farm sizes in the sample area and as reported for Halmahera Tengah:[1]

	Farm Size - Owned, Rented, and Sharecropped - in Hectares				
	0 - 1.0	1.1 - 2.0	2.1 - 5.0	5.1 - 10.0	>10.0
Sample	28%	28%	30%	10%	3%
Project Area	42%	25%	24%	6%	3%

A.4. Sample Design for Other Surveys

In addition to the household interviews, five other surveys were conducted, and an administrative survey was made for each kecamatan by having a series of questionnaires completed by Government officials. In practice, these forms were filled out by officers in the kabupaten rather than in the kecamatans, where there is very limited staff.

In each kecamatan, interviews were conducted with transport firms, commercial firms, and agro-processing industries. No effort was made to draw a careful random sample. Interviewers were instructed to select a sample of each type of business with an eye to covering a range of the businesses that existed.

A.4.a. Traffic. It was not possible to conduct traffic counts in Indonesia because boat traffic is so sporadic. (The southern survey team saw only two copra sloops in its first five stops.) An effort was made to collect archival data on ship arrivals and departures, but this proved to be difficult. Complete data were available in Bacan, and there was fragmentary data in Patani. In one other kecamatan, interviewers were told that the data could not be obtained because the responsible official was out of town. Pioneer Sea Service schedules and logs were made available by the Local Study Team.

A.4.b. Transporters. A total of 29 transporters were surveyed, 6 in Ternate and 23 in eleven villages. The firms in Ternate include the most important local transporters

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[1] The kecamatans in Maluku Utara were unable to give a distribution of farms by size. Differences between the sample distribution and reported data may be because Halmahera is in the poorer part of the region.

serving the impact zone and probably a majority of the transportation firms in Ternate. The village-based firms provide a sample that covers at least 75% of all such firms in the villages surveyed and a majority of those in the impact zone.

Of the surveyed transporters, 17 (about 60%) provided water transport using motorboats or wooden boats with outboard engines, while 11 (about 40%) provided land transport using pickup trucks or minibuses. One transporter, operating out of Tobelo, provided both land and water transport service.

A.4.c. Commercial. Of commercial firms, 45 were surveyed, 4 in Ternate and 41 in 20 villages. The group includes 1 hotel, 1 restaurant, 2 commodity traders (copra, cloves, and nutmeg), and 41 general stores. Ten of the general stores wholesale to other stores, often in quite small amounts, although one firm in Ternate deals in rice and wholesales 50 tons a month. Thirty-two of the firms also deal in primary products, serving as middle-men between the farmers and outside agents. Three of these deal exclusively in nutmeg; the remainder purchase varying combinations of copra, nutmeg, chocolate, and cloves.

A.4.d. Primary Processing. Eleven agro-processing industry surveys were made, two in Ternate and nine in the impact zone. With the exception of Ternate and Doruba, they almost certainly represent a majority of agro-processing firms larger than a one-man furniture-making business. Of the 11 firms, 3 are soap manufacturers; 2 are rice mills; 2 are fish-drying plants (both of which are cooperatives processing their own catch); 1 is a furniture plant; 1 is a boat builder; 1 is an oil palm processing factory; and 1 is a jellyfish processing factory.

A.5. Instrument Modification

The most significant modification in the survey instrument for Indonesia was a change in the period covered by the survey. Because the Pioneer Sea Fleet started operation in 1973, 1972 was chosen as the pre-project year and the survey data cover the five-year period 1972-1977.

A.5.a. Household Survey. During the workshop in Kuala Lumpur, the household survey instrument was adapted to the conditions in Indonesia. The list of crops was changed to include crops grown in the area, such as sweet potatoes, cloves, nutmeg, and chocolate. The modes of transport were changed to include various means of water transport, since they are the most important means of transport in the area.

The questions regarding travel patterns by the household members were also modified. In the other three countries in the study, people were asked about frequency of travel to the district center and the provincial and national capitals. In the case of Indonesia, the district centers were too close to the villages, and Jakarta was too far away to be meaningful. Therefore, households were asked about travel patterns to Ternate, which is the regional trading center, to Menado, which is the next larger commercial center and a major port area, and to Ambon, the provincial capital.

The household survey and village questionnaires were translated into Indonesian.[1] Local dialects were generally not a problem, but to conduct the household surveys in a few villages it was necessary to recruit volunteer villagers to translate from Indonesian to the local dialects.

A few minor changes were made in the household survey questionnaire after some experience was gained in the field. The most important of these were the addition of a category of trader or private businessman to the list of other sources of income for farmers and the addition of the category of fishermen in the list of occupations other than farming.

There was, however, a persistent problem during the conduct of the household interviews with the definition of a sharecropper. Copra is the primary crop for the farmers in the study area, and the practice of collecting copra on shares is widespread. It was difficult to distinguish when copra collection was sharecropped from when it was labor for other farmers, with the laborer paid in shares. In both cases the share was universally 50% of the copra collected. The problem was created by the fact that, unlike row crops, coconut trees produce for a long period of time and little labor is involved in their maintenance.

During the surveys, the distinction between a sharecropper and a laborer was made on the basis of the duration and nature of the collection agreement. If an individual collected copra for another or others sporadically, he was classified as a laborer. If he was responsible for collecting all the copra from a given grove of trees under an agreement with an owner that had existed for a year or more, he was classified as a sharecropper. However, this distinction is somewhat artificial and it was difficult to maintain. For purposes of analysis, copra sharecroppers and copra collectors who were paid a share of the crop should probably be treated as interchangeable.

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[1] A translation prepared in Kuala Lumpur proved to contain too many Malay words, but fortunately, Mr. E.H. Daoe had also translated these instruments and his translation was the one that was used.

A.5.b. Village Survey. A few minor translation problems in the village survey instruments were corrected in the field. An example is "village meeting hall," which was translated as "gedung pertemuan," which is a fairly large meeting hall. During the interviews a more appropriate translation of "balai desa," or small village meeting hall, was used. The question regarding travel time to the nearest market town five years ago, was inadvertently omitted; however, the interviewers were instructed to add the question, and it presented no problem.

A.5.c. Other Surveys. A few modifications were made in the other Indonesian survey instruments based on experience gained in Malaysia. The transporter questionnaire was expanded to include questions about the transporter's investment now and five years ago. The agro-processing questionnaire was expanded to collect data on the number of employees and monthly earnings by category of employee. In the case of the commercial surveys, some data were also collected in the field on prices charged by retailers, primarily as a check on the volume of sales they reported.

In five kecamatans, unstructured interviews were also conducted with village women. Three to four women were interviewed in each village. The interviewers were selected in consultation with the headman to provide variety in terms of economic and educational status.

A.6. Field Methods

A.6.a. Local Study Teams. Prior to the conduct of the workshop in Kuala Lumpur, two members of the Consultants' staff visited Jakarta to discuss the project and the Project Manager traveled to Maluku Province with officials from the Ministry of Communications. Both Ambon and Ternate were visited to assess local conditions and to enlist the support of local officals in the project. It should be noted here that the support subsequently provided was extremely generous, and the hospitality offered throughout the course of the survey was as gracious as the Consultants have ever experienced.

The Local Study Team as finally constituted included four government officers from the Ministry of Communications in Jakarta. The Provincial Governor provided one official from the Provincial Planning Office and six lecturers from Pattimura University in Ambon, two of whom served as interpreters. In addition, Bupati Mansoer of Maluku Utara provided five government officers to serve as members of the survey team, plus transportation and other facilities. As noted above, these additional people permitted expansion of the survey coverage beyond that which was originally planned.

In the actual conduct of the survey, the team was divided into two field teams, a southern field team and a northern field team. The southern team, which covered an area that involved substantially greater travel distances, surveyed 15 villages in 5 kecamatans. It left Ternate on Tuesday, September 28 on a Government boat, which was used for the entire trip, and returned to Ternate on the morning of October 2. The northern field team flew from Ternate to Galela on Tuesday, September 20, and traveled back down the east coast of the northwest arm of Halmahera in small boats. They crossed the isthmus by road and then traveled by boat to Ternate on September 27. On September 29 this team traveled by boat to Morotai Selatan, returning again to Ternate on October 1.

Each team included five government officers, one of whom served as the team leader, three lecturers from Pattimura, and one member of the Consultants' staff. The northern field team was assisted by a senior transport economist from SEATAC.

A.6.b. Interviews. Eight interviewers were used to conduct the household interviews, four in the north and four in the south. They included four of the lecturers from Ambon and four government officers from Ternate. Each team of four included two agricultural specialists and one forestry specialist. The transporter, commercial and agro-processing surveys were conducted by the two Government officers from Jakarta who were on each field team.

Initial training of the interviewers consisted of a full-day training session held in the kabupaten conference room in Ternate. All interviewers were present, and the survey instruments were reviewed individually with each question explained in detail.

The procedure for the conduct of the interviews was as follows: After initial meetings with the Camat (the governing officer of the kecamatan), sample households for each village were selected from the voter lists. On arrival in each village, a meeting of the villagers was held in which the team leader discussed the purpose of the survey and enlisted the villagers' cooperation. The leader stressed the need for honesty in answering the questions. These speeches were skillfully done, with considerable humor, and undoubtedly were very helpful. However, the household interviewers were concerned throughout the course of the survey that villagers were not necessarily being honest in their answers; they felt the villagers were afraid and that they often attempted to understate production and income. Wherever possible, the household interviews were conducted in the home of the interviewee to ensure privacy and help elicit candor.

The village surveys were conducted with the headman for each village, normally in his house. An effort was made to keep the inevitable curious onlookers away during the interview, again in the interest of candor.

The commercial, transporter and agro-processing interviews were normally conducted by teams of two interviewers at the place of business.

A.6.c. Field Editing. The household and other questionnaires were edited as soon as possible in the evening after a day of interviewing, and any questions raised by the edit were discussed with the interviewers. In the case of the household surveys, this proved absolutely essential to ensure that complete and reasonably accurate questionnaires were obtained. Interviewers did not usually cross-compare answers to related questions and interpretation problems and contradictory answers were frequent. Even with the interviews done on the last day, it was unusual to find a complete and unambiguous questionnaire.

B. CHARACTERISTICS OF THE STUDY AREA

B.1. Physical Characteristics

The region of Maluku Utara straddles the equator at a longitude of 128°. As noted previously, it consists of two kabupatens, or districts: Maluku Utara and Halmahera Tengah. Their capitals, on the neighboring volcanic islands of Ternate and Tidore, are 2,400 kilometers by air from Jakarta. The region consists of a series of large and small islands spread over an area of 139,380 square kilometers, of which 32,000 square kilometers are land and 107,381 square kilometers are sea. The major islands in the region are Halmahera, Morotai, Bacan, Obi, Sulebesi, Mangoli, and Taliabu. The first three of these were part of the study area. Maluku Utara is the larger of the two kabupatens, containing two-thirds of the land area and the bulk of the total area. Halmahera Tengah consists of the island of Tidore, six kecamatans across the center of Halmahera Island, and the neighboring small island of Gebe to the east.

The region and the study area are dominated by Halmahera Island, a large island covering 18,000 square kilometers, roughly in the shape of the letter K. The next largest island is Bacan, which has an area of 2,700 square kilometers.

The islands are mountainous, covered with tropical rain forest and sparsely settled, with villages confined to the coast and the areas in the river valleys where they widen near the coast. Halmahera Island has a population of 150,000 for an average population density of 8.3 persons per kilometer; in contrast, Taiwan, which is 3/4 its size, had a 1972 population of 15,000,000.

The northwest arm of Halmahera, from the narrow isthmus across from Ternate north toward Morotai, is predominantly of volcanic origin. The remainder of Halmahera and Bacan are composed predominantly of uplifted coral and limestone. Several islands in the region contain active volcanoes. The different origins of the islands have not resulted in differences of terrain, and Halmahera has a high percentage of land with slopes of 50% or steeper. The areas with level or gently rolling topography of less than 25% slope, which would lend themselves to non-tree crop cultivation, are mainly confined to the coastline and a few large areas in river valleys. The island of Morotai is largely made up of steeply sloping land with a very narrow coastline area suitable for cultivation of other than tree crops.

Soils are moderately to very fertile and include young volcanic mediterranean, podosol (acidic forest soil), and lateritic soils. Water is generally not a limiting factor for agriculture. Rainfall is high, 1,500 millimeters to 4,000 millimeters per year, and relatively evenly distributed throughout the year. The northwest arm of Halmahera has the highest rainfall, 3,000 millimeters to 4,000 millimeters per year, and the best soil. This helps to explain its higher population density and more advanced development compared to the southern part of the island.

As a whole, the region has tremendous untapped agricultural potential. The East Indonesian Regional Development Study (EIRDS) estimated in 1974 that 19,200 square kilometers (60% of the land area) were suitable for agriculture. At present, only 2.6% of the total land area and 4.4% of the area suitable for cultivation is being cultivated.

B.2 Population Characteristics

The following table, taken from the EIRDS Study, shows population growth and density for 1971-1974. (The current estimated total population for the study area is 441,000.)

TABLE 4.1

POPULATION AND LAND AREA

Unit Study Area	Total Population 1970	Total Population 1974	Annual Increase (%)	Land Area (km^2)	Population Density 1971	Population Density 1974
Maluku Utara	300,348	321,273	2.5%	19,978	15	17
Halmahera Tengah	68,123	75,932	2.8%	11,234	6	7
Total Study Area:	368,471	407,205	2.5%	31,212	12	13
Impact Zone						
Maluku Utara	151,157	167,321	2.3%	10,829	14	15
Halmahera Tengah	39,202	45,463	3.8%	11,105	3.5	4
Total Impact Zone:	190,359	212,784	2.8%	21,934	9	10
Impact Zone as % of Study Area	52%	52%		70%		

The population density shown in the table is probably correct and corresponds to the estimated population density for Maluku Province as a whole. However, because the 1974 population was estimated, the population growth rates are

probably understated. The 1971 census showed a ten-year population growth rate for Maluku Province of 3.3%, and it is reasonable to assume that a growth rate of approximately this level applies to the study area as a whole. There are significant differences in population density within the study area and the impact zone as well as among the Kecamatans included in the survey.

Kabupaten Maluku Utara has a population density of 17 people per square kilometer, more than twice the density of Halmahera Tengah. The density of the kecamatans in Maluku Utara is nearly four times that of the kecamatans in Halmahera Tengah. As a result, among the kecamatans surveyed, the area north of the isthmus has a population density nearly twice that of the area to the south and a population that is estimated to be growing twice as fast.

Among the kecamatans in the impact zone, Patani/Gebe is estimated to have lost population from 1971-1974 at the rate of about 1% per year, while Obi, starting from a very small base, is estimated to have had a population growth rate of 17.8% per year. (Both are remote kecamatans at the extreme east of Halmahera Tengah, on the two right-hand arms of the K that is formed by Halmahera.) Population density per square kilometer ranges from 2 in kecamatan Wasile to 28 in Ibu, with four of the kecamatans having a population density of 20 persons per square kilometers or more.

The population data contained in the village surveys must be treated with a great deal of caution. Village headmen do not keep population records, current or past, and their memories are very unreliable. This is also true in the case of questions about numbers of families, since families and households tend to get confused. For example, one village headman reported a 1.6% annual increase in population and an 11.4% annual increase in the number of families, although he stated that only two families had moved in during the study period. Ten of the headmen were simply unable to answer questions about population or number of families in 1972. As a result, the current population figures are probably most realistic and the current number of families the next most accurate.

The average current village population for all sample villages is 894: 1,157 in the southern villages and 728 in the north. The villages range in size from about 250 persons to more than 3,850. Twenty-seven of them have a population of less than 1,000 and eleven have a population of less than 500. The villages currently average 146 families each, with the southern villages having an average of 179 families and the northern villages 124. Based on these data, the average family would contain 6.2 persons.

The reported population growth rates range from the unrealistic extremes of .04% to 16% per year. In fact, excluding migration, the growth rates are probably about 3% per year.

The population of the study area is very homogeneous. Over 99% are Indonesians, with the predominant foreign group being Chinese. Muslims consititute 56.5% of the population, Christians make up 42.7% and less than 1% belong to other religions. This division is slightly less even than that found in the province as a whole, which is 50% Muslim and 46% Christian. The population is 51% male and 49% female. The provincial figure of 87% rural is probably also true for the study area. As would be expected in a rapidly growing population, the dependency ratio is high: .94 in total, derived from .77 in the urban areas and 1.04 in the rural areas.

Few data exist to indicate income levels in the project area. A socioeconomic survey of households was carried out in 1976 by the Central Bureau of Statistics, but the results have not yet been compiled for Maluku Province. Results for Java indicate an average monthly per household expenditure of U.S. $40-U.S.$45 for households outside of the capital district of Jakarta. Urban households show an average monthly expenditure of about U.S.$80, while rural households expend about U.S.$35 monthly. These figures correspond to an annual per capita expenditure of U.S.$285, U.S.$190, and under U.S.$100 for Jakarta, urban areas outside Jakarta, and the rural areas of Java, respectively.

B.3. Economic Structure and Investment Patterns

The economy of the study area is predominantly agricultural. In 1971, 73% of the economically active population were in agriculture, 8% were employed in secondary activities, and 14% worked in services. The remaining 5% were in "activities not adequately defined," which includes those seeking work for the first time.

This agricultural focus is even greater in the impact zone, since a majority of larger business firms and the limited number of light and service industries are concentrated in a few major towns and the two kabupaten capitals, especially in Ternate.

Table 4.2 shows 1975 exports to foreign countries and inter-island shipments for Maluku Utara. The inter-island shipments are effectively regional exports and include shipments for consumption elsewhere in Indonesia or for processing and re-export.

TABLE 4.2

VALUE OF MAJOR COMMODITY EXPORTS AND INTER-ISLAND SHIPMENTS
MALUKU UTARA - 1975

Commodity	Direct Exports[1]	Inter-island[1]	Total[1]
Logs	12,056,000	-	12,050,000
Copra	703,500	3,650,000	4,353,500
Coconut oil	-	1,764,000	1,764,000
Coconut cake	211,700	-	211,700
Nutmeg	465,000	39,500	504,500
Cloves	-	12,000	12,000
Fish	48,400	1,100	49,500
Other	23,000	1,000	24,000
Total	$13,501,600	$5,467,600	$18,969,200

[1] In U.S.$ converted @ Rupiah 410 - U.S.$1.00.

With the exception of logs, these official figures seriously understate external shipments from the region. Logs are an exception because the taxes and royalty fees require all log ships to depart through the port of Ternate. The value of copra, coconut oil, and coconut cake shipments shown on the table is about one-quarter of the value of copra produced at local market prices, and the value of cloves produced is over U.S.$3.5 million, compared to exports of U.S.$12,000. In fact, except for small amounts of coconut oil consumed directly and used in soap manufacture, all copra produced is exported from the region, and all cloves are exported.

The table indicates that, excluding logs, 84% of external trade is in the form of inter-island shipments. In actual practice, the share is probably in excess of 95%. A large but undetermined share of the copra trade is conducted by small sailing vessels based on the island of Sulawesi that pick up the copra at the villages and market towns in the study area.

Recorded imports are all in the form of inter-island shipments and totaled $4.7 million in 1975. In terms of value, 53% was rice, 23% mixed goods, and 17% petroleum products. These

official figures are probably also understated since the copra sailing vessels almost certainly engage in two-way trade.

B.3.a. Agriculture

Within the dominant agricultural sector, commercial agriculture is largely confined to five tree crops, of which copra is by far the most important, representing 83% of the total value. The following tables show food crop area and production for the study area for 1974. The food crop table does not include sago since it is freely available and harvested wild, but sago reportedly is an important source of calories for the rural people in the study area. The EIRDS Study estimated that in 1973, 36.6% of the caloric requirements of Maluku Province were obtained in the form of rice, and almost all locally consumed rice is imported. The rice that is produced is upland rice. Interest in more intensive irrigated rice culture has probably been limited by the relative abundance of alternative foods such as sago and the unfamiliarity of the local people with irrigated agriculture.

TABLE 4.3

1974 FOOD CROP AREA AND PRODUCTION - NORTH MALUKU REGION

Crop	Area (ha)	Production (tons)
Rice	10,000	12,400
Corn	5,190	5,300
Cassava	9,800	80,300
Sweet potatoes	6,700	45,000
Vegetables	1,800	6,500
Pulses & groundnuts	1,660	930

Source: East Indonesia Regional Development Study

TABLE 4.4

1974 TREE CROP AREA AND PRODUCTION - NORTH MALUKU REGION

Crop	Bearing (ha)	Non-bearing (ha)	Total (ha)	Production (ton)
Coconut	49,700	12,800	62,500	96,500
Clove	520	2,900	3,420	440
Nutmeg	2,060	3,600	5,660	520
Coffee	200	300	500	180
Cocoa	1,500	2,400	3,900	670

Source: East Indonesia Regional Development Study.

The table below shows mean farm size in total and by type of tenancy for 1972 and 1977, based on the household survey.

TABLE 4.5

NUMBER OF SAMPLE FARMS AND MEAN FARM SIZE BY TENANCY

	Owned		Rented		Share-cropped		Total Farm	
Year	No.	Farm Size (ha)	No.	Farm Size (ha)	No.	Farm Size (ha)	No.	Farm Size (ha)
1977	301	3.2	3	1.0	24	1.7	328	3.1
1972	262	3.0	3	1.0	22	1.8	287	2.9

The farms range in size from 0.2 to 31 hectares, with the largest rented farm being 1.5 hectares and the largest sharecropped farm 8 hectares. The mean farm size is well above the median; 56% of the farms are two hectares or less and 72% are three hectares or less. There has been little change. Five years ago, 59% of the farms were two hectares or less and 76% were three hectares or less.

All of the farmers who are non-owners in the sample rent or sharecrop a grove of coconut trees. If the study area had a different cropping pattern that did not involve perennial tree crops, there would be virtually no land rented or sharecropped because the area is so sparsely settled that land is available for the taking, and it is almost never purchased. Only six village headmen could give a current price for farm land. Where prices were given, they ranged from U.S.$87 to U.S.$360 per hectare. In the two cases where before and after prices were available for a building lot in the village, the price is now U.S.$250 per lot, up four-fold in five years.

1) Major products and their value

These small farms are tree crop oriented. Food crops are typically planted among the trees and occasionally among each other. During the survey, the area planted by crop had to be calculated based on the farmers' estimates of the number of plants or, in the case of rice and maize, the amount of seed he had planted. Agriculture is dominated by cash crops and especially by copra. In terms of value, crops sold are 80% of production. The value of copra sold is 69% of all sales and 55% of the total value of production, with cocoa second at 13% and 11%, respectively. Copra is produced by 67% of the farmers, and although small farmers predominate in the area, the 16 largest producers (8% of the total) produce 28% of the copra.

In value, peanuts and maize account for 56% of food crops sold, while rice and bananas make up 47% of production. (Bananas are a ubiquitous food in the study area and a visitor to a Camat's or villager's house is always served fried bananas.) However, the findings of the survey do not support the contention in the EIRDS Study that sago provides about one-third of the caloric intake of the people in the area. Only seven farmers in the sample indicated that they produced sago. This would appear to support the statements frequently heard by the survey team that sago is a poor man's food that is usually eaten when no other food is available. Tables 4.6 and 4.7 show production and sales by volume and value and the number of farmers involved for the crops grown in the study area.

2) Marketing structure and prices

Food crops are almost exclusively marketed in the village or in the nearest market town for local consumption, and except for coffee, all of the tree crop production is exported from the region, though not necessarily from the country. (Surprisingly, Indonesia is an importer of cloves because they are used in the manufacture of cigarettes.)

The tree crops are marketed directly to traders who visit the village or market town or through local merchants who serve as first-tier middlemen. As noted earlier, many of the traders are based in Sulawesi.

In the commercial survey, 29 of the 45 firms surveyed dealt partly in tree crops, and two were exclusively commodity traders. Their volume of business varies considerably. Four of the firms buy less than 5 tons of copra a year, 16 buy from 5 to 100, 5 buy from 100 to 200, and 5 buy more than 200. The largest firm, whose business is exclusively commodity trade, reports purchases of 6,000 tons of copra per year. The firms dealing in other high-value commodities, such as cloves and cocoa, buy much smaller quantities, ranging from .3 to 3 tons. (A ton of nutmeg is roughly equivalent in value to 40 tons of copra.)

Twenty-five of the firms buy all their copra in the villages, and the other four buy 40% or less at their warehouses. Reported prices paid for copra vary from U.S.$0.25 per kilogram to U.S.$0.37 with the variation generally related to the distance between the firm and Ternate. The further the distance, the lower the price paid to the farmer. Clove prices are reported to be standard at U.S.$8.00 per kilogram. Chocolate is U.S.$2.00 to U.S.$2.50 and nutmeg is U.S.$0.50 to U.S.$0.65. Seventeen of the firms use their own boats or vehicles to collect the commodities.

TABLE 4.6

SAMPLE FARMERS'FOOD CROP PRODUCTION AND SALE - 1976

Crop	Production (kg) Mean	Production (kg) Median	Farmers producing No.	Farmers producing % of total	Mean Sales (kg)	Farmers selling No.	Farmers selling % of produce
Food Crops							
Rice	517	450	72	23%	843	7	10%
Maize	432	300	71	23%	297	46	65%
Cassava	1,029	500	171	55%	600	75	44%
Sweet potatoes	504	250	122	39%	230	49	40%
Peanuts	204	175	43	14%	228	33	77%
Bananas	717	500	216	76%	413	94	44%
Other fruits	420	175	28	9%	243	15	54%
Vegetables	120	80	55	18%	72	37	67%
Sago	923	250	7	2%	796	6	86%
Tree Crops							
Copra	1,492	1,000	207	67%	1,492	207	100%
Cloves	30	15	14	5%	30	14	100%
Cocoa	175	125	56	18%	175	56	100%
Nutmeg	157	100	17	5%	157	17	100%
Coffee	266	100	5	2%	108	4	67%

Source: SEATAC Household Survey.

TABLE 4.7

VALUE AND DISTRIBUTION OF SALES BY CROP - 1976

Crop	(US$) Value of Production Mean	Total	% of all Production	(US$) Value of Sale Mean	Total	% of All Crop Sales
Food Crops						
Rice[b]	158	11,375	7.0	257	1,800	1.4
Maize	105	7,480	4.6	72	3,330	2.5
Cassava	25	4,290	2.6	15	1,100	0.8
Sweet Potatoes	18	2,250	1.4	8	410	0.3
Peanuts[b]	174	7,490	4.6	195	6,420	4.9
Bananas	52	11,330	7.0	30	2,840	2.2
Other fruit	102	2,870	1.8	59	890	0.7
Vegetables	22	1,210	0.7	13	490	0.4
Sago	a	a	a	a	a	a
Sub-total		$48,295	29.6		$17,280	13.2
Tree Crops						
Copra	437	90,390	55.4	437	90,390	69.0
Cloves	256	3,585	2.2	256	3,585	2.7
Cocoa	320	17,920	11.0	320	17,920	13.4
Nutmeg	77	1,300	0.8	77	1,300	1.0
Coffee	324	1,620	1.0	132	525	0.4
Sub-total		114,815	70.4		113,720	86.8
Total		$163,110	100.0		$131,000	100.0

[a] Not available.

[b] Rice and peanuts are commercialized only by the larger producers. For this reason the mean value of sales (among those selling) exceeds the mean value of production.

Source: SEATAC Household Survey.

B.3.b. Fishing

In 1976 commercial fresh fish production for Maluku Utara totaled 16,509 tons with a value of U.S.$3.1 million. The household survey sample included 31 households for whom fishing was a primary occupation.

Table 4.8 summarizes their production and sales for 1976 and 1972.

TABLE 4.8

FISH CATCH AND PRODUCTION - 1972 & 1976

	No. of Fishermen	Catch and Sales - kg		
		Mean	Minimum	Maximum
1972				
Total fish catch	30	755	6	9,500
Total shellfish catch	1	150	150	150
Total fish sold	18	981	20	9,500
Total shellfish sold	0	0	0	0
1976				
Total fish catch	38	822	30	4,500
Total shellfish catch	2	538	75	1,000
Total fish sold	24	99	20	4,500
Total shellfish sold	1	1,000	1,000	1,000

Fish and shellfish exports from the study area are limited at present, and most of the production is consumed in the study area. As a result, fishing as it is currently carried out is not very sensitive to transport. However, any significant increase in fish production would depend on marketing outside the study area and thus would be very transport sensitive. (A Japanese/Indonesian joint venture firm currently operates a fleet of shrimp boats out of Ambon. Shrimps are frozen and packaged aboard the catching vessels and then off-loaded at sea to a carrier ship for export to Japan.)

B.3.c. Forestry

The study area's insular character, proximity to the equator, high rainfall, and relatively rich soils have resulted in a high volume of tropical hard wood. Typical stands comprised as many as 200 different trees of varying species in one

hectare with about 70 trees over 35 centimeters in diameter and 25 trees over 60 centimeters in diameter. Gross standing volumes per hectare are estimated to average 370 cubic meters with marketable log (over 60 centimeters) volumes estimated to be over 200 cubic meters per hectare. Nearly 2½ million hectares, over 78% of the total land area of the North Maluku region, is forested, and over 90% of this is primary forest. Total gross standing volume is estimated at 900 million cubic meters for trees over 35 centimeters, 60% of which is considered marketable. The island of Halmahera contains about half the marketable logs in the region.

Logging is being carried out by Philippine, Malaysian, and Indonesian logging contractors for the owners of forest concessions to serve the Japanese, South Korean, and Philippine log markets. There is no significant log processing for export. Total employment in logging in the study area was estimated in 1974 to be 2,000 people, of whom 300 are foreign nationals. However, forest concessions are normally for 20 years and most call for the building of a processing plant within 5 years of the beginning of logging operations.

Log exports in 1974 were estimated at 595,000 cubic meters, with a value of U.S.$22 million. Japan is the principal market, with South Korea second and Taiwan and Singapore third and fourth. Some logs shipped to the Philippines are re-exported to Japan. The ratio of destroyed and wasted timber in this logging activity is estimated to range from 25% (the Provincial Government's estimate) to 100% of the logs removed.

B.3.d. Manufacturing and Primary Processing

1) Type and total value

Industry is not a significant economic activity in the study area. The 1975 annual report for Maluku Utara shows 134 service and processing industries, including 7 lumber mills, 15 furniture makers, 13 soap manufacturers, and 11 coconut oil mills. These 134 firms employed a total of 140 women and 686 men in 1975.

During the survey, 11 agro-processing industries were interviewed: 2 in Ternate and 9 in the impact zone. With the exception of Ternate and Doruba, they almost certainly represent a majority of agro-processing firms in the study area larger than a one-man furniture making business. Of the 11 firms, 3 are soap manufacturers, 2 are rice mills, 2 are fish drying plants, both of which are cooperative in nature and catch their own fish, 1 is a furniture maker, 1 a boat builder, 1 an oil palm processing factory, and 1 a jelly fish processor.

Mean and median employment is eight employees per business, ranging from a low of one (a rice mill) to a high of twenty-three. Seven employ administrative or technical personnel at an average wage of U.S.$48 per month. Five employ laborers at an average pay of U.S.$28 per month. However, if the largest business, the oil processing plant in Ternate, is excluded, the average laborer's wage drops to U.S.$23 per month.

Only two of the firms are now producing at capacity. One reports production at 25% of capacity and the remainder range from 50%-80%. Most of the older firms report no change in production since 1972, but the oil palm processor, which started in 1960, has quadrupled its capacity and production in the last five years.

Except for the caustic soda used by the soap manufacturers, the firms all use local raw materials and all but one get their raw materials from within the kecamatans where they are located. The palm oil processor purchases palm oil nuts from a number of kecamatans in Halmahera. Five of the eleven firms own their own boats or vehicles and transport over 50% of the raw materials in them.

2) Pricing

Price information obtained in the survey is limited. The two rice mills do not buy padi. They do only custom grinding. The two fish driers, the boat builders, and the furniture maker all collect their own raw materials in the forest or the sea. Four of the remaining firms were willing to provide prices on commodities purchased. None is subject to government regulations. The most striking thing about these data is that these firms all pay higher prices at the farm or the source of the raw materials than they do at the enterprise itself. The jelly fish processing firm explained this difference as a difference in quality, but the other three, which show price differentials from 7%-14%, gave no explanation. It may be that the farmer who can choose among several traders at his village is at a competitive advantage over one who has brought his product to a particular plant or mill.

B.3.e. Commercial Activity

In the sample villages, the Southern villages report an average of 5.2 shops per village. The average in the North is only 2.3, probably because there is greater land mobility and hence greater reliance on the shops in the nearest market town. Data on the number of shops are less complete for the Northern villages, with reports available for only fifteen of

the twenty villages in the group. But in the villages for which data are available, there has been a 50% increase in the number of shops in the last five years. (A number of household interviews contain positive comments by villagers on the increased number of shops and the resulting increase in competition and lower prices.)

The only village with significant commercial activity is Doruba, the capital of Morotai Selatan. It has a population of 2,800 and contains 40 shops, 2 soap factories, and other businesses. In contrast, Amasing Kota in the South, with a population of 3,800 and also a kecamatan capital, has 12 shops as its only significant commercial enterprises.

Because of the greater isolation, itinerant traders are more important in the South. Six villages near the kecamantan capitals have never been served by itinerant traders. Of the remaining nine, who are served, all have more traders coming now than five years ago and all but two have more frequent service. The traders all come by boat. In the North, six villages are served by itinerant traders, some using boats and some trucks. However, three additional villages that did have such service five years ago no longer have it because a road has provided greater accessibility to the market town.

The 45 commercial firms that were surveyed provide limited employment opportunity. Only the hotel and the two commodity traders employ other than family members. The hotel is new and has eight employees, and employment by the commodity traders has increased from 20 persons in 1972 to forty-one now. Nine of the forty-five firms operate other businesses within the same kecamatan.

The forty-one general merchants in the sample handle similar commodities. All carry rice and sugar. While there are variations in the other goods, almost all sell soap, salt, kerosene, textiles, and some canned goods. A few carry more specialized goods such as clothing and even watches.

The firms were very reluctant to give specific current sales figures. This problem may have been compounded by the fact that many of them tend to think in terms of cash sales, ignoring what is often a substantial amount of credit business. In general, information provided on the monthly quantities of selected specific items is probably more reliable than the monthly sales figures, which are nearly worthless. For example, when quantities of four or five commodities sold are multiplied by local prices, the result usually exceeds stated total monthly sales - in some cases by as much as four times.

The 18 firms that reported monthly sales figures show the following change in sales during the study period:

- Four show a loss of 10% to 200%. (The firm showing the largest loss probably gave reasonably reliable figures; the owner attributes the loss to the new stores that have opened in the village, many of which sell on credit.)

- Three report no change.

- Two report increases too small to keep up with inflation

- Three show increases in sales about even with inflation, that is, no change in real sales.

- Six firms report increases in excess of inflation, that is, 200% or better.

Fourteen firms were willing to provide annual data on pre- and post-project sales. Eleven of these were given in terms of volume. Of these, three report increases from 100% to 400%, four report increases of 25% to 75%, and four report no change. Of the other three firms giving data in monetary value, two show increases of 200% and two had increases of 100%. In both cases, this gain represents little change, since the prices of nine basic retail commodities in the project area have increased by 70% to 180% during the same period.

Only 3 of the 45 firms state that Pioneer Sea Fleet has affected their business. One says business is better, one claims that it is easy for personal transport, and one says that it is easier to transport goods. This last effect would necessarily be limited since only goods that accompany passengers are carried. Two of the firms stating that the Fleet had no effect attribute this to the ship's short two-hour layover in each port.

B.3.f. Village Transport Service

The differences between the Northern and Southern villages are particularly stark in the general field of transport. In total, the people in the 15 Southern villages own 1 jeep, 2 motorcycles, 1 motor boat, 93 outboards (up from 22 five years ago), and 10 sailing boats. In contrast, the people in the 23 Northern villages own 7 minibuses, 5 trucks, 45 motorcycles (up from 4 five years ago), 1 motorboat, 72 outboards (up from 11), and 50 sailing vessels.

Only two Southern villages have regular boat service once a week or more often. The other 11 have regular service, but it is less frequent. Frequency has improved in only one village in the last five years.

In the North, 6 villages have regular boat service, 4 of them daily or more often, and 15 have bus service daily or more frequently. None of these had bus service five years ago. Two of these villages are served by both boats and buses.

For purposes of the village survey, the nearest market town was defined as the kecamatan capital, but these are still essentially villages with only four having more than seven shops. In the South, travel time to the market town ranges from ten minutes to seven hours and it was impossible to get data on trip costs. Where walking is impossible, travel is usually by perahu (small canoes), and this has not changed significantly in the last five years. No Southern village has regular commercial transport service to the market town, and when a villager who owns an outboard takes others with him, he does not charge them.

Patterns in the Northern villages are quite different. Inhabitants of eight villages walk to the nearest market town. For inhabitants of seven others that walked five years ago and now travel by bus, the trip time reductions range from 30 minutes to 3½ hours. In eight of the villages prior year data are incomplete, but all have bus service now where they almost certainly did not before, with concomitant time-savings. Current prices for a trip to the market town vary from U.S.$0.12-U.S.$0.50 per trip.

Although there is significant change in the travel time to the kecamatan capitals, neither the Northern or Southern villages report important changes in travel time to Ternate or Menado. In the case of Ternate, more regular and reliable service, particularly from Pioneer Sea Fleet, rather than time, is often cited as an advantage, and travel to Menado is so rare that a majority of village headmen did not know how long it took to get there.

B.4. Social Structures

B.4.a. Settlement Patterns

The typical village in the study area has straight, neatly leveled streets. The majority of the houses are masonry, with framed roof covered with tin or thatch. This may be explained by the fact that the government has forged a campaign to persuade villagers in the impact zone to build new houses, and considerable new house construction can be seen. (It is

interesting that villagers frequently cite "improved village houses" as one reason why life is better now than it was five years ago. Although some may believe this, many are obviously giving the Government--and hence approved--solution to the interviewers.) Poorer houses are made of wood and the poorest have walls made from the rib leaf of the sago palm. Houses vary in size, but they usually have a small entrance porch, followed by a living room and dining room down one side, typically the left, with bedrooms opening off on the other side. The kitchen is at the back. Furniture is simple and mostly locally made.

As a whole, the villages are isolated. While villagers travel often to the nearby kecamatan capital (really just a larger village), the average villager goes to Ternate only once every two years and never goes beyond. In the household sample, the most frequent traveler to Ternate went only 15 times in a year. The most frequent traveler beyond Ternate goes to the provincial capital at Ambon 1.7 times a year and to Menado once every two years.

The families that make up the village communities are nuclear. In the sample households non-nuclear family members average only 0.2 persons per family.

Farms are areas cleared in the surrounding forest, and the farmers walk or go by perahu to work. Often the plots are at a considerable distance from the village and uphill.

No religious questions were asked in the survey, but the sample villages are probably more heavily Muslim than the study area as a whole or the province. Ethnically the population is 99% Indonesian, but persons of Chinese descent dominate the commercial sector.

Villages are run by a Kepala Desa (village headman) who is selected by the villagers with the advice and consent of the Camat, who holds the ultimate appointment authority. During the survey, cases were noted where the headman had been changed after a petition from the villagers to the Camat.

B.4.b Migration

With some notable exceptions, such as the community of boat builders that migrated from Sulawesi to the village of Loleo in Weda, overall migration is not significant in the study area. Two government-sponsored trans-migration schemes are underway to redistribute people from small overcrowded islands, but they have had limited results to date.

Population growth or loss due to migration is significant in only eight of the sample villages. Three of these had an out-migration of ten families each and the others had in-migration, almost all from outside the kecamatan, of 11, 15, 20, and 23 families. Overall, migration accounted for an increase of only 2% in the village populations over the five-year period.

B.4.c Education

Table 4.9 shows elementary schools and school enrollments for all but two of kecamatans in the impact zone:

TABLE 4.9

Elementary schools (1975)

Primary & Secondary

Kecamatan	Schools	Enrollment	Teachers	Enrollment as % of total Population[1]
Jailolo	23	2,795	90	14.6
Sahu	12	1,108	33	13.7
Ibu	18	2,023	38	15.2
Loloda	27	2,232	52	15.7
Tobelo	27	3,716	147	15.3
Galela	16	1,748	45	13.9
Kao	20	1,744	56	17.0
Gane Barat	22	1,431	42	13.8
Gane Timur	9	725	21	12.0
Bacan	40	3,666	71	11.1
Morotai Selatan	12	2,653	67	13.0
Total	226	23,841	662	

[1] Population age 5-14 = 29% for all Maluku Province.

There are 18 public and private secondary schools in the impact zone, 1 vocational and 17 academic. Only 1 kecamatan, Gane Barat, does not have a secondary school, and Tobelo has six. In the study area, there are also one private university (1974 enrollment, 158 students), one State Institute (84 students), and one academy (60 students).

B.4.d. Health

Health services in the impact zone and the study area are very primitive. There are two professionally trained dentists and seven doctors in Ternate, where the only hospital is located. In the study area there are over 50,000 persons per doctor and 6,300 persons per nurse, but these ratios are much higher in the impact zone because of the concentration of health personnel in Ternate and Soa Siu. Table 4.10 shows health personnel and facilities for all but two of the kecamatans in the impact zone.

TABLE 4.10

HEALTH PERSONNEL AND FACILITIES

	Personnel			Facilities		Maternal & Child Health Center
	Doctors	Nurses	Midwives[1]	Health Center	Clinics	
Jailolo	-	1	12	1	1	1
Ibu	1	2	7	-	1	-
Sahu	-	2	1	1	-	1
Loloda	-	2	4	-	1	-
Galela	-	1	6	1	-	1
Tobelo	2	10	16	1	3	1
Kao	-	1	4	-	1	1
Gane Barat	-	2	2	-	1	-
Gane Timur	-	-	2	-	2	-
Bacan	-	3	12	1	2	3
Morotai Selatan	-	2	1	1	-	1
Total	3	26	67	6	12	9

[1] Midwives and visiting nurses.

Patani-Gebe, one of the kecamatans not listed above, has a new health center built with impress funds that lies unused. The government doctor assigned there is kept in Soa Siu, and there is no source of funds for equipment or medicine.

While the survey did not gather specific health data, the Consultants' observation is that health problems are largely man-made and are endemic to the area. They result primarily from poor nutrition (only 22% of the farmers grow vegetables, for example) and unsafe drinking water. These views are supported by the Maluku Utara Health Officer.

B.4.e. Community Development

1) Community facilities

The existing pattern of community facilities is clearly influenced by the allocation of funds for development projects from higher levels of government. With the exception of schools the emphasis has been on facilities that have little economic impact.

Every village has at least one mosque or church. Counting massalahs (small mosques for women), half of the villages have two or more. About half of the mosques or churches were built in 1972 or earlier, but 60% of the ones in the South have been built since 1972 with government support. Of the villages, 24 have Balai Desa (village meeting halls), 19 of which have been built since 1972, again with government support.

Community wells exist in 21 of the 38 villages, but only 3 villages have enough community wells to supply their population. The principal source of water is private wells, usually built near the bathhouse and almost always open. Not one of the villages surveyed had what might reasonably be classified as a pure drinking water supply.

Of the seven villages that have markets, six have been built since 1972 with government funds and several of them are lying unused. Four villages in the South have village electricity, all installed since 1972.

With 26 of the sample villages on or near the water, it is surprising that only 6 have wharves, half of which have been built since 1972.

2) Development projects

Local taxes are almost exclusively excise taxes and provide only a small share of development funds. Data on development projects in Maluku Utara for fiscal year 1975/1976 are given in Table 4.11.

TABLE 4.11

DEVELOPMENT PROJECTS AND FUNDING 1975-76 MALUKU UTARA

Source of Funds	No. of Projects	Total Funding[1]
Local revenues	45	$ 540,000
Impress projects[2]	762	$1,672,000
Desa projects	(352)	(957,000)
Kecamatan projects	(343)	(90,000)
Other projects	(67)	(625,000)
Regular centrally funded projects	29	$1,380,000
Total	836	$3,592,000

[1] U.S. dollars.

[2] Special development project funding handled directly by local governments under expedited procedures with considerable flexibility.

In the last five years there have been 94 village projects in the 38 sample villages. Most of these have involved government support, usually for imported materials such as cement, nails, and roofing. All involve contributions of labor, materials, and money--or more often all three--from the villagers themselves. Fifty of these projects are in the South. Given the smaller number of sample villages there, this would indicate a deliberate government effort to promote more development projects in the less developed areas. The projects include 21 roads or streets, 13 Balai Desas, 27 mosques or churches, and 16 others, including health centers, schools, markets, wells, and the four village electrification systems. (An interesting example of the latter is a village that communally collected copra and sold a village-owned outboard motor and boat to raise funds for the generator for their village electricity system.)

B.4.f. Government Services

Thirty-six villages regularly get agricultural information, such as prices of crops, from outside the desas. All 15 of the Southern villages get information by radio and 3 of these (which are on Bacan) also get information from a resident government agricultural officer. Data are less complete for the North, but in Galela and Tobelo, five out of six villages

get agricultural information from the government; the sixth hears from a cooperative. Eleven of the Southern villages have never been visited by an agricultural officer and one is visited very sporadically. In contrast, all 23 of the Northern villages report regular agricultural officer visits. In seven cases, the officer walks or rides a bike; in ten, he comes by minibus or motorbike, in four by motorboat. This represents substantial change from five years ago, when he never visited one village and he walked or rode a bicycle to 17 others.

No Southern village has ever been served by a mobile government service unit such as health, post office, or extension. Eleven of the Northern villages have mobile health service; and ten of these have had it for ten years or more.

B.4.g. The Role of Women

During the survey, 31 unstructured interviews were held with women in 10 villages in Southern Halmahera and Bacan. The interviews indicate that most of the women have a very heavy work load. They keep house, cook, clean, and wash, bear and raise the children, frequently work on the farms, and frequently carry on some sort of outside money-making business, such as baking for sale, running small shops, making mats or mattresses, or being a seamstress or a nurse. They also sew and share in the control of the family finances.

The only complaints were related to having too many children or to husbands having more than one wife. The women felt that too many children made their income seem less. Not only did the women with eight or more children seem more physically worn out, but the interviews indicate that the infant mortality rate is higher for these women than for the women with fewer children. Of the ten women who had eight or more children, seven have lost two to four children. Of the ten women who had five or six children, three have lost two to four children. None of the nine women who have one to four children have had a child die.

Twenty-seven of the women feel that their lives are much better now than they were five years ago. They gave the following reasons for this: better education; better transportation, which means it is easier to get necessities and easier to sell farm produce; better health; better prices; and many improvements, including electricity in some villages.

Six of the women had never left their village while 17 others had been as far as Ternate or further. The remainder of the women had only visited nearby villages. The trips to Ternate usually were to accompany a sick child or to visit family.

C. TRANSPORT SECTOR CHANGE

C.1. Study Project Characteristics

The Pioneer Sea Fleet is subsidized by the Government of Indonesia and is intended to provide regular shipping service with small ocean-going freighters to what are described as "weak areas" in Indonesia. These are undeveloped areas where lack of regular sea tranport, by other than very small boats, is expected to be a limiting factor in development. The primary functions of the pioneer ships are threefold:

- To provide regular and reliable sea service to the "weak areas" where such service was not yet commercially viable
- To provide floating markets
- To serve as government ships in support of district administration and mobile government services. (Although not formally a part of the survey, one benefit of the Pioneer ships is that they provide regular pay and communication for government officers. In view of the morale effects of a system of sporadic pay, this benefit is probably significant.)

Maluku Province is served by 3 of the 15 ships in the Pioneer Fleet.[1] Only one goes to Halmahera Island. A round trip from Ambon takes from 20 to 22 days. Allowing some days in port for repairs, paper-work, loading, and contingencies, this results in approximately monthly trips.

The scheduled route is: Ambon - Sanana (Sulawesi Island) - Laiwi (Obi Island) - Labuha (Bacan Island) - Ternate (Island) - Jailolo - Ibu - Galela - Doruba (Morotai Island) - Tobelo - return to Ternate (Northern Swing) - Ternate - Saketa (Gane Barat) - Gane (Gane Barat) - Mafa (Gane Timur) - Weda - Patani - Buli (Maba) - Sayati (Island) - return to Ternate (Southern Swing) - Sanana - Ambon.

In practice, service by the Pioneer Sea Fleet differs substantially from the schedule. Regular monthly service is provided

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[1] According to the Ministry of Communications, Maluku Province is served by 6 of 15 ships, with two serving Halmahera Island.

to the southern kecamatans - Labuha, Saketa, Gane, Mafa, Weda, the call in each port lasting not more than two hours.[1] In the North, only Tobelo, Galela and Doruba receive regular monthly service. Jailolo was visited a few times when the service started, and the other ports have never been visited.

These changes in the scheduled service probably result from two factors. The first is that the port facilities are very limited. Except in Ternate harbor, there are no wharves that would accommodate the pioneer ships, and in most cases only the most primitive sort of lightering is available. (Typically cargo is loaded and unloaded directly onto the beach from small vessels.) If the Pioneer ships picked up cargo in these instances, it would significantly extend the round-trip time for the ships. In the case of the Northern ports, service has also apparently been restricted because it has been determined that private shipping adequately serves them.

In the sample villages, nine Southern and eight Northern village headmen report that the Pioneer Sea Fleet service has improved life in the village. In the South, the reasons given all center on transportation to the kabupaten capital, that is, Ternate or Soa Siu. The service is said to be quicker and cheaper; to permit the traveler to carry more goods; and, most important, to be regular and on time. The only negative statement is that since a traveler can carry more goods, which take more time to assemble, there is a problem if the boat is not on time. In the North the reasons are more general, such as better government service or better life. Headmen who said that the service had had no effect frequently express the need for better and more roads. In Jailolo the need for a regular ferry service to nearby Ternate was also expressed.

C.2. Private Transport

Sixteen of the 29 transport firms surveyed carry passengers and cargo, 5 carry passengers only, and 8 carry only cargo. Of these, four carry general cargo and four carry only copra. Of the 24 firms that carry cargo, 12 specified the cargo carried - 10 only carry copra, 1 carries copra and chocolate, and 1 carries foodstuffs.

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1 According to the Ministry of Communications, the Pioneer ships sometimes carry copra. In the study area, however, freight transport appears to be limited to what passengers can carry with them.

The following table shows round-trip distances for the routes served by the sample transporters. (The one firm that operated a sailboat before the project reported that a round trip was five days, "depending on the wind.")

ROUTE DISTANCES - (NUMBER OF ROUTES)

	LAND		WATER			
	< 16 km	16-85 km	< 16 km	16-85 km	86-165 km	>165 km
Pre-project	4	-	-	5	3	3
Present	10	8	3	17	4	8

C.2.a. Investment. Over half the firms (17) have started in business since 1972. When asked why they had started business, three firms said because a new road had been built, two replied that it was because it is possible to operate a motor boat now, and five said it was because additional business was available or that they had been able to acquire the capital.

The firms' investment and number of vehicles increased dramatically in the five-year period covered by the survey. The resulting substantial increase in private transport services in the impact zone has undoubtedly had far greater effect than the Pioneer Sea Fleet. As the following table shows, there are about four times as many privately owned trucks, buses, and motorboats serving the impact area as there were five years ago:

	No. of Firms	Number of Vehicles (Truck/Minibus)	Sailboats	Motorboats
Pre-project	12	7	1	9
Present	29	29	0	36

Reported investment by the transport firms has increased simultaneously. Total investment in 1972 was U.S. $222,000, and it has increased to U.S. $575,000 at present. In 1972 there was one transporter with an investment of over U.S. $100,000, now there are three. Excluding these large firms, average investment has increased from U.S. $2,800 to U.S. $5,400 per firm. Part of this increase is due to investment by new firms and part is due to increased capacity of existing firms. Of the nine firms that reported reasons for increasing capacity, four converted to diesel boats to achieve lower cost, three changed to faster boats, and two increased boat size.

Of the 12 firms that were in business since 1972, 4 report their capacity utilization is higher now, 4 report that it is the same, 4 say it is lower. However, seven of the firms have substantially increased their capacity during the project period.

These changes are also reflected in the competition. Only one firm reported that it had significant competition in 1972, and this was from a general cargo carrier. Eleven firms now report that they have significant competition, ten from a general cargo carrier and one from a copra carrier.

C.2.b. Tariffs. Three firms that provide land passenger transport services reported that their tariffs are regulated by the government. Of the remaining 26 firms, 11 reported that tariffs are established by bargaining and 15 reported that they are fixed by transporters alone. All of the firms state that distance is a factor in determining tariffs, and six of them indicated that a combination of distances and the commodity carried is the determining factor. Only three firms provided data on pre-project tariff rates, and they show increases of 100% to 300% during the last five years. Present short-haul prices per ton/kilometer for cargo are about double those for long haul, but there is no discernible difference in ton/kilometer rates on routes of 100 kilometers or more. The reported present ton/kilometer rates for cargo are as follows:

General cargo	6¢ to 7¢
Cement, rice, and sugar	3¢ to 4¢
Copra	4¢ to 6¢

Passenger fare charges vary from U.S. $0.01 to U.S. $0.04 per kilometer, but the differences are related to location and not to distance.

C.3. Change in Accessibility

The index of change in accessibility is based on changes in access stemming from three sources: the Pioneer Sea Fleet, privately owned sea transport, and improved roads. The access provided by the Pioneer Sea Fleet is more dominant in the southern kecamatans, although private sea transport also has an effect there. In the northern kecamatans, changes in access result primarily from improved privately owned sea transport and improved road access on the island of Halmahera itself. (There is essentially no road access in the southern kecamatans.)

D. BEHAVIORAL RESPONSE TO TRANSPORT SECTOR CHANGE

D.1. Production

D.1.a. Tree Crops. The most important production change in the study area is yet to come. During the last five years the number of farmers planting new high-value cash tree crops has increased significantly, while previous planters have increased their stands. Three times as many farmers have clove trees now and more than twice as many have nutmeg trees. These tree crops take four to six years to begin bearing; since most of them were planted after 1972, they have not started producing yet. As they come increasingly into production over the next several years, there should be substantial gains in income in the impact zone. Table 4.12 summarizes key statistics on increases in tree crop cultivation by the sample farmers.

TABLE 4.12

TREE CROPS, 1972-1976

	Number of Trees		Number of farmers	
Crop	Mean	Total	Total	With Crops planted but not Producing
Cloves				
1972	56	1,790	32	a
1976	70	7,280	104	86
Cocoa				
1972	188	12,970	69	a
1976	240	30,070	125	69
Nutmeg				
1972	56	2,370	42	a
1976	60	5,925	99	41
Coffee				
1972	95	475	5	a
1976	93	745	8	3

[a] Not available.

A clove tree normally begins producing in the fourth or fifth year, producing about 1 kilogram; within a few years, production builds up to 5 kilograms per tree and it continues to increase indefinitely thereafter. Thus, if clove prices remain stable, 104 farmers (one third of all the farmers in the sample) will experience average increases in income of U.S. $600 over the next several years, an increase of 1.2 times the value of the average farmer's total crop production now.

This commitment by small farmers to planting crops when there will be no return for several years is unusual. It may be fostered partly by the fact that little risk is involved, since subsistence farmers normally base their actions heavily on risk aversion. The link to transport is less clear, especially in the case of cloves, whose volume is very small.

However, agricultural extension would not appear to be an important factor. The increase in cash tree crops has occurred in both the Southern and Northern parts of the study area, and agricultural extension is virtually nonexistent in the South. The increases probably result from a perception of high potential returns and thus indirectly from increases in transport and radio communications, which have made the sample villages less isolated and the farmers more conscious of the substantial potential returns involved.

D.1.b. Fertilizer and High-Yielding Varieties. Fertilizer use is virtually nonexistent in the study area. It is confined to cloves, and only 10% of the clove farmers use fertilizer. This pattern did not change during the project period. The percent of farmers planting a given crop who plant high-yielding varieties is: cocoa 9%, nutmeg 18%, coconut 16%, and cloves 30%. Of these farmers, 80% began using a high-yielding variety after 1972.

D.1.c. Sales. During the last five years, patterns of transport of crops by farmers for sale have changed. Hand and canoe transport has decreased from 89% of the farmers to 80% and transport by outboard or motor vehicle has increased from 4% to 7% and 5% to 12%, respectively. There has also been some shift in the point of sale, but it is less of a change than in means of transport. In 1972, 62% of the farmers sold their crops in the village and 33% did so in the nearest market town. In 1976 the division was 59% and 36%. Sales further away (only 31 cases in 1976) remain essentially unchanged.

D.2. Consumption

Table 4.13, which gives ownership data for selected major consumption items, shows substantial change over the project period. Except for farm machinery, and the one outboard owner, over half of the families owning such assets have acquired the items during the last five years.

TABLE 4.13

MAJOR CONSUMPTION ITEMS

Item	Number	% Purchased Since 1972
Tin roof	91	65
Radio	50	56
Bicycle	9	67
Motorcycle	12	75
Outboard engine	1	0
Farm machinery	114	41
Private electricity	1	100

Other evidence of significant consumption change in the impact zone can be seen in the 50% increase in the number of shops in the sample villages and the increases in village-owned boats and vechicles, shown in Table 4.14.

TABLE 4.14

NUMBER OF BOATS & VECHICLES - SAMPLE VILLAGES

Item	Number owned in Village 1972	Present
Motor vehicles	0	13
Motorcycles	4	47
Outboards	33	165
Motor boats	0	2
Sailing vessels	43	60

D.3. Travel

Some changes in travel outside of the kecamatan took place during the project period, but the change was not significant, and as noted above, travel is infrequent. Of those who traveled to Ternate in 1976, 35% are traveling more frequently now than five years ago and the remainder are traveling with the same frequency or not at all. Only 27 persons reported traveling to Ambon and 21 to Menado. As might be expected, household heads travel most frequently-about twice as many household heads as spouses make trips outside the kecamatans. On a per capita basis, travel by other household members is about one-third as frequent as it is for spouses.

D.4. Service Utilization

D.4.a. Agriculture. Only 30% of the household heads and 5% of the spouses are members of cooperatives or other agricultura organizations; however, this low percentage probably reflects the limited number of such organizations and is not necessarily

indicative of villagers' willingness to join them. The same is probably true of agricultural training courses, which were attended by only 6% of the respondents in 1976.

Of the farmers in the survey sample, 43% have never been visited by an agricultural extension officer, 14% were visited once in the previous year, and 43% were visited twice or more. Of those visited, 68% report that they are visited more frequently now than they were five years ago. Forty percent of the farmer respondents stated that agricultural extension meetings were held in their community and that most of them (80%) regularly attend such meetings when they are held.

D.4.b. Education. Only 45% of household heads in the sample have completed a basic education (four years of primary schooling); 12% have never attended school. Only 35% of spouses have a basic education, and 30% have never been to school.

In contrast, 60% of all children over six have achieved adequate educational levels, and only 12% have no education at all. In addition, a surprising 40% of all children have gone beyond primary school, compared to only 3% of their parents. The proportion of adequate educational attainment is slightly higher than the norm (64%), as is the share with more than adequate education (49%), among children living away from home.

Male childeren are slightly more likely than females to have received an adequate basic education (63% compared to 57%). There is slightly more equality of educational opportunity for children at home (males 61%, females 57%), and differentials are more marked among children away from home (males 74%, females 59%). Eleven percent of male children and 12% of female children have never had any education. The shares are equal among children at home, but males away from home are slightly less likely (12%) to have had no education than are females (15%).

A somewhat greater discrepancy shows up in access to secondary education. More than adequate educational levels have been attained by 44% of male children and 35% of female children. The differential is slightly less among children at home (42% of males, 34% of females) and greater among children away from home (64% of males, 40% of females). However, the relative position of women has improved during the last generation. The share of female children with adequate education or better is now 90% that of male children, while it was only 77% among their parents.

Other household members are somewhat younger, on the average, than household heads and spouses. (39% are in the 15 to 24 age groups compared to 13% of heads and spouses.)

They have an intermediate level of basic education (51%) but a disproportionate share have no education at all (49%). The majority of these adults (52%) have no job; 33% work on the family farm, 3% work on other farms, and 12% have non-farm jobs.

Change in literacy rates by age groups can be used as a proxy measure for service delivery impact and communications change in the project area. The sample data show that 46% of children between the ages of 6 and 10, 58% of those between the ages of 10 and 20, and 72% of those over 20 have adequate basic education. Among household heads, spouses, and other adults, literacy rates are 70% in the 15 to 24 age group, 51% among those 25 to 44, 14% in the group from 45 to 64, and 19% among those over 65. On the basis of these data, it would seem that little change in educational attainment has taken place over the study period.

D.4.c. Health. The limited nature of health care in the study area was noted previously. None of the respondents reported living less than one kilometer from a health center or similar facility, but 56% say that such a facility is within 4 kilometers of their villages and an additional 22% report that one is five to nine kilometers away. Most families visit the health center five times a year or less, and the number of visits does not vary as a function of distance. Apparently, when a villager is sick enough to seek medical help, he or she does so, whether the trip is one kilometer or more than ten. Thirty-six percent of the respondents say they visit the health center more frequently than they did five years ago, 41% make the same number of trips, and 17% go less often. Change is not correlated with distance and probably reflects a growing awareness and availability of more facilities.

The great majority of the children born in the impact zone were delivered at home without a formally trained midwife in attendance. No pattern of change during the project period can be seen.

D.4.d. Credit. There is little use of agricultural credit in the impact zone, and that is confined largely to the Northern part. Nine percent of the farmers borrowed for agricultural production purposes in 1976, two-thirds of them from a bank or agency and one-third from other sources, although other sources were the first means of credit for both. Of those who did borrow, 60% began borrowing during the last five years.

E. IMPACTS ON INCOME DISTRIBUTION

This section examines the socioeconomic composition of the project area population as revealed by the household surveys and describes the characteristics of different socioeconomic groups. Changes in the socioeconomic composition of the population over the project period are then determined. Finally, the incidence of income-related impacts of the transport investment is analyzed by socioeconomic group.

E.1. Composition of Socioeconomic Groups

Subsistence farmers (that is, farmers whose cash sales of farm products are no more than half the total value of farm production and who have no outside source of income) made up 20% of the household survey sample. The average household income found for this group was 284,929 Rupiah, or about U.S.$695. The average household size was 6.3, slightly above the sample mean. The corresponding per capita income was 50,550 Rupiah, or about U.S.$123. The typical subsistence farmer owned about 1.2 hectares and cultivated 1.0 hectares. In 12% of cases, subsistence farmers also rented or sharecropped land, but they did not have wage labor income.

Low-income cash cropping farmers were defined as those with a household income of under U.S.$300 who nevertheless derived more than half of their income from cash sales of crops and who had no other source of income than the farm. This category comprised 16% of the sample. The average household income for this group was 74,483 Rupiah, or about U.S.$182. The average household size of 5.7 is below the sample mean, but this group still has a very low per capita income of 14,579 Rupiah, or U.S.$36. These farmers own somewhat smaller amounts of land (0.9 hectares on the average) and cultivate even less (0.7 hectares). Of this group, 7% also sharecrop land, but they do not earn outside income.

The category of "high-income farmers," that is, cash cropping farmers with household incomes over U.S.$300, accounted for 31% of the sample. The mean value of household income for this group is 505,081 Rupiah, or about U.S.$1,232. Even with a relatively high average household size of 6.5, this group generates a per capita income of 89,134 Rupiah, or U.S.$217. A large amount of land is owned (1.6 hectares on the average) and intensively cultivated (1.5 hectares). Sharecropping is done by 9% of this group, and wage labor income contributes an average of 11,869 Rupiah (U.S.$29) to 4% of the households.

Of the sample, 6% were those respondents who have farms but who also have outside income sources and who sell less than half of the value of their farm produce. The average farm income reported for this group is 246,035 Rupiah, or about U.S.$600. The average household size is 6.4, corresponding to a per capita income of 40,435 Rupiah, or about U.S.$99 from the farm. The amount of land owned is relatively small (0.9 hectares on the average) and is entirely cultivated. One case (4% of this group) was a sharecropper rather than a landowner. No wage labor income was found in this group; outside income came from trading, government jobs, private business, and so on.

Cash cropping farmers with non-farm income sources made up 11% of the sample. Their average farm income was greater than that of the preceding group: 536,139 Rupiah, or about U.S.$1,307 per household. This group had an average household size of 6.2, resulting in a per capita farm income of 87,931 Rupiah (U.S.$215). They had a relatively large average farm size (1.3 hectares) and, due to double cropping, cultivated even more (1.5 hectares). One household (2%) was sharecropping land. Wage labor did not provide income for any of these households.

Farm laborers (5% of the sample) had a below-average household size (5.8) and slightly under-average household income (339,085 Rupiah, or about U.S.$827), resulting in a per capita income just over the sample mean (66,118 Rupiah, or U.S.$161). Income data were reported by only five respondents, or 26% of the households in this group.

Non-farm laborers constituted 8% of the sample. Their average household size was 5.1, lowest of all the socioeconomic groups. Wage income was not reported for these households.

Finally, 3% of the sample consists of respondents with no farms but with sources of income such as trading or industry. The average household size for this group (5.2) is well below the sample mean. No income data are available from the survey for this group.

E.2. Characteristics of Socioeconomic Groups

E.2.a. Demographic Characteristics. The majority (51%) of household heads are in the 25 to 44 age group. The next largest group is from 45 to 64 (36%), with 8% from 15 to 24 years of age and 5% over 65. Farmers with non-farm income conform most closely to this sample distribution. Subsistence farmers are more likely to be found in the younger age group (25 to 44), while cash cropping farmers, particularly those with high incomes, are more likely to be found

in the older age groups. Landless laborers (farm and non-farm) are distinctly more likely to be young, while other non-farm households are disproportionately represented in both the very young and the very old age groups.

Of sample household heads, 12% have had no education; 43% have had less than four years of primary school. Only 14% are dropouts after completing four grades, while 31% claim to have completed more than a primary education. This gives an overall literacy rate of 45%.

Subsistence farmers are likely to have had some education but not enough to retain literacy. An even higher share of low-income farmers have inadequate educations. High-income farmers, on the other hand, are more likely to have either no education at all or an adequate amount.

Food farmers with non-farm income have education patterns similar to those for subsistence farmers. Cash cropping farmers with non-farm income more closely resemble the patterns of high-income farmers. However, both of these groups are exceptionally likely to have had more than adequate (beyond primary) education.

Laborers (farm and non-farm) are overrepresented in the group with no education, but also contain a surprisingly high share of respondents with more than adequate education. Households with other non-farm income are most likely of all to have more than adequate education. In general, higher education is associated with the presence of non-farm income sources rather than a successful farm enterprise.

E.2.b. Travel Patterns. All farming groups travel to Ternate about once in three to five years, on the average. Low-income farmers are the least frequent travelers (0.20 annual trips per capita), and cash cropping farmers with non-farm income are the most frequent (0.38 annual trips per capita). In contrast, farm laborers go more than once every two years (0.72 trips per capita) and non-farm laborers go much more often (2.33 trips per year). Other non-farm households travel to Ternate about once every two years (0.51 trips per capita).

Travel to Ambon is infrequent and affects only cash cropping farmers and non-farm groups. Subsistence farmers and food farmers with non-farm income never go to Ambon. Cash cropping farmers (both low and high-income) travel to Ambon once in ten years, on the average, and cash cropping farmers with non-farm income go twice as often. Non-farm laborers also occasionally travel to Ambon (0.06 annual trips per capita).

Farmers without a non-farm income source may visit Menado, but these trips are very rare (0.002 for subsistence farmers, 0.006 for low-income farmers, and 0.005 for high-income farmers). Cash cropping farmers with non-farm income travel to Menado more frequently, but still such a trip is quite unusual (0.02 trips per capita annually). Laborers and other non-farm households do not go to Menado.

E.2.c. Income Sources. Seasonal farm labor provides extra income to 23% of subsistence households, 18% of low-income households, and 12% of high-income households. Fishing and forest products are even more important for subsistence households (34%) and high-income households (21%) but less important for low-income households (13%). Craft products also contribute to income for 8% of subsistence households, 9% of low-income households, and 4% of high-income households.

Farmers with non-farm income have more diversified income sources. Food farmers with non-farm income derive that income primarily from non-farm labor (48%), but also from salaries (30%), pensions (13%), and private business (9%). The pattern is similar for cash cropping farmers with non-farm income: non-farm labor contributes to 39% of households, salaries to 22%, pensions to 20%, support from children to 10%, and a private business to 12%.

In addition, both groups have other income from the agricultural sector. Nine percent of food farmers and 5% of cash croppers work in seasonal farm labor; 13% and 7%, respectively, have income from fishing and forest products. Another 7% of cash croppers have income from the sale of craft products.

Non-farming groups have relatively fewer income sources. One case (5%) of landless farm laborers has income from fishing; 7% of non-farm laborers also work in seasonal farm labor, and 10% have income from fishing. Three percent (one case) also receives support from children. Other non-farm households cite pensions (22%), support from children (22%), and private business (11%) as secondary sources of income.

E.2.d. Production Patterns. Table 4.13 shows the percentage of farmers in each socioeconomic group who produce each crop considered in this study. Cassava, rather than rice, is the most common food crop in the area, and sweet potatoes are also found in almost half of all households. Bananas are extremely common, whereas other fruits and vegetables are relatively rare.

Rice is cultivated by about a third of all subsistence households (with and without non-farm income), and by a somewhat

TABLE 4.15

PRODUCTION PATTERNS BY FARMING GROUP
(PERCENTAGE OF HOUSEHOLDS PLANTING EACH CROP)

CROP	FARMING GROUP				
	1	2	3	4	5
Rice	36	14	23	39	12
Maize	24	16	28	30	27
Cassava	76	56	55	70	44
Sweet Potato	51	40	46	52	27
Peanuts	15	9	19	17	15
Coconuts	85	93	94	74	88
Bananas	86	70	77	87	63
Vegetables	19	21	21	26	15
Other fruits	11	7	14	17	20
Cloves	28	21	40	30	46
Cocoa	30	19	55	30	56
Nutmeg	28	30	36	30	34
Sago	4	0	3	0	7
Coffee	3	0	3	4	5

Key: 1 = Subsistence farmers.
2 = Low-income cash cropping farmers.
3 = High-income farmers.
4 = Food farmers with non-farm income.
5 = Cash cropping farmers with non-farm income.

Source: Household Survey.

smaller share of cash cropping farmers (23% of high-income farmers, 14% of low-income farmers, and 12% of cash croppers with non-farm income). Maize is found in 25% to 30% of all farm households except for those of low-income farmers, where the share drops to 16%. Cassava (tapioca) is really the staple food, produced by 70% to 75% of subsistence farmers and 45% to 55% of cash cropping farmers. Sago, a less preferred substitute, is cultivated by only a few farmers in each income group. Sweet potatoes are an important supplemental source of calories for 40% to 50% of all farm households except cash croppers with non-farm income, where the share drops to 27%.

Bananas are produced by well over half of all farmers, including over 85% of subsistence farmers (with and without non-farm income), 70% to 80% of cash cropping farmers without non-farm income, and about 65% of cash croppers with non-farm income. Other fruits are cultivated by less than 20% of households in all groups, with low-income farmers having the smallest share (7%) and cash croppers with non-farm income the highest share (20%). Vegetable growing is relatively constant across socioeconomic groups at about 20% of households in each group. Patterns of peanut production are similar to those for other fruits except that a slightly higher share of farmers with non-farm income participates in production of this crop.

Coconuts (copra) is the traditional cash crop in the project area. Coconuts are cultivated by 85% to 95% of all farmers without non-farm income and by 75% to 85% of farmers with non-farm income. Within each category, cash cropping farmers are slightly more likely than subsistence farmers to cultivate coconuts.

Cloves, nutmeg, cocoa, and coffee are high-value cash crops recently introduced into the study area. Cloves are planted by 40% of high-income farmers and 46% of cash croppers with non-farm income, compared to 28% of subsistence farmers, 30% of food farmers with non-farm income, and 21% of low-income farmers. The patterns are similar for nutmeg and cocoa. Cocoa is slightly more popular with high-income cash cropping farmers with or without non-farm income, while nutmeg is slightly more popular with low-income farmers. Coffee is planted by less than 5% of farmers in all groups and not at all by low-income farmers.

E.2.e. Marketing Patterns. Table 4.16 shows the percentage of producers in each group who sell some of their production by crop. Rice is infrequently sold, most often by cash croppers with non-farm income (20%) and least often by subsistence farmers (4%), averaging about 10% in the other groups. Maize, on the other hand, is sold by more than half of all producers,

TABLE 4.16

MARKETING PATTERNS BY FARMING GROUP
(PERCENTAGE OF PRODUCERS SELLING EACH CROP)

CROP	FARMING GROUP				
	1	2	3	4	5
Rice	4	13	12	11	20
Maize	50	88	73	56	82
Cassava	29	53	81	86	67
Sweet Potato	29	48	37	42	45
Peanuts	27	100	86	50	100
Copra	60	70	93	41	72
Bananas	30	50	44	83	58
Vegetables	43	75	58	67	100
Other fruits	22	25	31	50	63
Cloves	0	8	20	0	16
Cocoa	18	27	65	14	39
Nutmeg	19	24	15	14	7
Sago	67	b	67	b	67
Coffee	100	b	33	0	100
Fish[a]	18	2	9	13	5
Livestock[a]	42	11	32	26	27

[a]Percentage of all households.
[b]No production.

Source: Household Survey.

including about half in the subsistence groups and 75% to 85% in the cash cropping groups. Cassava is frequently sold by high-income farmers (81%) and food farmers with non-farm income (86%). It is less frequently sold by cash croppers with non-farm income (67%) and low-income farmers (53%) and least frequently sold by subsistence farmers (29%).

Sweet potatoes are marketed by about 45% of producers, slightly less by high-income farmers (37%), and substantially less by subsistence farmers (29%). Vegetables are marketed by well over half of all producers except for subsistence farmers (43%). A similar pattern prevails for bananas and other fruits, as well as peanuts, which subsistence farmers are consistently least likely to sell. Sago is produced by very few farmers, but two-thirds of producers in each group sell some of their crop.

Copra is sold by all farming groups. Food farmers with non-farm income are least likely to market copra (41%) and high-income farmers are most likely to do so (93%). In the other groups, 60% to 70% of coconut cultivators market copra.

Cloves take a long time to mature, so only a few clove planters are now producing for sale. These are predominantly high-income farmers (20%) and cash croppers with non-farm income (16%). One low-income farmer (8%) also reports producing cloves for sale.

Nutmeg is sold by 15% to 25% of producers except for cash croppers with non-farm income (7%). Cocoa is sold by under 20% of subsistence producers (with or without non-farm income), by 27% of low-income farmers, 39% of cash croppers with non-farm, and 65% of high-income farmers planting this crop. Coffee is sold by all producers except for the high-income group (33%).

Fish are a source of cash income for 18% of subsistence households and 13% of food farmers with non-farm income. Less than 10% of households produce fish for sale in the cash cropping farm groups. Livestock sales are significant in all farm groups; they are most important for subsistence farmers (42%) and least important for low-income farmers (11%).

E.2.f. Agricultural Service Delivery and Social Participation. Participation in agricultural organizations is remarkably consistent across socioeconomic groups at about 30% of farm households. Subsistence farmers are only slightly less likely than others to participate (27%). Spouses participate in farm organizations in only 6% of cases; a somewhat lower rate appears among subsistence farmers (3%) and a somewhat higher rate is characteristic of cash cropping farmers with non-farm income (13%)

Few farmers in the project area have attended an agricultural training course. Cash croppers with non-farm income are most likely to have attended (13%), while subsistence farmers (with or without non-farm income) are least likely to have done so (4%). Cash cropping households may attend more than one course in a year; this was true for all the low-income farmers attending as well as 40% of high-income farmers and 60% of cash croppers with non-farm income attending.

Agricultural extension has been fairly successful in reaching farmers in the project area. Only 43% of farm households report that they have never been visited by the extension service. This pattern is consistent throughout all income groups, with subsistence farmers slightly above the norm (46% never visited) and food farmers with non-farm income slightly below the norm (39%).

Of all visited farms, 75% are visited more than once a year. The proportion is slightly higher (80%) among high-income farmers and cash croppers with non-farm income and lower among food farmers with non-farm income (65%). Thus, on balance, the extension service is spread fairly evenly over the different socioeconomic farming groups.

When agricultural meetings are held in the community (as reported by 64% of households), 71% of farm households report regular attendance. The proportion is highest among high-income farmers (80%) and food farmers with non-farm income (88%) and lowest among low-income farmers and cash croppers with non-farm income (64%). Low-income farmers are most likely (15%) never to attend such meetings, while subsistence farmers and cash croppers with non-farm income are near the norm, and high-income farmers and food farmers with non-farm income are least likely to stay away (5%).

Only 8% of all farm households have made use of credit to support their farm operations during the past year. The share is quite consistent across socioeconomic groups except for food farmers with non-farm income, who do not make use of credit.

E.3. Change in Composition of Socioeconomic Groups

It was not possible to reconstruct with any degree of confidence the income levels by household that prevailed ten years ago. Therefore, the Consultants do not have detailed data on the actual change in income levels and income distribution occurring over the project period. Thus, it was necessary

to infer changes in the socioeconomic structure of the project area population and project impacts on income distribution by looking at qualitative changes in the characteristics defining socioeconomic status and the incidence of behavioral change by socioeconomic groups.

E.3.a. Change in Land Tenure. Of those respondents reporting change, 88% were landholders both before and after the project; 6% did not have land either before or after the project; 6% have land now and did not have it before; and only 1% has gone from landholding to a landless condition. The small amount of change in landholdings is well within the range that could be accounted for by life-cycle changes.

E.3.b. Change in Sources of Income. Only 10% of all subsistence farmers reporting change had no other source of income than their farms either now or before the project; 84% had other income both now and before; and 6% (one case) has other income now but did not have it before. Thus, this group experienced little change over the project period.

Cash cropping farmers are more likely to have no source of income other than the farm, both now and before (65% of low-income farmers, 51% of high-income farmers). Those who have other income now usually had it before the study project (30% of low-income farmers, 46% of high-income farmers). Five percent of low-income and 3% of high-income farmers (one case each) report having other income now but not five years ago.

Almost all of those with non-farm income now had other sources of income five years ago as well. Only 4% of cash cropping farmers (one case) report having other income now and none in the past. Generally, there has been very little change over the project period and what changes have occurred are well within the range of what would be expected from life cycle changes. (No income change data were reported for landless farm laborers, non-farm laborers, and other non-farm households.)

With respect to non-farm income (excluding income from farm labor, fishing, hunting and gathering, and sale of craft products), 69% of the sample had none either before or after the project and another 11% have such income now but did not have it ten years ago. Of those who had non-farm income in the past, 94% have experienced no change and 6% (one case) report fewer non-farm income sources now than in the past.

The first three socioeconomic groups by definition have no non-farm income now. None of those reporting change have had such income in the past. The two groups of farmers with non-farm income are basically split between those whose income sources

have not changed over the project period (71% of food farmers and 58% of cash cropping farmers) and those who have such income now but did not ten years ago (29% of food farmers and 38% of cash cropping farmers). The remaining 4% of cash cropping farmers (one case) has fewer sources now than ten years ago.

E.4. Distribution of Income Impacts by Socioeconomic Groups

The distribution of income impacts will be assessed by examining the incidence of changes in production patterns and agricultural innovation (use of high-yielding varieties) by socioeconomic groups. The degree to which these impacts are attributable to the transport improvement will be determined by examining the relationship between different types of access change and change in income-related behavior.

E.4.a. Change in Production Patterns. The vast majority of respondents (74%) decreased their cultivated area over the project period. This may be attributed to the introduction of high-value cash crops requiring little area to produce an adequate income. Seventeen percent of the sample have no farms now, and 8% began farming during the study period. Only 1% report increasing the area cultivated, and none have stayed the same.

Only 4% of subsistence farmers have expanded their cultivated area over the project period, while 84% have less cultivated area now than before, and 12% began farming during the project period. Similarly, only 2% of low-income cash cropping farmers (one case), and no high-income cash cropping farmers expanded their cultivated area over the project period. However, 83% of low-income farmers and 97% of high-income farmers decreased the area cultivated. Fourteen percent of low-income farmers, but only 3% of high-income farmers, began farming during the study period.

Only 2% of food farmers with non-farm income (one case) and no cash cropping farmers with non-farm income report increasing their cultivation area over the project period. In addition, 30% of food farmers and 11% of cash croppers began farming during the study period. In contrast, 65% of food farmers and 84% of cash croppers with non-farm income decreased the area cultivated.

Change in area cultivated by crop was correlated with selective measures of access change and socioeconomic change. The results are shown in Tables 95 and 96 (see Volume 2). In general, the correlation with access change is extremently low.

The only significant findings are the following:

1. Changes in food crop production are not significantly related to any form of access change.

2. Increasing coconut cultivation is positively, but weakly, associated with both household access change and market access change.

3. Addition of cloves to the crop mix is positively associated with change in household access. The same is true for nutmeg.

4. Planting of coffee or cocoa is positively, but weakly, associated with change in household access.

None of these correlations exceeds .15 in magnitude, so the perceived relationships are extremely weak.

As alternate socioeconomic determinants of change in crop production, four indicators were tested: household income, cash income, age and education of household heads. Generally, these indicators yield an equally low correlation. The following findings are significant:

1. Increase in rice cultivation over the project period is positively associated with education of the household head and negatively associated with age.

2. Change in the cultivation of other food crops is independent of socioeconomic variables, except for sago (positively associated with household income) and bananas (positively associated with cash income). Cultivation of other fruits is somewhat more strongly related to both household income and cash income.

3. Coconut cultivation is rather strongly linked to both household income and cash income (.43), and is more weakly associated with education of the household heads (.11).

4. Introduction of cloves, and to a lesser extent nutmeg, is positively associated with both household income and cash income.

5. Cocoa cultivation is linked to cash income (.28) and household income (.25) as well as to education (.14).

The highest correlations are those found for coconut cultivation. The correlations for cloves, cocoa, and other fruit are strong enough to be suggestive. Correlations for rice, sago, bananas and nutmeg are between .10 and .20 in magnitude and should not be given too much significance.

E.4.b. Farm Enterprise Change

Two types of farm enterprise change are studied in this section: planting of high-yielding varieties of coconuts, and clove planting. The relationship of these behavioral changes to access change is first examined, and then the distribution of impacts by socioeconomic groups is discussed.

Planting of high-yielding varieties of coconuts shows a distinct relationship with household access change. The share of households planting high-yielding varieties of coconuts is 16% in the two groups with least access change, 34% in the middle group, 39% in the next group, and 46% in the group with greatest accessibility change over the project period. All of this planting took place over during the past five years.

Clove planting, on the other hand, is relatively unaffected by change in household accessibility. The greatest share of clove planters is found among those in the middle range of access change (28%). The next largest share is found among those who have had the greatest change in household access (16%), while the remaining groups are fairly constant with 5% to 8% of farm households planting cloves.

On the average, about 32% of all farm households (26% of all sample households) are now cultivating high-yielding varieties of coconuts. The share is highest among cash farmers with non-farm income (43%) and high-income farmers (38%), considerably less for subsistence farmers with or without non-farm income (25%), and lowest for low-income farmers (21%). Since these trees are too young to be producing yet, they do not account for the income differentials among these groups. The data therefore support the hypothesis that agricultural innovation begins with high-income groups who can afford a certain amount of risk and "trickles down" over time to lower-income groups.

Clove production, on the other hand, is fairly constant through all income groups at about 12% of farm households (10% of all sample households). The highest share is found among subsistence farmers and cash cropping farmers with non-farm income (14%) and the lowest share among high-income farmers (9%), but this variation is not significant. Among all farm house-

holds, about 2% planted cloves more than five years ago and 10% began planting them during the study period. The share of those first planting cloves is higher than the norm among farmers with non-farm income, just below the norm for cash cropping farmers with non-farm income, and lower than the norm for subsistence farmers. This indicates that the innovation began with those farmers who had more exposure to new ideas through non-farm employment, passed on to those involved in the cash economy, and came last to those who had least contact with the outside world.

F. IMPACTS ON THE QUALITY OF LIFE

The relationship between access change and quality of life can also be examined by looking at the variation in socio-economic structures between areas with different degrees of accessibility at the present time. In this section, the composition of the sample by accessibility groups is defined, the characteristics of these groups are described, and the perceived relationship between transport change and change in the quality of life in the project area are discussed.

F.1. Composition by Accessibility Groups

Households were assigned by kecamatan to five accessibility groups. These groups, starting at the nearest point to Ternate, represent decreasing levels of access at the present time and generally increasing levels of market accessibility change over the project period. The distribution of the sample by access group is the following: Group 1 (Jailolo) 11%, Group 2 (Kao, Sahu) 29%, Group 3 (Galela, Tobelo, Morotai) 18%, Group 4 (Bacan, Gane Barat) 17%, and Group 5 (Gane Timur, Weda, Patani) 25%.

Mean household size in Jailolo (6.2), Sahu (5.8) and Kao (5.9) varies little from the sample mean of 6.1. Households are somewhat larger in Galela (6.8) and Tobelo (7.7), though just under the mean for Morotai Island (6.0). In the southern part of the project area, household size is average on Bacan Island (6.1), considerably lower in Gane Barat (5.4), Gane Timur (5.7), and Weda (5.4), but high in Patani (7.0).

Average household income in Jailolo, closest to Ternate, is 411,118 rupiah, or about U.S. $1000, corresponding to a per capita income of 65,202 rupiah, or U.S. $159. In the next access group, incomes are considerably higher in Sahu (376,018 rupiah, or U.S. $917, per household) than in Kao (270,071 rupiah, or U.S. $659). Per capita income is 86,438 rupiah, or U.S. $210, in Sahu and 46,810 rupiah, or U.S. $114, in Kao.

Reported household incomes are significantly higher in the northern kecamatans of Galela (466,715 rupiah, or U.S. $1138), Tobelo (365,598 rupiah, or U.S. $892), and on Morotai (786,352 rupiah, or U.S. $1918). Because of the high average household size in this area, per capita incomes are somewhat closer to the mean (64,566 rupiah, or U.S. $157, in Galela; 46,770 rupiah, or U.S. $114, in Tobelo; 139,790 rupiah, or U.S. $341, on Morotai, based on a relatively small sample).

In the southern group, household incomes are lower on Bacan (298,723 rupiah, or U.S. $728) than in Gane Barat (410,017 rupiah, or U.S. $1000). Gane Timur (313,764 rupiah, or U.S. $765) and Weda (327,224 rupiah, or U.S. $798) are also below the mean, while Patani has the lowest household income of all (234,394 rupiah, or U.S. $594). Given the relatively low average household size in Gane Barat, Gane Timur, and Weda, the per capita incomes in these districts are closer to the mean: 70,427 rupiah, or U.S. $171, in Gane Barat, 55,356 rupiah, or U.S. $135, in Gane Timur, and 66,852 rupiah, or U.S. $163, in Weda. On the other hand, household size implies a low per capita income on Bacan (44,031 rupiah, or U.S. $107) and in Patani (35,814 rupiah, or U.S. $87).

These data indicate that market accessibility to Ternate and accessibility change over the project period have relatively little relationship to present patterns of income distribution in the project area. Income levels are generally higher in Maluku Utara than in Halmahera Tengah, but Bacan Island and Kao in the former area are among the poorest districts in the sample. When averaged by accessibility group, household incomes are highest in the middle group (U.S. $1084) and in Jailolo (U.S. $1000), medium in the second and fourth groups (U.S.$841 and $871 respectively), and lowest in the group with least accessibility (U.S. $718).

Cash income from sales of perishable products constitutes a very small share (0.1% to 0.4%) of cash income throughout the study area. Wage labor income is reported on Bacan and Morotai islands as well as in Weda, Gane Barat, and Tobelo, for a small percentage of cases in each area. The average annual contribution of wage labor to household income is 10,353 rupiah, or U.S. $25.

The amount of land cultivated per household is near the sample mean in Jailolo (1.1), Bacan (1.1), Gane Barat (1.0), and Kao (1.0). It is slightly higher in Sahu (1.6), Tobelo (1.4), and Galela (1.7); slightly lower in Weda and Gane Timur (0.9); and lowest in Patani and on Morotai (0.7). These variations are not large enough to be significant and probably relate more to variations in household size than to differential access by community.

F.2. Characteristics of Accessibility Groups

F.2.a. Demographic Characteristics. The distribution of households by access group and age of household head shows little variation from that of the whole sample. Household heads tend to be younger than the average in Jailolo, the group with the greatest access. There is a greater preponderance of young adults (aged 25 to 44) in the third and fifth groups and a greater share in the middle-aged category (45 to 64) in the second group.

Education, on the other hand, shows distinct differences by access group. Over the entire sample, 45% of household heads have completed enough education to be considered literate. The proportion is significantly higher in the northern kecamatans (60%) and Jailolo (57%) and slightly higher in the southwestern group (49%). It is lower in the southeastern districts (40%) and least in the group including Sahu and Kao (34%).

On the other hand, the southern districts as a whole have the highest proportion of household heads with no education at all (17% and 18%). This rate is relatively high in Jailolo (14%), lower in the next group (9%), and lowest in the northern districts (3%). The relatively low educational attainment in Group 2 --Sahu and Kao --is the result of a high proportion of dropouts in the first four years of primary school in both kecamatans.

Opportunities for secondary education follow the pattern set by completion of a basic education. Jailolo and the northern kecamatans have the highest participation rate (40%) and Bacan and Gane Barat as a group are above the mean (37%). However, in this respect Sahu and Kao are slightly better off (26%) than are the households of the remote southeastern districts (23%). In fact, Sahu by itself has a rate comparable to that of Gane Barat (30%) while the rate is quite low in Kao (17%). These data suggest that access may be a significant constraint on the provision of, or participation in, secondary education.

F.2.b. Travel Patterns. Of the three destinations for which data were collected in the household survey, only Ternate recorded a significant number of trips. Travel to Ternate is, of course, most frequent in Jailolo, but even here it is less than two annual trips per capita. Relatively high rates of travel to Ternate were also recorded in Gane Barat, Sahu, Gane Timur, and Bacan (more than one in five persons travelling annually). The more remote districts varied from a high of 0.16 annual trips per capita (Galela) to a low of 0.11 trips (Tobelo).

The inhabitants of Galela are, however, significantly more likely to visit Ambon than any other group. They travel to Ambon nearly as frequently as they do to Ternate. Apart from Bacan, where one in twenty persons visits Ambon annually, the rest of the districts show virtually no travel to Ambon (less than 0.01 trips per capita).

Travel to Menado is equally infrequent throughout the study area. Only Weda, Galela, and Jailolo have recorded annual trips in excess of 0.01 per capita, and none of these exceed 0.02, or the equivalent of one in fifty persons travelling to Menado each year.

F.2.c. Sources of Income. Across the entire sample, 13% of respondents report additional income from farm labor, 24% from fishing, 5% from sale of craft products, 8% from nonfarm labor, 4% from salaries, 4% from pensions, 2% from children, and 2% from private business. None of these outside income sources is significant for more than 2% of households (one case each) in Jailolo. Farm labor contributes income to 11% of households in Group 2 (Sahu and Kao), 12% of households in Group 5 (Gane Timur, Weda, and Patani), and 14% of households in Group 3 (Galela, Tobelo, and Morotai). This rate rises to 22% for Group 4 (Bacan and Gane Barat). In fact, the rate is also high for Gane Timur (23%) while it is much lower in Weda and Patani(5%).

Fishing is a major income source for 11% of households in Group 2, for 20% of those in Group 4, and for 44% of those in Group 5. Sales of craft products add income to between 2% and 7% of households in each access group. Nonfarm labor contributes to between 7% and 9% of households in each group with the exception of Jailolo, where there is only one case (2%).

Salaries and pensions are slightly more frequently reported in the southern districts. Support from children is also mentioned in this area but not in the north. In contrast, income from private business is reported only in the northern districts (Groups 2 and 3) and on Bacan. All of these income sources contribute to between 2% and 7% of sample households in each access group where they appear.

F.2.d. Production Patterns. Table 4.17 shows the percentage of households in each access group planting each crop considered in this study. As noted above, the principal subsistence crop is not rice but cassava, grown by about 40% to 50% of households except in the least accessible area (Group 5), where it is grown by 72% of all households. Bananas are also widely produced throughout the study area, ranging from 34% of households in Group 5 to 68% of households in Group 4. Sweet potatoes are important everywhere but in Jailolo; there they are grown by 15% of households, compared to approximately 35% in Groups 2,3, and 4 and over 50% in Group 5.

Rice is cultivated by about 15% of farmers in all groups except Group 2, where it is grown by 35% of farm households. Maize is relatively common in Groups 1 and 4 (about 25%) and quite widespread in Group 5 (40%), while it is much less common in Group 2 (12%) and virtually unknown in Group 3 (3%). With less variation, a similar pattern is found for peanuts. Cultivation of vegetables and fruits (other than bananas) is most common in the southern districts; only 5% of households in Jailolo and 3% to 7% of those to the north cultivate these crops. Sago is produced only in the south and is significant only for Group 5 (9%)

TABLE 4.17

PRODUCTION PATTERNS BY ACCESS GROUP
(PERCENTAGE OF HOUSEHOLDS PLANTING EACH CROP)

Crop	Access Group 1	2	3	4	5
Rice	17	35	17	15	13
Maize	24	12	3	27	39
Cassava	37	48	40	47	72
Sweet Potato	15	36	38	35	51
Peanuts	15	12	0	18	19
Coconuts	39	77	95	70	81
Bananas	46	66	48	68	34
Vegetables	5	7	3	33	83
Other fruits	5	7	6	25	14
Cloves	37	31	32	30	19
Cocoa	22	30	51	53	20
Nutmeg	27	25	18	23	38
Sago	0	0	0	2	9
Coffee	0	0	0	8	3

Key: 1 = Jailolo
2 = Sahu, Kao
3 = Galela, Tobelo, Doruba (Morotai)
4 = Bacan, Gane Barat
5 = Gane Timur, Weda, Patani

Coconuts, the principal cash crop, are cultivated by 70% to 95% of households except in Jailolo, where they account for less than 40% of farm households. Cloves, on the other hand, are most frequently found in Jailolo (37%), occur in about 30% of farm households in Groups 2 to 4, and are least common in Group 5 (under 20%). Nutmeg is popular in Jailolo and the surrounding areas (about 25%), somewhat less so in the northern districts (18%), and distinctly more so in the remote southeastern districts (38%).

Cocoa cultivation is fairly widespread over the project area, ranging from 20% of households in Groups 1 and 5 to 50% in Groups 3 and 4. Coffee is unknown in Jailolo and the north but is planted by about 5% of households in the south. The crop mix is highly diversified in all areas, but a greater relative emphasis on cash crops can be seen in Jailolo and the northern kecamatans (Groups 2 and 3) compared to the continued importance of food crops in areas with less market accessibility (Groups 4 and 5).

TABLE 4.18

MARKETING PATTERNS BY ACCESS GROUP
(PERCENTAGE OF PRODUCERS SELLING EACH CROP)

Crop	Access Group 1	2	3	4	5
Rice	14	16	0	0	0
Maize	40	38	50	69	80
Cassava	40	27	8	46	63
Sweet Potatoes	0	26	8	43	65
Peanuts	100	77	b	45	71
Coconuts	81	79	74	74	70
Bananas	26	30	10	50	32
Vegetables	50	43	50	50	32
Other Fruits	0	14	0	40	62
Cloves	33	6	10	11	11
Cocoa	22	41	79	38	17
Nutmeg	18	7	0	0	35
Sago	b	b	b	100	63
Coffee	b	b	b	60	33
Fish[a]	0	2	2	7	26
Livestock[a]	32	30	15	28	28

[a]Percentage of all households.
[b]No production.

F.2.e. Marketing Patterns. Cassava is sold by 40% to 60% of producers in Jailolo and the southern districts. The share of producers selling drops to under 30% in Group 2 and less than 10% in Group 3 (see Table 4.18). Bananas are most often sold in the southern area (70% to 80% of producers), much less often sold in the north (25% to 30% in Jailolo, Sahu, and Kao, and only 10% in the far northern group). Sweet potatoes follow a similar pattern with somewhat less dispersion between the groups; the maximum share of producers selling is 65% in Group 5.

Rice, in contrast, is sold by about 15% of producers in Jailolo and the surrounding area but not by anyone else, although it is produced throughout the study area. Maize is frequently sold, by 40% of producers in Groups 1 and 2, 50% in Group 3, and 70% to 80% in Groups 4 and 5. Vegetable marketing is

quite consistent throughout the study area at about 50% of producers, somewhat less in Group 5. Other fruits are rarely marketed in Jailolo and the north but are sold by 40% to 60% of households in the south. Sago is only produced in the south and is fairly often marketed there (67% of producers).

Coconuts, or rather copra, are consistently sold by 70% to 80% of producers in each access group. The share is highest near Ternate (Groups 1 and 2) and declines slightly with distance from the capital. Peanuts are sold by all producers in Jailolo and by 70% to 80% of producers elsewhere, except for Group 4 (45%) and Group 3 (where there is no peanut production).

Cloves are most commonly marketed in Jailolo (33%), probably reflecting an earlier average age of planting. The remaining access groups show about 10% of clove producers marketing their crop at the present time. The lowest share (6%) is in Group 2, which is closest to Jailolo, indicating that market access is not a significant stimulus or constraint to production of this high value/volume, nonperishable tree crop.

Nutmeg is most frequently marketed (35%) by producers in Group 5, where it is also most commonly produced. Less than 20% of producers in Jailolo and fewer still in the remaining areas sell nutmeg at the present time. This seems to indicate that cultivation of this crop has recently diffused northward from an origin in southeastern Halmahera or further east.

Cocoa, in contrast, is a common cash crop in the northern districts, where it is marketed by nearly 80% of producers. Cocoa cultivation has caught on in Groups 2 and 4 (the west coast of Halmahera), where cocoa is now marketed by about 40% of producers. It appears to be most recent in Jailolo and on the southeast coast (Group 5), where cocoa is marketed by about 20% of producers. Coffee is produced only in the southern districts and is marketed by about 50% of producers.

Fish sales are insignificant for households in the northern group but contribute to income for 7% of households in Group 4 and 26% of households in Group 5. Livestock sales are fairly constant at about 30% of households throughout the region, except for Group 3, where livestock was sold by only 15% of households during the past year.

F.2.f. Service Delivery and Social Participation. Over the whole sample, about 30% of household heads participated in farm organizations. The percentage was significantly higher in Group 2 (37%) and especially Group 3 (54%), where over half of all household heads belong to such an organization. The share is lower in

Groups 1 (21%) and 4 (18%) and lowest of all in Group 5 (11%). Only about 5% of spouses participate in these organizations; the share is less than 5% in all areas except the far north (Group 3), where participation by spouses is up to 15%.

An overwhelming proportion (94%) of farm respondents had not attended an agricultural training course during the past year. About 3% had attended one and 3% had attended more than one. None of the sample households in Jailolo reported attendance, those in Group 2 were slightly above the mean, and Group 3 had 18% of farm households participating, 6% more than once. (However, there were no participants on Morotai Island.) In Group 4 only 2 households (3%) participated (both were on Bacan Island), and in Group 5 only one household (1%) participated in training courses. In both of the latter groups, all participating households attended more than one course during the past year.

About 55% of all farm households receive visits from the agricultural extension service. The pattern of visits shows a marked correlation with access. All sample farm households in Group 1 were visited at least once, whereas 83% in Group 2, 72% in Group 3, 33% in Group 4, and only 17% in Group 5 were visited during the past year. The frequency of visits also follows this pattern: 85% in Group 1, 64% in Group 2, 54% in Group 3, 17% in Group 4, and 8% in Group 5 were visited more than once during the past year.

Agricultural meetings held in the community were reported by 64% of farm households. Such meetings are held in almost all the sample communities in the north but in relatively few (reported by 16% of households) in the south. Where applicable, most respondents (71%) report regular attendance, 19% say they attend sometimes, and 10% say they never attend. This pattern does not vary significantly among access groups except for Group 5, where fewer (38%) attend regularly and the majority (54%) attend only sometimes.

Over the whole sample, 7% of households report use of agricultural credit during the past year. The share is highest in Group 1 (29%), next highest in Group 3 (12%), near the mean in Groups 2 and 4 (8% and 6% respectively), and very low (1%) in Group 5. It appears that the distribution of credit services depends more closely on cash income (farm and nonfarm) than on access constraints.

F.3. Perceived Effects on Transport Sector Change

Household survey respondents were asked two open-ended questions in order to determine their own perceptions of change in the quality of life over the project period. These were:

1. "Has improved transport changed your life in any important way over the past five years? If so, how?"

2. "Do you think that life in general is better than it was ten years ago? In what way?"

F.3.a. Effect of Transport Change. Only 5% of respondents felt that the Pioneer Sea Service had made a difference in their personal lives during the past ten years. All of these felt that the service offered an improvement over the previously unscheduled coastal freighters. Other types of transport improvements, particularly roads, however, had made a greater impact on the lives of project area residents. Of respondents, 81% feel that it is now easier to obtain necessities (i.e., stores are better stocked); 5% feel that it is now easier to market their farm products; and 43% gave other reasons for feeling that transport change had improved their lives over the project period. As a disadvantage, 8% cited increased transport cost, as compared to 1% who found that transport costs had decreased.

F.3.b. Life Satisfaction. About 23% of respondents felt that they were economically better off than they were five years ago, while 9% felt they were worse off, and the majority (68%) perceived no net change. The predominant cause of an increase in well-being is an improved family situation (mentioned by 15% of respondents), followed by improved transport (6%), better prices for goods sold (6%), increased job opportunity (5%), more government support (3%), increased opportunity for schooling (1%) and improvements in rural housing (1%). Negative effects were felt from inflation in the price of consumer goods (14%) and deteriorating family situations (6%). In general, transport sector change has made little impact on perceived welfare in the project area in comparison to price changes and life cycle changes.

CHAPTER 5
THAILAND

5

CHAPTER 5

THAILAND

The kingdom of Thailand covers an area of 518,000 square kilometers stretching southward 1,600 kilometers from the Mekong River to the border with Malaysia. A constitutional monarchy currently being controlled by an interim government, it is a very homogeneous nation. Of its population of about 46 million, more than 98% were born in Thailand, 97% speak Thai, and more than 93% are Buddhists. Chinese are the most important ethnic minority.

Thailand has four natural regions. The northern region of about 109,000 square kilometers is a mountainous area with peaks rising to 2,590 meters. The northeast region, where the project study areas are located, covers about 171,000 square kilometers and is composed mostly of the Korat Plateau. The central region, the fertile and prosperous basin of the Chao Phya River, covers about 176,000 square kilometers. The southern region (peninsular Thailand) is about 800 kilometers long and covers an area of 78,000 square kilometers.

The government agency most directly involved in planning and executing the study was the Ministry of Communications. Local Study Team members included, in addition, representatives of the National Economic and Social Economic Development Board, the Office of Accelerated Rural Development (ARD), and the Ministry of Agriculture and Cooperatives. Substantial support in the field was also provided by the provincial officers of ARD.

A. SAMPLE DESIGN AND FIELD METHODS

A.1. Definition of the Project Area and Impact Zone

A.1.a Project Area. There are two project areas related to the improvement of two separate dirt all-weather roads. Both are located in the Northeast, historically the poorest and most disadvantaged region in Thailand. The area has been troubled by Communist-led insurgency for more than 20 years. The escarpment that marks the beginning of the Korat Plateau is an economic as well as a geographic dividing line. Using a conversion rate of 20 Baht = U.S.$1.00, the average total rural household income (in money and in kind) in the Northeast in 1971-1973 was equivalent to $345. In contrast, the average rural household incomes were $555, $560, and $760 in the other three regions and $1,200 around Bangkok. The average household income in urban Bangkok was $1,685, almost five times that of the Northeast.

The two ARD road projects were selected by the government in an effort to provide diversity. The area served by the road in Changwat (Province) Udon Thani is more developed, as is the changwat itself, and reportedly has had a higher level of government development activity than the area served by the road in Changwat Sakon Nakhon. (However, these development activities and their impact are not evident from the survey data, which tend to show more direct involvement in the second project area.)

The first project is the road from Phen in Amphoe (district) Phen to Ban ChiengDa in King Amphoe Sang Khom. (A king amphoe is a newly created amphoe in the process of being split off from another amphoe -- in this case from Phen.) The road was constructed under Thailand's ARD Program in 1967 and 1968. It is 35.7 kilometers long and cost 3,329,000 Baht, or about U.S.$4,660 per kilometer. It is built to an all-weather (laterite surface) standard.

The second project is the ARD road from Ban Khok Si in Amphoe Sawang Daen Din to Ban Kut Rua Kham in Amphoe Wanon Niwat.[1] It is 30.5 kilometers long. It was built to an all-weather standard under the ARD Program in 1968 and 1969 at a cost of 3,190,200 Baht (about U.S.$5,235 per kilometer).

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[1]Hereafter in this report these two projects are referred to as the "Phen Road" and the "Khok Si Road" and the impact zones as the "Phen" and "Khok Si" impact zones, respectively.

Although they were constructed nearly ten years ago, both roads are in relatively good condition. The Phen Road is well maintained and the overall condition of the Khok Si road is good, although it has been severely damaged in several places. The changwat engineer reported that he did not have sufficient funds to perform major repairs on the road after the last rainy season and that it has been damaged by logging trucks, although it was not evident during the survey.

A.1.b. Impact Zone. The impact zones were defined as the area within 10 kilometers on either side of each road, provided no major geographic barrier intervened. There was no such barrier in either case. In practice this definition was expanded to include one village that actually was 13 kilometers by dirt track from the project road. This village was retained in the sample since it met the criterion of being within reasonable walking distance of the project. Based on this definition, 25 villages were identified as being within the Phen impact zone and 24 within the Khok Si impact zone.

A.2. Selection of Sample Units

A.2.a. Districts. As indicated, the districts involved were those through which the two roads passed, although the impact zones constituted only a portion of each of them. The amphoe seat for Phen is located at the end of a paved road that links it to the changwat capital of Udon. (See Figure 9.) The seat of King Amphoe Sang Khom is located about two-thirds of the way along the ARD road, and the area would probably not be a King Amphoe now if the road had not been built. Sang Khom has been the most significantly affected of the four Amphoes.

The amphoe seat for Sawang Daen Din is a major town on the Udon - Sakon Nakhon Highway; the Khok Si project, which begins about 6 kilometers from there, has had a relatively limited effect on the town. (See Figure 10.) Wanon Niwat's situation is similar. It is on a paved highway leading to Sakon Nakhon, and only a small part of the district's area is located in the impact zone of the study project.

A.2.b. Communities. Villages within the impact zone--that is, within 10 kilometers on either side of the roads --were selected on a structured sample basis to provide a range of villages in terms of distance from each road. In the Phen project, 20 sample villages were selected out of the estimated 25 in the impact zone. In the Khok Si project, 16 sample villages were selected out of the estimated 24 villages in the impact zone. In one case in Phen, interviews were held in two contiguous sub-villages. For survey purposes these villages are counted as one village and the interviews were coded under one name. Table 5.1 shows the distances of the villages in the sample from the project and from an all-weather road.

FIGURE 9

THAILAND
PHEN PROJECT AREA

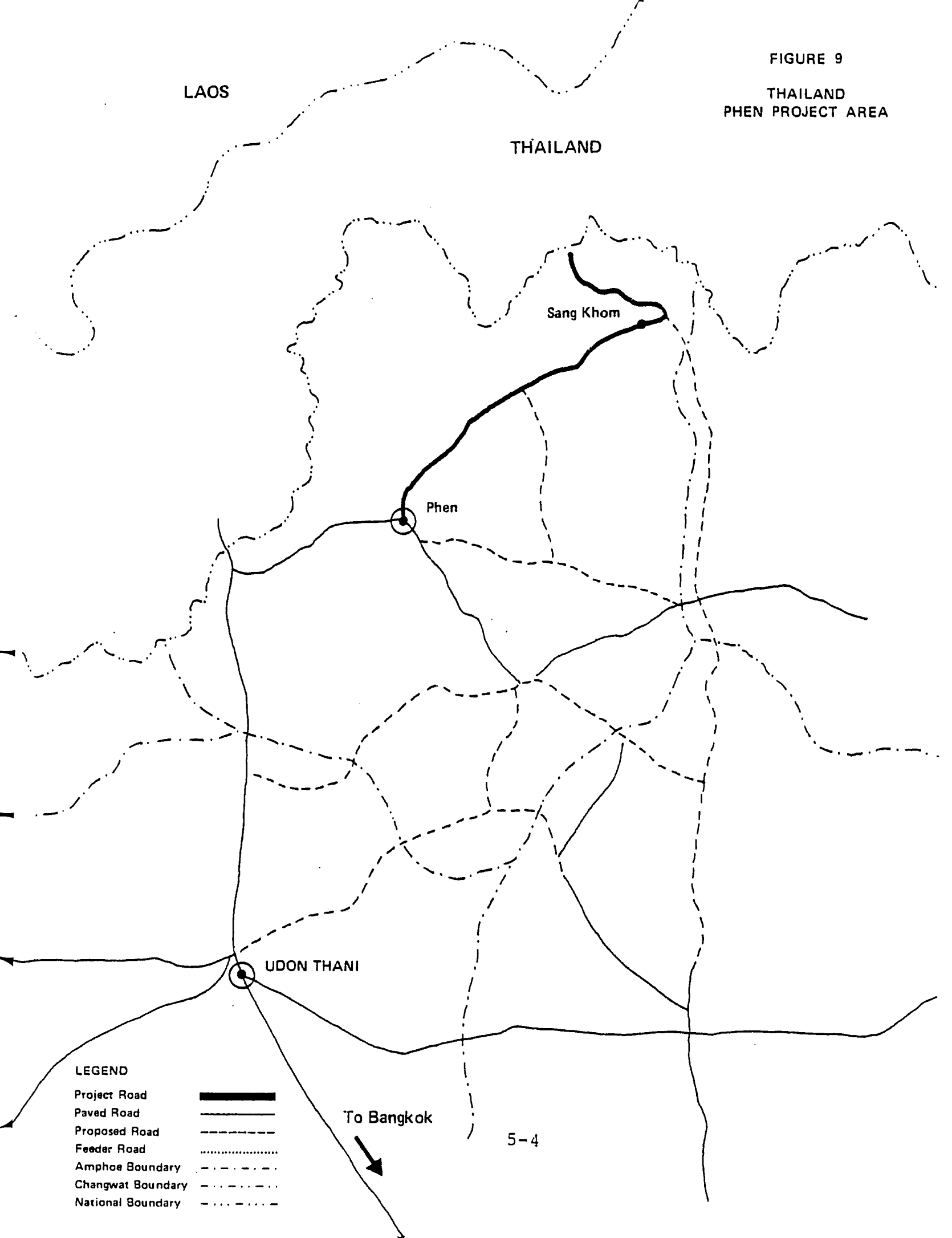

FIGURE 10

THAILAND
KHOK SI PROJECT AREA

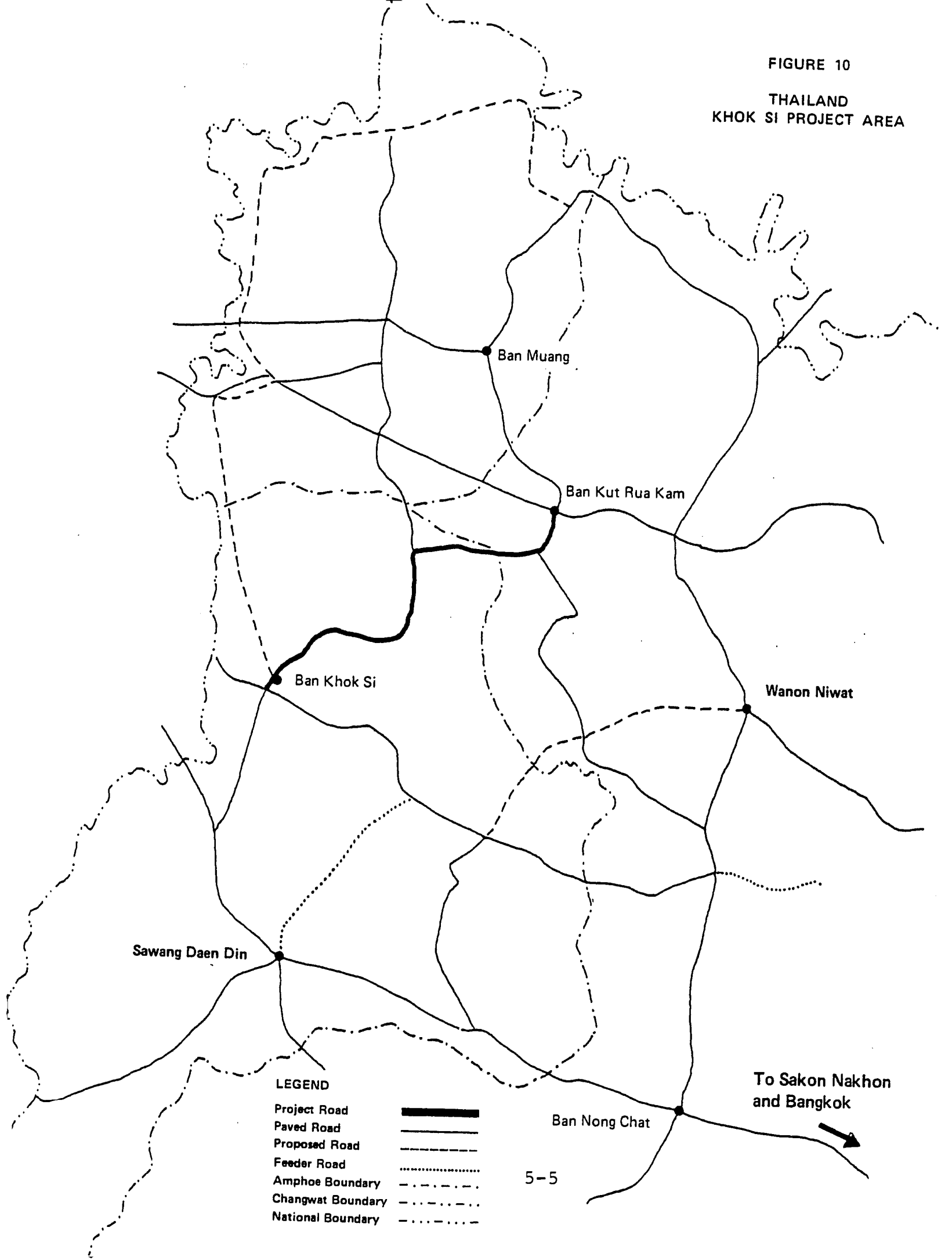

TABLE 5.1

VILLAGE DISTANCE FROM THE PROJECTS AND ALL-WEATHER TRANSPORT

	Number of Villages			
	By Distance From The Project		By Distance From An All-Weather Road	
	Phen	Khok Si	Phen	Khok Si
On the road (0 km)	5	11	6	11
2 kms. or less	7	1	6	2
2.1 to 5 kms.	1	2	1	2
5.1 to 10 kms.	6	1	6	0
> 10 kms.	1	0	1	0

In the Phen sample, 60% of the sample villages are on or close to the road, and in the Khok Si sample 80% are. This is due to the fact that a major criterion for determining the original road alignments was the maximization of the number of villages that were reached directly by the roads.

Measurement of the impact of the roads is complicated by the existence of a number of other ARD roads that were built in the same area after the study project roads had been constructed. (Changwat Sakon Nakhon has been the site of a major ARD construction training center. As a result, the changwat has completed its entire master plan for all-weather dirt roads.) Several villages that were further away from the study project roads have subsequently been linked to them by other ARD roads, some of which are village access roads and are now regarded as part of the project. All of these were included in the sample and are considered as part of the impact zone, since the purpose of the study was to measure the effect of the construction of all-weather roads and not the Phen and Khok Si roads per se.

A.2.c. Households. In all but two villages a sample of ten households was taken. In the two exceptions, eight and six household interviews were conducted. Thus the survey includes a total of 200 Phen rural households and 154 Khok Si rural households. The sample is 10% of the total number of households in Amphoe Phen and King Amphoe Sang Khom and approximately 8% of the households in the impact zone for the Phen project. In the Khok Si project area, the sample is 7% of the households in Amphoe Sawang Daen Din and Wanon Niwat and approximately 4% of the households in the impact zone.

Households were randomly selected from a list of houses that is maintained by the Puyaiban (village headman) and at the amphoe headquarters. This procedure presented two problems. The first was that the lists were not absolutely current and included some houses where the family had moved away. In these cases substitutes were chosen. The second problem was that the lists are of houses, not households, and a single household can sometimes occupy several houses. While this definition of a household presented some problems, the difference was not significant enough to affect the randomness of the sample.

The names of the selected households were sent to the village a day ahead of time so that the Puyaiban could arrange for the people to wait for the survey teams. This procedure worked very well and held down the number of substitutions required.

When it was necessary to choose substitutes, the Puyaiban's copy of the house list was normally used. Substitutes were chosen by picking first the next higher house number on the list,or if that householder was not available, the next lower. In three villages the Puyaiban's list was not available. In one, two substitutes were chosen by taking houses next door to the ones originally in the sample. In the other two, the Puyaiban was asked to identify a comparable substitute;for example, if the original candidate was a landless laborer, the Puyaiban was asked to identify another landless laborer as a substitute.

A.3. Comparison of Sample Characteristics to Population Characteristics

A.3.a. Household Size. The sample shows a mean household size of 7.5 persons, compared to a mean rural household size in the Phen project area of 6.9 persons and in Sawang Daen Din (Wanon Niwat data are not available) of 5.4 persons. The project area data are current estimates by amphoe officials, not census data, and may well be understated.

A.3.b. Education. In the sample, 30% of the household heads and spouses and 91% of the children have achieved an education of four years or more and thus are presumed to be literate. This percentage compares with a national literacy level of over 70% in 1970. This level, which has been increasing steadily since 1948, agrees with the different levels for adults and children shown in the sample data.

A.3.c. Agriculture. Table 5.2 shows mean farm size and mean area cultivated for the sample households and for the two changwats.

TABLE 5.2

MEAN FARM SIZE AND AREA CULTIVATED

	Farm Size[1]	Area Cultivated[1]
	(Hectares)	
Sample households	5.6	4.2
Changwat Udon Thani	6.2	4.9
Changwat Sakon Nakhon	NA	5.2

[1]The land area measure used in Thailand is a rai; 6.25 rai equals one hectare.

NA = Not available.

Although the changwat data in Table 5.2 are for 1975 and the sample was taken in 1977, this would not explain the differences shown above. It may be that the sample area, being more remote, has more small farmers than do changwats as a whole. In the sample area, 88% of the cultivated area is planted in rice, compared to 69% for the two changwats as a whole and 89% to 95% reported for the amphoes that comprise the project areas.

A.3.d. Income. The households in the sample area had a mean income (cash and kind) of $579 at the time of the survey in October 1977, compared to a $345 average total rural household income found in 1971 for the northeast region as a whole. The difference, representing a growth rate of 9% a year, would hardly be enough to keep pace with inflation and is substantially less than the 18% per year increase in the export price of rice over the same period.

A.4. Sample Design for Other Surveys

In addition to the household interviews, five other surveys were conducted and an administrative survey was made for each amphoe by asking responsible amphoe officials to answer questions on general administration, agriculture, health, education, and community development. In addition to traffic counts, interviews were conducted with transport firms, commercial firms, and agro-processing industries. In these surveys no effort was made to draw a careful random sample. Interviewers were instructed to select a sample of each type of business with an eye to covering the range of businesses existing in the project areas.

A.4.a. Traffic. Traffic counts were made at one location along each project road. The locations were selected at a point sufficiently distant from the main terminus of the road to catch a majority of traffic. A form was designed in the field to collect data on: the point of origin and destination, vehicle type, time of departure, expected arrival time, number of passengers, and type and volume of cargo carried. ARD field personnel were recruited and trained briefly in the use of the form; they were supervised while they recorded the first few operations.

A.4.b. Transporter Surveys. Transporters were selected on a structured basis to provide a range in terms of types of service and location. One large commercial transporter in Udon Thani was interviewed. The eight transport firms that were interviewed in the four amphoe seats almost certainly constitute a majority of firms based in those towns, with the possible exception of Sawang Daen Din. The ten other firms interviewed in eight villages include some based in villages that were not part of the household survey sample but are in the impact zone. They probably constitute over 75% of the transporters based in villages in the impact zone.

A.4.c. Commercial. The sample of commercial firms was also selected to cover the range of commercial activity in study areas. An effort was made to include at least one newspaper dealer and, where possible, fertilizer dealers. A substantial sample was selected in Amphoe Phen and Sang Khom, which in each case constitutes about one third of the commercial establishments. Because of the more limited effect of the Khok Si Road on the amphoe towns there, only a few specific firms that might be directly affected by the construction of the road were interviewed in Sawang Daen Din and Wanon Niwat. Retail shops were not sampled in every village because they are generally very small businesses. They are nearly identical in the goods they carry and method of operation, and much of the village trade is actually done in the amphoe towns. Shops were sampled in half of the villages in the two impact zones, and the sample covers 21% of the shops in the villages that were included in the household survey sample.

A.4.d. Agro-Processing Industry. Agro-processing industries in the project areas are very limited. As a result, the survey was necessarily restricted to 22 rice mills and the only known tapioca processing firm. Mills in 3 of the amphoe seats and 17 villages are included, and the sample covers at least 50% of the mills in the impact zone and is certain to be representative.

A.4.e. Village Surveys. A village survey was conducted in each sample village by means of an interview with the Puyaiban.

A.5. Instrument Modification

A.5.a. Household Survey. The Thailand household questionnaire was not revised at the workshop in Kuala Lumpur because of time pressures and because the Thailand field work was last in the schedule. After the workshop, Dr. Charles E. Stonier from SEATAC traveled to Bangkok to review the questionnaires with the Thai Government personnel and to make necessary changes. Major changes made were the addition of crops grown in Thailand (kenaf, which is a jute substitute; sweet potatoes; beans and peanuts; cotton; and tapioca) and the deletion of others, such as coconuts, which do not grow or are not significant in the study area.

The household survey questionnaire was translated into Thai and a bilingual Thai/English version was used in the field. This minimized translation problems during the survey but did not eliminate them. Many of the villages in the study area speak the Northeastern Thai dialect, which is as much akin to the Lao Language as it is to Thai. In order to deal with this, each survey team was accompanied by at least one local person who spoke the Northeast dialect. These interpreters were provided from the changwat ARD staff, and the need for their services varied from village to village. In some villages the interviews could all be conducted in Central Thai. In others, all were conducted in Northeast Thai. This translation problem was lessened by the fact that several of the interviewers also spoke the Northeast dialect.

The nature of extended families in Northeast Thailand and of patterns of land ownership, past and present, caused some problems in identification and definition of households. In the field, distinctions were made based on the kitchen or hearth;that is, a group that pooled its production and ate together was considered a household, whether they lived in separate houses or not. This resulted in some arbitrary classifications. A parent who allowed a child to use his land rent free was classified as a landlord who received zero share of the crop and his son was classified as a tenant with a share of 100%. A son who worked on his father's farm ten years ago, received a share of the production, and maintained a separate kitchen, was classified as a non-landowner doing wage labor for other farmers. If his father subsequently gave him a piece, or all, of the land to work on his own, he was then shown as a farm operator. If the interviewee had a separate house but he and his parents worked a single piece of land, didn't divide the production, and ate together, both houses were classified as a single household. Either the father or the son, depending on who was available and their relative shares, was interviewed as the head of household.

In the questions regarding the type of transportation used for marketing farm products, "lorry" was changed to heavy truck and light truck was added. A category of minibus should have been added also, as its absence presented problems in the field. A minibus is a truck that has been converted to carry passengers and universally carries both passengers and goods. Minibuses come in three sizes: the small 4-wheeler, which is normally thought of as a minibus, a larger 4-wheel truck, and a 6-wheel truck. In the survey, all of these were coded as "light trucks," together with the small pickup trucks that only carry cargo. The distinctions that were blurred as a result may not be significant. The various minibuses serve the same function and have the same design, and there were relatively few pickup trucks.

In this same set of questions, the category "bicycle" was defined in the field to include tricycles with cargo-carrying bodies -- a common means of transport for short distances.

In the questions about point of sales of farm products, the categories "at or near the farm" and "in the village" proved to be distinctions without a difference. The Thai live in the village and farm the surrounding land, and the two categories should be counted as one for purposes of analysis.

The following additional changes were made in the field:

- A category of "other" non-farm income was added to cover private businesses, such as minibus operators and traders, and other income was recorded for all respondents, not just landholders. If a respondent owned no land ten years ago, the other income category includes income from his main occupation then.

- Agricultural training courses were strictly defined to include only those lasting more than one day in order to distinguish them from extension meetings.

- Bananas were listed separately from other fruits because they are more common and there is a price difference.

- In the questions for laborers, months of labor by all members of the household were recorded rather than those of the head only. This included labor by farmer owner/operators and landlords, as well as landless laborers. This seemed essential to try to get a measure of total income.

- Under household assets, "tin roof" was defined to include any modern roof, such as tile or wood shingles, that involved an expenditure of money.

A.5.b. Other Surveys. The village survey questionnaire was also translated and a bilingual version was used. A few modifications were made in the other survey instruments based on experience gained in Malaysia, but the instruments were not translated. The transporter questionnaire was expanded to include questions about the transporter's investment now and five years ago. The agro-processing questionnaire was expanded to collect data on the number of employees and the monthly earnings by category of employee.

A.6. Field Methods

In July 1977, two members of the Consultants' staff met in Bangkok with officials from the Ministry of Communications, the Office of Accelerated Rural Development, the National Economic and Social Development Board, and the Ministry of Agriculture and Cooperatives to discuss the survey plan and to identify sources of secondary data. Subsequently Miss Tipsuda Charavejasararn, Chief of the Economic and Technical Research Section of the Ministry of Communications, attended the seminar in Kuala Lumpur.

Training sessions for the survey team members were held in Bangkok on October 13, 14, and 15 at the Ministry of Communications. The training was conducted by Dr. George W. Hill of the Consultants' staff and Dr. Charles E. Stonier of SEATAC. The training procedure was similar to that used in Indonesia. Each questionnaire was reviewed in detail with each individual question and the possible responses explained and discussed. All members of the survey team attended these training sessions.

On Sunday, October 16, the team traveled to Udon Thani in vehicles provided by the several government offices. (These vehicles were also used for transport throughout the conduct of of the field work.) A planned meeting on Monday morning, October 17, with the Vice-Governor had to be canceled because of the unexpected arrival of high-level visitors from Bangkok. However, the Vice-Governor hosted a dinner for the survey team later in the week and the survey work was discussed in detail with him at that time. Late Monday morning the team traveled to Amphoe Phen and the procedure followed there was the same as that used later in the other three amphoes. A meeting was held with Nai Amphoe (the appointed official in charge of the amphoe) and the heads of the amphoe agricultural, education, health and community development offices, if they were available. In cases where any of these were not immediately available, separate meetings were held with them later.

At these meetings, the purpose of the survey was explained and the administrative questionnaires were discussed and distributed with the request that they be completed and returned to the team. A list of sample villages was agreed on, and house lists for selected villages were obtained. Individual households were selected from these lists following the procedure described previously, and the Nai Amphoe was asked to notify each Puyaiban of the date of the team's arrival in the village and the names of the householders whom the team wished to interview. The team attempted to conduct some household interviews that first day but had limited success because there had not been time to notify the villagers.

During the next two weeks, the survey team operated in two separate groups. Each group surveyed two or three villages a day, operating completely independently. The groups came together to meet briefly in the morning and when the work was done at night. Each group consisted of a team leader, three interviewers, and a member of the Consultants' staff.

While in the field the two groups followed somewhat different procedures in conducting the household interviews. Group 1 normally chose a central spot, such as a wat or the porch of the Puyaiban's house, and asked that the interviewees be assembled there. Group 2 followed this procedure in a few larger villages but normally conducted its household interviews in the householder's home. To avoid biasing answers, both groups made an effort to avoid having a person who had not been interviewed listen to another interview. The village surveys were normally done in the Puyaiban's home.

As was the case in Indonesia, the household interviewers expressed continuing concern over the fact that the villagers were often frightened by the interview and that, because of this, their answers were not always candid. This is probably particularly true for economic questions, such as crops produced and sold. There also were occasional problems of understating answers about part-time labor. By checking cash incomes at the end of the interview, it was often possible to correct these misunderstandings.

While the household interviews were being conducted, another study team did all the traffic, transport, and agro-processing surveys, and most of the commercial surveys. The village surveys were conducted by the two survey group leaders. In addition, the surveyors received invaluable guidance and logistic assistance from the ARD Chief Engineers and their staff in Udon Thani and Sakon Nakhon.

On Sunday October 23, the survey team traveled from Udon to Sakon Nakhon. Meetings were held with changwat officials on Monday, and the survey work was completed on Friday, October 28.

A.6.a. Editing and Coding. Each evening all the household questionnaires completed during the day were edited by a member of the Consultants' staff. Questions and ambiguities were discussed with the interviewers that evening or the next morning before the groups left for the field. The training program for Thailand had benefited from experience gained in coding questionnaires from Malaysia and Indonesia, so that a greater precision in answers was possible in Thailand. However as was true in Indonesia, careful editing was absolutely essential to ensure complete and accurate questionnaires. During the survey, several meetings were also held with the survey team to discuss common interviewing problems and to reach a consensus on how to deal with them.

The household surveys were coded for machine processing in Kuala Lumpur. All of the coding was done by someone who had participated in field work, either in Thailand or in Indonesia. The following coding changes were made:

- Land planted of less than 0.1 rai (e.g., kitchen gardens) was coded as 0.1.

- Fertilizer use and High-Yielding Varieties (HYV) were coded only for rice, since there were not more than two farmers that used fertilizer on other crops, and no other HYV were reported by the farmers.

- The condition under which fish were transported for sale was coded even though the fishermen did not transport it because fishermen do not transport their catch for sale beyond the village.

B. CHARACTERISTICS OF THE STUDY AREA

B.1. Physical Characteristics

The 171,000 square kilometers of the Northeast Region are almost one-third of the country's total area. The region's long dry season and relatively scarce rainfall make it the least favored region in the country. Natural vegetation is limited to scrub forests, weeds, and grasses. The Korat Plateau is essentially a large basin tilted to the north and east toward the Mekong River. It is rimmed on the south by the Phanom Dongrak Range, a mountain chain rising to between 300 meters and 760 meters above sea level on the Cambodian boundary, and by the Petchabun Mountains on the west, which have a maximum altitude of over 1,200 meters. The region's principal river, the Mun, which is augmented by the Chi and other smaller tributaries, flows eastward to join the Mekong at the Laotian frontier east of Ubon Ratchathani. The marshy flats extending along the Mun and Chi are the only areas in the region that are well watered throughout the year. Elsewhere, the level ground is swampy during the rains and forms dried up wastes of grass and reeds in the dry season.

The transitional climatic periods between the two distinct seasons offer only a slight variation. The high and low pressure masses that alternate in continental Asia in the vicinity of Lake Baikal in the Soviet far east are the governing climatic factors. From late March or early April to September the low pressure area over Lake Baikal and a similar high pressure area over the Indian Ocean cause warm, moist winds to be drawn from the southwest across the Bay of Bengal and into Thailand, bringing the moisture that precipitates over the country. From September to March a high-pressure system over Lake Baikal sends dry continental winds from the northeast toward the lows of the Indian Ocean, and the dry monsoon is dominant. The wet monsoon of March through September is the more distinct season because the winds are constant and the rainfall is regular. Thunderstorms in the afternoon and early evenings are common between May and October in the Northeast. In the center of the region, annual rainfall is between 1,000 millimeters and 1,500 millimeters. Except for a small belt in the extreme northeast corner, rainfall in the remainder of the region, including the two project areas, averages between 1,500 millimeters and 2,000 millimeters per year.

On the Korat Plateau, the soils are fine sandy loams. Most are low in plant nutrients, and some are saline. Deeper and richer soils are found on some of the higher elevations, but the prevailing natural vegetation is the sparse grass that provides forage for livestock. Unused land in the two project

areas is covered predominantly with scrub forest, which provides forage for livestock, wild vegetables, and wood.

B.2. Population Characteristics

In 1970 the population of Udon Thani was 1,113,000, of which 84,795, or 7.6%, were in the two amphoes comprising the Phen project area. The average population density for the changwat was 67 persons per square kilometer compared to 58 persons per square kilometer for the project area. From 1960 to 1970 the changwat population grew at a rate of 4% per year, but this period involved the build-up around the American-operated airbase at Udon, so that growth probably includes substantial in-migration.

Sakon Nakhon is a smaller, more rural changwat, with a 1970 population of 598,000, of which 239,036, or 46%, were in the two amphoes comprising the study area for the second project. The changwat's average population density was 65 persons per square kilometer compared to 67 persons per square kilometer for the second project area. From 1960 to 1970 the population growth rate was 3.4% per year. Sakon Nakhon was much less affected by the Vietnam war build-up than Udon was.

As would be expected with these high population growth rates, the two changwats have high dependency ratios. Nearly 60% of the population of each is 19 or under, and 20% are four years old or less.

Table 5.3 shows population, land area, and household size for the four amphoes for 1976.

TABLE 5.3

POPULATION AND LAND AREA BY AMPHOE - 1976

		Population			
Amphoe	Area (Km^2)	1976 Tot.	Density Per Km^2	% Rural	Average Household Size
Phen	1,180	65,479	55.5	94%	6.3
King Sang Khom	329	19,316	58.7	99%	4.3
Total	1,509	87,795	56.2	93%	5.7
Sawang Daen Din	1,696	150,301	88.6	90%	5.6
Wanon Niwat	1,869	101,735	54.4	92%	NA
Total	3,565	252,036	70.7	91%	NA

NA = Not available

Data on village population and number of families must be treated with caution. The Puyaiban maintains a current list of each house in his village with an enumeration of its occupants. Although current population figures were not always taken directly from these lists, the act of maintaining them gives the Puyaiban a good sense of the current population of the village. However, past lists are not retained, so that pre-project data -- in this case ten years ago --had to come from the Puyaiban's memory, and in some cases the Puyaiban had changed during that period. The house listing also is an aid to the current number of families, but as discussed earlier, the list counts houses not households. Therefore the household data are probably less reliable than the population figures. The data that follow should be read with these caveats in mind. Tables 5.4 and 5.5 show the number of households and population for the sample villages in the two project areas. Data for three villages in the Phen project area are not available.

TABLE 5.4

POPULATION PER VILLAGE BY PROJECT AREA - SAMPLE VILLAGES

Amphoe		Average	Range	Number of Villages With		
				500 Persons	500 to 1000 Persons	>1000 Persons
Phen	- Present	635	150-1239	4	11	1
	1967	503	104-850	7	9	-
Khok Si	- Present	933	367-2680	3	8	4
	1967	595	110-1900	8	6	1

TABLE 5.5

HOUSEHOLDS PER VILLAGE, BY PROJECT AREA - SAMPLE VILLAGES

Amphoe		Average	Range	Number of Villages With		
				<100 Households	100 to 200 Households	200 Households
Phen	- Present	95	28-151	7	9	-
	1967	69	26-130	11	5	-
Khok Si	- Present	146	66-412	5	9	1
	1967	84	20-200	9	6	-

The tables show that the Khok Si villages are larger in size, both on the average and in the range among the villages included in the sample. They also indicate a greater rate of population growth for the Khok Si villages. While these figures must be treated with some caution, they are supported by migration data from the two project areas.

B.3. Economic Structure and Investment Patterns

The economy of Changwat Udon Thani is somewhat more developed than that of Sakon Nakhon in overall terms and is much more balanced. In 1970, recorded per capita gross provincial product (GPP) of Udon Thani and Sakon Nakhon were $93 and $89 respectively. In 1975, their respective sectoral shares of GPP were as follows:

- Agriculture (including crops, livestock, fisheries, and forestry) 39% and 67%. Crops and livestock alone were 36% and 45%, with fishing substantially more important in Sakon Nakhon.

- Secondary sectors (mining, manufacturing, construction, power, and transportation) 19% and 13%.

- Wholesale and retail trade 22% and 7% (this difference reflects Udon's status as a major trading center for the region astride the main north-south road to Laos)

- Tertiary sector (including services, government, finance, and real estate) 20% and 13%

From 1967 to 1976, GPP in the two provinces grew at 5.3% and 5.8% per year in real terms, with the agriculture sector keeping pace at 5.8% and 5.5%. However, crops and livestock grew much faster in Udon, 6.3% versus 3.8% in Sakon Nakhon. The difference was made up by fishing, which grew at an annual rate of 12.7% in Sakon Nakhon.

These GPP data are in contrast with the 1970 census data, which show that 73% of Udon Thani's households and 79% of Sakon Nakhon's are rural. The difference partly reflects lower rural incomes but also results from the fact that reporting is much less accurate in the rural sector. Taken at face value, the data would indicate that per household GPP in Udon is one-third lower than in Sakon Nakhon. This is almost certainly not the case. In fact, rural productivity is as high and perhaps higher in Udon, and its per capita GPP is probably considerably higher than recorded data show and concomitantly farther ahead of that in Sakon Nakhon.

B.3.a. Agriculture. Despite the recorded GPP data, agriculture is undoubtedly the dominant sector in both changwats. This is increasingly true as one drops down to the project area and then to the impact zone. In the latter, agriculture probably constitutes over 90% of the economic activity; wholesale and retail trade is second most important, but it is minor because it is concentrated in the amphoe towns. Agro-processing is negligible.

Unused land is largely scrub forest in the two impact zones and often went unreported. Uncultivated land is not significant for many of the farmers.

Farms in the impact zone are small, particularly when one considers that there is almost no irrigation and the major rice crop is grown under rain fed conditions. Table 5.6 shows farm size by tenancy status for the sample farms.

TABLE 5.6

SAMPLE FARMS-FARM SIZE BY TENANCY STATUS

	Farm Size (hectares)							
	Mean		High		Low		No. of Farmers	
	1967	Present	1967	Present	1967	Present	1967	Present
Owners	4.9	5.0	20.0	20.8	0.2	0.3	241	299
Renters	2.3	1.3	4.8	3.2	0.3	0.2	4	7
Tenants	3.5	2.5	7.7	7.7	1.1	0.2	3	11

Although the number of persons in the sample who are now farming but were not farming in the impact zone ten years ago is important (28%), farm-size patterns have not changed significantly, either in average size or in the range of size of farms. As Table 5.6 indicates, farm owner-operators dominate. In the sample, half of those who rent or sharecrop land also own some land of their own, so that farmers who only rent or sharecrop constitute only 2% of all farmers.

The average price for a rai of rice land in Udon Thani and Sakon Nakhon increased from $50 to $90 and $45 to $150 respectively over the last ten years. If the three villages in Khok Si where land was free prior to the project are included, the average price there ten years ago was $36. The price increases along the Phen Road range from 1.3 to 10 times the price of ten years ago. Along the Khok Si Road, they range from 2 to 25 times the price a decade ago, but most are clustered around the median four-fold increase.

1) Major Products and Their Value.

Within agriculture, rice is preeminent. It constitutes 69% of the cultivated land at the changwat level, 89% or more in the project areas, and 88% among the sample farmers. Indeed, during the household surveys, care had to be taken when asking farm size, since farmers were likely to answer in terms of rice land, which is what really matters to them.

Of the sample farmers, 96% grow rice, and no other crop is so widely produced. About half of those who grow rice sell it. Vegetables are grown by more than one-third of the farmers, but the amounts are small and over one-half of the growers raise vegetables only for home consumption. The second most important crop is kenaf, which is grown by 17% of the farmers. No other crop is produced by 10% of the farmers in the sample; none is significant in total output terms; and only sugar cane and tobacco (two farmers each) are produced in quantities that are significant for the individual farmers concerned.

The rice produced is predominantly glutinous, or "sticky" rice, even though at the time of the survey it was selling for 17% less than regular rice. Glutinous rice is the staple of the diet of the Northeastern Thai, and regular rice is, at best, an inferior substitute. In a risk-aversion posture, the Northeastern farmer will grow glutinous rice, despite a price differential, because he will still have his preferred food to eat if the crop is small.

The same pattern prevails in terms of crop value. Rice accounts for 91% of the total value of farm production and 74.9% of the value of crop sales. Kenaf, historically a cash crop in the region, accounts for 11.7%. The price of kenaf, which follows the jute market, has been very unstable in the past, fluctuating as much as 45% from year to year. As a result, farmers in the Northeast have been shifting to tapioca, which experienced a 9% per year increase in export prices over the study period. This shift is probably just beginning in the impact zone. The first tapioca mill has just opened.

At the time of the survey, 5% of the farmers produced cassava, accounting for only 0.4% of the value of production and 1.5% of the value of sales. (It is difficult to explain the three farmers in the sample who planted tapioca but did not sell it, because tapioca is not eaten in the area - it is produced for export to Europe for use as animal feed.)

Except for tobacco and sugar cane, the remaining crop sales are all for local consumption, in the village or the amphoe town, and no single crop is significant in terms of the value of production or sales.

The farmers in the impact zone are definitely subsistence farmers who grow rice and a few other crops for home consumption, selling the surplus when they have one. Even cotton is grown primarily for subsistence purposes. (One young farmer in Wanon Niwat who has irrigated land grows every crop listed in the survey and markets as far away as Korat. He also holds down a full-time job, but he is a marked exception to the farming patterns of the area.)

In the sample, sales amount to 28% of production in terms of value, although this may be somewhat understated. There is also some barter trade in the villages. Unfortunately, the survey instrument was not designed to identify and measure barter trade.

Tables 5.7 and 5.8 show production and sales of crops for the sample farmers in terms of quantity and value.

TABLE 5.7

SAMPLE FARMERS' FOOD CROP PRODUCTION AND SALES - 1976

Crop	Mean Production (Kg)	Farmers Producing		Mean Sale (Kg)	Farmers Selling	
		No.	% of Total		No.	% of Producers
Rice	3,322	294	96%	1,584	140	48%
Maize	159	13	4%	91	5	38%
Tapioca	1,361	15	5%	1,692	12	80%
Kenaf	343	53	17%	346	52	98%
Sugar cane	2,200	5	2%	2,200	5	100%
Peanuts	76	18	6%	68	12	67%
Vegetables	90	109	36%	105	49	45%
Bananas	347	23	8%	372	20	87%
Other fruit	218	12	4%	140	4	33%
Sweet potatoes	178	9	3%	320	2	22%
Chili peppers	108	9	3%	70	4	44%
Cotton	43	28	9%	93	7	25%
Tobacco	851	2	1%	851	2	100%
Mulberry	3	3	1%	2	2	67%

TABLE 5.8

SAMPLE FARMERS' VALUE AND DISTRIBUTION OF SALES BY CROP - 1976

Crop	Value of Production (U.S.$) Mean	Value of Production (U.S.$) Total	% of All Production Value	Value of Sales (U.S.$) Mean	Value of Sales (U.S.$) Total	% of Value of All Crop Sales
Rice	346	102,000	91.0%	165	23,100	74.9%
Maize	16	210	0.2%	9	45	0.1%
Tapioca	31	465	0.4%	38	455	1.5%
Kenaf	69	3,635	3.2%	69	3,600	11.7%
Sugar cane	220	440	0.4%	220	440	1.4%
Peanuts	10	170	0.2%	9	100	0.3%
Vegetables	18	1,960	1.7%	21	1,030	3.3%
Bananas	35	800	0.7%	37	745	2.4%
Other fruit	53	635	0.6%	34	135	0.4%
Sweet potatoes	22	200	0.2%	40	80	0.3%
Chili peppers	27	245	0.2%	18	70	0.2%
Cotton	11	300	0.3%	23	165	0.5%
Tobacco	405	810	0.7%	405	810	2.6%
Mulberry	60	180	0.2%	40	80	0.3%
Total		112,050	100%		30,855	100%

2) Marketing Structure and Prices

Of the 24 firms covered by the commercial survey, 6 also buy and sell rice and 2 buy and sell forest products and tapioca. Four did all their procurement through middlemen. All six report that higher prices are paid at the shop than at the farm, with the difference ranging from 2% to 14%. The smaller the shop, the higher the differential. Over 80% of the sample farmers market their rice in the amphoe town, and all but one kenaf farmer markets there. The remainder of the crops and all animals are sold primarily in the village.

B.3.b. Fishing. Fishing is a source of additional income and food for 40% of the households in the sample, but only two household heads, both in Khok Si, report fishing as their

primary occupation. Fishing is also highly seasonal. Swamps and depressions that are fished during the rainy season dry up during the dry season. Fishing is almost exclusively done with nets and traps, and all fish are marketed in the village, although often to middlemen rather than other villagers

B.3.c. Forestry and Wood Products. There is no forest, other than scrub, in the impact zones. There is no commercial logging, although wood gathering is a secondary source of income for a few households.

B.3.d. Manufacturing and Primary Processing. There is no manufacturing in the two study areas, and primary processing is not significant. The agro-processing survey, which covered a substantial portion of the firms in the study areas and the impact zones, included 23 firms. The 23 included 10 rice mills in the Phen impact zone and 12 rice mills and one tapioca chip processor in the Khok Si zone. All are owned by people who live in the village or town where the business is located. All but two rice mills have started in business since 1972, and all are family operated.

The 22 rice mills are virtually identical. They are small diesel-powered mills that can handle two bags of rice an hour.[1] Most do custom grinding only. Their charge for the service is the by-products, which they keep. These by-products, which are used for animal feed, constitute about 10% of the volume of the padi before it is milled and have a reported value of $4-$7 per bag. At the median capacity utilization of 70%, a rice mill would gross about $8 a day in the value of retained by-products. Some of the mills sell the by-products, but most of them are also in the animal-raising business. Many mills have brood sows, chickens, and ducks. Only two of the rice mills actually buy rice to mill and resell.

Only two of the mills have changed location in the ten years. One of them - which buys, processes, and sells rice - moved because, although rice was cheaper at the previous location, transport was too expensive.

During the last ten years, tapioca exports from Thailand have increased 375%, and most of this increase has come since 1972. As a part of this phenomenon, the production of tapioca has been moving from the traditional growing area in the South into the Northeast. This transition is beginning to have its effects on the two impact zones. The tapioca mill that was surveyed just opened in 1977, and another is under consideration in the Khok Si area. The owner of the new mill has another mill in a neighboring amphoe, about 30 kilometers away, and he is currently buying almost all of the tapioca there until the local

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[1] One bag of rice = 100 kilograms of padi.

people get into production. The mill, which can process 1.2 tons per hour, is currently operating at 70% of capacity. The price for tapioca is reported to vary with the season; at the time of the survey, it was $50 per ton.

B.3.e. Commercial Activity. Of the 19 sample villages along the Phen Road, 12 now have village shops, compared to 7 ten years ago. The total number of shops has increased from 11 to 27, and the average number per village from .7 to 1.7 shops. Every sample village along the Khok Si Road has at least one shop now, while only nine had shops ten years ago. The total number of shops has increased from 24 to 61, and the average number of shops per village from 1.6 to 4.

Only three villages along the Phen Road and two along the Khok Si Road are not visited regularly by itinerant traders. Twenty-four of the remaining 26 report that more traders come to the village now that it has more access and that they come more frequently. Only Kut Rua Kam, the largest village in the sample, has a village market.

The 29 commercial establishments that were surveyed include 12 in the various amphoe towns and 17 small retail stores in the sample villages. The amphoe businesses include three hotels, one restaurant, one general merchandise wholesaler three firms that do both wholesale and retail trade, and four retail stores.

Only 2 of the village shops existed before the road projects, but 10 of the 12 amphoe businesses existed prior to 1967 - the wholesaler and one retail shop are new. Only four firms, all in amphoe towns, employ more than three persons. They employ 10, 11, 11, and 12 persons, respectively.

The retail shops in the villages and amphoe towns all carry general consumer goods. Virtually all carry rice, sugar, soap, and kerosene. In addition, they carry varying mixtures of other goods, such as patent medicine, gasoline, cosmetics, and clothing. Only one firm sells newspapers and magazines. There is some range in size among the village shops, but there is a much larger difference between shops in the villages and those in the amphoe seat, whose average volume is three times that of the largest village store. Many of the village shops are very small. One has a total inventory of $900. Another village shop's major sales are 100 small packets of monosodium glutamate, 50 small packets of soap, 72 liters of kerosene, 24 bottles of nam plah (fish sauce), and 100 packets of patent medicine per month.

Nine of the shops carry fertilizer, which they sell in very small amounts. Reported sales range from 150 to 300 kilograms per month. However, the wholesale firm in Amphoe

Phen reports monthly sales of ten tons of fertilizer. Six of the nine firms sold fertilizers ten years ago. Three of them along the Phen Road reported that sales are lower now due to the drought. Three along the Khok Si Road report that sales have increased since the road was built.

The most dramatic effect of the construction of the roads has been on the three hotels in Sawang Daen Din and Phen. All three report that their business has been seriously hurt, and one of them is going out of business. While comments of the other firms are mixed, on balance they report that the construction of the roads has helped their business. The wholesalers say that they are selling more to village shops, and the retailers in the amphoe towns report that business has increased because more people come to town now. But all complain about the fact that it is easier for people to go to the changwat capital to shop. Virtually all of the village shops have come into existence since the roads were built, yet almost all say that the roads have hurt their business because people can go to the amphoe town easily. However, over half of them also give the road credit for their business in terms of both bringing them customers and making it easier for them to obtain merchandise.

B.4. Social Structures

B.4.a. Settlement Patterns

1) Village Structure

The farmers, laborers, and businessmen in the impact zones live in compact villages surrounded by farm land. Farmers walk to their fields or go by bullock cart, usually taking their cattle and buffaloes with them to graze the edges of the fields or the nearby scrub. The village streets are generally haphazard and unimproved, except where a government program such as ARD has graded them and paved them with laterite. The houses are all made of wood, but they cover a wide range of size and quality -- from one bamboo-walled room with a thatch roof to a large, several room, house with solid plank walls and a tin or shingle roof. Each house has a covered porch (some are very small) that serves as a living room, dining room, and usually as a kitchen. The enclosed rooms are bedrooms. The houses are raised, and livestock and implements are kept under the house at night. All of the sample households own their homes.

The extended family is common in the impact zones, but not universal. In part, the existence of an extended family depends on the availability of land. If the father has enough

land to give to his sons, they set up separate nuclear households. If the land is not enough to divide, the family operates as an extended family, farming the available land together and sharing the product, often eating together even though they may have separate houses.

The villages have relatively easy access to the outside in the daytime, but they are relatively isolated at night. The population in the household survey made an average of 6.3 trips per year per person to the amphoe town, one trip per year to the changwat capital, and one person in ten travels to Bangkok during the year. (There is a historic pattern of migratory labor going from the Northeast to Bangkok to work during the off season or for longer periods.)

The villages are run by the Puyaiban, the elected headman, who also serves on the tambol council, the next higher level of government. The Puyaiban's powers are limited since there are no local taxes and administration is exercised from the Ministry of Interior down to the amphoe level. In many ways the Puyaiban, beyond mediating disputes, serves primarily as an extension or representative of the Nai Amphoe. In the past, grants of development funds have been made down to the tambol level, but not to the village.

2) Community Facilities

Community facilities in the impact zone villages are limited to wats (temples), primary schools, some meeting halls, and village wells. Only one village has a market, and nine have meeting halls, which are usually roofed, open-sided structures. All but three of the meeting halls existed before the road projects. The Puyaiban's office is usually the porch of his house.

Wats exist in all but two of the sample villages, although in some cases, they are very simple structures. In all, there are 36 wats, only 5 of which have been built in the last 10 years.

B.4.b. Migration. Both project areas experienced substantial in-migration during the project period, although the rate was lower for the villages along the Phen road, which was built through an area that was already relatively more settled. The sample Phen villages, as a group, have had in-migration of about 160 families during the past 10 years, of whom 100 have come from outside the amphoe. A total of 68 families have moved out. Only two of the villages have experienced a net loss in number of families and two have had no change. One village, Naw Ah, lost 21 out of 85 families during the period and showed a concomitant population loss of 13% per year.

A total of 560 families moved into the sample villages along the Khok Si road during the project period, 500 from outside the amphoe. A total of 108 moved out during the period. Only one village suffered a net loss in number of families, and one indicates that there was no change. In a number of villages the net in-migration has been substantial in relation to the existing population, and one, Kut Rua Kam, was founded at the time the project was built and the entire population are in-migrants, or their very young children.

B.4.c. Occupational Structures. Of the household heads interviewed, 94% operate farms and 2% are landlords. Of the farm operators, 55% supplement their farm income by working as laborers, primarily doing seasonal work for other farmers. The next largest sources of additional income (in cash or kind) are fishing and gathering of forest products (21%), followed by salaried work, primarily teachers and other government officers (7%), and non-farm labor and sale of craft products (each 5%). The laborers work an average of 3.8 months per year, and the average daily wage is $0.93.

B.4.d. Education. Thai law provides for compulsory education through seventh grade, but the law is far from being implemented, particularly in remote rural areas such as the two project areas. There, the majority of children stop school after the fourth grade. They are presumed to be literate from then on, but past studies have shown that many became functionally illiterate over time because reading materials are not available to maintain their skills.

No sample village had a store that sold newspapers or periodicals. Most village schools do not go beyond the fourth grade, so that a child must leave home to continue his or her education. (One family has a son in Switzerland studying for his Ph.D.) Table 5.9 shows the high drop out rate in three amphoes after the fourth grade. (Phen data are not available.)

TABLE 5.9

PRIMARY SCHOOL ENROLLMENT BY GRADE

	Sang Khom		Sawang Daen Din		Wanon Niwat	
Grade	Enrollment	As % of Grade 1	Enrollment	As % of Grade 1	Enrollment	As % of Grade 1
1	971	100	5,014	100	3,375	100
2	788	81	5,050	101	2,639	78
3	668	69	4,032	80	2,347	70
4	625	64	3,777	75	1,871	55
5	130	13	1,539	31	247	7
6	126	13	981	20	231	7

B.4.e. Health Services. The household survey instruments did not attempt to gather information on health care, except for distance to a health center and frequency of visits. These data show that 8% of the sample villages are less than 1 kilometer from a health center, 30% are from 1 kilometer to 4 kilometers away, 3% are 5 kilometers to 9 kilometers away, and 59% are 10 kilometers away, or more. Almost all households (96%) report that they visit the health center one to five times per year; this percentage does not vary with the distance of a health center.

In any case, health care is limited. Table 5.10 shows that the number of medical personnel is small in relation to the population served. (The data are from the amphoe health officer and apparently do not include one ARD mobile medical team in each project area):

TABLE 5.10

NUMBER OF TRAINED MEDICAL AND PARAMEDICAL PERSONNEL BY STUDY AREA

	Phen & Sang Khom		Sawang Daen Din & Wanon Niwat	
Personnel	Number	Population Ratio	Number	Population Ratio
Doctors	-	na	2	1:126,000
Nurses	1	1:88,000	6	1:42,000
Trained Midwives	10	1:8,800	16	1:15,750
Other paramedical	7	1:12,570	1	1:252,000

The 36 sample villages have a total of 106 community wells. These wells are a major source of water supply for the villagers. Private wells are relatively rare. In many cases, the wells have been improved by adding better protection of the opening or hand pumps, but safe drinking water is still a widespread need. Five villages in Phen and six in Khok Si have constructed other sources of water, primarily ponds. Of the 14 such sources, 6 (3 along each road) have been built since 1967.

B.4.f. Community Development

1) Village Projects

Every sample village along each road has had at least one village project during the last ten years, and some have

had as many as five. The majority of these projects were based entirely on village initiatives. Only five projects in Phen and two along the Khok Si road have received any government assistance. Table 5.11 shows the number of village project by type for each project area.

TABLE 5.11

NUMBER OF VILLAGE PROJECTS BY TYPE

	Phen	Khok Si
Road	7	8
Temple	7	8
School	9	3
Meeting hall	1	3
Community well	3	3
Pond	1	2
Other	1	2
Total	28	29

2) Government Services

All but three of the villages along the Phen Road are visited by mobile government services covering such areas as health, family planning and agriculture (one even has a visiting dentist). As a group, more of the Phen villages receive services than the villages along the Khok Si Road, where seven are now visited by mobile government units. None of the villages on either road had such services ten years ago. In contrast, more Khok Si villages receive visits from agricultural extension officers. Eight of them report regular visits, and in all cases the officer comes by some form of motorized transport. Only two of the villages were visited before the project. Along the Phen Road, agricultural officers regularly visit only two villages, none were visited before.

C. TRANSPORT SECTOR CHANGE

C.1. Village Transport Service

As might be expected, substantial change in village transport took place during the project period. The only motorized vehicles in any of the villages along the Phen Road prior to the project were one automobile and ten motorcycles. Presently there are four minibuses, four trucks, one automobile and sixty motorcycles. Every village has at least one motorcycle owner among its residents. The change is even greater along the Khok Si road. Prior to the construction of the road there were two minibuses, one truck, and one motorcycle. Today, there are twelve minibuses, eleven trucks, two automobiles, and forty-two motorcycles.

In addition to vehicle ownership, there have been significant changes in public transportation services available to the sample villages along both roads, with the Khok Si sample villages showing greater change than the Phen villages. In Phen, prior to the road, only four villages had regular public transportation service. Now only three villages, all well off the road, do not have regular service. Of the thirteen villages that are served, only one has regular bus service, but all thirteen have minibus service, three more often than once a week, and the remainder daily or more often. Of the villages along Khok Si Road, only three had public transport service one year ago. Only two, again well off the road, do not have it now. Seven of the villages have regular bus service, and all fifteen have minibus service, three daily and the rest more frequently. Villages along the road have minibus service as often as twenty times a day.

In terms of time required to travel to the nearest market town, which in every case but one is also the amphoe seat, the Khok Si villages have received relatively greater benefit than the Phen villages, as Table 5.12 indicates.

Table 5.12

TRAVEL TIME TO NEAREST MARKET TOWN

Time Saving 1977 vs. 1967	Phen	Khok Si
No Saving	2	0
Less than 1 hour	6	1
1 to 8 hours	8	5
More than 8 hours	0	9

Three villages along the Phen Road and one along the Khok Si Road report that the construction of the road has not materially changed the time required to travel to the changwat capital. The remaining twenty-seven all report that, before the projects were built, the trip required an overnight stay, but that now it is possible to go to the capital to conduct business and return the same day.

Changes in travel time to Bangkok are somewhat less conclusive. All of the villages report that the trip requires at least an overnight stay. In fact, it probably requires several days, since it is an all-day bus ride from Udon or Sakon Nakhon to Bangkok. Fourteen of the most remote villages report that it previously took a week or more. However, the real time savings resulting from the construction of these two roads are on shorter hauls since all the savings accrue in the first leg, where a short minibus trip has taken the place of a trip taking ten hours or more by ox-cart.

Fares to the nearest market town vary with distance, generally amounting to $0.01 per kilometer or less on the longer hauls and up to $0.03 per kilometer on the shorter runs.

The construction of the roads has clearly reduced the costs of public transport. Nine villages reported fares to the nearest market town ten years ago as compared with the present. In one case, the fare was less before, in one case there was no change, and in the remaining 7 cases the fare was reduced by up to 50%.

C.2. Private Investment

Of the 19 transport firms surveyed, only 4, including the large firm in Udon and the one other, equally large, Amphoe-based firm, were in existence prior to the project. Of the remaining 15, 2 stated that they had gone into business because the road had been built, 3 said they had done so because the village did not have adequate transport service, and 10 said they started because they wanted to get additional income or start a new occupation. It is interesting to note that at least six of these people were farmers before going into the transport business.

Twelve of the firms report that they carry only passengers. Four, including two pick-up truck operators and two minibus operators, reported that they carry both cargo and passengers, and three firms carry only general cargo. However, for the majority of the firms, the distinction between passengers and cargo is not as clear as these answers would imply. Any passenger on a minibus can carry a certain amount of cargo with him, such as a bicycle or a pig or a couple of sacks of rice. The two minibus operators who

report that they carry both cargo and passengers are willing to hire out to carry only cargo.

One of the two large operators who were both in business before had a fleet of 24 minibuses and 4 buses in 1967. The other had 36 minibuses. Their total investment in 1967 was reported to be $184,000. Both have substantially expanded capacity in the last ten years. The first now operates 24 larger-size minibuses - a kind of midibus built on a medium-sized truck body - and 4 regular buses. The other now operates 46 minibuses. Together they report a current investment of $600,000. The two other firms who operated prior to the projects have doubled their investment during the last 10 years.

For the two largest operators, traffic to and from the project areas represents only a small fraction of their business. The remaining 17 operate primarily or exclusively in the project areas, and largely within the impact zones of the two projects. They are small operators. Eleven have only one vehicle, five have two, and one has four. They have an average investment of $6,600. Perhaps the most striking observation from these transport surveys is that, in terms of transport investment that is actually providing service in the impact zones, over 90% of the investment has been provided by local people who reside in the village or the amphoe town. About 17 minibuses operate exclusively in the two project areas, and 13 of these are owned by villagers.

C.3. Changes in Transport Flows and Transport Tariffs

C.3.a. Transport Flows. In total, the 19 firms operate 26 routes that begin or end in the impact zones or operate entirely within the zones. These figures exclude one route run by the large Udon firm and two by the firm in amphoe Phen that run from Phen to Udon itself. Of the 26 routes mentioned, 9 begin in the impact zones and end at the changwat capitals. The other 17 begin or end at the amphoe seat. Only three of the routes are operated less than daily. The average travel time per round trip is 50 minutes, and the range is 10 minutes to 2 hours.

Despite the number of firms that have gone into business, only six report serious competition, and all of them carry cargo.

The commercial and agro-processing firms generally rely on transport companies to move their goods. In the sample, only one rice mill owns a truck, which it uses to pick up the rice it purchases, and one mill owner also operates a minibus as a separate business. The tapioca mill owns two trucks, which it uses to pick up tapioca, and it also hires large trucks for this purpose. Five of the twenty-nine commercial firms own minibuses or trucks, while only one did ten years ago. Two use them to collect goods, although

the commodity dealer apparently hires all his transport or relies on transport provided by the middlemen. All five of the commercial firms use their vehicles to deliver goods, and three also transport goods for hire for other persons.

C.3.b. Transport Tariffs. All 19 of the transport firms report that tariffs are set by the transporter and are not regulated by the government. Seventeen say that the rates are based exclusively on distance, and the other two say it is a combination of distance, travel time, and commodity carried. One of these firms says the time of year is also a factor. Presumably his rates are higher in the rainy season.

Of the 15 firms that carry passengers, 11 cite different rates for passengers who are accompanied by cargo and who are not. (Note that this number far exceeds the number of firms that say they carry both passengers and cargo.) The other four charge the same rate whether passengers bring something with them or not.

Cargo rates vary, but apparently not within a given route. Differences are related to longer overall routes, and occasionally rates vary among commodities. Only four firms cite per kilometer rates. The rates given range from $0.10 per 100 kilograms to $0.75 per 100 kilograms, with the great majority being at $0.25 per 100. The highest rates are levied on the longest, for example, 70 kilometer routes.

Of the four firms that operated prior to the project, the second-largest firm says its utilization rate is higher now despite a substantial increase in capacity; the other three say their utilization rates are lower, with one citing competition as the reason.

C.3.c. Perceived Effect of the Project. Every Puyaiban interviewed along both roads reports that the construction of the road has improved life in the village. The principal reasons for the improvement are listed below with the number of times each reason is cited for Phen/Khok Si shown in parentheses:

- Greater ease of transportation (7/3) - The "expected" solution.
- More government help (2/3). This category also includes the construction of a secondary school made possible because the road permitted enough pupils to be assembled to justify it.
- Higher prices are received for products sold (3/4).
- Medical help is now available (1/6).
- It is easier to go the the market and buy things (4/3).
- Life is generally better (1/3).
- The village has acquired new ideas on how to improve itself (1/2).
- Other (0/2).

Ten villages, five along each road, also cite adverse effects from the construction of the road, with some giving more than one reason. More thieves, dust, accidents, and flooding caused by inadequate culverts along the road are each cited three times. One village headman complained that the teenagers are now rowdy, whereas the village used to be peaceful and quiet. One said that the road does not get repaired if it gets damaged in the rainy season, and one complained of loss of farm land for the road right-of-way. (Land owners were not compensated for land taken for the right-of-way for either road.)

D. BEHAVIORAL RESPONSE TO TRANSPORT SECTOR CHANGE

D.1. Production

In part because of in-migration, about 23% of the sample's farm owner-operators are new. They did not own land in the impact zone ten years ago, and while rice predominates, 30% of the rice growers did not plant rice ten years ago. Of those who did, 29% devote more land to rice than they did before the roads were built. This increase has probably also been fostered by increasing prices: Although the export price of rice had some sharp fluctuations over the project period, it increased an average of 4.3% per year. This gain is slightly less than the average increase in the consumer price index for the Northeast of 5.4% per year.

The change for the remaining crops, although it involves fewer farmers, is even greater. All of the farmers growing tapioca, and 92% of those growing kenaf, planted the crops after the roads were built. Since these are cash, export-oriented crops, the change would appear to be directly related to improved access to markets. The same pattern obtains for the other crops: 50% or more of the farmers who grow them now did not plant them ten years ago. While these crops are largely marketed locally, the change is probably almost directly related to the change in transport and access. A village with no all-weather road that is a day's trip away from the nearest market town is very isolated, and its cash economy is very small. Access has changed this, and increasing numbers (although still a minority) of farmers are growing crops to sell to others in the village or in the amphoe town. It is relatively easy to put a few kilos of vegetables or a sack of peanuts on a minibus and take them to market. (One observation frequently heard during the survey was that farmers prefer to market their product in small lots because it gives them a reason to go to town more often.)

D.1.a. Change in Cropping Patterns. Farming practices in the impact zones remain very traditional. No sample household owns farm machinery, and only 13% of the farmers report that they use high-yielding varieties of rice for half or more of their hectarage. However, there has been a definite increase in the use of fertilizer by the sample farmers since the roads were built. Ten years ago over half of the rice farmers did not use any fertilizer. Now half use commercial fertilizer, either alone, or in combination with manure. The following table show change in fertilizer use since 1967:

Percent of Farmers Using Fertilizer-Sample Households

	No Fertilizer	Manure Only	Commercial Fertilizer	Manure and Fertilizer
Present	31.4%	19.8%	40.7%	8.1%
Past	57.4%	32.5%	6.6%	4.9%

D.1.b. Change in Marketing Patterns. Among the sample households, twice as many (216%) farmers sell products now as sold them ten years ago, and there is a marked change in the point of sale and the means of transport. Ten years ago, 52% of the sample farmers who sold products transported their produce to the amphoe town by bullock cart. Now none do. The percentage of sellers who hand carry their produce for sale in the village has increased from 19% to 53%, and the proportion who use minibusses to transport goods for sale has increased from 6 % of the sellers to 47%. Thus, the opening of the roads has had a definite positive impact on crop sales, and in one way it is different than might be expected, since so many more farmers sell in the village than did ten years ago. The roads have opened the villages to middlemen who come to the village to purchase produce. Since transport to the amphoe town is easier for the farmers now than it was ten years ago, one must assume that the middlemen are competitive in price, or the farmers wouldn't patronize them. This is especially so since more farmers travel outside the village now, and they should be aware of price differentials.

D.1.c. Non-farm Income. Opportunities for employment outside of one's own farm have increased substantially since the roads were built. Half of the farmers who also do seasonal work for other farmers did not do such work ten years ago. The majority (84%) of those who fish, fished before, and almost every household that makes craft products has done so for more than ten years. However, one household had non-farm labor income before the roads, while 17 do now, and 19 of the 23 salaried positions in the impact zone sample households are new.

D.2. Consumption Changes

With rice prices nearly keeping pace with inflation, gains in area planted, the introduction of other minor crops, and increased employment opportunities have undoubtedly meant increased household incomes. Some confirmation of this can be seen in the increased acquisition of certain consumer assets since the roads were built. Except for sewing machines and looms, 51% or more of these items have been purchased since 1967 (see Table 5.13).

TABLE 5.13

HOUSEHOLD ASSETS--SAMPLE HOUSEHOLDS

Item	% of Households Owning	Length of Ownership (% of owners) Less than 5 years	5 to 10 years	more than 10 years
Metal roof	87%	29%	33%	38%
Radio	72%	56%	18%	24%
Bicycle	50%	48%	20%	33%
Motorcycle	4%	75%	25%	---
Loom or sewing machine	48%	23%	11%	64%
Electricity	2%	---	100%	---

D.3 Travel

The construction of the roads has substantially increased travel outside the village. The change is relative to the proportionate time saving involved. The greatest change is in travel to the amphoe town, which is entirely or almost entirely on the new road. Next greatest is travel to the changwat capital, where the new roads are one-third to one-half of the distance. Least affected is travel to Bangkok, where the new roads are only a very small fraction of the journey. Still, considering the distance involved, even the increase in travel to Bangkok is significant. Table 5.14 shows change in travel by destination.

TABLE 5.14

CHANGE IN TRAVEL BY DESTINATION - SAMPLE HOUSEHOLDS

% OF RESPONDENTS BY CATEGORY OF CHANGE

Destination	More trips now	Less trips now	No change	No trips before and none now
Amphoe	77.7%	3.5%	10.4%	8.4%
Changwat	35.6%	10.4%	9.4%	44.6%
Bangkok	3.9%	0.4%	1.0%	92.6%

Although household heads travel somewhat more than other household members and have experienced somewhat greater changes in their travel patterns, increases in travel outside the village have occurred for all family members, as Table 5.15 shows.

TABLE 5.15

CHANGE IN TRAVEL BY TRAVELER - SAMPLE HOUSEHOLDS

% OF RESPONDENTS BY CATEGORY OF CHANGE

Traveler	More Trips now	Less Trips now	No Change	No trips before and none now
Household head	47.9%	4.1%	8.2%	39.7%
Spouse	30.3%	7.5%	9.5%	52.7%
Other Household Members	40.3%	2.7%	2.7%	54.3%

D. 4. Migration

Since the roads have been built, twice as many families have moved into the impact zones as before. This increase almost certainly results from the opening-up of the area, and the change in reasons for moving supports this hypothesis. Before the roads, 73% of the in-migrants came for personal reasons, that is to follow their parents or spouse. In contrast, 57% of the families that have moved in since the roads were built came to buy land or to find better land. Only 19% came for personal reasons.

D.5. Service Utilization

D.5.a. Agriculture. Agricultural services, or the lack of them, reflect the traditional character of the agriculture in the impact zones, but they also show patterns of change since the roads were built. One-fourth of the sample farmers and 4% of their spouses belong to farm clubs, while only one household head belonged 10 years ago. Attendance at agricultural meetings in the village is more common. One-third of the sample farmers report that such meetings are held in their village. Where meetings are held, two-thirds of the farmers attend them, with about half of those attending regularly.

Agricultural extension service is also limited. During the year prior to the survey, 71% of the farmers were not visited by any agricultural extension agent. But the pattern of change is ambivalent. Of the farmers, 30% say they receive more extension visits than they did before the roads were built, but 40% say they receive less visits now and 30% say they have never been visited by an extension agent. This pattern is difficult to interpret, since the number of professional and para-professional agricultural personnel has increased from seven to twelve in the four amphoes that make up the project areas.

D.5.b. Health. There-fourths of the respondents who have lived in the impact zone for ten years or more report that they now make more visits to the health centers than they did ten years ago. Only two households make fewer visits. The only significant variation is for families who live more than ten kilometers from a health center. Of these families, 37% say they make the same number of vists and 59% say they visit

more frequently. Part of overall increase may be attributable to the opening of new health centers, but even this is an indirect result of transport change. It is very unlikely that the government would be able to open and staff health centers in the impact zone if all-weather access did not exist.

D.5.c. Credit. Approximately 66% of the sample farmers have never borrowed for agricultural purposes, and 95% of these have never applied, primarily because they were afraid, they had no security, or they didn't need credit. Almost all who borrowed got their loan from a bank or government agency, and 90% of them have gotten their first loan within the last ten years.

D.5.d. Education. A total of 75% of household heads report receiving an education sufficient to maintain literacy (four years or more of primacy schooling). No education was received by 16%, and 9% completed less than four years of primary school. An even higher percentage of spouses (75%) is reported as having completed a basic education, while 13% have no education and 8% have less than four years. However, males are twice as likely as females to have obtained some secondary or higher education.

The proportion of children with adequate levels of education is slightly less (72%) than for adults. This may be because of delays in completing the first four years of primary school. Literacy levels are significantly higher for children away from home (91%) than for children at home (66%). Only 8% of children (over five years of age) have never attended school; the proportion is slightly higher (9%) for children at home and lower (3.5%) for children away from home.

The data shown little difference in educational opportunity between the sexes. Adequate educational levels have been attained by 73% of male children and 71% of female children, while 8% of males and 7% of females have never attended school. This equality of opportunity exists both for children away from home and for children at home.

About 50% of all children at home are in school. (Children away at school are counted as children at home for this purpose.) Of the remainder, the overwhelming majority (90%) are employed on the family farm; 3% have other farm employment; 3% have non-farm jobs; and 4% are unemployed. Of those not now in school, 88% have completed a basic education, and most of the rest (10%) have had some exposure to schooling.

The pattern is similar for children away from home. A total of 77% are employed on farms, 17% have other rural jobs, 4% have urban jobs, and 2% are unemployed. At least a basic education has been attained by 91% and 5% more have had some exposure to schooling.

Other household members in the sample are less likely to have an adequate basic education (80%) and more likely to have none at all (20%). On the average this group is younger than household heads and their spouses (44% are in the 15 to 24 age group, compared to 3% of heads and spouses). Of them 77% are employed on the family farm, 4% have other rural jobs, 5% have urban jobs, and 14% are unemployed.

A comparison of literacy levels by age group illustrates the change in educational service utilization over the project period. Only 39% of children between the ages of 6 and 10 have adequate educational levels, probably reflecting the fact that rural children may start later and take longer to complete a basic education than the standard assumes. Of children from 10 to 20, 63% have an adequate basic ecducation, and so do 91% of all children over 20.

Combined data for household heads, spouses, and other household members indicate that adult literacy levels are 88% in the 15-24 age group, 89% in the 25-44 age group, 56% in the 45-64 age group, and 20% among those over 65. These data suggest that literacy levels have been relatively stable at just under 90% in the project area for more than twenty years. Under these conditions the project roads could not have made much impact in terms of educational service delivery.

D.6. Communications

Hard evidence on communications change is not available from the survey, but the increase in the number of radios--up to three radios for every four families--and villager comments on new ideas being introduced to the village, are both indications of positive communications change.

E. IMPACTS ON INCOME DISTRIBUTION

This section examines the socioeconomic composition of the project area population as revealed by the household surveys and describes the characteristics of different socioeconomic groups. Changes in the socioeconomic composition of the population over the project period are then determined. Finally, the incidence of income-related impacts of the transport investment is analyzed by socioeconomic group.

E.1. Composition of Socioeconomic Groups

Of the household survey sample, 38% were classified as subsistence farmers (that is, farmers whose cash sales of farm products are no more than half the total value of farm production and who have no outside source of income). The average household income found for this group was 8,300 Baht, or about U.S.$415. The average household size was 7.0, slightly above the sample mean. The corresponding per capita income was 1,289 Baht, or about U.S.$64. The typical subsistence farmer owned 1.9 hectares of land and cultivated 1.5 hectares, or 81%. In 5% of cases, subsistence farmers rented or sharecropped land, and 20% of subsistence households also had wage labor income.

Low-income cash cropping farmers were defined as those with a household income of under U.S.$300 (6,000 Baht) who nevertheless derived more than half of their income from cash sales of crops and who had no other source of income than the farm. Only 2% of the sample fell into this category. The average household income for this group was 3,608 Baht, or about U.S.$180. The average household size of 5.5 is well below the sample mean, but this group still had the lowest per capita income of 681 Baht, or U.S.$34. These farmers own slightly smaller amounts of land (1.6 hectares on the average) and cultivate even less (1.06 hectares, or 66%). They do not rent or sharecrop land nor do they earn outside income.

The category of "high-income farmers," that is, cash cropping farmers with household incomes over U.S.$300, accounted for 15% of the sample. The mean value of household income for this group was 25,506 Baht, or about U.S.$1,270. With an average household size of 6.8, this group generates a per capita income of 4,042 Baht, or U.S.$202. A large amount of land is owned (2.3 hectares on the average) and partly cultivated (1.7 hectares, or 74%). Renting and sharecropping are not found in this group, but wage labor contributes to income in 6% of cases.

Respondents who have farms but who also have outside income sources and who sell less than half of the value of their farm produce made up 28% of the sample. The average farm income reported for this group was 9,521 Baht, or about U.S.$476. The average household size was 6.8, corresponding to a per capita income of 1,466 Baht, or about U.S.$73 from the farm. The amount of land owned was relatively large (2.0 hectares on the average) and was only partly cultivated (1.4 hectares, or 69%). Of this group, 9% were renters or sharecroppers rather than landowners. Wage labor income was reported for this group in 52% of cases.

Cash cropping farmers with non-farm income sources made up 11% of the sample. Their average farm income was greater than that for the preceding group: 15, 781 Baht, or about U.S.$789 per household. This group also had a large average household size (7.3), resulting in a per capita farm income of 2,528 Baht (U.S.$126). It had the largest average farm size (2.5 hectares) and the largest average area cultivated (1.8 hectares, or 73%). Two households (6%) in this category were sharecropping land; they had smaller farms (0.85 hectares on the average). Wage labor provided income for 34% of these households.

Landless laborers (2% of the sample) had a small average household size (5.5) and household incomes similar to those for low-income farmers (3,717 Baht, or about U.S.$186), resulting in a per capita income of 733 Baht, or U.S.$37. One respondent in this group rented a small amount of land.

Non-farm laborers also constituted 2% of the sample. Their average household size was 7.0, just above the sample mean. Wage income reported for 33% of these households averaged 5,000 Baht (U.S.$250) per household. Farm income of 11,910 Baht, or U.S.$596, was reported for the other 67% of households. These figures result in an average household income of 9,607 Baht (U.S.$480), close to the sample mean, and a per capita income of 1,516 Baht (U.S.$76).

Finally, 2% of the sample consists of respondents with no farms but with sources of income such as trading or industry. The average household size for this group (8.0) is the highest of all.

E.2 Characteristics of Socioeconomic Groups

E.2.a. Demographic characteristics

The sample is remarkably homogeneous with respect to age distribution: 47% falls in the category of household heads aged between 45 and 64; 44% are between 25 and 44; 7% are over 65; and 2% are under 25. Subsistence farmers and food farmers

with non-farm income follow the sample distribution very closely. Low-income farmers are overrepresented in the very old and very young age groups. High-income farmers and cash cropping farmers with non-farm income are more frequently found in the middle-aged group (45 to 64), whereas landless laborers (farm and non-farm) are much more likely to be in the younger group (25 to 44). Those with other income sources are disproportionately likely to be in the oldest age group.

Both subsistence and high-income farmers are very close to the sample distribution on education of the household head (no education, 16%; less than four years, 9%; four to six years, 72%; more than six years, 3%). Low-income farmers and those with other income sources are more likely to have no education but may have completed basic primary schooling. Farmers with non-farm income are more likely than the others to have had some exposure to education, and landless laborers (farm and non-farm) are highly likely to have completed an elementary education.

E.2.b. Travel Patterns

Low-income farmers and landless farm laborers are least likely to travel to any destination. After them come subsistence farmers, high-income farmers, and food farmers with non-farm income. Cash cropping farmers with non-farm income travel more frequently to all destinations, and non-farm laborers travel more frequently still, particularly to the amphoe center. Those with other income sources are by far the most likely to travel longer distances, such as to the changwat and the national capital.

E.2.c Sources of Income

Of all subsistence farmers, 32% have additional cash income from fishing, hunting, and gathering forest products. About 26% have income from seasonal farm work, and 13% from the sale of craft products. Low-income cash cropping farmers have outside income only from seasonal farm work (25%) and craft sales (25%). High-income farmers are also active in fishing (42%) as well as in seasonal farm labor (12%) and sale of craft products (8%).

Farmers with non-farm income naturally show a greater diversity of income sources. Those who sell less than half of their farm produce are most likely to have income from non-farm labor (73%), but they may also have income from children (16%), salaries (9%), private business (10%), or a pension (1% - one case). In addition, such households often have other income sources in the agricultural sector: fishing, hunting, and gathering (25%), farm labor (14%), or craft sales (3%). Cash cropping

farmers showed a similar pattern, with non-farm income coming from non-farm labor (51%), children (20%), private business (17%), salaries (17%), and pensions (9%). Agricultural income sources for this group included fishing and forest products (29%), farm labor (6%), and craft sales (6%).

Among respondents without farms, few income sources were found other than the principal occupation. Of landless farm laborers, 33% had income from fishing, hunting, and gathering, and 17% (one case) had income from non-farm labor. One case (17%) of non-farm laborers received income from fishing and one case (17%) from private business. Of those with other non-farm sources, 25% had farm labor income, 25% had income from fishing, 38% received support from children, and 13% (one case) had a private business.

E.2.d. Tenure Class

Among subsistence farmers, 77% are owner-operators only and 18% are both owner-operators and farm laborers; 4% are renters and laborers; and 2% are both owner-operators and landlords. Owner-operators only comprise 63% of low-income cash cropping farmers and 84% of high-income cash cropping farmers. One low-income farmer is a landlord only, and so are two high-income farmers. In addition, two low-income farmers and five (10%) high-income farmers combine the roles of owner-operator and laborer, while one high-income farmer combines those of owner-operator and landlord.

Those with non-farm income sources are less likely to be owner-operators: 43% in the case of food farmers and 37% in the case of cash cropping farmers. A significant share are both owner-operators and laborers: 50% and 34%, respectively. In each class, 2% are renters or sharecroppers and 17% are cash cropping farmers or landlords. Farm laborers, non-farm laborers, and other non-farm households, by definition, have no farms.

E.2.e. Production Patterns

Table 5.16 shows the percentage of farmers in each socioeconomic group who produce each crop considered in this study. Rice is produced by practically all farmers except in the low-income group, where it is still produced by over half of households. Maize and other food crops, including beans and peanuts, vegetables, fruits, sweet potatoes, and chili peppers, are cultivated by small numbers in each socioeconomic group except low-income farmers. The latter cultivate only vegetables and bananas (one case each).

TABLE 5.16

PRODUCTION PATTERNS BY FARMING GROUP
(PERCENTAGE OF FARM HOUSEHOLDS PLANTING EACH CROP)

Crop	Socioeconomic Group				
	1	2	3	4	5
Rice	98	63	94	98	80
Maize	4	0	10	8	6
Tapioca	10	13	22	8	14
Kenaf	15	0	24	17	26
Sugar cane	1	0	6	0	3
Beans and peanuts	5	0	10	5	9
Vegetables	34	13	28	43	37
Fruits	7	0	8	9	3
Sweet potato	1	0	2	5	3
Chili peppers	2	0	2	4	3
Cotton	7	0	12	13	14
Tobacco	2	0	0	1	6
Banana	7	13	14	7	6
Mulberry	4	0	2	2	0

Key: 1 = Subsistence farmers
2 = Low-income cash cropping farmers
3 = High-income cash cropping farmers
4 = Food farmers with non-farm income
5 = Cash cropping farmers with non-farm income

Kenaf, a traditional cash crop, is cultivated by 15%-25% of farmers in each group, except for low-income farmers. Tapioca has been recently introduced in the study area and is most popular among high-income households (22%). Other groups (including low-income farmers) have about 10% of households involved in tapioca cultivation. Sugar cane, another new cash crop, is also most often found among high-income farmers(6%)

Cotton, tobacco, and mulberry are cash crops cultivated by all groups except low-income farmers. Cotton is most frequently found among high-income farmers and those with non-farm income (10%-15%); it is less frequent among subsistence farmers (7%). Tobacco is quite rare and is cultivated mostly by cash cropping farmers with non-farm income. Mulberry, used to feed silkworms, is also unusual but is more common among subsistence farmers than among cash croppers.

E.2.f. Marketing Patterns

Table 5.17 shows, by crop, the percentage of producers in each group who sell some of their production. Rice is sold by 40% to 60% of producers in every socioeconomic group. High-income farmers and cash cropping farmers with non-farm income are more likely to sell rice than are subsistence or low-income producers.

Maize is sold by some producers in every income group. Other food crops, such as beans and peanuts, vegetables and fruits are also sold occasionally, without regard to socioeconomic group. Sweet potatoes are sold only by farmers with non-farm income, and chili peppers are sold by these plus high-income farmers.

Kenaf is sold by almost all producers (85%-95%) in all income groups. Tapioca is sold by 60% of producers in the high income and cash cropping/non-farm income groups, by 15% of subsistence producers, and not at all by producers in the low-income and food farming/non-farm income categories. Sugar cane is sold by all producers in the cash cropping category, by 67% of high-income producers, and not at all by subsistence producers.

Cotton is marketed by 40% of cash croppers with non-farm income and 33% of high-income farmers, but by only 11% of subsistence producers and 17% of those who are food farmers with non-farm income. Tobacco is marketed only by cash cropping/non-farm income producers (50%). Mulberry is sold by 40% of producers in the subsistence group but not by producers in the higher income groups.

TABLE 5.17

MARKETING PATTERNS BY FARMING GROUP
(PERCENTAGE OF PRODUCERS SELLING EACH CROP)

Crop	Socioeconomic Group				
	1	2	3	4	5
Rice	42	40	60	44	64
Maize	40	b	20	14	50
Tapioca	15	0	64	0	60
Kenaf	85	b	92	94	89
Sugar cane	0	b	67	b	100
Beans and peanuts	67	b	80	80	33
Vegetables	40	100	50	45	38
Fruits	11	b	50	13	0
Sweet potato	0	b	0	20	100
Chili peppers	0	b	100	25	100
Cotton	11	b	33	17	40
Tobacco	0	b	b	0	50
Banana	22	0	57	67	50
Mulberry	40	b	0	0	b
Livestock[a]	60	50	90	62	74

[a] Percent of all households.
[b] No production.

Livestock sales are a significant source of income in all farming groups. Of high-income households, 90% sold some livestock or poultry during the past year. The percentage drops to 75% for cash cropping farmers with non-farm income, 60% for subsistence farmers (with or without non-farm income), and 50% of low-income farmers. Sale of craft products, on the other hand, is insignificant as a source of household income in this project area.

E.2.g. Agricultural Service Delivery and Social Participation

Participation in agricultural organizations is reported by 20% of subsistence farmers, 32% of high-income cash cropping farmers, 16% of food farmers with non-farm income, 37% of cash croppers with non-farm income, and 33% (two cases) of farm laborers. Low income farmers and non-farm laborers report no participation. Participation by spouses includes one case each from the groups of subsistence farmers and food farmers with non-farm income, and two cases each from high-income farmers and cash croppers with non-farm income, for a total of only 2% of farming households (with spouses) in the sample.

Of all farmers, 91% have never participated in an agricultural training course, including 93% of subsistence farmers and 92% of food farmers with non-farm income. This proportion drops to 83% for low-income farmers (one household participated), to 88% for high-income farmers, and to 89% for cash cropping farmers with non-farm income. High-income cash cropping farmers, with or without non-farm income are the most likely to participate in training courses more than once a year (8% and 9% respectively). During the past year, 5% of food farmers with non-farm income and 3% of subsistence farmers attended more than one training course. Low-income farmers have never participated in more than one training course.

Between 70% and 80% of all farmers have never been visited by the agricultural extension service. Extension agents most frequently visit food farmers with non-farm income (30%). High-income farmers (26%) and subsistence farmers (22%) are next most likely to be visited, while cash cropping farmers with non-farm income and low-income farmers receive a relatively low share of extension service (18% and 20% - one case - respectively). Those farms that are visited are often visited more than once; this was true for 55% of households receiving visits in the subsistence farming group, 92% of those in the group of high-income farmers, 79% of those who were food farmers with non-farm income, and 100% of those who were cash croppers with non-farm income. No low-income farmers have been visited more than once by the extension service during the past year.

When agricultural meetings are held in the community, 67% of cash cropping farmers with non-farm income report regular attendance. The share drops to 48% for subsistence farmers and 46% for high-income farmers, to 33% for low-income farmers, and to 25% for food farmers with non-farm income. A total of 67% of low-income farmers, 31% of subsistence farmers, and 28% of food farmers with non-farm income say that they never attend such meetings.

Use of credit is most common among cash cropping farmers with non-farm income (26%) and high-income farmers (24%). Food farmers with non-farm income (18%) and subsistence farmers (12%) are less likely to make use of credit. Low-income farmers have not participated in credit programs at all.

E.3. Change in Composition of Socioeconomic Groups

It was not possible to reconstruct , with any degree of confidence, income levels by household ten years ago. Therefore, the Consultants do not have detailed data on the actual change in income levels and income distribution occurring over the project period. Thus, it was necessary to infer changes in the socioeconomic structure of the project area population and project impacts on income distribution by looking at qualitative changes in the characteristics defining socioeconomic status and the incidence of behavioral change by socioeconomic groups.

E.3.a. Change in Land Tenure

Out of the entire sample, 80% of households were landholders both before and after the project; 5% did not have land either before or after the project; 13% has land now and did not have it before; and 2% has gone from landholding to a landless condition. Change in landholdings is mostly accounted for by migration into the study area.

E.3.b. Change in Sources of Income

Over the entire sample, 16% of households had no source of income other than the farm either now or before the study project, while 64% of households had other income both now and before the project. Thus, 80% have experienced no change. A total of 13% has other income now but did not before, while 7% had it before and do not have it now. The greatest change has come about for non-farm households and food farmers with non-farm income, 24% of whom now have income sources that they did not have five years ago. A substantial share of high-income farmers (14%) no longer have sources of outside income that they had before, although 8% have also gained sources of income that they did not have before. A loss of outside income is reported by 17% (one case) of low-income farmers and 16% (one case) of landless farm laborers.

With respect to non-farm income (excluding income from farm labor, fishing, hunting, and gathering, and sale of craft products), 57% of the sample had none either before or after the project and another 20% has such income now but did not have it ten years ago. Of those who had non-farm income in the past, 82% have experienced no change, 8% have more non-farm sources now than in the past, and 10% (2% of the entire sample) report fewer non-farm income sources now than in the past.

The first three socioeconomic groups by definition have no non-farm income now. Only 1% of the subsistence farmers (one case), 17% of low-income farmers (one case), and 6% of the high-income farmers had such income in the past.

The two groups of farmers with non-farm income are basically split between those whose income sources have not changed over the project period (48% of food farmers, 40% of cash cropping farmers) and those who have such income now but did not ten years ago (49% of food farmers, 51% of cash cropping farmers). The remaining 3% of food farmers and 9% of cash cropping farmers have fewer sources now than ten years ago.

No farm laborers have any non-farm income at present; 17% (one case) had such income in the past. Of non-farm laborers (one case), 17% had no non-farm income ten years ago. Of other non-farm households, 50% reported a change in non-farm income sources over the project period: 75% of these reported an increase and 25% (one case) a decrease.

E.4. Distribution of Income Impacts by Socioeconomic Group

The distribution of income impacts will be assessed by examining the incidence of changes in production patterns and agricultural innovation (use of fertilizer and high-yielding varieties) by socioeconomic group. The degree to which these impacts are attributable to the transport improvement will be determined by examining the relationship between different types of access change and change in income-related behavior.

E.4.a. Change in Production Patterns

Over the project period, 42% of subsistence farmers expanded their cultivated area, while 34% remained unchanged, 7% have less cultivated area now than before, and 16% began farming during the project period. In contrast, 50% of low-income cash cropping farmers, and 52% of high-income cash cropping farmers, expanded their cultivated area over the

project period. Conversely, 17% of low-income farmers, and 8% of high income farmers, decreased the area cultivated. 17% of low-income farmers (one case) and 40% of high-income farmers began farming during the study period.

Among those farmers with non-farm income, 29% of food farmers and 15% of cash croppers started farming during the study period. Another 37% of food farmers and 38% of cash croppers expanded their area under cultivation during this period. A substantial share (23% of food farmers and 21% of cash croppers) remained the same over the project period, while relatively few (10% of food farmers and 9% of cash croppers) decreased the area cultivated. Farm laborers, laborers and other non-farm households show no change over the project period.

Change in area cultivated by crop was correlated with selected measures of access change and socioeconomic change. The results are shown in Tables 95 and 96 (see Appendix volume). In general, the correlations with access change are extremely low. The only significant findings are the following:

1. Increase in the area devoted to rice is negatively associated with market access change, but positively associated with village access change.

2. Increase in tapioca production is positively associated with change in household and village access.

3. Kenaf, like rice, is negatively associated with market access change but positively associated with village access change.

4. Change in food crop production (sugar cane, peanuts, vegetables, fruits, sweet potatoes and chili peppers) is not significantly associated with any form of access change.

5. Change in cotton production is slightly positively associated with village access change and slightly negatively associated with market access change.

6. Change in tobacco or mulberry (silk) production is unrelated to access change.

None of these correlations exceed .20 in magnitude, so the perceived relationships are extremely weak.

As alternate socioeconomic determinants of change in crop production, four indicators were tested: household income, cash income, age and education of household head. Generally, these indicators yielded equally low correlations. The following findings are statistically significant:

1. Increase in the area devoted to rice is positively associated with household income, negatively associated with age of the household head and positively, but weakly, associated with education of the household head.

2. Increase in maize production is positively, but weakly, associated with both household income and cash income.

3. The same is true, with slightly stronger correlations, for tapioca production and for chili peppers.

4. Change in production of kenaf, cotton, tobacco, mulberry, and all other food crops show no relationship to socioeconomic variables.

E.4.b. Farm Enterprise Changes

Two types of farm enterprise change are studied in this section: fertilizer use and planting of high yielding varieties of rice. The relationship of these behavioral changes to access change is first examined, and then the distribution of impacts by socioeconomic group is discussed.

Fertilizer use. Households which do not use fertilizer (or manure) on rice are most likely to be those having the smallest amount of accessibility change. On the other hand, those in the next lowest access group are likely to be households which have increased their fertilizer use over the project period, while households in the middle range are most likely to have stayed the same. In the second highest range, respondents are split between those whose fertilizer use has not changed (25%) and those who are using less now than before (64%). In the highest access change range, a fair share (30%) use less now than before, but the majority (67%) did not have rice planted before the study project.

The vast majority of subsistence rice producers (89%) use no fertilizer on their rice. Of those who do use it, 36% use more now than before, 55% use the same as before, and 9% use less than before. Low-income farmers show a similar pattern; 82% use no fertilizer and the remaining 18% use more now than before. High income farmers are most likely (86%) to be using the same amount as before, with equal numbers using less and more (7% each)

Farmers with non-farm income appear to have decreased their fertilizer use over the project period (77% of food farmers and 50% of cash cropping farmers). However, a significant share of food farmers with non-farm income have not changed their fertilizer use (17%), while a significant share of cash cropping farmers with non-farm income have begun planting rice during the project period (39%). These data support the view

that, while access and adequate incomes may be constraints on fertilizer use, removal of these constraints will not automatically produce an increase in fertilizer use. In fact, after an initial spurt, it seems as if such use tends to decrease gradually over time.

High-yielding varieties. 90% of rice producers do not report using high yielding varieties of rice. This pattern persists across all levels of access change. In all access groups, those households which have introduced high-yielding varieties are more likely (71%) to have introduced them in the past five years than previously.

In our sample, low-income farmers do not use high-yielding varieties of rice. Subsistence farmers are slightly less likely than the average (6%) to use HYV, and high-income farmers have an average participation rate (10%). Farmers with non-farm income are slightly more likely to have HYV (12% for food farmers and 18% for cash cropping farmers). They are also somewhat more likely to have planted HYV rice prior to the study project.

F. IMPACTS ON THE QUALITY OF LIFE

The relationship between access and quality of life can also be examined by looking at the variation in socio-economic structures between areas with different degrees of accessibility at present. In this section, the composition of the sample by accessibility groups is defined, the characteristics of thse groups are described, and the perceived relationship between transport change and change in quality of life in the project area is discussed.

F.1. Composition by Accessibility Groups

Households were assigned by market town (amphoe) to four accessibility groups. Of these, Sang Khom experienced the greatest change in market accessibility due to the study project. Phen also experienced a change, but the other two towns were unaffected. However, villages in the Khok Si project area had a markedly greater increase in village accessibility than those in the Phen project area. The distribution of the sample by market town is as follows: Phen 12%, Sang Khom 43%, Sawang Daen Din 27%, and Wanon Niwat 18%.

Mean household size varies somewhat by access groups from the sample mean of 6.9. It is lower in Phen (6.6) and Sawang Daen Din (6.3) and higher in Sang Khom (7.2) and Wanon Niwat (7.5). The average household income is highest in Wanon Niwat (14,932 Baht, or U.S.$747). In the remaining towns, it drops to about 75% of this level (11,574 Baht, or U.S.$579 around Sang Khom; 10,872 Baht, or U.S.$544 near Sawang Daen Din; and 10,203 Baht, or U.S.$510 near Phen).

On a per capita basis, the income levels in Phen (1,677 Baht, or U.S.$85) closely approximate those of Sang Khom (1,693, or U.S.$85). Per capita income in the other project area is around U.S.$100 (1,937 Baht, or U.S.$97 in Sawang Daen Din, and 2,220 Baht, or U.S.$111 in Wanon Niwat).

The average amount of land owned does not vary significantly by access group. It is slightly higher in Wanon Niwat (2.5 hectares) than in the other areas (2.0 in Sang Khom, and 1.9 in Phen and in Sawang Daen Din). The percentage of sample households who are landowners is highest in Phen (93%), next highest in Sang Khom (90%), lower in Sawang Daen Din (87%), and least in Wanon Niwat (85%). The percentage of land cultivated varies from 63% in Sawang Daen Din to 89% in Phen, with 75% in Sang Khom and 77% in Wanon Niwat.

Labor income contributes to household income in all districts. The average value of wage labor is higher in Phen (2,792 Baht, or U.S.$140) and Sang Khom (2,413 Baht, or U.S.$121) than in Sawang Daen Din (1.579 Baht, or U.S. $79) and Wanon Niwat (1,887 Baht, or U.S.$94). On the other hand, fewer households report labor income in the Phen project area (8% in Phen and 18% in Sang Khom) than in the Khok Si project area (44% in Sawang Daen Din and 48% in Wanon Niwat.

F.2. Characteristics of Accessibility Groups

F.2.a. Demographic Characteristics. Sang Khom and Sawang Daen Din households show an age distribution very similar to that for the whole sample. Households in Amphoe Phen are weighted toward the older age groups, while those of Wanon Niwat tend to be younger than the average for the sample.

Reflecting this age distribution, household heads in Phen are slightly less likely than the norm to have completed a basic education (four years of primary schooling). Those in Sawang Daen Din have an even greater proportion of illiterates, although they also have a disproportionately high number of household heads completing more than primary school. Sang Khom households are close to the sample distribution on education. Households in Wanon Niwat have the smallest share with no schooling and by far the largest share of those with a basic education, although none of the household heads in this area have gone beyond primary school.

F.2.b. Travel Patterns. Residents of Amphoe Phen are the most frequent travelers in the sample. They visit the amphoe 13.4 times a year on the average, or more than once a month. They make 2.7 trips annually to the province capital, Udon Thani, and more than half of them traveled to Bangkok at least once in the past year.

Sang Khom households, in the same project area, are almost as frequent travelers. They go to the amphoe center an average of ten times a year, and visit Udon Thani 2.5 times annually. However, they are much less likely to travel to Bangkok (less than 10% have done so during the past year).

In the Khok Si project area, personal travel is much less frequent. Villagers visit the amphoe center between 6 and 7 times a year (6.5 for Sawaeng Daen Din and 6.3 for Wanon Niwat). They go to the province capital, Sakon Nakhon, less than once a year (0.7 annual trips per capita) and rarely go to Bangkok (only about 5% go in a given year).

The ability of spouses to travel as frequently as household heads varies inversely with present accessibility. In Phen, spouses travel 94% as often as household heads to the amphoe seat. In Sang Khom, this proportion drops to 77%, in Sawaeng Daen Din it is 60%, and in Wanon Niwat it is 43%. However, spouses in the Phen project area visit the province capital much less often than household heads (64% in Phen, 50% in Sang Khom), while spouses in the Khok Si area are relatively less deprived (they visit the province capital 67% as often as household heads). Trips to Bangkok are about equally divided between both sexes.

F.2.c. Income Sources. Fishing, hunting, and gathering are the predominant sources of outside income; 41% of households in Phen received income from this source, 35% in Sang Khom, 20% in Sawang Daen Din, and 27% in Wanon Niwat. Non-farm labor is important in the Khok Si Project area: 13% of households in Phen, 18% in Sang Khom, 36% in Sawang Daen Din, and 42% in Wanon Niwat have income from this source. Farm labor contributes to income for 15% of households in Phen, 20% in Sang Khom, 18% in Sawang Daen Din, and 13% in Wanon Niwat. Craft sales have more importance in the Phen project area (13% of households in Phen and 11% of those in Sang Khom) than in the other area (7% in Sawang Daen Din and none in Wanon Niwat).

Of non-farm income sources other than non-farm labor, support from children is the most common. It applies to 5% of households in Phen, 7% in Sawang Daen Din, 3% in Wanon Niwat and 11% in Sang Khom. Private business contributes to income for about 5% of families in all access groups. Salaries are mainly found in Sang Khom (6%) and Wanon Niwat (7%) with one case in Sawang Daen Din (1%). Pensions were reported only in Sang Khom (3%).

F.2.d. Production Patterns. Rice is cultivated by almost all households in all access groups (see Table 518). Maize is slightly more common in Phen (13%) than in the other areas (average about 5%). Vegetables are frequently found across all access groups (30% to 45% of households).

Beans and peanuts, and fruit, including bananas, are produced by a small percentage of households in each market area. Each of these crops is slightly more common in Phen and in Wanon Niwat than in the intervening market areas. Sweet potatoes and chili peppers are cultivated by a very small share of households throughout the study areas, with the highest participation in Wanon Niwat (5%).

Tapioca is more prevalent in Phen (15%) and Sawang Daen Din (17%) than in the more remote households of Sang Khom and Wanon Niwat (8%). Kenaf is considerably more important in the Khok Si project area, where it is cultivated by 31% of households, compared to only 5% in the Phen project area. Sugar cane is grown by less than 5% of households in all access groups.

Cotton is most important in Wanon Niwat, where it is produced by 37% of households. Elsewhere, it is produced by about 5% of households. Tobacco has made significant inroads only in Wanon Niwat (7%). Mulberry is infrequently cultivated and is no longer grown at all in Phen.

TABLE 5. 18

PRODUCTION PATTERNS BY ACCESS GROUP

(PERCENT OF HOUSEHOLDS PLANTING EACH CROP)

Crop	Phen	Sang Khom	Sawang Daen Din	Wanon Niwat
Rice	90%	88%	91%	93%
Maize	13%	4%	4%	7%
Tapioca	15%	8%	17%	8%
Kenaf	5%	6%	31%	31%
Sugar Cane	3%	1%	2%	3%
Beans/Peanuts	10%	4%	4%	10%
Vegetables	33%	32%	28%	46%
Fruit	15%	6%	4%	7%
Sweet Potato	3%	3%	0	5%
Chili Pepper	3%	1%	3%	5%
Cotton	3%	4%	6%	37%
Tobacco	0	1%	0	7%
Banana	13%	6%	6%	10%
Mulberry	0	3%	1%	5%

F.2.e. Marketing Patterns. Rice is sold by 40% of producers in all market areas except Wanon Niwat, where it is sold by 75% of producers (see Table 519). Maize, beans and peanuts, vegetables, sweet potatoes and chili peppers are occasionally sold in all areas, although a producer is less likely to sell in Phen or Sawang Daen Din than in Sang Khom or Wanon Niwat. Bananas are frequently sold in all areas and other fruits are less often marketed.

Of the kenaf producers in the Khok Si area, 89% sell the crop, while only 50% in Phen and 22% in Sang Khom do so. Similarly, tapioca is sold by 40% to 50% of producers in the Khok Si area, by 17% of producers near Phen, and by only 9% in Sang Khom. All sugar cane producers market their production.

Cotton is produced in all areas but commercialized only in Wanon Niwat. Tobacco, a recently introduced cash crop, is 25% commercialized in Wanon Niwat and not at all elsewhere. Mulberry is produced but not sold in the Khok Si project area, not produced near Phen, and sold by 50% of producers in Sang Khom.

Livestock is a major source of cash income in all access groups. About half of all households sold livestock during the past year in Phen and in Sawang Daen Din. A higher proportion (70% - 80%) sold livestock in the more rural areas of Sang Khom and Wanon Niwat.

F.2.f. Agricultural Service Delivery and Social Participation. On the average, 23% of farm household heads in the sample reported membership in agricultural organizations, and so did 23% of their spouses. Farmers in Amphoe Phen and Sawang Daen Din were somewhat less likely than the norm to belong to agricultural organizations (16% and 17%), while those in Sang Khom were slightly above the norm (26%)and those in Wanon Niwat were substantially above it (32%). The rate of participation by spouses was also highest in Wanon Niwat (5%, as compared to 3% in Phen and 1% elsewhere).

There was little variation by access group in the share of households participating in agricultural training courses. Slightly more than the norm (11%) participated during the past year in the Phen project area, while slightly less than the norm (6%) participated in the Khok Si project area. Of participating households in the Phen area, 68% attended more than one training course during the past year, while only 38% of participating households attended more than one course in the Khok Si area.

TABLE 5.19

MARKETING PATTERNS BY ACCESS GROUP

(PERCENT OF PRODUCERS SELLING EACH CROP)

Crop	Phen	Sang Khom	Sawang Daen Din	Wanon Niwat
Rice	40%	41%	41%	75%
Maize	20%	50%	0	25%
Tapioca	17%	9%	53%	40%
Kenaf	50%	22%	89%	89%
Sugar Cane	100%	0	100%	100%
Beans/Peanuts	25%	100%	50%	83%
Vegetables	31%	58%	20%	52%
Fruit	17%	25%	25%	0
Sweet Potato	0	25%	[b]	33%
Chili Pepper	0	100%	0	33%
Cotton	0	0	0	32%
Tobacco	[b]	0	[b]	25%
Banana	40%	44%	20%	67%
Mulberry	[b]	50%	0	0
Livestock[a]	46%	71%	58%	81%

[a]Percent of all households.

[b]No Production.

Of all sample farm households, 75% have never been visited by the extension service. The proportion is markedly lower in Sang Khom (60%), higher in Phen and Wanon Niwat (80%), and highest in Sawang Daen Din (90%). As noted above, those farms that receive visits are frequently visited more than once in a year. This is true for 73% of visited households in Phen, Sang Khom, and Wanon Niwat; visited households in Sawaeng Daen Din are much less likely (57%) to be visited more than once a year.

When agricultural meetings are held in the communtiy, 63% of farm households in Phen and 53% in Sawang Daen Din report regular attendance. This proportion drops to 35% in Sang Khom and 36% in Wanon Niwat. About 25% of all respondents say they never attend such meetings; the proportion is very slightly higher (27% to 29%) in the Khok Si project area.

Over the whole sample, about 18% of farm households have made use of credit to support their farm enterprise. A strikingly high share of participants in credit programs is found in Wanon Niwat (41%). Phen (20%) is also above the norm, while Sang Khom (11%) and Sawang Daen Din (12%) are well below it. It is difficult to explain this phenomenon in terms of access improvement, but these patterns of credit use may well be related to the patterns of cultivation and marketing of cash crops described above.

F.3. Perceived Effects of Transport Sector Change

F.3.a. Effect of Transport Change. Of household heads interviewed, 80% believe that their life has improved as a result of the construction of the road. Some gave more than one reason why, but three reasons predominate:

- transport is easier, safer, or more reliable (73%)
- it is easier to market products (31%)
- it is easier to buy things in the market (18%)

F.3.b. Life Satisfaction. The sample household heads were also asked whether, in general terms, life was better or worse now than ten years ago. (In practice, it was sometimes difficult to get respondents to distinguish this question from the perceived effect of transport change, and there is some duplication of answers as a result. Identical answers were coded and analyzed only under perceived effect of transport change.) Of household heads, 54% think that life is better now, 16% think it is worse,

CHAPTER 6
SUMMARY AND CONCLUSIONS

6

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A. RELATION OF TRANSPORT INVESTMENT TO REGIONAL GROWTH IN EACH COUNTRY

A.1. Malaysia

A.1.a. Actual Economic Growth. The major change in the study area during the study period was the increase in commercial activity, as shown in the following table. The major industry of logging and sawing lumber underwent changes (a sharp decline in 1975-1976 followed by an upturn), but these were mainly the result of changes in the world market prices, which were depressed after 1974 because of the increase in oil prices. Growth in trading of fish and game was also significant over the study period, but the total production of fishing, hunting, and gathering was affected very little.

Producer Value of Major Economic Activities in Study Area

Activity	1966 Value Before ($M000)	1976 Value After ($M000)	Average Annual % Change	Investment 1965-1977 ($M000)
Agriculture & livestock	1518	2488	5.1	negligible[b]
Fishing, hunting, & gathering	1252	1411	1.2	negligible
Wood products	290[a]	500[a]	5.6	40,000-45,000
Primary processing	218	208	-0.5	15-30
Commercial and trading	8755	15573	5.9	3,200
Total	12,033	20,180	5.3	43,000-48,000
Transport (pass.)	———	———	13.7%	1,940

Note: In constant prices.

[a]Wages and salaries.
[b]Except for part of government subsidies.

There have been major changes in economic activity, principally in the upstream portion of the study area, where the accessibility change was greatest, above the rapids. In this area, the small traders have set up village shops principally within the last five years. This commercial activity reflects a greater cash income and purchasing power in the upstream area.

Most of the increase in income upstream has come from the sale of fresh fish and meat and the introduction of pepper. Pepper planting has also played an important role in increasing income downstream. Rubber production, which used to be a major income earner, has declined (because of declining market prices), and logging income has also fluctuated, mainly because of outside market forces.

The marketing structure in the study area became more competitive over the study period with an influx of more traders and groups of traders into the region. This increase in competition appears to have had an effect on the price structure: trader margins have been reduced, producers are well aware of export price quotations, and local prices fluctuate in relation to changes in announced export prices. This means that local producers are now getting a higher percentage of the export price.

A.1.b. Sensitivity of Regional Sectors to Transport Characteristics

1) Agriculture

More marketing of all products is encouraged by improvements in accessibility from farms to market centers. However, perishable products are generally much more sensitive to transport improvements than non-perishables. The agricultural products of the study area are mostly non-perishable or do not readily deteriorate in storage. The exceptions to this are vegetables, fruit, and livestock (pigs and chickens), which are usually found near urban areas. Of these products, vegetables and fruits are the most transport sensitive since they must be marketed within one or two days and freshness is a major price factor. Livestock can be kept longer if it is fed and is therefore not as sensitive to transport time; this is illustrated by the fact that livestock, such as pigs, is frequently shipped on the slower "Chinese launch" type of ships in the study area rather than on the faster express boats.

The inputs to production of some agricultural products are relatively perishable and therefore transport sensitive. Pepper cuttings, for instance, and other cuttings used to start new plantations are very perishable and must be planted within a few hours of cutting in order to survive. This means that these cuttings are much more likely to be introduced in an area linked to a nursery by fast transport means.

Other indirect factors in agriculture are influenced by transport as well. The accessibility of information concerning new farming techniques is influenced by the availability of extension agents and by the exposure of farmers to these techniques. Both of these factors are influenced by transport change, but the linkage to changes in agricultural production is weak.

2) Fishing, hunting, and gathering

It is fairly clear that fish and game marketing are sensitive to transport characteristics such as travel time. The existence of high-speed express boats has opened up an export market for fish and game that was not accessible before. To take advantage of this market, complementary investments and entrepreneurial skills were needed also, and these were found in the area's business community. Higher prices to producers that resulted from this activity encouraged hunters and fishermen to increase the supply.

Certain fruits that are very perishable, such as durians, have also benefitted from the availability of faster transport; the result has been less spoilage and faster marketing of fresh fruits.

3) Wood products

The wood industry is sensitive to transport characteristics in the sense that transportation costs are the largest part of logging costs, particularly for export. However, it appears that logging companies rely on their own ships for most river transport to market or to major ports. Lorries are used for transport to the sawmill from the logging sites, and speedboats serve the transport needs of management.

The express boats serve the operation indirectly by rapid delivery of spare parts and by reducing leave travel time. These two items are estimated by the logging companies to increase total production by 10%. The quality of workers that can be attracted to the site with better accessibility is also higher, according to logging company management.

4) Primary processing

Both types of agricultural processing industries (rice mills and rubber smokehouses) rely on river transport to deliver their inputs. However, neither one is sensitive to changes in transport time along the Rajang River. The rice mills serve basically a local traffic that arrives by canoe. This service may have been facilitated indirectly by express boats, but the rice mill customers do not frequently use them.

The smokehouses are located close to major centers where traders collect rubber. Their actual distance from these traders is small, so that the effect of change in transport time is very little.

5) Commercial activity

The construction or operation of a commercial shop is not intrinsically dependent on the existence of express boat service. However, virtually all shops interviewed rely heavily on the express service to transport their supplies. Many of the business people interviewed owned a part interest in an express boat or had an arrangement with an express transport company to ship their supplies. Several of the smaller village shops upstream used express boat captains as agents to deliver and pick up supplies in the market centers on commission. Clearly, the express service serves as an important facilitator, and small shop owners have stated that they would not now be in business without it.

It is necessary, however, to distinguish between those areas that were served by motor launches before the express service (Kapit and downstream) and those that were accessible only by long boat (upstream or Kapit). The upstream shops were much more sensitive to the introduction of express service than the downstream shops.

A.1.c. Relation of Regional Growth Potential to Transport Change. The transport change has clearly made a difference in the growth potential upstream of the rapids. The increase in income resulting from the export of fresh fish and meat has been significant. However, this must be recognized as a primarily short-term phenomenon because fish and game production on the lower reaches of the river have been declining because the streams are over-fished relative to their production potential and good hunting and gathering grounds are moving farther away. The long-term equilibrium will be at a lower production level of fish and forest products than that reached in the last five years. It will continue to be a significant source of income if other factors such as river pollution are kept in check.

The realization of the potential for fresh fish and meat export was dependent on the existence of complementary private sector investment in cold stores upstream and the entrepreneurial organization to link these cold stores to the export trade.

The role of transport in facilitating the introduction of pepper appears to have been significant but indirect. The transport of fresh seedlings by express has increased the chances of success for plantings, and the agricultural extension services appear to provide critical inputs for this crop. Obviously, the price structure has played a major role in encouraging pepper planting in the same way that it has discouraged the tapping of rubber trees in the study area despite their presence as a past investment.

Other economic growth has been relatively independent of the express, although use of the express by businessmen and traders has made the study area more accessible to outside resources. This may have had a significant effect on regional growth potential as well.

A.2. Philippines

A.2.a. Actual Economic Growth. The major change in the economy of the study area over the last 10 years has been an increase in commercial and trading activities, which has been closely related to an increase in rice productivity. The patterns of agricultural production in terms of area planted by crop have remained essentially the same, but more inputs (fertilizer, high-yielding seeds, irrigation water) are being used. The recently completed sugar mill and related sugar cane plantations will generate new cash employment for the area, possibly drawing off labor now engaged in small farming.

In primary processing, the change has been both positive and negative, with increases in rice milling in parts of the study area and decreases in others, such as Tabuk, where a rice mill went out of business.

The marketing structure in the study area has become more competitive because of an influx of outside traders. These traders have effectively penetrated the rice milling market, offering higher prices to farmers. Thus, the effect of increased competition on the purchasing side has been upward pressure on farmgate prices.

While consumption patterns have not changed significantly, improved access has increased travel to provincial capitals and Manila, and the use of credit for agricultural inputs has grown.

A.2.b. Sensitivity of Regional Sectors to Transport Characteristics

1) Agriculture

The production mix of rice, maize, vegetables, and tobacco (in order of importance) remained essentially the same over the study period. The study area has seen, however, an increase in marketing activities, particularly for palay. This gain can be attributed to improved access resulting from the study projects and the Japanese-financed Friendship Highway, which was also built during the study period.

The increase in use of high-yielding variety seeds and fertilizer for palay production is due partly to improved communications and transportation facilities, which facilitate marketing. These improvements are also the results of major government extension efforts that are often locally based (and therefore not sensitive to the transport changes).

Other complementary government investments were made in irrigation facilities. The success of these investments, however, depended to a large extent on marketing access, which was assured by the transport projects.

2) Primary processing

Improved transport was a direct cause of the moving of rice milling establishments into Cagayan to avoid the higher costs of milling operations in another location. In these cases, mills were moved closer to the producer. The shutting down of the local mill at Tabuk, however, was caused by the inability of the local processor to compete with buyers from outside the area. This occurrence was a result of improved access to the area for outside traders. The loss of local jobs was compensated for by higher prices to local producers.

The sugar mill investment in Piat is also directly related to the elimination of the transport constraint on supplying inputs and marketing outputs for sugar cane production and processing. This will be a major increase in economic activity in the study area that would not have happened without the study project.

3) Commercial and trading

These activities have increased substantially in the project area. More traders have come into the area because of the improved transport situation. They have been able to offer a wider variety of consumer goods at more competitive prices than other traders active in the study area.

Local commercial establishments have also had strong sales in agricultural inputs and building materials, partly because of lower transport costs of these goods from outside. This has also brought about a reduction in the need for local warehouse space.

A.2.c. Relation of Regional Growth Potential to Transport Change. The elimination of a major transport constraint in the form of bridge construction has been the key factor in large-scale agricultural investments for irrigation and for sugar cane processing.

The other major effect of the transport projects has been increased competition from outside traders due to improved access. This has had the indirect positive effect of increased prices to agricultural producers and the negative effects of the closing of local mills and the loss of local jobs when the mill buyers could not compete with outside buyer prices. These

changes have led to a "shake-out" of firms that are not competitive on operation costs or marketing structure. Another indirect effect has been the greater opportunity that rice farmers have gained to sell directly to merchants who can market their products to food deficit areas in other parts of the country. With less access this trade did not take place.

Better access has also generated more commercial activities in the area. Increases in purchasing power as a result of increased productivity, irrigation investments, and cash employment from the sugar cane industry have spurred increased commercial opportunities and are indirect effects of the transport investment.

A.3. Indonesia

A.3.a. Actual Economic Growth. Generally, there was little change in agricultural production over the project period. The majority of farmers, in fact, decreased the area cultivated for food crops. However, tree cropping is on the rise and large production increases are expected when recently planted clove and nutmeg trees begin producing.

Although the fish catch is still essentially for local consumption, it increased somewhat (35%) over the project period (a growth rate of 6% per year). On the other hand, forestry activities (logging) for export continued at about the same level over the project period on Halmahera Island. Similarly, primary processing remained virtually stagnant in the study area as a whole over the project period, with the striking exception of oil palm processing, the production of which has quadrupled in the last five years (a growth rate of 32% per year).

The northern section of this study area has experienced more growth than the southern section. This growth can be partly attributed to its greater ease of access from Ternate, and to the existence of feeder roads serving villages in this area.

Commercial activity is the dominant economic activity in the southern part of the study area, but it is matched by other processing activities in the northern zone. There has been a 50% increase in the number of village shops over the last five years, resulting in increased competition and relatively lower prices to customers outside of market centers.

The total volume of commodity trading appears to have doubled over the project period, but this activity has become more centralized in the north of Halmahera Island because of other transport investments in the form of roads.

The 1976 total value of sales and percent of production sold for major products is given in the following table, which is based on extrapolation from the 1.1% sample.

Food Crops		Tree Crops		Fishing		Forestry	
Value($)	% Sold	Value($)	% Sold	Value($)	% Sold (Locally)	Value($)	% Sold
1,570,000	13.2	11,910,000	100	340,000	80.8	22,000,000	100

A.3.b. Sensitivity of Regional Sectors to Transport Characteristics

1) Agriculture

Most cash crops are destined for export from the study area. The main cash crops (copra, cloves, and nutmeg) are exported by sea, and the percent of these products marketed is sensitive to access to sea transport, especially copra, which represents a higher weight-to-value ratio than the other products. The increase in clove and nutmeg planting suggests a response to increased marketing opportunities despite the lag between planting and harvesting, which delays the actual crop marketing for years. The marketing of these crops may be more sensitive to local road improvements in the northern study area than to improved sea transport.

2) Fishing

Fishing for export from the study area would be sensitive to transport characteristics; however, most of the fish catch on Halmahera is presently consumed locally and is therefore not responsive to transport changes in outsides markets. Development of a fish export trade would require major investment in modern fish production and processing facilities as well as the provision of refrigerated transport.

3) Wood products

Logging and sawmill operations are highly transport intensive, but they have not been affected by the sea service, which did not affect shipping to export markets in Japan, South Korea, and the Philippines.

4) Primary processing

Local processors are highly dependent on local transport routes for raw materials and output distribution. Many of these processors have their own vehicles for these needs. Their business has, therefore, not been affected by the sea service, but it may have been increased by local road improvements in the northern study area.

5) Commercial activity

While commercial activity increased over the project period, the increase does not appear to be related to the sea service. Only 7% of the firms interviewed indicated that their businesses were affected by the sea service.

A.3.c. Relation of Regional Growth Potential to Transport Change. Linkages between agricultural production and the sea service were found to be very weak, primarily because the service is not covering the majority of island ports and it is not designed for cargo service. The major indirect linkage is found in the information flow leading to greater clove and nutmeg production. This linkage, however, has not been thoroughly established. The same type of indirect linkage can be postulated for the other sectors of the economy, but its measurable effects are very weak.

The major project effects have been to increase reliability of passenger service to Ternate from a limited number of towns in the study area. This has made some difference to groups in the towns with links to the outside. However, because of the insignificant time savings and lack of freight traffic, the indirect effects of sea service on these towns is negligible for the study area as a whole. The Pioneer Sea Service does provide more regular payment of the salaries of government officials, thus perhaps increasing incentives for improved service delivery in remote communities.

Although local road improvements were not a part of the study project, it is possible that their impact in northern Halmahera is greater than that of the sea service. In addition, the combination of the roads and small motorized boats has also had some impact on travel to Ternate.

A.4. Thailand

A.4.a. Actual Economic Growth. Overall growth in GPP over the study period was 5.5%-6.0% per year in the two study areas.

Over the nine-year study period, the crop and livestock sectors grew faster in Udon Thani (6.3%/year) while fishing grew faster in Sakon Nakhon. Glutinous rice has remained the

main product, despite its being priced 17% lower in recent years than other rice. This former choice is due to the fact that glutinous rice is a home consumption item for the risk-averse farmers. For cash crops, production of kenaf, because of its unstable price structure, has been largely replaced by tapioca, which appears to be a growth item.

Agro-processing has experienced substantial growth in the study area, as 20 of the present 22 rice mills have been established since 1972. These family-run mills are related to an increase in livestock raising because of the availability of feed by-products. The future potential for tapioca processing is evidenced by a recently opened tapioca mill in the study area that has a substantial capacity and is to be supplied by increased local production.

The number of villages with shops has increased by 70%, while total shops have grown by 140%. This growth in commercial activity has been much less in the amphoe seat (20% increase over the study period).

There was a significant increase in nonfarm income over the study period. The sample shows 40 households with nonfarm incomes now, compared to 5 ten years ago.

A.4.b. Sensitivity of Sectors to Transport Characteristics

1) Agriculture

The agricultural sector is strongly market oriented in the study area and is sensitive to transport for crops exported out of the area. Almost 30% of the farmers have increased rice lands in an apparent response to improved access, and more have migrated to the study area along the road. In addition, all farmers growing tapioca and 92% of those growing kenaf planted after the road was built, indicating the sensitivity of these export crops.

Marketing patterns have also shifted. Farmers are mostly selling in the villages and using minibuses to transport goods now, while 10 years ago a majority of them moved their produce to the amphoe by bullock cart.

2) Nonfarm income

The construction of the study roads appears to have provided a substantial number of farmers with the opportunity

to supplement their income with other jobs. This has led to a significant increase in nonfarm income sources.

3) Primary processors

The spectacular increase in the number of family-run rice mills is indirectly related to the study roads, which have facilitated the acquisition of fuel and the marketing of by-products and livestock. This is strongly supported by the fact that out of 44 rice mills in the sample villages, all but 3 started business after the road projects were completed.

The tapioca milling for export is even more sensitive to the road investments. While the spread of tapioca growing in Thailand has been stimulated primarily by increasing export prices and overseas demand, its entry into the impact zone is directly dependent on the existence of the two study projects and the resulting access to all-weather transport by heavy trucks.

4) Hotel industry

This service industry in the amphoe seats has suffered from the road investment in the short term as travelling time to and from these seats is reduced, eliminating the need for overnight stays. This is a significant negative impact of the study roads.

A.4.c. Relation of Regional Growth Potential to Transport Change. The major impact of the study roads has been the encouragement of more production of agricultural products exported from the study areas. Crop sales have increased for rice, kenaf, tapioca, fish, and vegetables. Improved access has encouraged farmers to use minibuses and sell their produce to middlemen at the village level.

The major increase in small shops is indirectly linked to the expansion of agricultural production and marketing through increased incomes. The augmentation of nonfarm income sources has also stimulated local commercial activity. Furthermore, the increased commercial competition has meant better prices to local consumers.

Rice milling operations are really dual enterprises that rely heavily on transport for the export of livestock as well as the inflow of clients bringing rice.

Tapioca milling represents a major investment opportunity that has become a reality because of the elimination of the transport constraint by the study roads.

A.5. Summary of Change in Regional Growth Potential

All project areas experienced a significant growth rate of between 5% and 6% per year in the total value to the producer (in constant money) of study area production. This growth is twice as fast as that of the population and indicates that per capita incomes were increasing by 2.5% to 3.5% per year. Of course, only part of this growth is attributable, directly or indirectly, to the transport investment.

All project areas experienced a rapid growth in the number of small commercial shops found in the villages and in the number of traders operating in the project area. The growth in these two items was much faster than the general economic growth of the marketing centers in the project areas. This growth may represent an increased specialization of urban shops as they became wholesale suppliers to village shops as well as retail sales points. The number of small-scale agro-processing industries such as rice mills also increased substantially in three project areas. In the fourth (Indonesia), there appeared to be a significant increase in the part of the project area (northern Halmahera) where complementary investment in local roads was made.

Large-scale investments are conditioned by other factors, but they seem to have been facilitated by better transport and would not have taken place without it in certain cases (for example, the sugar mill and irrigation works in the Philippines). The increase in certain irrigated crops, such as rice, is clearly tied to these complementary investments and to a favorable price structure.

The increase in the production of other cash crops, such as pepper in Malaysia, tapioca in Thailand, and cloves and nutmeg in Indonesia, has not been dependent on major public investments, but it is certainly related to the existence of a marketing structure and favorable prices to the producer. The influence of subsidies and extension services, as in Malaysia, has also helped. On the other hand, government support in Malaysia for coffee and cocoa plantings has not had much effect, and certain traditional cash crops declined in production (rubber in Malaysia, kenaf in Thailand) as a result of decreases in export prices over the study period.

In some cases the marketing of perishable crops has increased due to transport investments. This gain may be only a short-term phenomenon. An increase has also been experienced by fish and game in Malaysia, now exported to Singapore. The total amount of fish and game produced in the project area has not increased very much, and it clearly takes more effort to find the fish and game than in the past. (This greater difficulty has led to a reduction in the amounts of fish and game available to local consumers as well as to an increase in cash income for certain fishermen and hunters.)

In every study area a change in the marketing structure has occurred such that the point of sale for most marketed goods is now closer to the farm. The greater availability of traders and the expansion of small rural shops with a trading sideline has given the farmer more alternatives for selling his crops. This increased competition has meant higher farm-gate prices probably in all four study areas, but certainly in Malaysia and the Philippines.

In the transport industry, there has been a substantial increase in the number of vehicles used and an opportunity for entrepreneurs from both inside and outside the project areas. This opportunity has been perceived and acted on in all project areas, indicating that there is a sufficient number of entrepreneurs with resources available in all four countries. In most cases it is the transporters from outside the project area who are dominant.

The transport investment appears to have affected the regional growth potential in other important ways: increased contacts with outside areas (local travellers and outsiders coming in), ease of transport for certain inputs (pepper seedlings in Malaysia), and encouragement of government officials, businessmen, and traders to visit or take up residence in project areas. All of these functions can have indirect effects on regional growth.

It may be just as important to mention the significant amount of complementary investments enccuntered. In the Philippines there were irrigation systems, extension services, the sugarmill, and the Japanese-financed Friendship Highway. In Indonesia there were local road improvements in the north, the planting of clove and nutmeg trees, and an oil palm processing plant. In Thailand there were irrigation works and cold stores. All of these complementary investments take advantage of the transport investments, and many of them would not have been made without the transport investment. They also contribute to regional growth potential.

B. COMPARATIVE ANALYSIS

In this section, the findings for each study area are reviewed and compared to see if differences between them can be explained by variation in the characteristics of the study projects or, alternatively, by variations in study area characteristics (situational factors or policy variables). The results of this analysis may be taken as indicative of new directions to pursue in transport planning, but they should not be construed as definitive proof that desired outcomes can be obtained by changing the characteristics or location of transport investments in remote areas.

B.1. Comparison of Project Characteristics

B.1.a. Scope. The transport investments selected for this study were very different between countries, although they were often similar within countries. Investments in three countries (Malaysia, Indonesia, and the Philippines) were made to link a remote area more closely to the main transport and communications network of the country. They were designed to improve access between the population centers of the project area and the outside world. The other type of investment (in Thailand) was designed primarily to improve village-to-market access, although it also increased the accessibility of a new administrative center to the main road network of the country. All study projects, however, have led to the introduction of motorized travel, which usually replaced non-motorized travel (canoes, sailboats, oxcarts, etc.).

It is not possible to make meaningful comparisons between the size and cost of the study investments. Bridges in the Philippines, for example, are extremely expensive but increase accessibility over a wide area. Feeder roads, as in Thailand, can be evaluated on a cost per kilometer basis. Except for local investment in jetties, there is virtually no public expenditure associated with river transport improvement in Malaysia. The Pioneer Sea Service in Indonesia, on the other hand, is publicly owned and operated but provides no significant access change in the project area.

Analysis of the impact of the study projects is complicated by the fact that other transport sector investments, both public and private, within and outside of the study areas, contributed to the change in transport flows and associated behavioral changes over the study period. Many of these investments are interdependent. For example,

construction of the bridges in the Philippines could not be interpreted as inducing the improvement of the Friendship Highway, yet the bridges were built first and the area they link to the highway contributes to its traffic flows. In turn, the highway improvement outside the study area has generated additional traffic within the study area. Similarly, the Sibu-Kuching road in Sarawak, outside the study area, has increased the travel and transport opportunities of study area residents, and local road improvements on northern Halmahera Island have substantially increased village accessibility in that part of the study area.

Investment in vehicles may be interpreted as a consequence of the study project if these vehicles make trips that would not have been made without the project. This is clearly the case for road and bridge improvements; a corresponding increase in vehicles providing transport service can be seen in the Philippines and Thailand. In Malaysia and Indonesia, the study project is in the form of boat and ship investment and operating costs with complementary investments in jetties and ports. These port improvements are not likely to make a significant reduction in transport costs in the study areas. However, in these areas parallel investments in smaller motorized vehicles continue to be made because of the time savings, comfort, and convenience achieved by motorizing water transport.

B.1.b. Mode. Two of the study projects concern land transport and two concern water transport. Land transport requires construction of a path between fixed points, while water transport requires construction of transfer facilities at the end points. Both, of course, require investment in vehicles, and a shift from non-motorized vehicles to motorized vehicles is a common element in all study projects. Travel by motorized vehicles generally costs more per kilometer of distance traveled, but time savings, and such intangibles as safety, comfort, and convenience are clearly of greater value to travellers in most cases than the increased cost.

B.1.c. Access change. To arrive at a comparable measure of access change that could be applied across all study projects, the percentage change in travel time was used. This index was adjusted to reflect the impact of increased frequency or regularity of service (see Appendix B for a fuller explanation). Table 6.1 shows the mean value of access and access change measures determined for each project area.

TABLE 6.1

COMPARISON OF ACCESSIBILITY AND ACCESS CHANGE ACROSS PROJECT AREAS
(index form 0 to 1)

	Malaysia	Philippines	Indonesia	Thaila
Market access to outside	0.263	0.261	0.016	0.765
Change in market access	0.637	0.714	0.363	0.419
Village access to markets	0.372	0.768	0.533	0.354
Change in village access	0.181	0.297	0.269	0.682
Household access (composite)	0.358	0.167	0.199	0.167
Change in household access	0.336	0.459	0.277	0.627

Thailand has a much higher average market accessibility (amphoe to changwat) at present than any of the other project areas, owing to the presence of paved roads and the relatively short distances involved. Malaysia and the Philippines show comparable levels of market accessibility, while Indonesia has the least accessible market towns in the study.

In all of the project areas, the travel time from market towns to the nearest outside center was substantially reduced over the study period (although the Indonesia reduction was only in small part due to the study project) The highest gain was made in the Philippines (71% average increase in accessibility) and the lowest in Indonesia (36% average increase). In the Philippines, this increase is spread fairly evenly over the project area, but it is slightly higher in the south (Gamu Bridge area) than in the north (Buntun Bridge area). In contrast, Malaysia's average increase of 64% represents changes that vary as an inverse function of distance from the outside center.

The Thailand average increase is much lower (42%), representing a high average change in the Phen project area (73%) combined with no change at all in the Khok Si project

area (because the market towns are outside the impact zone). Market accessibility change in the Phen project area is partly the result of the study project, but it is also due to improvements on the Phen-Udon Thani road made during the same period. In Indonesia, the average includes two market towns (Jailolo and Sahu) that experienced no change over the project period (motorized boat service was available prior to the Sea Service). Excluding these two, the average market accessibility increase rose from 36% to 51%. However, only a third of the sample villages have market accessibility increases attributable to the Pioneer Sea Service. Increases in another third are attributable to combinations of bus and boat service, and the last third owe increases to improvements in boat service alone.

Village accessibility to markets varies widely between project areas. The sample villages were most accessible in the Philippines, averaging under fifteen minutes travel time from the municipality. (This finding is partly the result of the sampling procedures used in the Philippines, where one-third of the sample villages were located in the poblacion, or municipality center.) Villages in Indonesia are the next most accessible, while those in Malaysia and Thailand have the lowest average accessibility at present. However, sample villages in each project area averaged less than half an hour's travel time from the market center by the most commonly used mode of transport.

The most dramatic change in village accessibility to markets has occured in Thailand, where accessibility has been increased by an average of nearly 70%. (Village accessibility change in the other project areas averages less than 30%.) The increase in Thailand applies to all but three villages (9% of the sample) located within a short distance of the amphoe seats at either end of the Phen project road. Twenty-four villages (69% of the sample) using motorized transport now did not do so before the study project. Nine villages (26%) had motorized transport before the study project, and two (5%) are close enough so that walking is the most frequently used mode, although motorized transport is available.

Village access change is next highest in the Philippines, where the average increase in village accessibility was 30% over the project period. One-third of the sample villages are now served by motorized transport (jeepneys), while they previously used trishaws (16%), calesas (6%), or walking (11%). Of the remaining two-thirds, 83% had motorized transport before the study

project and 17% are close enough to walk to markets. The principal improvements in village access are due to better road conditions, which permit use of larger and faster vehicles, and to more frequent and regular transport service.

Village accessibility change in Indonesia was in no way caused by the study project. Accessibility has actually changed in less than half of the sample villages over the project period. Farmers in twelve villages (32% of the sample) in the north of Halmahera Island now travel to market by minibus, whereas they previously had to walk. One village in the south now uses a motorboat that was not available five years ago. The average accessibility increase for the villages that experienced change is 77%. The remainder (65% of the sample) experienced no change over the project period; in most of them farmers walk to market, and in the rest they use canoes.

Malaysia showed the least change in village access over the project period. About one-fourth of the sample villages now use the express as their most frequent mode of transport to market. However, an even larger share (33%) now uses motorized longboats, whereas before they were dependent on canoes or motor launches. Of the villages, 42% made no change over the project period. Nearly half of these continue to use canoes, and the remainder use motorboats, motor launch, or walking as their principal mode of transport to market.

Household accessibility is a composite index made up of elements representing both travel "out" of the village and contact with outsiders coming "in." This index is still relatively low in all project areas. It is highest in Malaysia, where mobile services provide a wide range of contacts even in remote villages. It is low in Indonesia and still lower in the Philippines and Thailand. Nevertheless, there has been a substantial increase in overall household accessibility over the project period, ranging from a 63% increase in Thailand and 46% in the Philippines to 34% in Malaysia and 28% in Indonesia.

B.2. Comparison of Situational Factors and Policy Variables

B.2.a. Physical characteristics. The four study areas are all remote from the centers of government in the countries to which they belong. In three of the four cases, this separation is partly because of natural features creating a physical barrier to access. The Cagayan River valley in the Philippines is cut off from the rest of Luzon

by mountains on three sides, and the study area is further isolated by the river itself. The Rajang River valley is steep and narrow, and the river presents formidable obstacles to navigation. Halmahera Island is separated from the population centers of Indonesia by vast stretches of open sea. In all three cases, the study projects were similarly designed to overcome these geographical access constraints.

In the case of northeast Thailand, the study area, although geographically remote from the center of government, presents few physical barriers to access and is relatively well linked to the national transport network. Consequently, the study project is concerned with overcoming socioeconomic constraints rather than physical constraints on contact and communication. This focus on socioeconomic objectives is reflected in the project's design characteristics, which are based on the need to serve local rather than long-distance traffic.

All of the project areas present a significant potential for agricultural production, a potential which is currently exploited to different degrees depending on population characteristics (see subsection B.2.b). The steep slopes and heavy forest cover found in the project areas of Malaysia and Indonesia present physical constraints on agricultural development that are not found in the relatively flat project areas of the Philippines and Thailand. In contrast, fish and forest resources offer significant opportunities for regional development in the former areas, while they are relatively unimportant in the latter. Any potential for mineral development inherent in the physical characteristics of the project areas remains unexploited at this time.

A combination of slope, soils, and rainfall characteristics distinguishes the same two sets of project areas with regard to the potential for increasing agricultural productivity through irrigation and double cropping. In Thailand and the Philippines, this potential is very great and programs are underway to exploit it. In Malaysia and Indonesia, there have been some experiments with irrigated rice cultivation, but suitable land is relatively scarce in the project areas and, therefore, widespread use of these techniques appears unfeasible.

B.2.b. Population characteristics. For reasons undoubtedly related to the physical characteristics and access constraints described above, the same two sets of study areas differ on the dimension of population density. The project

areas in Malaysia and Indonesia have an average of less than ten people per square kilometer. Access to land is not a major constraint on agricultural productivity, and slash-and-burn techniques of cultivation are still in common use. In Thailand and the Philippines, population density in the project areas ranges from 50 to 100 people per square kilometer. This density is not excessive for agricultural development. It is very close to the national norm in Thailand and is well below the national average in the Philippines.

All of the project areas are predominantly rural, with urban populations ranging from 9% (in Thailand) to 14% (in the Philippines). Even this slight variation can be accounted for by differences in the definition of urban population across study areas. It would probably be safe to assume that urban population (living in settlements of over 3,000 people) is constant at about 10% of the population in each study area.

Population growth rates vary from 2.3% in the Buntun Bridge project area in the Philippines to 4.0% in the Phen project area in Thailand. Migration into the study areas has contributed to population growth in the Phen area; in the Khok Si area in Thailand to a lesser extent; in northern Halmahera; and in the Gamu Bridge area in the Philippines. Net out-migration may partly account for the relatively low growth rates in the Buntun Bridge area and in Malaysia. The average rate of natural increase for all the study areas is probably close to 2.5% per year.

The typical population unit in the study area is a household of 6 to 7 people. The average household size is slightly higher in the areas of greater population density and more intensive agriculture, Thailand and the Philippines, and slightly lower in the less densely populated project areas of Malaysia and Indonesia. Villages follow a similar pattern, averaging close to 1,000 population in the Philippines, between 500 and 1,000 people in Thailand and Indonesia, and less than 500 persons in Malaysia.

B.2.c. Economic structures. Agriculture is the major economic activity in all of the study areas. Within this sector, there is considerable variation in the mix of subsistence, cash, and food crops. Rice is the staple food crop in all areas except Indonesia and is the major commercial crop in the Philippines and Thailand. Rubber is the principal commercial crop in Malaysia, and copra plays a similar role in Indonesia. There are secondary cash crops such as kenaf in Thailand, tobacco in the

Philippines, and coffee and cocoa in Malaysia and Indonesia. Crops recently introduced in the project areas include sugar cane (Thailand and the Philippines) and spices (Malaysia and Indonesia).

Of all the project areas, that in the Philippines is perhaps the most heavily dependent on an exchange economy and the cash sales of crops. To varying degrees, subsistence farming plays a more important role in Thailand, Indonesia, and Malaysia. In addition, fish and (in Malaysia) forest products are supplementary income sources. This results in a greater diversity of crops and income-generating activities in these areas and a lesser emphasis on commercial crop cultivation.

Average household income for farmers in the study areas is compared to estimated national averages in Table 6.2. Farmers in the Thailand project areas are the worst off, both in absolute terms and in comparison to farmers in other parts of the country. Those in Malaysia are also relatively poor, while farmers in the project areas of Indonesia and the Philippines are doing quite well in comparison to the rest of their countries.

TABLE 6.2

COMPARISON OF INCOME LEVELS ACROSS PROJECT AREAS
(In U.S. dollars)

	Malaysia	Indonesia	Philippines	Thailand
Estimated average[a] rural household income (1977)	NA	622	792	958
Mean household income in sample[b]	690	870	875	592
GNP/capita (1974)	688	174	360	328
Mean per capita income in sample[b]	110	153	150	93
	16%	88%	42%	28%

[a]Data from latest household income survey, updated to 1977 using an assumed inflation rate of 10% per year.
[b]Excluding nonfarm income and including the market value of domestic consumption.

Malaysia has the highest GNP per capita of the four countries, placing it in the middle ranks of developing nations. Nevertheless, the per capita income of farmers in the project area is quite low. Indonesia has a national productivity rate that qualifies it as one of the least developed countries of the world, yet its study area farmers command a higher per capita income than those of any other project area. The Philippines and Thailand have roughly comparable levels of GNP per capita, just over the international poverty line. Farmers in the Philippines project areas are generating a reasonable share of this productivity, while those in Thailand are farther behind their counterparts in the nonagricultural sectors.

It is interesting to note that while national level estimates of household income and per capita GNP vary widely between countries, the range of variation among the project areas selected for this study is much smaller. Average per capita (farm) income ranges between U.S. $100 and U.S. $150 in all of these remote areas, and these variations can be largely accounted for by differential price structures for major crops. It should be remembered, however, that these estimated income levels do not include the contribution of nonfarm income sources such as salaries, pensions, and private businesses. This omission leads to a slight understatement in the average study area incomes shown.

Table 6.3 shows the distribution of survey respondents by tenure class in each country. Owner-operators predominate in every country but the Philippines, where sharecropping is also a significant pattern.

TABLE 6.3

COMPARISON OF TENURE PATTERNS ACROSS PROJECT AREAS

	Malaysia	Philippines	Indonesia	Thailand
No farm	7%	1%	15%	8%
Landlord only	1%	1%	1%	3%
Owner-operators	83%	45%	74%	85%
Sharecroppers or renters	6%	43%	2%	4%
Mixed tenure	3%	10%	9%	0%

Thailand shows the highest percentage of households having income from farm labor and nonfarm labor. Sales of fish and forest products are important everywhere but in the Philippines. Craft products contribute income to less than 10% of households in each project area. The same is true for all nonfarm income sources except support from children, which is mentioned by 13% of sample households in Malaysia (see Table 6.4).

TABLE 6.4

COMPARISON OF SUPPLEMENTARY INCOME SOURCES ACROSS PROJECT AREAS

	Malaysia	Philippines	Indonesia	Thailand
Farm labor	10%	11%	12%	17%
Fish and forest products	33%	5%	18%	29%
Craft sales	3%	0%	5%	8%
Nonfarm labor	4%	7%	8%	26%
Salary	6%	0%	4%	5%
Pension	2%	0%	3%	2%
Children	13%	0%	2%	8%
Business	5%	0%	2%	5%

The project areas also differ significantly with respect to the number and size of supporting investments that have been made concurrently with the study project in either the public or the private sector. Major public investments have been made in the Gamu Bridge area of the Philippines and in the Phen Road project area in Thailand. These consist mainly of infrastructure (flood control, irrigation, and hydroelectricity) in the Philippines, and of services (Accelerated Rural Development Program) in Thailand.

A large amount of public capital has been invested in meeting the operating costs of the Pioneer Sea Service in Indonesia. However, relatively few port improvements have been undertaken on Halmahera Island. In Malaysia, public investments are smallest, limited to the construction of wharves at district

centers and jetties at villages under the program for Minor Rural Projects, and to the purchase and operation of government boats for decentralized service delivery.

In the private sector, a remarkable response can be detected in the areas opened up by transport investment. These investments create opportunities for cost savings to which some individuals respond by providing transport service at a profit. Thus, there emerges a class of entrepreneurs whose aggregate investment in vehicles, commercial stocks, and processing equipment can be considerable. These mobile transporters and traders receive the initial benefit of user cost savings; indeed, such savings are essential to induce them to provide services in the project area. However, in the absence of a monopolistic structure, the number of individuals seeking to make a profit usually exceeds the number of opportunities. Thus, competition keeps profit to a minimum and encourages the pass-through of cost savings to producers and consumers.

The principal constraint affecting this class of entrepreneurs is access to the necessary capital, credit, knowledge, and information required for successful operation of their businesses under competitive conditions. To the extent that these resources are not present in the study area, or are available only to certain classes of residents, the opportunities for gain are unequally distributed. Financial institutions alone are not a key constraint, as the data show that such businesses spring up even in areas where credit is theoretically unavailable. More important are the informal networks of communication through which opportunities can be perceived and risks can be evaluated so that local resources can be mobilized for supplementary investment.

The development of an entrepreneurial class can be seen in all of the project areas, although it is somewhat more striking in Thailand and in Malaysia. In Indonesia, the development has taken place in the northern part of Halmahera, apparently more in response to improved road and motorboat transport than to any service provided by the Pioneer Sea Fleet; it has not occurred to any appreciable extent in the south, where land transport is essentially unchanged. In the Philippines, existing local businesses that had derived a comparative advantage from isolation are giving way to competition originating outside of the project area but providing more efficient services to area residents.

Finally, price and tax policies play an important part in determining the response of farmers to new opportunities. According to the partial data available, there are no tax structures in the project areas that significantly encourage or

discourage economic development. Conceivably, land reform in the Philippines could increase the cost of producing crops that offer significant economies of scale, but this does not apply to the major crops cultivated in this project area. There are certain limitations on land ownership in Malaysia that could also become a constraint on production.

Price supports for rice encourage its production in the Philippines, where new technologies and credit have also become available to farmers. Rice prices held low in Thailand and Malaysia to benefit urban consumers have resulted in a slower pace of change in these areas. Traditional, low value/volume cash crops such as copra and rubber are giving way to high value/volume tree crops such as pepper, cloves, and nutmeg. Also, kenaf production in Thailand is giving way to tapioca. All these data seem to show that project area farmers are highly responsive to price incentives within the limits of their resources and risk acceptance.

High prices for timber and other forest products, including rattan, firewood, and charcoal, have encouraged deforestation of the areas opened up by transport investments. Timber resources offer a valuable development potential, but they are also closely tied to the ecological balance of an area. Excessive deforestation contributes to problems of erosion, siltation, and lowering of the water table, which can have significant long-range effects on agricultural productivity. This process is already advanced in the Philippines and Thailand, is beginning to have a localized impact in Malaysia, and has yet to be felt in the Indonesia project area. As forest resources decrease, the importance of forest products for regional growth will decline. In addition, as erosion resulting from this process reduces the availability of good topsoils and changes drainage patterns, future agricultural productivity will also be affected.

B.2.d. Social Structures. As noted above, all of the project areas are predominantly rural. Villages designated as administrative centers have grown into small towns having populations of 3,000 to 5,000. These towns are usually tied into the transportation network for reasons of administrative convenience. They also serve an important commercial function as centers for the collection, processing, and distribution of goods and for the provision of services to the rural population.

Some of the study areas have experienced significant in-migration from other rural parts of their countries in response to new agricultural opportunities in the study areas and pressures felt elsewhere. This is particularly true of

Thailand and the Philippines. Northern Halmahera has also had a small amount of in-migration in response to changing opportunities in the commercial sector; a similar phenomenon has taken place in Malaysia. These movements are not significant in terms of numbers but may have important implications for regional growth.

Rural-urban migration in the study areas is not yet of major significance. Since the study areas place relatively few constraints on the expansion of agricultural activities, there is no great labor surplus in these areas. Individual household members may leave the study areas, particularly to seek advanced education, but they are few in number and tend to maintain ties with their community of origin. The out-migration of educated young people may have slightly increased dependency ratios in the project areas, but this is partially compensated for by children residing outside of the project area contributing to the support of households within them.

Some indicators of the social characteristics of communities in the project area are shown in Table 6.5. Thailand has the highest adult literacy rates (defined as having completed four years of basic education) and shows little intergenerational change. The Philippines has slightly lower adult literacy rates but has surpassed Thailand in the education of its rural youth. Indonesia is considerably further behind, and Malaysia has very low literacy among household heads but has made enormous gains in education amoung young people.

TABLE 6.5

COMPARISON OF SOCIAL INDICATORS ACROSS PROJECT AREAS

	Malaysia	Philippines	Indonesia	Thailand
Adult literacy	14%	67%	40%	77%
Male	19%	69%	45%	75%
Female	9%	65%	35%	79%
Youth literacy	61%	87%	60%	72%
Male	67%	85%	63%	73%
Female	53%	89%	57%	71%
Primary and secondary schools/1000 pop.	1.4	2.2	1.6	NA
Health care units per 1000 pop.	0.34	0.47	0.17	NA
Health care personnel per 1000 pop.	0.69	1.81	0.67	0.13
Households with permanent roof	35%	50%	25%	83%
Households with electricity	6%	6%	0.2%	4%
Households with private water supply	19%	50%	62%	3%
Households with radios	45%	70%	14%	75%

Generally, males are more likely than females to have received an adequate basic education, but the gap narrows as the percentage of literate adults increases. Literacy rates reflect quite closely the provision of educational services, as shown by the ratio of schools to population. The Philippines project area has the greatest number of schools and the most diversified opportunities for advanced education. In the other project areas, transportation may be a key constraint to access to secondary and higher education.

The Philippines area is also best served with respect to health care facilities and personnel. In facilities, Malaysia runs a close second, principally because of the travelling dispensary units; without them, its health care patterns would be similar to Indonesia's. Data on facilities are not available for the project areas in Thailand, but the data on health care personnel suggest that these areas are the least well served in terms of social infrastructure.

Housing quality indicators show considerable variation across project areas. Permanent roofs were found in 83% of households interviewed in Thailand and 50% of the Philippines, compared to 35% in Malaysia and 25% in Indonesia. Rural electrification is rare in all project areas and depends on locally owned generators rather than a regional power supply. (This situation will soon change in the Philippines, where a major program will provide abundant hydroelectric power for both domestic and industrial uses.) Private water supply systems are owned by about half of the households in the Philippines and Indonesia study areas, by 20% of households in the Malaysia area (because of government initiatives), and by very few households in the Thailand study areas, where communal wells are the most common source of supply.

The use of literacy rates as indicators of the capacity of a community to absorb information from the outside world is questionable when little printed matter is circulated in the project areas. More important in the dissemination of modern ideas is the radio, a relatively inexpensive consumption item found in households throughout the study areas. It is interesting that the pattern of radio distribution follows that of literacy quite closely. The single exception is in Indonesia, where radio broadcasting is still unable to reach remote parts of Halmahera Island because of the great distances involved. The data indicate that communication flows most freely in Thailand, which is closely followed by the Philippines; Malaysia is in a middle position and Indonesia shows the slowest pace of communications change.

B.3. Comparison of Outcomes

B.3.a. Behavioral Change in the Project Areas. Behavioral change was examined in six different areas: production patterns, marketing patterns, farm enterprise changes, travel and migration, service utilization, and social participation. The findings in each area are briefly reviewed below.

1) Production patterns

In all project areas, production of subsistence crops remained relatively stable over the project periods. Production of subsistence crops that also have commercial value generally increased over the project period. However, major increases in production of food crops are more strongly associated with technological changes (irrigation, use of high-yielding varieties) than they are with transport change *per se*. Only in the case of highly perishable food crops (fruits, fish, and game in Malaysia) can an increase in production be directly attributed to transport change. This effect, however, appears to be both relatively short-lived and small in relation to total production for household consumption.

Production of non-food cash crops has increased more dramatically in the project areas. These crops seem to be of two types: (1) those that have been promoted by complementary government investments or subsidy schemes, such as pepper in Malaysia or sugar cane in the Philippines, and (2) those that have diffused into the project area through a process of communication with neighboring regions, such as cloves and nutmeg in Indonesia, kenaf and tapioca in Thailand, and tobacco in the Philippines. Other cash crops have been promoted by the government but have shown relatively little growth in the study areas. Thus, improved access creates a potential for the development of cash crops, but the realization of this potential depends on price to the farmer, risk, government investment, and other factors.

2) Marketing patterns

Marketing of food crops is done by only a part of all producers in each study area. Where cash crops have become important contributors to household income, the share of producers marketing food crops seems to have declined (e.g., Malaysia and Indonesia). Only major technological innovations such as irrigation and use of high-yielding varieties seem capable of generating a significant surplus that can contribute to increased commercialization of food crops. It is possible that local access improvements combined with urban growth in remote areas encourages the local marketing of perishable food

crops such as fruits and vegetables grown within a feasible transport distance from the urban center. The sale of perishable crops usually represents an increase in marketing rather than production in the project areas.

By definition, cash crops are intended for sale. In those instances where they are produced but not sold, the crop has either failed (for reasons generally unrelated to transport) or it is not mature enough to be harvested (which is the case for many cash crops in the study areas). A third possibility is that actual sales are underreported by the sample respondents. Change in the volume of cash crop sales over the project period closely follows change in the patterns of cultivation, but often with a lag time of five to ten years, reflecting nonproductive growing time.

In all project areas, change in the mode of transport of crops for sale reflects the impact of the study investment. Use of human and animal transport has declined, while use of motorized vehicles has distinctly increased. Bicycles, motorcycles, and various other forms of intermediate transport technology have come into use wherever conditions permit. Although farmers complain that their transport costs are higher now, their behavior reflects a preference for the use of new vehicles over the old ways, which, in most cases, are still available to them. The intangible value of time savings, safety, comfort, and convenience to the farmer explains this behavioral shift.[1]

Another significant change in marketing patterns is in the typical point of sale for farm products. In all the study areas, the access improvement has increased the circulation of traders and middlemen. As a result, the point of sale has generally moved closer to the farm. Increasing competition among crop purchasers encourages the pass-through of cost savings to the farmer. There is also an intangible saving to farmers of time and energy formerly spent on crop transport that now can be devoted to increased production or other pursuits.

It may be that the possibility of selling certain bulk or perishable products at the farmgate encourages marketing or producing them for sale in situations where the farmer would otherwise consider the transport element too onerous or risky. In this way, the zone within which commercial crop production is viewed as feasible by producers is widened by transport

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[1] This preference could be calibrated by examining farmer decisions when faced with choices of cost and each element with its "intangible" value.

improvements, even when farmers do not themselves transport crops for sale. The benefit of transport cost savings is, of course, divided between farmers and middlemen in this case. While farmers could theoretically capture all the benefits by providing their own transport service, in practice this would require of the farmers a level of capital investment, cooperative marketing organization, and financial planning not usually found in remote areas.

3) Farm enterprise changes

Table 6.6 summarizes reported farm enterprise change over the project period as a percent of all households in each study area. There are two distinct patterns of change, one found in Malaysia and Indonesia and the other in the Philippines and Thailand. The former involves a basically subsistence economy shifting into cash crop production, while the latter involves expansion of an existing cash economy through the addition of new technologies and infrastructure.

TABLE 6.6

COMPARISON OF FARM ENTERPRISE CHANGE ACROSS STUDY AREAS

	Malaysia	Philippines	Indonesia	Thailand
Increased cultivation of cash crops	50%	16%	71%	36%
Addition of new cash crops	55%	17%	73%	47%
Increase in livestock	18%	31%	26%	44%
Increase in storage	5%	27%	24%	37%
Increase in irrigation	10%	40%	24%	36%
Increased use of fertilizer on rice	14%	64%	NA	49%
Increased planting of HYV rice	0%	68%	NA	6%

NA = Not available.

The increase in cash cropping is most striking in Indonesia, closely followed by Malaysia; it also occurs to a substantial extent in Thailand, whereas cash crops were dominant in the Philippines before the study period, and little change was possible. It follows that irrigation, fertilizer use, and

planting of high-yielding varieties of rice, the traditional cash crop, are all most strongly marked in the Philippines. These innovations are also found extensively in Thailand (except for use of HYV rice) but are unimportant in Malaysia and virtually unknown (except for irrigation) in Indonesia. Increases in livestock inventories and storage facilities show less wide variations, involving less than half of all households in each study area, but they are typically most common in Thailand, somewhat more common in the Philippines than in Indonesia, and least likely to be found in Malaysia.

The type of farm enterprise change that takes place in a remote area following a transport improvement appears to be conditioned by existing economic and social structures, physical and population constraints, the extent and nature of complementary investments, and price and marketing structures on a national and even international scale. All of these factors are involved in one or more of the project areas. It is difficult within the scope of a comparative analysis limited to the present set of projects to sort out the influence of a single factor in determining the patterns of farm enterprise change and, in the absence of control areas, to determine whether or not these changes might have taken place without the transport improvements under study. All that can be said is that the transport investments have increased the opportunity for goods, services, and ideas to flow more freely within the study areas and between them and the outside world and that very substantial changes in the structure of farming activities can be observed in the project areas as a result.

4) Travel and migration

In all study areas there has been a significant increase in local travel in response to local transport improvements. Medium- and long-distance travel by study area residents appear relatively unchanged, even when the reduction of travel time has been significant. This may be attributable to the fact that although time savings have been achieved, the financial cost of travel increased over the study period, largely because of rises in the price of fuel, which counteracted the decrease in other transport costs. Since the value of the farmer's time is relatively low, even substantial time savings and other intangibles such as greater comfort and convenience will not induce much additional travel over long distances. (This pattern may also be subject to cultural variations with respect to the perceived intrinsic value of making a long-distance trip.)

In all study areas, household heads travel more frequently than other household members to all destinations. The frequency of travel by spouses approaches that of household heads

with respect to local travel, but the ratio declines with increasing distance. Both heads and spouses may be engaged in marketing farm products, with a tendency for men to market bulk cash crops and women to market food crops for local consumption. Travel by other household members is less frequent, more often local, and generally related to service utilization (education, health), off-farm employment, or social participation purposes rather than to the marketing of farm products.

The data on migration do not show any major change in response to transport improvements in the study areas. Three of the areas have experienced significant in-migration over the study period: the Gamu Bridge area in the Philippines, the Phen project area in Thailand, and northern Halmahera. In each case, the response appears to be to a perception of new opportunities in these areas occasioned by major government investments, of which the study projects formed only a part.

Minor movements have been felt in areas such as the Khok Si project area in Thailand and the Malaysia study area, apparently in response to transport investments alone. These movements tend to be of entrepreneurs or commercial farmers who can perceive the advantages offered by improved transport and plan to profit from them. These migrants are few in number but may have a significant impact on the socioeconomic structure of the project area. They may also introduce new crop types, demonstrate new production technologies, and increase socioeconomic linkages between the project area and the outside world.

There is little evidence from this study to support the idea that transport investment may encourage rural-urban migration and thus decrease the productivity of remote areas. Most of the migration encountered in this study involved entire households moving from one rural location to another. To the extent that transport improvements bring new services into the project area, they may ultimately succeed in changing aspirations and/or employment structures in such a way as to encourage substantial out-migration. This effect takes place over a generation or so, however, and cannot be expected to show up significantly in the first ten years following a transport project.

It should be noted that none of the project areas contained important "push" factors such as excessive population density or lack of employment opportunities in the agricultural sector. Access to land was not a major constraint in any of the areas, although sharecropping was a significant pattern in the Philippines largely for historic and sociocultural reasons. It may well be that if important "push" factors were present, transport investment would stimulate significant flows of rural-urban migration. Of course, under these conditions, such migration would not have a negative impact on productivity in the project area.

TABLE 6.7

COMPARISON OF SERVICE UTILIZATION ACROSS PROJECT AREAS

	Malaysia	Philippines	Indonesia	Thailand
Percent of children ever attending school	78%	96%	88%	92%
Percent increase in basic education over study period[1]	3%	-5%	-14%	-28%
Percent increase in advanced education over study period[2]	18%	40%	-15%	11%
Average annual trips per capita for health care	1.2	2.0	2.5	1.9
Percent using health care more now than before	57%	21%	34%	61%
Percent ever visited by agricultural extension	68%	54%	57%	25%
Percent visited by agricultural extension more often now than before	43%	33%	39%	20%
Percent using formal credit now	33%	55%	7%	18%
Percent began borrowing during study period	25%	55%	5%	18%

[1]Completion of four years primary schooling among children aged 10 to 20, as compared to those over 20.

[2]Completion of more than six years of primary schooling among children aged 12 to 20, as compared to those over 20.

5) Service utilization

Service delivery in the study areas generally increased over the project period. This increase is more striking in the Philippines and Malaysia than in Thailand and Indonesia. A major increase in service delivery is often associated with the use of mobile units to reach remote area residents. There has been relatively little government use of public transport facilities to make services more accessible to the rural clientele.

Table 6.7 shows some indicators of service utilization and change over the study period, drawn from the household survey data. A relatively high proportion of children in all project areas has had some exposure to education. The increase in the proportion of children successfully completing a basic education in the last ten years is quite small in Malaysia and is actually negative in all the other project areas. In other words, more children over the age of 20 have completed basic education than those in the 10 to 20 age group in these areas. This means that there has been essentially no change in the utilization of educational services at the primary level over the study period (except for Malaysia, where the change is small), and rural children in all of the project areas experience severe delays in completing a basic education.

It has been suggested that transport investment may play a part in increasing access to opportunities for secondary education. There has been a marked increase over the study period in the share of young people with some secondary education in the project areas of Malaysia and Thailand. In both of these areas, travel to the district center is required to obtain secondary schooling, but travel outside the study area is not.

In contrast, there has been no significant increase in secondary schooling among young people in the Philippines and Indonesia. In the Philippines, such opportunities are often locally available and transportation is not a major constraint. In Indonesia, they are rare and transportation still presents an almost insuperable problem, causing considerable delays in the acquisition of secondary schooling by those who can achieve it. In both these situations, transport investment has, so far, had little impact on the access of project area residents to opportunities for advanced education.

Health care utilization patterns are quite similar across all project areas. The average number of health care visits per capita varies only slightly, from 1.2 per year in Malaysia to 2.5 in Indonesia. Most households make between one and five visits per capita for health care regardless of distance to the point of service delivery, although there is a tendency to make somewhat more frequent use of services that are closer. Health care is generally perceived as curative rather than preventive, and families are reluctant to visit health services except in cases of injury or sickness. However, access to medical care in emergencies is highly valued in remote areas, and transport improvements that increase the margin of safety provide a genuine benefit to rural residents even if they do not often have occasion to use it.

More than half of the sample households in Malaysia and Thailand stated that they are visiting health services more

frequently than before the study projects. In contrast, there has been relatively little change in the Philippines and Indonesia. The pattern appears to be similar to that for secondary education. Where services have become newly available in the villages or district centers, use has increased. Where service delivery patterns have not been significantly changed by the transport investment, service utilization has not changed much either.

The delivery of agricultural extension services varies more widely between project areas. Nearly 70% of sample households in Malaysia, about 55% in the Philippines and Indonesia, but only 25% in Thailand had ever been visited by an extension agent. Correspondingly, the biggest increase in frequency of extension visits is seen in Malaysia, followed by Indonesia and the Philippines, with Thailand showing the least increase in activity during the project period.

It is hard to interpret this finding in light of the fact that the study projects in Thailand were the only ones in which farm-to-market access was significantly changed, the others all being trunk system improvements. On the face of it, this finding seems to imply that the level of activity of extension agents is more closely dependent on their links to the center than on their links to client farms. In fact, however, local access improvements--not included in the study projects--had much to do with increasing the range of extension services in the other project areas. All-weather access for motorized vehicles seems to be the key constraint to effective extension service delivery, although sociocultural factors may also play a part in determining where and when such services are provided.

Participation in formal credit programs or subsidy schemes also varies widely between project areas. In the Philippines over half of all farmers are using institutional credit, whereas the range is from 33% in Malaysia to 18% in Thailand and only 7% in Indonesia. Most, if not all, of this credit activity in the project areas began during the study period. Only in Malaysia, where many farmers participated in rubber schemes more than ten years ago, is there a significant share of households whose involvement with credit institutions antedates the transport improvement. It may be inferred from this finding that, as a general rule, access to major markets is a prior constraint on credit availability, which in turn is a key determinant of change in agricultural production patterns.

6) Social participation

Table 6.8 shows some indicators of levels of social participation in the project areas before and after the transport investment. The Philippines project areas have by far the

highest rates of participation in farm organizations and in agricultural training courses. In Indonesia and Thailand, 20% to 25% of household heads participate in farm organizations, whereas less than 10% do so in Malaysia. Participation by spouses is negligible everywhere but in the Philippines, where it is still well behind that of household heads.

TABLE 6.8

COMPARISON OF SOCIAL PARTICIPATION ACROSS PROJECT AREAS

	Malaysia	Philippines	Indonesia	Thailand
Participation in farm groups				
Head	8%	43%	26%	21%
Spouse	2%	30%	5%	2%
Participation prior to project				
Head	-	a	26%	21%
Spouse	-	a	5%	2%
Attendance at agricultural meetings				
Regular	38%	28%	44%	12%
Occasional	8%	24%	12%	10%
Participation in training courses				
Now	23%	37%	6%	9%
Prior to project	29%	38%	4%	3%

[a]Less than 1%.

Practically all of the households participating in farm organizations in the study areas of Malaysia and the Philippines began doing so in the early part of the study period, whereas all of those participating in Thailand and Indonesia did so before the study project. In fact, in every project area the great majority of memberships date from five to ten years ago, regardless of the date of the transport investment. This fact suggests that participation is attributable not to transport change but to a wave of farm organization activity that seems to have taken place all over Southeast Asia during the period from 1967 to 1972.

Attendance at agricultural meetings varies from slightly under 50% of households in Malaysia to slightly over 50% in the Philippines and Indonesia. The exception is Thailand, which has less than 25% attendance. The difference is largely accounted for by differences in the percentage of sample communities where such meetings are held. However, the pattern in

Malaysia and Indonesia is predominantly one of regular attendance when meetings are available, whereas in the more stratified societies of Thailand and the Philippines, there is a greater share of households that attend irregularly or not at all. The organization of community meetings presents the same paradox as agricultural extension service delivery, in that Thailand, the only country where the study project is a village access improvement, has the lowest rate of community meetings and consequently the lowest share of attendance.

The Philippines has the highest rate of participation in agricultural training courses; however, this rate did not change much over the study period. Malaysia, too, has a relatively high rate and a history of participation that antedates the study project. In contrast, Indonesia and Thailand both have low rates now but showed a substantial increase over the period prior to the transport improvements in their areas. Since the project period is ten years in the Philippines and Malaysia but only five years in Indonesia and Thailand, the differences between these two groups are even more striking.

These findings suggest that, in general, participation in formal organizations is more a function of social structures in the project areas than it is of transport constraints. Local access improvements may increase the opportunities for social participation, but other factors determine the extent to which this increased potential is realized. Like service utilization, social participation seems to be an intervening variable between transport change and productivity change in remote areas.

B.3.b. Impacts on income distribution. This section compares the social structures and income distribution patterns of the project areas in the four countries. Changes in the socioeconomic structure of each area over the project period are compared and the incidence of behavioral change by socioeconomic group is analyzed to determine transport investment impacts on income distribution in remote areas.

1) Comparison of social structures and income distribution patterns

Table 6.9 shows the percentage of each sample in each socioeconomic group and the average household income and per capita income found for each group in each area, converted to U.S. dollars for comparison. In each area, the categories of landless laborers (farm and nonfarm) and other nonfarm households made up a negligible share of the sample. These groups are present in small numbers in each project area, but differences in sampling techniques could easily account for the observed variations between areas in group size. Numbers for which income data were reported are generally

TABLE 6.9

COMPARISON OF SOCIOECONOMIC GROUPS
ACROSS PROJECT AREAS
(Income in U.S. dollars)

	Malaysia	Philippines	Indonesia	Thailand
Subsistence farmers				
% of sample	31%	56%	20%	38%
Household income	344	655	695	415
Per capita income	65	103	123	64
Low income farmers				
% of sample	8%	2%	16%	2%
Household income	173	165	182	180
Per capita income	28	27	36	34
High income farmers				
% of sample	26%	15%	31%	15%
Household income	1118	1750	1232	1270
Per capita income	202	307	217	202
Food farmers with non-farm income				
% of sample	9%	19%	6%	28%
Household income	560	523	600	476
Per capita income	100	89	99	73
Cash crop farmers with nonfarm income				
% of sample	14%	8%	11%	11%
Household income	1320	1728	1307	789
Per capita income	161	334	215	126
Farm laborers				
% of sample	4%	0%	5%	2%
Household income	495	--	827	186
Per capita income	109	--	161	37
Nonfarm laborers				
% of sample	4%	0%	8%	2%
Household income	542	--	NA	480
Per capita income	68	--	NA	76
Other nonfarm				
% of sample (Income data unavailable)	4%	0%	3%	2%
Total sample				
Household income	690	875	870	592
Per capita income	110	150	153	93

too small to assure reliable estimates of income levels for these groups.

Although the distribution of the sample household among socioeconomic groups varies considerably between project areas, the income levels corresponding to each group are surprisingly similar, especially on the low end of the scale. Low-income cash cropping households, defined as those whose income was less than U.S. $300, have an average household income varying from U.S. $165 in the Philippines to U.S. $182 in Indonesia. This corresponds to an extremely low per capita income ranging from U.S. $25 to U.S. $35. This group constitutes only 2% of the samples in the Philippines and Thailand, 8% in Malaysia and 16% in Indonesia.

Subsistence farmers are the largest single group in every country but Indonesia. In the Philippines, they make up over half of the entire sample. Their income levels are below the mean in all samples but vary considerably between project areas. Those in Malaysia and the Philippines are further below the mean than are those in Indonesia and Thailand. On a per capita basis, subsistence farm income is approximately equal at U.S. $65 in Malaysia and Thailand and is comparable at just over U.S. $100 in the Philippines and Indonesia.

High-income cash cropping farmers have roughly comparable income levels at about U.S. $1,200 per household, or a little over U.S. $200 per capita, in all areas except the Philippines, where the household income level for this group is $1,750 and the per capita income is over U.S. $300. This group is relatively small in the Philippines and Thailand, larger in Malaysia, and largest of all in Indonesia.

Subsistence farmers with non-farm income have farm income levels varying from about U.S. $475 in Thailand to U.S. $600 in Indonesia. In two countries (Malaysia and Thailand) this class has more farm income than subsistence farmers with no non-farm income source; in the other two, they have less farm income (although their total income is probably higher). In all cases this group, too, is below the sample mean. Per capita farm income for this group is fairly consistent at U.S. $75 to U.S. $100. The group represents a relatively small share of the sample in Malaysia and Indonesia, a larger share in the Phillipines, and a major share (second largest group, after subsistence farmers) in Thailand.

Cash cropping farmers with non-farm income form a relatively constant share of each sample (8% to 15%).

Their farm incomes are highest of all groups in Malaysia and Indonesia, about the same as that of high-income farmers in the Philippines, and well below that of high-income farmers in Thailand. In every case, their income is well above the sample mean. Absolute farm income levels for this group are highest in the Philippines, about the same (U.S. $1,300) in Malaysia and Indonesia, and significantly lower (just under U.S. $800) in Thailand. Per capita incomes are correspondingly highest in the Philippines (about U.S. $350) and lowest in Thailand (about U.S. $125)

In assessing the income stratification of each project area, it becomes apparent that the two project areas with the highest average incomes, Indonesia and the Philippines, exhibit very different characteristics. In Indonesia, the proportion of farmers in both the highest and lowest income groups is high in relation to the proportion of farmers in the middle groups. However, income levels in the middle groups as well have been raised by the overall prosperity of the project area. In the Philippines, very few farm households are found in the lowest category and relatively few are in the two high income categories compared to the large majority in the middle. The difference between these two high income areas seems to reflect a difference in emphasis on subsistence versus cash crops. The cash crop economy of Indonesia is much more highly stratified in terms of income distribution.

Among the relatively less well-off areas of Malaysia and Thailand, Malaysia exhibits the more stratified pattern. The differences, however, are not so marked. This pattern again reflects the relative emphasis on subsistence versus cash crops, with the cash crop economy being more sharply stratified.

The range of income variation between groups is least in Thailand and greatest in the Philippines, with Malaysia and Indonesia occupying a middle range. Nonfarm income is a key determinant of farm income levels in Malaysia, of cash cropping income levels in Thailand. In the other situations there seems to be some trade-off between farm and nonfarm income; that is, households with nonfarm income have slightly lower farm income levels than corresponding households with no other income source.

The general picture seems to be that as a region begins to experience economic growth, income gaps widen between different groups in both absolute and relative terms. The degree to which this occurs, or conversely, the degree to which the economic benefits of growth "trickle down" to

lower-income households, is related to the dependence of this growth on the commercial production of cash crops, which cannot be consumed as food. All other things being equal, then, a focus on increasing the production and commercialization of food crops will have more equitable income effects and will generally enhance the quality of life in remote areas more than a focus on increasing the production and marketing of cash crops.

The data suggest that under certain conditions households with nonfarm income may have access to information and other key inputs that enable them to increase the productivity of their farm enterprises in comparison to those who do not have such communications links. However, this effect is by no means universal. It occurs for both subsistence farmers and cash cropping farmers in Malaysia, for subsistence farmers in Thailand, for cash croppers in Indonesia, and not at all for farmers in the Philippines. Given the crop mixes found in each project area, one is led to suspect that in fact this effect is everywhere related to cash crop cultivation, even among groups where such cultivation does not account for more than half of farm income.

Finally, it appears that in the low-income groups for each project area, the rock-bottom level of living below which survival is not possible has been identified as a productivity level of U.S. $25 to U.S. $35 per capita per year. As the wealth of a region increases, the level of living rises and income groups begin to differentiate according to crops cultivated, participation in the cash economy, and participation in the nonfarm sector. Some households remain at the bottom, but most move upward in an uneven rhythm determined by structural social and economic constraints. Physical and population factors place limits on overall regional growth potential but have relatively little to do with the patterns of income distribution with a region.

It is interesting to note that patterns of land tenure apparently have little to do with social stratification by income groups. The Philippines, the only country with a significant share of farm households who are not owner-operators, has both the highest average income level and the largest share of farmers in the middle-income groups. It is also the least diversified economy in terms of the number of crops cultivated. It may be that tenure patterns in the Philippines, with the associated duality of obligations between tenant and landlord, give small farmers there access to information, inputs, and informal credit arrangements that enable them

to produce at a level that cannot be reached by small farmers elsewhere. An alternative explanation is the very high level of investment in agricultural support services that has been made by the Philippine Government, possibly overriding any negative effects of existing tenure patterns.

2) Changes in socioeconomic structure over the project period

The principal changes that have taken place in the project areas over the last five to ten years are the introduction of new cash crops and new techniques for producing traditional crops, and the development of a more commercial agricultural economy. Low-income farmers are those who have participated least in this development. High-income farmers are most likely to have participated; some, at least, undoubtedly moved out of the subsistence sector during the project period. Subsistence farmers improved their income levels through the adoption of cash crops, but did not change their fundamentally conservative orientation over the project period. (The data collected in this study are insufficient to determine whether or not the increase in productivity by subsistence farmers has actually kept pace with the increase in other sectors as reflected in the prices of consumer goods.)

Relatively few households have changed their patterns of participation in the nonfarm sector over the project period. Generally, there was a slight increase in the number of households with nonfarm income sources over the project period in each study area, associated with the increase in commercial and government activity following the transport improvement. The tendency in many areas to restrict access to nonfarm employment opportunities according to ascriptive characteristics effectively limits the distributive impact of this change, which is small in any case. In a few areas where high returns can be obtained in the agricultural sector, there are cases of high-income farmers who shifted out of nonfarm employment over the project period.

Tenure changes are also relatively small and fall well within the ranges that might be expected as a result of life cycle changes over the project period. In some cases, migration into the project area has made it possible for farmers to become owner-operators or to increase the size of their holdings over what they might have been in their previous location. There is no evidence to support the hypotheses that land may be alienated from project area residents as a result of transport

sector change or that economic advantage accruing to a few may force former landholders into a renter or tenant status.

Renting has increased slightly in Malaysia and the Philippines, chiefly as a means of bringing formerly unused land into production. Most renters have their own farms or gardens for meeting subsistence needs but find it feasible to rent additional land for the production of high-value cash crops. A few are forced to rent land because of legal restrictions on land ownership, regardless of economic status.

Sharecropping persists as a pattern with rich social overtones in the Philippines. In Thailand, sharecropping is rare, the more usual pattern being daily wage labor on large farms. In Indonesia and Malaysia, sharecropping is really a form of profit-sharing in place of wage labor, as the sharecropper simply collects, processes, and markets a permanent tree crop. To the extent that new crops provide a higher return on the farmer's investment of time and effort, it can be expected that this pattern will decline in the future.

In sum, there was relatively little change in the socioeconomic structure of these remote areas over the project period. Involvement of producers in the cash economy has distinctly increased, and specialization of economic functions has led to somewhat greater social differentiation. Income gaps between the richest and the poorest have undoubtedly widened as a result of increased prosperity, as well as a more complex social organization involving an emerging nonfarm sector. However, social mobility between groups remains a relatively rare phenomenon in comparison to the changes brought about by the arrival of commercial and administrative households in the project areas.

3) Incidence of behavioral change by socioeconomic group

Changes in area cultivated occur consistently across all farming groups, although cash cropping farmers are generally more responsive to current trends than are subsistence farmers. In Malaysia, there was a general pattern of expansion over the project period, consistent with the addition of new crops. In Indonesia, on the other hand, cultivated area has declined as the extensive pattern of copra production has given way to more intensive tree crops and, in some areas, irrigated rice production. In the Philippines, there has apparently been no change at all

in area cultivated. In Thailand, as in Malaysia, there has been a general expansion of farming activity; in addition, there is a relatively high number of new farms because of in-migration.

The introduction of new agricultural techniques, in contrast, shows significant variation by socioeconomic group, particularly when it involves a cash outlay by the farmer. Fertilizer use seems to be especially responsive to income levels. High-income farmers and cash croppers with nonfarm income are generally most likely to make use of fertilizer, while subsistence farmers are less likely to do so and low-income farmers almost never do. Farmers with nonfarm income usually lead the way in fertilizer use, but only those who place a greater emphasis on cash crops are likely to continue this use for a prolonged period.

Use of high-yielding varieties of rice and maize is widespread only in the Philippines, where 91% of all farmers are using HYV rice and 18% are using HYV maize. Participation is quite consistent across socioeconomic groups for rice. In maize, farmers with nonfarm income show a distinctly higher rate of participation in HYV planting (nearly 30%) followed by subsistence farmers (15%) and by cash cropping farmers without outside income sources (10%). These data again suggest that nonfarm income is closely related to innovative behavior and risk-taking among farmers and that successful innovations will eventually diffuse throughout the agricultural sector regardless of income constraints.

Only 9% of farmers in the Thailand project area use HYV rice and none use HYV maize, although both crops are common in the project area. Again, farmers with nonfarm income have led the way in experimenting with HYV rice. However, the new technology has not diffused as rapidly in this project area. This discrepancy may be explained by the difference in the level of extension effort being made in the two areas and its success in reaching the small or subsistence farmer.

In Indonesia, high-yielding varieties of coconut are planted by 37% of all farmers. Participation here is highest among the high-income groups, with cash cropping farmers with nonfarm income playing a leading role. Subsistence farmers (with and without nonfarm income) are now following suit; low-income farmers participate the least. Rice and maize are produced by only 27% of all farmers, and no use of high-yielding varieties is reported.

In Malaysia, 38% of farm households cultivate HYV rubber and 13% plant irrigated rice. Participation in HYV rubber planting is quite similar among all groups except low-income farmers, who lag slightly behind. Most of the HYV rubber in the project area was planted prior to the transport improvement. Farmers with nonfarm income are distinctly more likely to have planted irrigated rice, followed by high-income farmers; the subsistence sector exhibits relatively low participation.

The patterns of HYV rubber in Malaysia and HYV coconuts in Indonesia appear to be very similar, allowing for the more recent plantings in Indonesia. Participation has diffused downward through the socioeconomic groups but has stabilized at less than half of all farm households because of a shift in interest to higher-value cash crops. The extent to which irrigation and use of high-yielding varieties of rice and maize can be expected to diffuse in these project areas is sharply limited by soils and slope constraints as well as by the lack, so far, of impressive demonstration effects.

Finally, access to extension services and to credit have been identified by some as key factors in determining income impacts. To the extent that these services are unevenly distributed over socioeconomic groups, they constitute a constraint on the equitable distribution of the benefits of access change. Table 6.10 shows for each project area the percentage of households in each farming group that received at least one visit from the agricultural extension service during the past year and the percentage of participants in credit or subsidy schemes.

Generally speaking, the variation between study areas is more important than the variation between socioeconomic groups within study areas. Malaysia and the Philippines have relatively high rates of farmer access to both extension services and credit programs. Indonesia has an effective extension service but very little institutional credit, while a relatively small share of farmers in Thailand have access to both.

High-income farmers are consistently among those who most frequently benefit from extension services. Subsistence farmers with non-farm income have even higher participation rates in Indonesia and Thailand but lower rates (though still above the sample mean) in Malaysia, and relatively the least well served in the Philippines. Low income farmers are comparatively well served by extension everywhere but in Thailand. Subsistence farmer service is generally below the norm, and perhaps surprisingly, cash crop farmers with non-farm income are also relatively less likely to receive extension services.

TABLE 6.10

COMPARISON OF ACCESS TO SERVICES BY FARMING GROUPS ACROSS PROJECT AREAS

	Malaysia	Philippines	Indonesia	Thailand
Extension				
Subsistence	55%	48%	54%	22%
Low income	73%	80%	56%	20%
High income	82%	67%	59%	26%
Subsistence/nonfarm	73%	44%	61%	30%
Cash crop/nonfarm	61%	50%	55%	18%
Sample mean	68%	54%	57%	25%
Credit				
Subsistence	39%	46%	7%	12%
Low income	0%	60%	9%	0%
High income	33%	80%	8%	24%
Subsistence/nonfarm	27%	47%	0%	18%
Cash crop/nonfarm	42%	73%	7%	26%
Sample mean	33%	55%	8%	18%

The picture with respect to credit is more consistent across project areas. Cash croppers with nonfarm income are by far the most likely to receive credit or to participate in subsidy programs (except in Indonesia, where the numbers using credit are too small to make the differences between them statistically significant). High-income farmers have an average participation rate in Malaysia and Indonesia but a considerably greater than average rate in the Philippines and Thailand. Low-income farmers do not participate in Malaysia or Thailand but have a high participation rate (based on a small number of cases) in the Philippines and Indonesia. Subsistence farmers, with or without nonfarm income, are below the sample mean in most cases. It would appear that cash cropping is the principal factor affecting access to credit or subsidy schemes in all project areas.

B.3.c. Impacts on the Quality of Life. In addition to impacts on regional growth reflected in changing income levels and patterns of income distribution, transport investments bring about a number of behavioral changes that have a real but intangible impact on the quality of life in remote areas. This section summarizes the effects of changes in travel

patterns, service delivery, contact, and communications on the rural quality of life as perceived by remote area residents.

Significant increases in travel are found in study areas with local transport improvements, whether or not these form part of the study project. This increase in personal travel cannot be accounted for simply by increased marketing activity, since generally the point of sale for crops has moved closer to the farm over the project period. People are traveling for other reasons: to spend newly earned cash for consumer goods, to visit friends and relatives in other communities, to make use of newly available services, and simply to see something of the world beyond the village.

A high proportion of respondents in all study areas felt that their lives had been personally affected by improved transport over the study period, although far fewer would attribute this change directly to the study project. Most of these respondents felt that the change was, on balance, beneficial.

Changes in transport costs were important to project area residents. In Malaysia and in Thailand more respondents felt that transport costs had declined than felt that they had risen over the project period. In Indonesia and the Philippines, however, the reverse was true. The perceived increase in transport costs is more than offset by the increase in comfort, convenience, and safety of personal travel, which was cited as a benefit by more than half of all respondents in all project areas except Indonesia.

Some contributions of transport change to the quality of life in the project areas were unique to specific situations. In Malaysia and, to a lesser extent, in Thailand, access to services in emergencies was viewed as a benefit of the study projects. In all countries except Malaysia, but most strikingly in Indonesia, respondents felt that transport change made it easier for them to obtain necessities and provided a wider choice of consumer goods in the market. Finally, the effect of transport change in facilitating the marketing of farm products was most important in Thailand, but it was also mentioned by respondents in the Philippines and Indonesia.

Attitudes concerning change in the quality of life over the project period were most positive in Thailand and Malaysia, where over half of the respondents felt that life in the project area had improved over the study period. Slightly under half felt this way in the Philippines and less than one-fourth shared this view in Indonesia, despite the fact that these two

areas currently have the highest average incomes. In the areas where life is getting better, a relatively high proportion of respondents also feels that life is changing for the worse, whereas the areas experiencing little improvement also report little deterioration, and a larger share of respondents sees no net change over the study period.

The outstanding factors affecting perceptions of changes in the quality of life are economic. Higher income and higher prices for farm products are the principal reasons given for improvement in the quality of life in both Malaysia and Thailand. Other major factors in Malaysia are more government support and improved transport, while in Thailand they include increased job opportunities and improved transport. Those who feel that life has gotten worse cite chiefly higher prices for consumer goods, with an additional mention in Thailand of recent drought conditions and in Malaysia of declining natural resources.

Two other dimensions may be discerned in the responses to questions concerning changes in the quality of life. The next most important after economic changes seems to be family concerns, so that life has gotten better or worse according to whether a respondent feels his family situation has improved or deteriorated. These life cycle changes are relatively independent of transport change as perceived by respondents. A third, less important dimension might be called access to services, including more opportunity for schooling, improved rural housing, better medical service, and general perceptions of government interest in the welfare of remote area residents. Most respondents did not tie perceptions of change in the service dimension to their perceptions of transport change, although the two are in fact often related.

In summary, transport sector change is one of a set of primarily economic factors contributing to change in the quality of life in remote areas. Changes in transport costs and associated changes in prices for both rural products and consumer goods are important elements in perceptions of rural welfare. Increases in the comfort, convenience, and safety of travel provide major benefits to rural residents, however, even when costs are increased. The value of these benefits can be inferred from observed changes in travel behavior.

Indirectly, transport change affects the quality of life by facilitating the provision and utilization of services, by increasing employment opportunities, and by encouraging contact and communication among groups. It may also have a negative effect insofar as it contributes to the decline of natural resources. To the extent that transport sector change

...uces growth in remote areas, it helps to destabilize existing social arrangements and creates conditions under which some households will be relatively better off and others worse off than before. So far, however, the magnitude of this effect has been small in the project areas considered for this study.

C. ASSESSMENT OF THE MODEL AND METHODOLOGY

In this first phase of Project RR-2, a preliminary attempt has been made to identify the availability of data and to develop measurement methods and instruments in order to test the relative strength or weakness of linkages postulated in our theoretical model of transport investment impacts on income distribution, quality of life, and regional growth in remote areas. Data were collected in seven project areas in four Southeast Asian countries concerning four different types of transport investments. Over 1,200 household interviews were conducted for this study, as well as numerous interviews with village officials, administrators, transporters, shopkeepers, and entrepreneurs. This section presents the findings of the first phase of the study in terms of an assessment of the model and the methodology used to test it and indicates what appear to be the most promising avenues for future research in this area.

C.1. Assessement of the Model

The theoretical model developed for this study is described briefly in Chapter 1 and more fully in the Inception Report submitted to SEATAC in June 1977. It is presented in graphic form in Figure 1 (page 1-17 of this volume). Basically, this model considers as inputs the transport sector investment, other government investments, and private sector investments in a remote area. These investments bring about a sequence of cost changes that, it is hypothesized, will induce behavioral changes in a wide range of activities. These behavioral changes result in changing income levels, income distribution patterns, and quality of life in the project areas. All of these factors then contribute to change in the regional growth potential.

In order to make a quantitative assessment of the model, it would be necessary to have detailed data on every element, using comparable measures across project areas, for points in time both prior and subsequent to the study project. In addition, data on control areas having similar characteristics but without a transport investment would be highly desirable. Furthermore, a sufficiently large number of cases should be examined to assure a reasonable probability of statistically significant findings among the results.

None of these conditions was met in this initial phase of the study. Only scattered data were available on the project areas selected for study. Few comparable measures could be found, and there was no standard time frame for these measurements. Since all of the study areas were genuinely remote, virtually no data could be found on conditions prior to the transport investment. None of the projects selected for this study by the participating governments had been the subject of a feasibility study prior to investment.

It soon became apparent that most of the data to be used in the analysis would have to be collected through field work by the Local Study Teams, with the Consultants' assistance. An attempt would have to be made to reconstruct conditions in the study areas prior to the transport investment through respondent recall. A general program for field work and a set of instruments for use in each country were cooperatively developed by the Local Study Teams and Consultants in a workshop at SEATAC headquarters. Severe resource constraints made it necessary to eliminate some projects proposed for study and completely precluded the analysis of control areas.

The field work program was generally highly successful, thanks to the excellent cooperation and coordination provided by host governments and Local Study Team members. The result is a data base that is immensely rich compared with existing data, but still lacking when measured against the data requirements for comprehensive evaluation of the theoretical model. A mass of information has been obtained concerning change in the transport, agricultural, commercial, industrial, and administrative sectors in these remote areas, as well as in the socioeconomic characteristics and behavior of the project area population. Even with this wealth of data, the relatively small number of projects and the wide variation of situational factors make it difficult to sort out the effects of transport change and to distinguish them from other factors at work in the same situations.

One of the major problems encountered in the beginning of this study was establishing comparable definitions of a project area, an impact zone, and a transport investment. The first two were resolved at the workshop, where a set of criteria was proposed, approved, and applied in the study areas. The third was conceptually solved at the workshop by introducing the notion of "access change," but an operational definition remained to be developed during the data analysis.

It was decided at the workshop that certain linkages postulated in the model could not be tested in this first phase, because of either the difficulty of obtaining needed data or a lack of variation among projects. The model as modified for Phase I is presented in Figure 3 (page 1-19 of this volume). Short-term impacts on employment and on the natural environment, generated traffic, service provider perceptions of costs of transport and communication, service outcomes, and information flow were all formally excluded from the model at this stage. Thus, the data collection program did not systematically seek information in these areas. Nevertheless, opportunities sometimes arose in the field for such information to be obtained through observation or informal interviews. Although these data are qualitative and unsystematic, they may suggest some ways of pursuing these linkages further in a more advanced phase of the study.

In establishing an operational definition of access change that could be plausibly linked to behavioral changes in the project area, it became necessary to develop separate measures of market access change, village access change, and household access change. Some study projects affected only market access, while village access change occurred at the same time. Others changed village access while leaving market access relatively unaffected, and still others brought about changes in both areas. The total accessibility impact of the study projects and associated government and private sector investments was thus made up of different components in each case.

The use of access change instead of transport costs as a measure of transport investment impact for the study project is significant because in virtually every case the study projects led to an increase in motorized vehicle transport, which replaced nonmotorized transport (canoes, sailboats, oxcarts, and so on). The new services cost more in cash but reduced travel times and significantly increased comfort, convenience, and safety. The use of accessibility indices based on the inverse of travel time reflects the positive changes but does not reflect the increase in travel costs, which reduces the potential response to the accessibility change (although in some cases the use of larger vehicles cut costs to the shipper per ton shipped).

In some cases the motorized travel resulted in reduced costs for travellers (e.g., in the middle of rapids on the Rajang River). In other cases, traditional means of transport still successfully compete with the new motorized transport, usually when smaller motorized craft were traditionally available (e.g., small boats travelling to

Ternate from the west coast of Halmahera Island and motor launches on the Rajang). In these cases, people with little cash income and people moving goods with a low value-to-volume ratio have a preference for the traditional transport means.

The relation of transport costs to transport prices is clearly a function of competition. In three out of four project areas, new transporters entering the newly opened areas charged relatively high prices for transport. However, as more transporters entered the area, these prices were cut until a stable price was established on which the transporters could make enough profit without being too attractive to other potential transporters looking for opportunities. This was clearly the case in Malaysia when passenger prices decreased as competition increased in the early stages of the introduction of the express service.

The pass-through of transport savings by traders and shopkeepers to local producers and consumers is less directly traceable. However, in Malaysia and the Philippines there were strong indications that a significant share was being passed through, mainly because of competition between traders and shopkeepers. The producer prices for export crops, fish, and game in Malaysia, for example, closely followed changes in export prices, and interviews with traders revealed that if they raised their prices, they would lose sales to their competition, even in the upstream areas. In the Philippines the competition from outside traders was so strong that a local rice mill had to close because its buyers could not compete on price. This strongly indicates a significant pass-through of the savings achieved by lower transport costs incurred by the outside buyers. In Thailand and Indonesia the relationship is not as clear, but the presence of transporter competition is a positive indication.

Change in production and marketing patterns was measured in considerable detail in each area through a household survey. Little attempt was made, however, to collect data linking this change to price changes or other direct consequences of the transport investment. Before such a study could be planned, it was necessary to know what behavioral changes had actually occurred in the project areas. The Consultants' interviews now provide a basis for hypothesizing the nature of the decision-making processes that result in behavioral change and suggest the key factors that should be included in any subsequent study of this linkage.

A more cursory study of consumption patterns, travel patterns, migration service utilization, and social participation was made through the household survey. The survey also provided the data needed to stratify the sample by

socioeconomic group and by access group. An analysis of the distribution of behavioral change across these groups was used to assess the linkages between access change and behavioral change on the one hand, and between behavioral change and change in income distribution and the quality of life on the other hand.

Generally speaking, the links between access change and behavioral change were found to be weak. The Consultants' interpretation of this finding is that transport change creates an opportunity for behavioral change but the probability of the change taking place depends on other factors. Further analysis of the data would permit the identification of certain determining factors, although others are inadequately documented for this purpose.

The relation between access change and production change was examined in some detail. Access change appears to make a little difference in the production patterns of subsistence food crops. It does seem to encourage the production of cash crops, in two ways: (1) through direct reduction of transport costs, making marketing more feasible for the farmer, and (2) through increased contact and communication, providing information about new crops, new production techniques, and (crucially) price changes

Access change can increase the commercial production of food crops over a subsistence level. For this gain to occur, however, a wide range of support services seems to be required. Farmers in remote areas are understandably concerned about assuring their own food supply first. They must see a reasonable return on their investment of land and labor in order to produce a surplus that can be commercialized. The support services required may include physical infrastructure, extension services, provision of inputs and/or credit programs to reduce capital investment constraints, storage and/or marketing systems, and price supports for food crops. The appropriate mix of support services in a particular situation should be determined by the crop type and production technology to be encouraged and by the physical and population characteristics of the area.

The relationship between access change and marketing behavior seems to depend somewhat on the nature of the access change. Increasing market access to the outside world encourages middlemen to come into the study areas, thus increasing the volume of sales in market centers. It is often followed by improvements in local transport that bring buyers closer to the farms. A project designed to

improve farm-to-market access does not necessarily attract new buyers, but it increases the circulation of existing ones and thus brings more farmers into the cash economy. Generally, farmers in remote areas do not have the capital or the organizational ability to capture, as a class, the benefits of transport cost savings (although individual farmers may well become entrepreneurs in the transport sector).

Personal travel definitely increases in remote areas as a result of access change. The major change, however, is in local travel within the study area. Market access improvements remove constraints and provide incentives that encourage the growth of local transport services. With such improvements, it becomes possible to import vehicles, fuel, and spare parts; market towns become designated administrative centers and centers for service delivery. Culturally, remote areas show an unfulfilled demand for travel, which assures rapid growth and high returns on transport investments. All of these factors encourage the growth of a local transport sector and increase the feasibility of local transport improvements.

The data do not show a significant linkage between access change and migration patterns. To the extent that transport investment "opens up" a remote area, there seems to be a net movement into that area. The nature and magnitude of the movement depends on "push" factors (population, ethnic, and political pressures) elsewhere in the country and on "pull" factors (other government investments, opportunities for commercial gain) in the project area. Out-migration from the study areas is of minor magnitude in the decade following a transport investment, although it may become significant in succeeding generations. This finding, however, may not apply to remote areas with extremely high population densities.

Market access change is clearly linked to increased service provision in the market centers of remote areas. Local access improvements may facilitate the delivery of services in rural areas, but this seems to depend on government policies and constraints concerning the provision of vehicles and fuel and on the decentralization of service management structures. Local access change provides an opportunity for increased use of services located in market centers, but whether or not this change takes place depends primarily on perceived need for services. Market access change increases the opportunity for specialized services such as hospital treatment, secondary education, or agricultural training

courses. In practice, this change affects a relatively small proportion of the population in remote areas, but it has a comparatively high impact on the quality of life and regional growth potential.

The data do not permit a detailed analysis of the relationship between access change and communications change. Some communications change certainly took place over the study period in each area. Literacy rates rose in those areas where they were not already high. Radios are widely diffused in the project areas. The volume of contacts and communication with traders and government officials certainly increased. More detailed study needs to be made, however, in order to distinguish those communications changes that resulted from access improvements from those that would have occurred even without a transport investment.

The analysis of the distribution of behavioral change by socioeconomic groups and by access groups was cut short by a lack of funds and time constraints. Enough data were developed to describe the characteristics of these groups in each study area and changes in the composition of the study area population over time. The distribution of production and farm enterprise changes was examined in order to assess income distribution impacts.

It was found that cultivation of new cash crops, the key to income changes, is fairly evenly distributed across socio-economic groups. Cultivation of subsistence crops is also common to all groups, though it may be declining among high-income cash cropping farmers. Subsistence crops are in any case non-responsive to access change and contribute relatively little to total household income.

Increased production and marketing of food crops seem to depend on inputs such as irrigation, fertilizer, high-yielding varieties of seeds, and credit and extension services. To the extent that access to these inputs is unequally distributed among socioeconomic groups, the production response is also uneven. Fertilizer, pesticides, and seeds require a cash outlay and thus are particularly sensitive to income levels. Irrigation is most affected by access constraints. Participation in extension, service, and credit programs varies with income levels and emphasis on cash crops but is also considerably affected by access constraints.

To summarize, the study projects have not had a major impact, either positive or negative, on income distribution patterns in the project areas. Income levels generally have risen, and as a result, the range of income levels has widened. In areas where the income increase is heavily dependent on export crops, there may be a tendency toward greater income stratification, whereas in areas where the increase is largely from commercial food crop production, there may be a tendency toward greater income equity. It would be difficult, however, to attribute these tendencies to characteristics of the transport improvement.

Project impacts on the quality of life are generally viewed as positive. To the extent that transport costs are reduced, prices of farm products are raised, or prices of consumer goods are reduced, farmers perceive a significant economic benefit. Greater comfort, convenience, and safety in travel are also highly valued, often overriding increases in transport costs in determining the behavior of study area residents. Access to services is viewed as a passive benefit that becomes important only when the need for such services is felt.

Negative impacts perceived by project area residents are minor in comparison. Motorized vehicles present new hazards with which residents must learn to cope. Land taking for construction of transport facilities may become an issue in areas where land pressures are beginning to be felt. Environmental degradation, including dust, erosion, and removal of vegetation, becomes a serious concern only when it threatens to have economic consequences for project area residents. Secondary environmental impacts, such as induced depletion of natural resources, are important constraints on regional growth potential but are not readily linked to transport change by project area residents.

Regional growth potential is a combination of all these things. Responses, both direct and indirect, to transport investments were observed, as well as to complementary investments in irrigation works and large-scale agro-processing plants. A rapid expansion in trading and in rural village shops seems to be linked to increased accessibility, and certainly increased marketing of crops takes place where the price conditions are favorable to local producers. Finally, encouragement is given to an entrepreneurial group of transporters and traders who capitalize on the economic opportunities and, through their competition, increase income to local producers.

C.2. Assessment of the Methodology

This section briefly reviews the research design, instrumentation, data collection, and analysis programs

developed in Phase I and evaluates their usefulness for future research concerning the impacts of transport sector investment.

C.2.a. Research Design. Project RR-2 was designed as a comparative study involving a number of cases and comparable measurements made in each case. The advantage of the comparative method over individual case studies is that it permits the identification and analysis of situational factors that may cause variation in the outcomes found in particular cases. Its advantage over quantitative cross-sectional studies using secondary data is that it permits a relatively high degree of precision in the definition of comparable measurements. The disadvantage is that data cannot be obtained for any project area in the depth that would be possible at the level of a case study, nor can a sufficient number of cases be studied to provide a high degree of statistical reliability in the comparative findings.

In this study the Consultants found it necessary to move in the direction of conducting case studies in greater depth, allowing for the analysis of events in each project area, in order to obtain reasonably reliable measurements of change in each case. As the team's instruments and interests became more adapted to the realities of each project area, it became correspondingly more difficult to make a comparative analysis of the causes of change. The Consultants are confident of the reliability of the findings with respect to the individual project areas. The comparative conclusions are necessarily more qualitative and should be taken as preliminary research results, subject to further testing. They should not be treated as a definitive guide to planning practice.

The success of this phase depended very much on the number of projects selected for study and on the availability of pre-project data. In fact, almost all of the pre-project data had to be reconstructed through interviews and is therefore of doubtful reliability. A conscious attempt was made in developing the instruments to phrase recall questions in such a way as to maximize reliability in the response. This effort often resulted in substituting nominal or ordinal response categories for numerical responses. As a result, the statistical power of the analytic techniques that could be applied to the data was greatly reduced. Furthermore, the probability of statistically significant findings was severely limited by the small number of cases under consideration.

Finally, it is regrettable that because of limited research resources, the study could not be extended to include control areas. Some attempt was made to compensate for this

lack by stratifying the sample on the dimension of access change and examining the incidence of behavioral change by access groups. The findings generally support the attribution of changes in remote areas to transport investment, but they illustrate the important role that may be played by other factors, notably price structures and communications change, either simultaneously or independently. A future comparative study should focus more closely on these alternative explanations of change in remote areas and therefore should select projects for study that will provide systematic variation on these dimensions.

C.2.b. Instrumentation. On the assumption, expressed in the Terms of Reference for this study, that both pre-project and post-project data on the selected study areas would be available, the Consultants originally proposed to focus the Phase I field work more narrowly on the traffic generated by the study projects. When it became necessary to devise instruments for field collection of all of the required data, the original concept of an expanded traffic survey gave way to a battery of instruments designed to obtain measurements of change at several levels of aggregation: individual, household, community, district, and region. These instruments are presented in Appendix A.

Generally, the instruments proved effective, despite the lack of time for pre-testing and pre-coding. The household survey took approximately half an hour to administer, and respondent fatigue was not a serious problem. Village surveys were also well received and provided an excellent point of departure for household survey activities in each village. The administrative questionnaires were perhaps excessively lengthy for the amount of data available in remote areas, not to mention the amount of time administrative officials felt they could spare for filling out survey forms. The transport, commercial, and industrial survey forms were meant as a guide for informal interviewing; they could perhaps be expanded and made more specific if they were to be used by inexperienced interviewers.

Based on the Consultants' attempts to analyze the data obtained with these instruments, there are several minor modifications that are recommended for future use. Generally, however, the instruments have proved to be effective for analyzing the impacts of transport sector change. With relatively few changes, these instruments could also be adapted for use in studying the impacts of other types of development projects in rural areas. The areas of behavioral change to be examined should, of course, be determined on the basis of the anticipated consequences of the development project.

C.2.c. Field Methods. The period of two weeks allotted for field work in each country was extremely short. It is greatly to the credit of the Local Study Teams that they were able to mobilize local resources and carry out the field work program in the time available. The short timeframe kept protocol visits to a minimum and also precluded extensive interviewer training or pre-testing of the instruments as modified for each country. In fact, both training and pre-testing took place during the first few days of the actual survey work, resulting in some loss of comparability between interview schedules.

Although sampling procedures differed in practice from one project area to another, the Consultants are confident that each sample represents a good cross-section of the impact zone population. The extent to which one can generalize from the impact zone to the study area depends on how far the effects of access change are expected to extend and on the peculiarities of social structure in the impact zone as compared to the project area. The samples provided good data on the behavior patterns of farming groups, but the subsamples of landless farm laborers, nonfarm laborers, and other nonfarm households were too small to provide reliable population estimates.

Language difficulties did not present a major problem, despite the wide range of local dialects in which the interviews were conducted, partly because of the factual and concrete nature of most of the survey questions. Detailed probing of attitudes and decision-making processes, as opposed to behavior, would require much more attention to problems of linguistic comparability.

The effective execution of the field work was very much facilitated by the excellent cooperation and kind hospitality of project area residents, from district officials to the simplest farm households. The study project was taken as a tangible sign of interest in the welfare of remote area residents on the part of a central government that often seems to be removed from their concerns. Household heads were generally willing to be interviewed, even after a hard day's work, and they appeared to be quite frank in their responses to the survey questions.

It is possible that some suspicion concerning the purposes of the study may have colored respondents' reactions to certain questions, particularly those regarding production and marketing. To the extent that such coloring occurred, it would have taken the shape of understating the absolute value of household incomes and the volume of commercial activity.

If such understatement was systematic, however, it would not have affected either the comparative analysis of socioeconomic groups within project areas or the analysis of change over time.

C.2.d. Analysis. When it was decided at the July workshop to concentrate the research resources for Project RR-2 on an expanded field work program, no one fully realized the implications of the decision for the analytic phase of the project. The team acquired a very large array of data that required coding, processing, and in the case of the household survey, computer analysis. Composite indices of access change, behavioral change, income distribution, and quality of life needed to be developed. Furthermore, the data set presented tantalizing possibilities for analysis of research questions that were not part of the project as originally conceived. At the same time, available resources were severely limited by the emphasis that had been placed on carrying out sound, reliable field work.

Coding instructions were developed for the household survey used in each country. The questionnaires were coded by SEATAC staff under the Consultants' supervision in Kuala Lumpur, and data cards were punched at the Consultants' home office. Programs were written to print out each country data set in readable form, and the data were visually checked against the original questionnaires. A computer edit program was then prepared for each data set to test for internal consistency.

This editing process revealed a good deal of error and confusion in the data, which was only partially solved by referring to the questionnaires. In the end, owing to tight time constraints, the analytic programs were run on data sets that had not been fully edited to the satisfaction of project personnel. Although the amount of error has been reduced to an acceptable level, it would still be desirable to complete the computer edit process and to correct or eliminate those questionnaires that are still causing problems.

Two sets of computer programs were written to analyze the household survey data. One, called the "descriptive" program set, provided information on demographic characteristics, migration and travel patterns, land tenure and sources of income, production and marketing patterns, farm enterprise change, service utilization, social participation, household assets, and perceptions of change for the whole sample. The second, called the "analytic" program set, allocated each household to a socioeconomic group and an access group and presented all of the above data broken down by each set of groups. It also undertook certain elementary forms of statistical analysis.

The programs were written for the Malaysia data set, which was the first to be coded, and were then converted into new programs for each other country data set. This process was not quite complete when limited research resources and time constraints forced the Consultants to call a halt to the computer programming part of the analysis. Therefore, the analysis of behavioral change by socioeconomic group and by access group, except for production patterns and farm enterprise change, was completed for Malaysia only. Because this final program was not completed for the other data sets, none of its results (except a small piece on marketing in Malaysia) are presented in this report.

All of the other surveys were hand tabulated, and the findings were interpreted by consultant team members who had participated in the field work. Each country chapter was prepared by one or two team members, and all contributed to the comparative analysis. The Consultants' findings were submitted to the Local Study Teams and the latter have had an opportunity to participate in arriving at the country level and comparative conclusions. (See Appendix E for a Response to General Comments.)

C.3. Priorities for Future Research

This Phase I study has laid the groundwork for more specific studies of the linkages between transport investment, income distribution, and regional growth both in the study areas and elsewhere. A reliable data base has been established and preliminary analysis of the data indicates a number of new directions that might be taken in future research. This section describes those tasks that the Consultants feel it would be most useful to undertake during the second phase of the study and identifies those research issues that appear most promising for future studies.

First, there is room for considerably more analysis of the existing data base. A relatively small investment of time would permit completion of the analytic programs for the Philippines, Indonesia, and Thailand. Continued editing of the data sets would provide a more accurate data base and eliminate the remaining anomalies in the program outputs. In addition, a number of small studies could be undertaken using this data base concerning factors influencing the behavior of small farmers in remote areas whether or not this is linked to transport improvement.

A second category of potential research activities concerns replication or expansion of the field work at intervals in the same project areas. Such work could be useful for evaluating the continued impact of transport change. It would be even more helpful in evaluating the impact of complementary investments being made at the present time, since the existing data sets provide an excellent description of baseline conditions. Since data would be available for more than one point in time, it would not be necessary to rely on respondent recall to determine change measures; thus, the household interviews could be considerably shortened.

Another activity would be to carry out similar work in other remote areas with or without transport improvements, thus adding to the number of test cases or control cases. Comparability between cases would be slightly affected by the difference in the times at which the studies were executed, but this would not greatly affect the change processes under consideration. This type of work would provide greater confidence in the comparative analysis and would help to document conditions in other remote areas, as Phase I has done for the project areas. However, the work would suffer from all the other methodological problems of the Phase I study: lack of secondary data, dependence on respondent recall, and a relatively crude method of income estimation.

For a relatively small investment of time, considerable progress could be made in the refinement of instruments and indices. The Phase I analysis has indicated those key items on which more information is needed in order to evaluate the impact model, as well as those that could be abandoned, collapsed into a single dimension of variation, or modified to provide continuous variables in place of nominal categories. The components of access change can be further refined and separately related to behavioral change. Methods of estimating household income levels could be improved, particularly by finding ways to quantify the value of nonfarm income.

A number of topics can be suggested as appropriate research questions for more specific studies in Phase II. Each of these studies should be narrowly focused on the examination of a single problem, in contrast to the wide range of investments, activities, and behavior covered in Phase I. One or two settings should be sufficient to examine these issues in detail, with generalization made possible by the comparative context developed in Phase I. Following is a list of the issues that appear to promise the most significant research results.

1) What are the specific mental processes through which small farmers decide to take actions that are expected to contribute to an increase in their incomes, such as planting of cash crops or investing in inputs? To what extent and in what ways does transport change affect these decision-making processes, and what other situational factors and policy variables are involved?

2) How is the pattern of urban growth in remote areas stimulated by transport change, and what are the implications of this pattern for changing employment structures in remote areas? Is this spatial differentiation of economic functions related to a differentiation of social groups in the project areas? Does the development of exchange and interdependence between rural and urban areas perform an integrative social function as well?

3) What are the factors associated with entrepreneurship in remote areas? Who takes advantage of new opportunities created by transport change? Are there differences between those who invest in providing transport services, those who begin or expand commercial activities, and those who move into commercial agriculture or the agro-processing industry? What are the implications of entrepreneurship for changing social structures in remote areas?

4) Who actually travels on an improved transport network, and for what reasons? What commodities are moved on the network that were not moved before? How does this travel response reflect a changing pattern of production and consumption activities in the project area?

5) Under what circumstances will service providers move into a remote area following a transport improvement? What are their perceptions of the needs and constraints that determine their plans for service delivery? How do these perceptions compare to those of the needs and constraints expressed by remote area residents? Do these perceptions differ by socioeconomic group? How are they related to service utilization behavior?

6) What actually goes on in the process of contact and communication that seems to be important for certain kinds of behavioral change? To what extent and in what ways is this process related to access change? What unexpected, as well as expected, outcomes can be attributed to increasing contact and communication in remote areas?

These questions are very general in nature but could be defined in much more detail in the context of one or two specific cases. Phase I provides the necessary background data to enable the selection of critical cases and to plan a study that can be focused on the factors that appear to be salient in each particular case. Each of these studies would further illuminate a linkage in the model for which our evidence, at present, is relatively weak. Although they are all interrelated, any one could be deleted from the work program without seriously affecting the contribution of the others.

It is difficult to establish priorities among these proposed research tasks without a clear mandate as to the overall focus of the Phase II effort. To the extent that the second phase focuses on income distribution effects, factors related to cash cropping and nonfarm income will clearly be of the first importance. To the extent that it focuses on quality of life, perhaps travel pattern and service outcomes, in addition to consumption changes, will be most significant. With a focus on regional growth potential, entrepreneurship and urban growth might well be most significant.

It is probably not useful to try to distinguish the effects of a particular transport sector investment from the effects of other investments, both within and outside the transport sector, in stimulating regional growth. If this question is of concern, the best approach would be to lump together all the investments made over a particular period and to allocate proportionately the growth in regional production over a subsequent period. This exercise would at least show whether the benefits of transport change are increased or decreased by complementary investments. It probably would not be sufficient to establish a cost/benefit criterion for investment packages.

In conclusion, this Phase I study has documented past and present conditions in remote areas in four Southeast Asian countries that have received transport investments over the past five to ten years. A preliminary analysis of the data indicates that the transport investment stimulated real growth in each case, resulting in both rising incomes and increasing social differentiation. The perceptions of remote area residents indicate that the quality of life is generally enhanced by transport improvements. These findings suggest that the model of transport investment impact is generally valid but that much additional work is needed to identify and quantify the specific parameters affecting linkages at each level.

APPENDIX A
SURVEY FORMS USED IN FIELD WORK

SEATAC PROJECT RR-2
BERGER

July 28, 1977

District _____

ADMINISTRATIVE SURVEY - GENERAL

Data to be supplied by the District (Amphoe, Municipality, Kecamatan) Officer. (All data for the entire district).

	1976	1966
1 Population		
(a) District population		
Urban	_____	_____
Rural	_____	_____
Total	_____	_____
(b) Urban households	_____	_____
Total number	_____	_____
Average size	_____	_____
(c) Rural households		
Total number	_____	_____
Average size	_____	_____

(d) Population subunits. Attach a list, showing the name, location and population for 1976 and 1966 of all population subunits down to and including the village (kampong, barangay or desa) level. Identify those classified as "urban".

2 (a) Total land area of the district in km^2 _____

(b) Total urban land area in km^2 _____

3 Communications

(a) Please provide a list of post offices, showing location and identify those which have opened since 1966.

(b) Do you have mobile routes for rural mail delivery?

☐ Yes ☐ No How many _____

How many did you have in 1966? _____

4 Taxes - List each tax levied on the district (land tax, head tax, income tax, crop tax, water tax, etc) showing:

Type of tax	On whom levied	Tax rate	Responsible authority

5 Development Projects

List any development projects completed since 1966, other than community development, health and education projects. Include such projects as water supply, irrigation, electricity, markets, storage facilities and transport. For small projects such as wells or hand pumps, use one entry and show the total number.

Type of project	Location	Population or area served	Year completed

6 Please provide a list, showing location, of agricultural processing facilities in the district which employ more than five persons.

7 Please provide a list, showing location, of transport firms (passengers or goods) which have more than one vehicle.

ADMINISTRATIVE SURVEY - AGRICULTURE

Data to be supplied by the District (Amphoe, Municipality, Kocamatan) Agricultural Officer. (All data are for the entire District)

		1976	1966
1	Total Number of Farm Families	_____	_____
2	Tenure Classes in above estimates		
	(a) Farm owner-operators	_____	_____
	(b) Cash Farm Renters	_____	_____
	(c) Share Tenants	_____	_____
	(d) Non-Operating Landlords	_____	_____
	(e) Landless Farm Laborers	_____	_____

*Some of these owner-operators will have too small an economic unit to provide sufficient annual income, and therefore, they (and/or their wives) work for other farmers seasonally. How many of those in group (a) above are estimated to work for other farmers? These should not be reported in (e) as landless laborers.

3 Distribution of all farms by size (a "farm" refers to a single enterprise managed by its owner, renter, or tenant, and may consist of two or more separate plots). Specify whether data are in acres or hectares.

Combine into intervals in use in district records

						1976	1966
(a)	Under	-	.49	acres/hectares		_____	_____
(b)	.50	-	.99	"	"	_____	_____
(c)	1.00	-	1.99	"	"	_____	_____
(d)	2.00	-	4.99	"	"	_____	_____
(e)	5.00	-	9.99	"	"	_____	_____
(f)	10.00	-	14.99	"	"	_____	_____

Combine into intervals in use in district record

(g)	15.00 - 24.99 acres/hectares	_____	_____
(h)	25.00 - 49.00 " "	_____	_____
(i)	50.00 or over " "	_____	_____
	GRAND TOTALS:	==========	==========

4 Planted Acreage (hectarage) of crops, Annual and Perennial

		1976	1966
(a)	Rice (i) Padi rice	_____	_____
	(ii) Upland rice	_____	_____
(b)	Maize	_____	_____
(c)	Cassava	_____	_____
(d)	Millet	_____	_____
(e)	Sugar Cane	_____	_____
(f)	Vegetables	_____	_____
(g)	Fruit	_____	_____
(h)	Cotton	_____	_____
(i)	Kenaf or Jute	_____	_____
(j)	Rubber	_____	_____
(k)	Pepper	_____	_____
(l)	Tea	_____	_____
(m)	Coffee	_____	_____
	Others		
(n)	(specify).....	_____	_____
(o)	(specify).....	_____	_____
(p)	(specify).....	_____	_____
	TOTAL AREA PLANTED:	==========	==========

5 High Yielding Variety (HYV) Seeds

(a) Acreage (hectarage) of rice in HYV _____ _____

(b) Acreage (hectarage) of rice in Local Varieties _____ _____

6 Fertilizer

(a) How many kilograms/acre (or hectare) are recommended for HYV rice? _____

7 Estimated Production Yields	HYV	Non-HYV
(a) This past year, what was the "average" yield of rice/acre or hectare?	_____	_____
What was the yield for the lowest $\frac{1}{4}$ of farmers	_____	_____
What was the yield for the highest $\frac{1}{4}$ of farmers	_____	_____

8 Agricultural Professional Personnel	1976	1966
(a) Number of Assistant Agricultural Officers	_____	_____
(b) Number of Agricultural Extension Specialists who travel from District headquarters	_____	_____
(c) Number of semi-professional Agricultural Extension Assistants	_____	_____

9 Farm Organizations and Clubs (Please list by location)

(a) Number of Farmers Clubs	_____	_____
(b) Number of Farmer Club Members	_____	_____
(c) Number of Farm Women's Clubs	_____	_____
(d) Number of Women Club Members	_____	_____

10 Extension Service Facilities (Please list by location)

(a) Number of experimental stations	_____	_____
(b) Number of demonstration centers	_____	_____

Data to be supplied by the District (Amphoe, Municipality, Kecamatan) Health Officer (All data are for the entire district)

	1976	1966
1 Health Facilities (for each category please provide total numbers and attach list of facilities with location of each)		
(a) Hospitals		
Public	_____	_____
Private	_____	_____
(b) Clinics		
Public	_____	_____
Private	_____	_____
(c) Rural Health Centers		
Public	_____	_____
Private	_____	_____
(d) Maternal and Child Health Center		
Public	_____	_____
Private	_____	_____
(e) Other Health Care Facilities (specify)		
Public	_____	_____
Private	_____	_____
2 Number of Hospital Beds		
Public	_____	_____
Private	_____	_____
3 Number of Practicing Physicians and Surgeons	_____	_____

		1976	1966
4	Number of Registered Nurses	_____	_____
5	Number of Licensed Midwives	_____	_____
6	Other paramedical personnel (excluding clerks, drivers, etc)	_____	_____
7	Estimated total population	_____	_____
	(a) Population/Bed Ratio	_____	_____
	(b) Population/Doctor Ratio	_____	_____
8	Total Number of Live Births	_____	_____
	Number delivered in hospitals	_____	_____
	Number delivered in health centers	_____	_____
	Number delivered at home	_____	_____

ADMINISTRATIVE SURVEY - COMMUNITY DEVELOPMENT

Data to be supplied by the District (Amphoe, Municipality, Kecamatan) Community Development Officer (For those districts which have a formal Community Development Program). (All data are for the entire district)

		1976	1966
1	Professional Staff members		
	(a) Number of District headquarters personnel	_____	_____
	(b) Number of Field workers residing in the district center	_____	_____
	(c) Number of field workers residing in other villages or towns	_____	_____
2	Annual budget for Community Development Projects (amount)	_____	_____
3	Number of Community Development Projects completed, by type		
	(a) Village streets or roads	_____	_____
	(b) Water supply	_____	_____
	(c) Schools or school improvements	_____	_____
	(d) Community buildings	_____	_____
	(e) Occupational projects	_____	_____
	(f) Other projects - (specify type)	_____	_____

ADMINISTRATIVE SURVEY - EDUCATION

Data to be supplied by the District (Amphoe), Municipality, Kecamatan Education Officer. (All data are for the entire district)

	1976	1966
1 Number of schools (For each category please provide total numbers and attach a list of facilities with location of each).		
(a) Primary		
Public	_____	_____
Private	_____	_____
(b) Secondary		
Public	_____	_____
Private	_____	_____
(c) Vocational		
Public	_____	_____
Private	_____	_____
(d) Higher level (teachers colleges, colleges and universities)		
Public	_____	_____
Private	_____	_____
2 Number of Classrooms		
(a) Elementary		
Public	_____	_____
Private	_____	_____
(b) Secondary		
Public	_____	_____
Private	_____	_____
(c) Vocational schools		
Public	_____	_____
Private	_____	_____

	1976	1966
3 Total Public and Private Enrollment, by grade		
Grade 1	_____	_____
Grade 2	_____	_____
Grade 3	_____	_____
Grade 4	_____	_____
Grade 5	_____	_____
Grade 6	_____	_____
Grade 7	_____	_____
Grade 8	_____	_____
Grade 9	_____	_____
Grade 10	_____	_____
Grade 11	_____	_____
Grade 12	_____	_____
4 Number of teachers, public and private		
(a) Elementary	_____	_____
(b) Secondary	_____	_____
5 Pupil/Teacher ratio, primary school, by grade		
(a) Grade 1	_____	_____
(b) Grade 2	_____	_____
(c) Grade 3	_____	_____
(d) Grade 4	_____	_____
(e) Grade 5	_____	_____
(f) Grade 6	_____	_____

SEATAC PROJECT RR-2
BURGER

August 4, 1977

VILLAGE* LEVEL SURVEY

1. Country _____

2. District _____ 3. Township _____

4. Village _____ 5. Headman _____
(name - optional)

6. Distance of village from study project (specify kms or miles)

_____

7. Distance of village from all weather transport, road or water (specify kms or miles). (if same as 6, mark same) _____

8. Number of households in the village: Now _____ 10 yrs ago _____

9. Number of people in the village: Now _____ 10 yrs ago _____

10. Number of shops in the village: Now _____ 10 yrs ago _____

11. Number of other business in the village by type:

Type of business	Number	Year started
Rice Mill	_____	_____
Sugar Mill	_____	_____
Sawmill	_____	_____
Warehouse	_____	_____
Other (specify)	_____	_____
	_____	_____
	_____	_____
	_____	_____

Note: * Village means village, kampong, barangay or desa. The appropriate term will be used in the actual questionnaires for each country.

11. Community facilities - number of communal facilities by type:

Type of facility	Number	Year Built
Temple, mosque & church		
Meeting hall		
Community wells		
Other water supply (specify type)		
Market		
Warehouse		
Wharf or Jetty		
Other (specify)		

13. Have the villagers contributed labor, materials, or money to one or more community projects such as a road or street improvement, school, village well, etc., during the last 10 years?

(1) Yes (2) No. If yes, specify projects below:

Project	Year Completed	Estimated Village Contribution		
		Money	Labor (Man-days)	Materials

14. How many new households (families) have moved from another village into this village in the last 10 years? _____ (from within district)
_____ (from outside district)

15. How many households (families) have moved away from this village during the last 10 years?

16. How many vehicles are owned by people in the village:

	Now	10 years ago
Regular bus	_____	_____
Mini-buses	_____	_____
Lorry	_____	_____
Small Truck	_____	_____
Automobile	_____	_____
Motorcycle	_____	_____
Motorboats	_____	_____
Outboard motor boats	_____	_____
Sailing craft	_____	_____

17. Do buses, mini-buses or motorboats serve the village throughout the year?

Now : (1) Yes (2) No. 10 years ago (1) Yes (2) No.

18. When bus or boat service is available, how frequently do buses or boats come to the village:

Now	Less than once a week	once a week	more than once a week	daily	more than once a day
Regular buses					
Mini-buses*					
10 years ago					
Regular buses					
Mini-buses*					

19. What is the nearest major market town? _____

How far is it from the village _____ (kms or miles)

20. How long does it take to travel to the nearest market town? _____

How long did it take ten years ago? _____

21. How much does it cost to ride to the nearest market town?

(a) Now _____ (b) 10 years ago _____

22. How long does it take to travel to other destinations? (check one)

	Return same day	Overnight stay	Week or more
District - now	_____	_____	_____
ten years ago	_____	_____	_____
Province - now	_____	_____	_____
ten years ago	_____	_____	_____
Capital - now	_____	_____	_____
ten years ago	_____	_____	_____

23. What is the price per acre of land used for building a house in the village

(a) Now _____ (b) 10 years ago _____

24. What is the price per acre of good rice land near the village?

(a) Now _____ (b) 10 years ago _____

Note: * A mini-bus includes jeepney, light bus, etc

25. Do people in the village regularly get agricultural information, such as prices for crops, from outside the village?

(1) Yes (2) No.

If yes, how? _____

26. Is the village served by any mobile service units (such as health, posts, extension)?

(1) Yes (2) No.

If yes, specify which kind _____

27. Has this changed in the last ten years? (1) Yes (2) No.

If yes, specify change _____

28. Is the village served by itinerant traders? (1) Yes (2) No.

29. In comparison to ten years ago, are there (1) many more, (2) a few more, (3) about the same, or (4) fewer traders coming to the village than before?

30. In comparison to ten years ago, do traders come to the village (1) more often, (2) about the same, or (3) less often than before?

31. How does the agricultural extension officer come to your village? (1) Doesn't come, (2) Walks, (3) Bicycle, (4) Canoe or longboat, (5) Motor vehicle, (6) Motor boat, (7) Other (specify) _____

32. How did he come ten years ago? (1) Didn't come, (2) Walked, (3) Bicycle, (4) Canoe or longboat, (5) Motor vehicle, (6) Motor boat, (7) Other (specify) _____

33. Has the (study project) improved life in the village in any important way?

(1) Yes (2) No.

34. What is the most important improvement that the (study project) brought to the village?

_____

_____

35. Has the (study project) caused any problems for the village?

(1) Yes (2) No.

36. If yes, what is the most serious problem?

_____

_____

Interview No _____ (COUNTRY) Interviewer _____

RURAL HOUSEHOLD SURVEY RR-2

TRANSPORT INVESTMENT & RURAL DEVELOPMENT

1 District _____ 3 Village _____

2 Township _____ 4 Interviewee _____
(Name) (Optional)

5 How long has interviewee lived in present village? _____ years

IF LESS THAN (TEN) YEARS, NO RECALL QUESTIONS WILL BE ASKED.
THESE QUESTIONS ARE MARKED WITH AN ASTERISK (*).

Ask: Did you move to this village (1) from another place in the same district, or (2) from another district?
If (2), which one? _____

Why did you move to this village? _____

_____

Household Composition

6 Sex of Head of Household: (1) Male (2) Female

7 Age of Head of Household: (1) Under 25 (2) 25-44 (3) 45-65 (4) Over 65

IF UNDER 20, END QUESTIONNAIRE AND DRAW SUBSTITUTE HOUSEHOLD

IF UNDER 25, NO RECALL QUESTIONS WILL BE ASKED.
THESE QUESTIONS ARE MARKED WITH AN ASTERISK (*).

8 Education: (1) None (2) Less than 4 stds. (3) 4 to 6 (4) Completed 6 or more

9 Age of Spouse: (1) Under 25 (2) 25-44 (3) 45-64 (4) Over 65

10 Education of Spouse: (1) None (2) Less than 4 stds. (3) 4 to 6
(4) Completed 6 standards or more

11 Number of Children under 6 years: (0) (1) (2) (3) (4) (5 or more)

12 Other Children at home of head only:

	Age	Sex		Attending School	Not Attending School				
		M	F	Class Attending	Last class completed	Employment (check one)			
						Family Farm	Other Farm	Non Farm	None---
(1)									
(2)									
(3)									
(4)									
(5)									

13 Other Children Not at Home, of head only:

	Age	Sex		Attending School	Not Attending School			
		M	F	Class Attending	Last class completed	Employment (check one)		
						Farm	Other	None
(1)								
(2)								
(3)								
(4)								
(5)								

14 Other Household Members, over 15 years of age:

	Age	Sex		Last Class Attended	Employment (check one)			
		M	F		Family Farm	Other Farm	Non farm	None
(1)								
(2)								
(3)								
(4)								
(5)								

15 Total number present now in household: _____ Persons

Source of Income

16 Does this household own or rent land? (1) Yes (2) No

* 17 Did it own or rent land ten years ago? (1) Yes (2) No

IF ANSWER TO QUESTION 16 IS NO, ASK:

18 What is the occupation of the household head?
(1) Farm Laborer (2) Nonfarm worker (3) Trader, official, professional, pensioner
(4) Unemployed

19 What other sources of income does the household have: (check)

	Now	Ten Years Ago*
No other source of income than the farm	_____	_____
Seasonal work for other farmers	_____	_____
Fishing, hunting, gathering	_____	_____
Sale of cottage industry or craft products	_____	_____
Wage labor in nonfarm employment	_____	_____
Remuneration as an official, teacher or employee	_____	_____
Government, military or private pension	_____	_____
Support from children not at home	_____	_____

Travel Patterns

20 How many trips were made during the past year by household members

	To District Center	To Province Center	To Capital
Head of household	_____	_____	_____
Spouse	_____	_____	_____
Others	_____	_____	_____

21 For the household head, how has this changed since ten years ago? (check one for each destination)

	More trips	Fewer trips	About same	No trips 10 years ago
District	____	____	____	____
Province	____	____	____	____
Capital	____	____	____	____

22 How has it changed for the spouse?

	More trips	Fewer trips	About same	No trips 10 years ago
District	____	____	____	____
Province	____	____	____	____
Capital	____	____	____	____

23 How has it changed for other household members?

	More trips	Fewer trips	About same	No trips 10 years ago
District	____	____	____	____
Province	____	____	____	____
Capital	____	____	____	____

Social Participation

(Supervisor will advise if farm organizations are present in this area IF NOT, SKIP THIS SECTION)

24 Is the household head a member of any farmer's club or association?

(1) Yes (2) No (Specify) _____

25 How long has he been a member? _____years

26 Is his spouse a member of any farm women's club or association?

(1) Yes (2) No (Specify) _____

27 How long has she been a member? _____years

28 Number of Agricultural Training Centers or Courses attended last year, by any household member:

(1) None (2) One (3) Two or more

* 29 Is the household attendance at Agricultural Training Centers or Courses

(1) More frequent (2) Less frequent (3) about the same as ten years ago?

Use of Health Services

30 How far is it from the house to the nearest health center or clinic?

(1) Less than 1 km. (2) 1-4 kms. (3) 5-9 kms. (4) 10 kms. or more

31 How often have the family members visited the health center or clinic for treatment in the past year?

_____ visits (count one for each family member treated)

32 In comparison to ten years ago, are these visits:

(1) More frequent (2) Less frequent (3) About the same

33 For all children of first spouse of household head, give place of birth:

Present Age of Child	Home (granny)	Home (midwife)	Health Center	Hospital

IF RESPONDENT DOES NOT OWN OR OPERATE A FARM, CHECK HERE AND TO TO QUESTION 67

Farm Tenure

34 Household head is (1) Farm Owner-Operator
(2) Landlord only
(3) Share Cropper or Cash Renter
(4) Both owner-operator and laborer
(5) Both sharecropper or cash renter and laborer

IF (2) ABOVE IS CIRCLED, GO TO QUESTION 64

Farm Enterprise Production Patterns

35 Amount of Land (specify units) _____

	Now	Ten Years Ago*
Owned	_____	_____
Rented	_____	_____
Share Cropped	_____	_____

36 Crop Area, 1976: (specify units) _____

	Now	Ten Years Ago*		Now	Ten Years Ago*
Wet Rice	_____	_____	Vegetables	_____	_____
Dry Rice	_____	_____	Fruit	_____	_____
Maize	_____	_____	Fish Ponds	_____	_____
Cassava	_____	_____	Pepper	_____	_____
Millet	_____	_____	Rubber, HYV	_____	_____
Sugar Cane	_____	_____	Rubber, native	_____	_____
Coconuts	_____	_____	Other (specify)	_____	_____

37 Crop Production and Sales, 1976: (specify units) _____

	Produced	Sold		Produced	Sold
Padi Rice	_____	_____	Vegetables	_____	_____
Upland rice	_____	_____	Fruit	_____	_____
Maize	_____	_____	Fish Ponds	_____	_____
Cassava	_____	_____	Pepper	_____	_____
Millet	_____	_____	Rubber, HYV	_____	_____
Sugar Cane	_____	_____	Rubber, native	_____	_____
Coconuts	_____	_____	Other (specify)	_____	_____
	_____	_____		_____	_____

38 Livestock and Poultry, present numbers:

Hens and cockerels	_____	Young stock	_____
Cows	_____	Pigs or hogs	_____
Bulls and buffaloes	_____	Sheep or goats	_____

39 Livestock products sold and consumed, 1976:

	Sold	Consumed		Sold	Consumed
Poultry	_____	_____	Cows	_____	_____
Pigs	_____	_____	Buffalo	_____	_____
Fish (kg)	_____	_____	Young stock	_____	_____
Eggs (kg)	_____	_____	Milk (liters)	_____	_____

Farm Enterprise Marketing Patterns

40 Last year the farm operator transported his main products for sale or barter by: (circle any that apply and specify which crops)

(1) Hand carried	_____	(8) Lorry	_____
(2) Bicycle	_____	(9) Canoe	_____
(3) Motorcycle	_____	(10) Sailing vessel	_____
(4) Wheelbarrow	_____	(11) Motorized vessel	_____
(5) Bullock cart	_____	(12) Motor launch	_____
(6) Donkey pack	_____	(13) He transported nothing for sale or barter.	
(7) Bus	_____		

*41 Which of these did he use ten years ago?

(1) Hand carried	_____	(8) Lorry	_____
(2) Bicycle	_____	(9) Canoe	_____
(3) Motorcycle	_____	(10) Sailing vessel	_____
(4) Wheelbarrow	_____	(11) Motorized vessel	_____
(5) Bullock cart	_____	(12) Motor launch	_____
(6) Donkey pack	_____	(13) He transported nothing for sale or barter.	
(7) Bus	_____		

42 Last year, he sold his main products (specify)

(1) At or near the farm _____

(2) In the village _____

(3) In the nearest market town _____

(4) Farther, specify place or distance _____

*43 Where did he sell his main products ten years ago? (specify product)

(1) At or near the farm _____

(2) In the village _____

(3) In the nearest market town _____

(4) Farther, specify place or distance _____

Agricultural Extension

(Supervisor will provide name of the local agricultural extension officer).

44 The farm was visited by _____ last year

(1) Not once (2) Once (3) Two or more times

*45 Does he now receive more visits from the extension officer than he did ten years ago? (1) Yes (2) No

46 Does the agricultural extension service regularly schedule meetings in the community to discuss problems, programs and issues with farmers?

(1) Yes (2) No

47 If so, does this farmer (1) regularly attend (2) sometimes attend (3) never attend (4) no meetings, question not applicable.

Credit

(Supervisor will provide name of bank, loan agency or credit program operating in the area. IF NONE, GO TO QUESTION 51)

48 Has this farmer obtained credit from (agency)_____ for his farming operations during the past year or two? (1) Yes (2) No

49 If not, was this because (1) he did not ask for credit, or (2) he applied for credit, but his application was denied?

50 If he has never applied for credit, what are his reasons?

_____

51 Did he borrow money for farm operations during the past year or two from any of the following: (circle one)

(1) Local merchants or middlemen (2) Private moneylenders (3) Relatives

(4) Neighbours (5) A combination of the foregoing

(6) Has not borrowed from anyone.

52 When did he first start borrowing for farm operations? _____(date)

53 What was his first source of borrowed funds?

(1) Local merchants or middlemen (2) Private moneylenders (3) Relatives

(4) Neighbours (5) Bank or agency (6) A combination of the above

Use of Fertilizer and Seeds

54 What amount of fertilizer was used for the three most important crops during the past year?

Crop _____ Amount _____ kg per _____

Crop _____ Amount _____ kg per _____

Crop _____ Amount _____ kg per _____

55 Ten years ago (check one for each crop):

Crop	He did not use fertilizer	He used less fertilizer	He used about the same	He used more
(1) _____	_____	_____	_____	_____
(2) _____	_____	_____	_____	_____
(3) _____	_____	_____	_____	_____

56 How much of his land is planted in high yielding varieties (HYV) for each crop?

Crop	Little or none	About half and half	All or almost all
(1) _____	_____	_____	_____
(2) _____	_____	_____	_____
(3) _____	_____	_____	_____

57 When did he begin planing HYV?

Crop 1 _____ Year _____

Crop 2 _____ Year _____

Crop 3 _____ Year _____

Enterprise Changes

Determine whether changes have been made in this farmer's enterprise during the past (ten) years, as follows:

*58 A shift in the main site of operations to make the farm more accessible to markets (1) Yes (2) No

*59 A greater emphasis on cash crops (1) Yes (2) No

*60 Addition of new cash crops (1) Yes (2) No (Specify) _____

*61 Increase in livestock inventories (1) Yes (2) No

*62 More storage facilities (1) Yes (2) No

*63 Improvements in irrigation (1) Yes (2) No

GO TO QUESTION 76

Questions for Landlords and Sharecroppers

64 Harvests are shared in what proportion? _____% to landlord
_____% to tenant
_____ cash rental only

65 Tenurial agreements are (1) oral (2) written

66 Landlord:
How long has your present tenant(s) been with you? _____years

Tenant:
How long have you been working for your present landlord? _____years

GO TO QUESTION 85

67 IF RESPONDENT IS FISHERMAN ONLY, GO TO QUESTION 76

IF RESPONDENT IS TRADER, PROFESSIONAL, OFFICIAL OR PENSIONER
GO TO QUESTION 85

Questions for landless laborers (farm or nonfarm)

68 How many months was he employed during the past year? _____months

*69 Compared to ten years ago, is this (1) More (2) Less, or (3) About the same?

70 What is the present daily wage? (specify units) _____

71 If he is a farm laborer, does he also receive a share of the crops? (specify) _____

72 If married, is his wife also employed? (1) Yes (2) No (3) Not married

73 How many months per year did his wife work this year? _____months

74 Compared to ten years ago, is this (1) More (2) Less, or (3) About the same?

75 What is the present daily wage for women? _____

76 If she is a farm laborer, does she receive a share of the crops? (specify) _____

Questions for Fishing Families

77

Catch size	1976		10 years ago	
	Total	Amount Sold	Total	Amount Sold
Fish	_____	_____	_____	_____
Shell fish	_____	_____	_____	_____

78 Do you own a boat? (1) Yes (2) No

IF YES: Is it (1) Canoe or longboat
(2) Sailing vessel
(3) Outboard motor _____HP
(4) Motor launch _____HP

Under 3 GT
3-5 GT
5-15 GT
15-30 GT
30 GT and over Year acquired: _____

80 Method of Fishing: (circle any that apply)

(1) Pole and line (or long line)
(2) Pots and traps
(3) Nets
(4) Trawling

81 Method used ten years ago:

(1) Pole and line (or long line)
(2) Pots and traps
(3) Nets
(4) Trawling

82 Is fishing carried out (1) year round, or (2) seasonally?

83 Are fish transported to market for sale? (1) Yes (2) No

IF YES, Under what conditions?
(check one)

	Now	Ten Years Ago
Fresh	_____	_____
Dried	_____	_____
Iced	_____	_____
Refrigerated	_____	_____

(Supervisor will provide name of the local fisheries extension officer)

84 The fishing enterprise was visited by _____ last year.
(1) not once (2) once (3) 2 or more times

85 Changes in operating pattern:

	Now	Ten Years Ago
Distance to fishing grounds	_____	_____
Duration of fishing trip	_____	_____
Time spent fishing	_____	_____
Time spent sailing	_____	_____

Household Assets

86 Does the household (1) own or (2) rent their own house?

87 Did they (1) own or (2) rent a house ten years ago?

88 Do they now possess any of the following?

	Owned		Year Acquired
	Yes	No	
Tin roof	____	____	____
Radio	____	____	____
Bicycle	____	____	____
Motorcycle	____	____	____
Other vehicles (specify)	____	____	____
	____	____	____
	____	____	____
	____	____	____
Farm machinery (specify)	____	____	____
Sewing or weaving (specify)	____	____	____
Electricity	____	____	____
Private water supply	____	____	____

89 Has improved transport changed your life over the past ten years in any important way? How?

90 Do you think that life in general is better than it was ten years ago? In what way is it better?

TRANSPORTER QUESTIONNAIRE

1 NAME OF ENTERPRISE LOCATION

2 PRINCIPAL OWNERSHIP RESIDENT OF ☐ District ☐ Province ☐ Other

3 OPERATING IN PROJECT AREA BEFORE PROJECT ☐ Yes ☐ No

4 If "No", why did you begin _____

5 TYPE OF SERVICE

☐ Freight ☐ Passenger

Product specific cargo ☐

General cargo ☐

Cargo type _____

6 VEHICLES

Before Project			Present		
Type	Capacity	#	Type	Capacity	#

7 REASONS FOR CHANGE IN VEHICLE TYPE

☐ Increased speed ☐ Increased total fleet capacity

☐ Lower operating costs

8 ROUTES AND FREQUENCY

Significant Seasonal Variation in Frequency ☐ Yes ☐ No

If "Yes", explain (i.e, peak months and minimum service months, why, how does transporter minimize overhead costs associated with seasonal demand? Indicate High/Low range under RT/week in table below.

	Route To/From	km	RT/wk	Average running speed	Trip Time (m)
		BEFORE PROJECT			
(a)					
(b)					
(c)					
(d)					
		PRESENT			
(a)					
(b)					
(c)					
(d)					

9 PRINCIPAL COMPETITION TO SERVICE PROVIDED

Before project: ☐ None ☐ Other product specific carrier ☐ Other Common carrier

After project: ☐ " ☐ " ☐ "

10 TARIFF SETTING

Established by Government ☐

Transporter ☐

Bargaining ☐

If "Government" enumerator should try to obtain tariff schedule and attach to this form.

Tariffs per unit basically based on: (May check more than one. Do not complete if established by Government)

Distance ☐

Travel Time ☐

Commodity ☐

Time of Year ☐

Remarks: (See notes on page 4)

11A TARIFFS (See note)

COMPARATIVE TARIFFS Route (letter)_____ km_____

	Per Passenger		Principal cargos				
	W/cargo	W/o cargo	1	2	3	4	5
Before Project							
Present							

Cargo Specification & measurement unit: 1 _____ 3 _____ 5 _____
2 _____ 4 _____

11B ACTUAL TARIFFS

Routes/ kms	a		b		c		d	
	Per Unit	Unit/km*	Per Unit	Unit/km*	Per Unit	Unit/km*	Per Unit	Unit/km*
Passenger								
Passenger w/cargo								
Commodities								
(1)								
(2)								
(3)								
(4)								
(5)								

* Enumerator to compute.

Note: These questions probably not applicable to agro-processing industry transporter. For Part A Enumerator should select the most important pre-project route served by the transporter. If transport was not serving project area before project, leave Section A blank.

REMARKS:

12 CAPACITY UTILIZATION

Do you feel that the amount of cargo/passengers actually carried in comparison to capacity of your vehicle(s) has changed significantly since project improvement?

Route	Higher	Lower	Don't know	NA
(a)				
(b)				
(c)				
(d)				

Notes to Enumerator on Remarks for Item 10

Distance : Are there significant differences in facility (water or roadway) conditions or terrain for different routes which are considered in tariff?

Travel time: Does carrier run on a schedule? Any express services for which a premium tariff is charged?

Commodity : Is this related basically to the unit weight or volume of commodity or is it more related to value of product?

Time of year: Variation by season may be relatedto weather which increase costs of travel or to variations in demand for service., e.g. lower utilization of vehicle or vehicle capacity and thus higher costs at certain times of year, or, conversely, more competition for smaller volume of business resulting in tariff cutting.

Volume of Shipment : Tariff concessions may be given for larger single shipments or for persons giving the transporter a larger total volume of business over a period of time.

Where travel time, time of year, or volume of shipment results in a range of tariffs, this range should be entered in Tables for Item 10.

AGRO-PROCESSING INDUSTRY SURVEY

1 NAME OF ENTERPRISE

2 LOCATION

3 PRINCIPAL BUSINESS

4 OWNERSHIP Resident of: ☐ (district) ☐ (province) ☐ (outside)

5 YEAR OF OPENING (this location)

6 NUMBER OF EMPLOYEES

7 CAPACITY AND UTILIZATION (yearly)

	Product Intake		Covered Storage	
	Capacity	% Utilization	Intake Capacity	Output Capacity
Pre-Project (product)				
1.				
2.				
Present				
1.				
2.				

* Where storage is common for raw materials and processed materials (complete 1st column only)

8 Was this enterprise processing substantial products from project area previously at another location?

☐ Yes ☐ No

If "Yes" where _____?

If "Yes" what reason for relocation _____

_____

9 Sources of Raw Materials - (from project area)

Pre-Project		Present	
Municipality	%	Municipality	%

10 TRANSPORT

Do you use your own vehicles to transport farm products to your enterprise?

☐ Yes ☐ No

If "Yes" is more than 50% of such products transported in your own vehicles

☐ Yes ☐ No

If "Yes" complete Transport Survey questionnaire and 11c(2)

11 PRICES

A Are prices paid for raw materials regulated?

☐ Yes ☐ No

B Do price fluctuate ∓ 10% seasonally

☐ Yes ☐ No

C(1)

Prices presently paid for farm products brought to your enterprise		
Commodity	Unit	Price/Unit (range if necessary)

C(2)

Prices presently paid for farm products which you purchase and transported to enterprise		
Location where purchased	Distance from enterprise	Price/Unit

SEATAC PROJECT RR-2
BERGER
July 28, 1977

Village_____ Project Year_____

District_____ Interviewer_____

COMMERCIAL SURVEY

1 NAME OF ENTERPRISE

2 LOCATION

3 PRINCIPAL BUSINESS Type:_____

(1) Wholesale (sells to other retailers)
(2) Retail

4 OWNERSHIP Resident of (1)_____(district)
(2)_____(province)
(3)_____(outside)

5 YEAR OF OPENING _____

6 NUMBER OF EMPLOYEES Pro-project_____
Present_____

7 Do you own/manage/Operate other commercial establishments in project area?

☐ Yes ☐ No

If "Yes" a separate questionnaire should be prepared if respondent conversant with other enterprise.

8 Which items produce your greatest volume (revenue) of sales (by order of importance, not to exceed 8)

Pre-project		Present	
Item		Item	

9 Do you sell seed, fertilizer, pesticides now? ☐ Yes ☐ No

Did you sell more ☐ Less ☐ None ☐ than ____ years ago.

10 Do you purchase substantial amounts of local products?

Yes ☐ No ☐

If "Yes" complete following:

Commodity	Volume/Year	Seller		Price Per Unit at Store	Price Per Unit at Farmgate
		% From Farmer	% From Middle-man		

11 Do you have a warehouse? ☐ Yes ☐ No

(a) If "Yes" was it constructed or enlarged in the last_____years?

Yes ☐ No ☐

(b) If "Yes" specify increase in size (circle One)

(i) Constructed

(ii) Expanded by (1) 25% (2) 50% (3) 75% (4) More than 75%.

12 If seller of newspapers or magazines,

	Pre-Project	Present
	No. of Daily Sales	No. of Daily Sales
Newspaper		
Magazines		

13 Do you have a motorized vehicle? ☐ Yes ☐ No

If "Yes" do you use it to collect or deliver goods?

14 Collect? Yes ☐ No ☐

15 Deliver? Yes ☐ No ☐

16 Did you have a vehicle ten years ago? Yes ☐ No ☐

17 Do you transport goods for other people? Yes ☐ No ☐

18 If "Yes" fill out transporter questionnaire.

MALAYSIA

RIVER TRAFFIC SURVEY - KAPIT

INSTRUCTIONS FOR INTERVIEWERS

(1) The date and name of interviewer should be filled in every sheet.

(2) The boats should be numbered in sequence as they arrive or depart; with appropriate time of arrival or departure.

(3) Origin (0) and Destination (D): -

- Fill in the appropriate code number (as explained below) of EITHER the origins under Column O if the boat arrives at Kapit, OR the destination under Column D if the boat is leaving Kapit; together with the name of the place alongside, if necessary.

- The origins and destinations are grouped into 9 areas. These areas are numbered 1 to 9 and they are: -

  1) Sibu and below

  2) Kanowit District

  3) Song District

  4) Around Kapit (on Rajang River below Pelagus, and on Balleh River below Mujong)

  5) Between Pelagus and Ba (in Kapit District)

  6) Between Ba and Belaga (in Belaga District)

  7) Balui area (above Belaga)

  8) Mujong River and Part of Ballech River between Mujong and Sungai Putai

  9) Balleh River above Sungai Putai

(4) Types of boats: - Please tick the appropriate box.

The abbreviations stand for the following:

EX = Express Boat

ML = Motor Launch

LB = Long Boat

If other boats, please specify the type.

(5) Major products carried: -

- Please fill in the names of the major products carried by the boat, in appropriate boxes, on the row of their origin/destinations, together with the approximate amounts in weight or other appropriate units.

- The following are some examples of the products that may be carried by these boats: - rubber, pepper, rattan, wild bear or deer meat, fish, rice, drinks, other food stuffs, petrol and other fuel, livestock, etc.

- You may have to ask either the boat crew or the owner of the cargo, what the amount of the cargo is, and where it is going to or coming from.

- If there are more than 4 major products, you may use the next 4 rows below.

_____

_____

_____

_____

(6) Fill in the number of passengers in the appropriate boxes, on the same row as their origins or destinations. You may have to ask the passengers or the crew members for this information.

SAMPLE SURVEY FORM

RIVER TRAFFIC SURVEY - KAPIT

SEATAC PROJECT RR2
S.P.U. - Berger

Date:_____ Interviewer_____

Boat		Type of Boat				C or D		Name of Place	Major Products Carried								Passengers
No.	Time	EX	ML	LB	OTHER	From	To		Type	Amt.	Type	Amt.	Type	Amt.	Type	Amt.	

APPENDIX B
MEASUREMENT OF ACCESSIBILITY AND ACCESSIBILITY CHANGE

APPENDIX B

MEASUREMENT OF ACCESSIBILITY AND ACCESSIBILITY CHANGE

This appendix describes the measures of accessibility and accessibility change which are used in the SEATAC study to denote the primary socio-economic impact of transport investment in remote areas. Making a comparative study of transport impact that includes a number of different transport modes requires the definition of a very general concept to represent the change produced by transport investment. This concept is called "accessibility" in our model.

Accessibility is a measure of the ease with which one point in a transport network can be reached from another point. Put differently, it is an inverse measure of the "resistance" offered by the network to travel and transport. It is a function of distance, topography, mode of transport, vehicle type, cost, and intangible factors such as safety, comfort and convenience. A transport sector investment may increase accessibility by making changes in any one, some, or all of these factors.

A complicating factor in the definition of accessibility change in the SEATAC project areas is that usually more than one type of change has taken place over the project period. The projects under study are major investments in construction or services. At the same time, and possibly as a result of these investments, there have been numerous changes in the transport services provided by the private sector. These involve the introduction of new vehicle types, more frequent and more regular service on existing routes, and extension of transport service to new routes. All of these changes must be taken into account in establishing a measure of accessibility change which seems likely to be predictive of behavioral response on the part of remote area residents.

In order to deal with the different components of accessibility change in relation to specific expected behavioral responses, the Consultants defined five different types of accessibility:

1. Market accessibility
2. Village accessibility
3. Travel accessibility
4. Service accessibility
5. Household accessibility

Each of these measures has a value assigned for each household, based on the village in which the household resides and the market town which serves that village. The common denominator used to subsume the effects of change in distance, topography,

mode and vehicle type is the measurement of travel time by the most frequently used means of transport, before and after the study project, in each study area.

The operational definition of accessibility and accessibility change used in this study is given below.

1. Market accessibility (MAC) is defined for the principal market towns in the area covered by the surveys in each country. It is expressed as one over the number of time units required to travel from each market town to the nearest major center outside the project area. Thus, the value of the market accessibility measure always lies between zero and one. The time units used (minutes, hours, or days) are consistent within countries but not necessarily between countries.

There are 6 major market towns in the Malaysia study area, 4 in Thailand, 6 in the Philippines, and 11 in Indonesia. Each set can be rank ordered in terms of its present accessibility. In Malaysia, the criterion is the time (in hours) required to reach each town by express boat from Sibu; in Thailand the criterion is travel time by bus (in hours) from the two province capitals of Udon Thani and Sakon Nakhon; in the Philippines travel time by bus (in hours) is measured from Tuguegarao and Ilagan; and in Indonesia the accessibility is measured (in days) by the most common means of travel between each kecamatan and the island capital of Ternate. The most common mode of travel to Ternate is the Pioneer Sea Service in only four cases (Labuha, Maffa, Weda, Patani); in the remainder of the island, people generally prefer to travel to Ternate by motorboat or motorboat/minibus combination.

2. Market accessibility change (MACCH) is defined as change in time between the market town and the nearest outside center by the most common mode of transport used before and after the project, divided by time before. In Malaysia and Indonesia, the post-project time is defined as time using, respectively, the express boat service and the Pioneer Sea Service where these are the fastest available modes. An average waiting time before and after is included in order to reflect the improvement in accessibility brought about by more frequent and regular, though not necessarily faster, service (in Indonesia and the Philippines).

In general, almost all market towns in the study area experienced substantial increases in accessibility from the outside world, due both to study projects and to complementary or parallel investments in motorized vehicles by public and private operators. The exception to this is Thailand, where market accessibility to the outside world was essentially unchanged by the study projects.

3. Village accessibility (VAC) is defined as one over the time (in units of ten minutes) required to reach the nearest market town from the village by the most common mode of travel. Communities within ten minutes' travel time of the market town were assigned a village accessibility index of 1.000. The choice of a ten-minute time unit provided an intuitively meaningful range of values for the village accessibility index, from a high of 1.000 for villages within walking distance of the market town, to a low of 0.018 for villages more than nine hours journey from the market town.

4. Village accessibility change (VACCH) is defined as the percent reduction in travel time between the village and the market town over the project period by the most commonly used mode of transport before and after, i.e., (time before - time after)/ time before.

The amount of village accessibility change induced by the study projects varied considerably both within and between study areas. In Malaysia, only one-fourth of the surveyed villages reported a change in their travel time to the nearest market, and fewer still attributed this change to use of the express boat service as the most frequent mode of travel. About half of the Philippine villages reported a change in accessibility to the nearest market, usually as a result of a mode shift. Nearly all villages in Thailand experienced a high level of village access change (more than 50% reduction in travel time to market) as a result of the study projects in that country. In Indonesia, virtually no village access change occurred in the southern part of Halmahera Island, while high levels of access change were incurred by villages in the north because of road construction, independent of the Pioneer Sea Service.

5. Travel accessibility (TRAC) is defined as a combination of village and market accessibility, weighted by the proportion of short distance trips (village to market) and long-distance trips (to points outside the study area) taken by study area residents as a whole. This is interpreted as accessibility "out", or an inverse measure of network resistance to travel or transport activities on the part of study area residents. This measure can be expressed as

$$TRAC = \frac{TRD}{TT} \quad (VAC) \quad = \frac{(TRP + TRC)}{TT} \quad (MAC)$$

where TT = total trips made by survey respondents
TRD = trips to market town or district center
TRP = trips to nearest outside center (provincial capital)
TRC = long-distance trips (trips to national capital city)

6. Travel accessibility change (TRACCH) is similarly defined as the sum of village and market accessibility change, weighted by the percent of households experiencing an increase in short-term and long-term travel respectively. Operationally, the weighting factors were defined as follows:

> Change in short distance trips (TRDCH) = percentage of respondents traveling more often now than before to the district center, plus the percentage traveling there now who did not travel there before, minus the percentage traveling less often now than before.
>
> Change in long distance trips (TRPCH) = percentage of respondents traveling more often now than before to the provincial capital, plus those traveling now who did not do so before, minus those traveling less often now than before.

This permits the following formulation for change in travel accessibility (out):

$$\text{TRACCH} = \frac{\text{TRDCH (VACCH)} + \text{TRPCH (MACCH)}}{\text{TRDCH} + \text{TRPCH}}$$

7. Service accessibility (SVAC) is constructed from information obtained in the village surveys concerning visits to the village by various commercial and government services. This may also be considered as a measure of accessibility "in" or the inverse of the resistance of the network to travel or transport by outsiders.

The measure is calculated as an average of three indicators: Is the village regularly served by (a) the agricultural extension service, (b) the health care system, and (c) traveling traders? (In the case of Malaysia, missionary visits were also counted.) Each response is scored 1 for Yes, 0 for No, and the sum of positive responses is divided by 3 (or 4) to obtain an average for the village.

8. Service accessibility change (SVACCH) is defined using change measures for each of the indicators described above. These change measures are defined as follows: Each takes a value from -1 to +1 where 0 = no change, +1 means that the village is visited now and was not visited before, -1 means that the village was visited before but is not now, and a change in frequency or number of visits is given by (visits before - visits after)/visits before. Where a change in frequency is indicated but not given a numerical value, the value of 0.5 (more frequent than before) or -0.5 (less frequent than before) was used. The value of SVACCH is then determined by averaging the change measures for these three (or four) indicators.

9. Household accessibility (HAC) is a measure that gives equal weight to accessibility "in" and accessibility "out." Thus, $HAC = \frac{TRAC + SVAC}{2}$.

10. Similarly, household accessibility change (HACCH) is defined as (TRACCH = SVACCH)/2.

It will be seen that, according to these definitions, all the households interviewed in a given village are assigned the same value for household accessibility. Thus, the approach does not take into account such micro level variations as the difference in distance of farms from the village or individual differences in travel behavior. Nevertheless, the household accessibility index provides a meaningful measure of the major elements that constitute accessibility change from the point of view of the remote area resident: improved access from villages to markets, improved access from markets to the outside world, and improved contact and communication on the village level. By assuming that households in a single village experience approximately comparable accessibility change as a result of transport investment, it becomes possible to assess the relative importance of access change compared to other factors in determining behavioral response at the household level.

It can be argued that the accessibility measures used in this study fail to reflect the impact of changing travel costs. This impact is most noticeable in communities which have changed from predominantly non-motorized modes of travel (walking, canoeing, oxcarts or horse-drawn carriages) to motorized modes (bus or minibus, motorboat, or express). Even where motorized travel was commonly used in the project areas prior to the study projects, the rapid rise in the cost of petroleum products over the last five years has noticeably increased transport costs and consequently prices. It might be claimed that where rural incomes have risen less rapidly than transport costs (as is usually the case) remote area residents have actually experienced a decline in accessibility from the point of view of their purchasing power.

The true test of this contention is whether or not travel by rural residents has declined over the project period. To the contrary, it has increased. In addition, many communities report a voluntary switch to a more expensive mode of travel over the project period. The advantages in time savings, safety, comfort and convenience, not to mention the sheer adventure of motorized travel, are benefits for which they are willing to pay a substantial premium.

This is not to say that all the study project investments can be justified on the basis of time and cost savings. For many villages in the SEATAC study, the major change in accessibility was only indirectly linked to the study projects. Complementary or parallel investments in the private sector, in buses, motorcycles and motor boats, were essential to the achievement of access change at the village level. Further public sector investment in vehicles for service delivery was also a key element in increasing contact and communication at the village level.

The impact on patterns of rural income distribution of a change to motorized modes of travel requires further study at the community level. Detailed household budget data would be required to determine if the opportunity structure has been changed in such a way as to encourage increasing or decreasing stratification of rural society. It would also be interesting to investigate changes in the patterns of access to travel opportunities by age and sex resulting from the monetization and motorization of transport.

Finally, it should be stressed that the accessibility measures developed in this study are intended for use as a research tool, to enable comparison of the behavior of households exposed to different levels and types of accessibility change resulting from a wide variety of transport investments. It is not expected that these formulas will have a direct application in planning activities. Still, they may provide some guidance for the development of pre-project indicators in remote areas.

Indicators that lack of access is a key constraint on community socio-economic development could include the following:

Market access

1. Distance of major market towns from the nearest outside center and/or provincial capital.

2. Frequency of truck and bus (or boat) service between market towns and the outside center.

3. Cost of travel and transport between market towns and the outside center.

Village access

1. Distance of village from nearest market town.

2. Frequency of truck and bus (or boat) service to nearest market town.

3. Cost of travel to nearest market town by alternate modes.

Service Access

1. Frequency of visits to village by agricultural extension service.

2. Distances from village to nearest points of health care and educational service delivery.

3. Frequency of visits to village by mobile services.

4. Distance from village to nearest shop/commodity trader establishment.

5. Frequency of visits to village by traveling traders.

The way in which these indicators should be weighted and combined, as well as the absolute values which constitute a measurement of "need" for access improvement, are matters for national policy makers and regional planners to decide. The indicators will not necessarily show what type of transport improvement will most effectively accomplish the desired change. They would, however, be useful in prioritizing a list of competing projects within the framework of a regional access improvement program.

APPENDIX C
CALCULATION OF WEIGHTS AND MEASURES

APPENDIX C

CALCULATION OF WEIGHTS AND MEASURES

In compliance with the terms of the Consultant's contract, all measurements used in the SEATAC study report are expressed in the metric system. Specifically, the following units were used in the study:

Distance: Kilometers (1,000 meters)
Area: hectares (10,000 m^2) or square kilometers
Weight: kilograms (1,000 grams) or metric tons (1,000 kg.)

For consistency in comparing income levels across project areas, local currency was also expressed in U.S. dollar equivalents.

The conversion factors used in obtaining metric unit values from each country data set are given below.

Malaysia

Distance:	1 mile = 1.6 kilometers
Area:	1 acre = 0.405 hectares
	1 square mile = 640 acres = 2.59 square kilometers
Weight:	1 kati = 0.605 kilograms
	1 gantang = 6 katis = 3.63 kilograms
	1 pikul = 100 katis = 60.5 kilograms
Volume:	1 gunny sack (padi or maize) = 1.6 pikuls = 96.8 kilograms
Currency:	M$2.40 = U.S. $1.00

Area planted by crop was sometimes given in terms of the number of trees, vines, etc. planted. Conversion factors applied to determine total area cultivated include:

Pepper vines:	400 per acre
Coconut trees:	100 per acre
Sago trees:	100 per acre
Fruit trees:	100 per acre
Illipenut trees:	100 per acre
Cocoa trees:	150 per acre
Coffee trees:	150 per acre

Philippines

The metric system is already in extensive use in the Philippines. Distances are given in kilometers, land area in hectares or square kilometers. Coffee plantations, sometimes reported in numbers of trees, were converted to hectares at 145 trees per hectare.

A variety of weight and volume measures were used in reporting responses concerning production and sales of crops, principally rice and maize (corn). The following standard conversions were used:

Rice (palay)

1 ganta =	1.76 kilograms
1 sack =	44 kilograms
1 cavan =	44 kilograms
1 cart =	22 cavans = 1,000 kilograms or 1 metric ton

Corn (maize)

1 ganta (shelled) =	2.32 kilograms
1 cavan (unshelled) =	30 kilograms
1 cart (unshelled) =	20 cavans = 600 kilograms

Tobacco

1 "stick" =	1.0 kilograms
1 quintal =	46 kilograms
1 bale =	2.5 quintals = 115 kilograms

Coffee beans, mongo beans, peas, etc.

1 basket or bunch =	0.1 kilogram
1 ganta =	2.3 kilograms
1 cavan =	58 kilograms
1 sack =	58 kilograms

Monetary units were converted to U.S. dollars at the rate of 7.3 Philippine pesos = U.S. $1.00.

Indonesia

Indonesia also operates on the metric system to a large extent. Distances were given in kilometers, land area in hectares, and production and sales generally in kilograms.

A number of tree crops are important in Indonesia. The following conversion factors were used to determine cultivated area:

Sago trees:	200 per hectare
Coconut trees:	200 per hectare
Banana trees:	275 per hectare
Other fruit trees:	200 per hectare
Clove trees:	150 per hectare
Nutmeg trees:	150 per hectare
Cocoa trees:	400 per hectare
Coffee trees:	400 per hectare

Conversion of production or sales figures was required only in the case of bananas. The following factors were used:

1 hand =	1 kilogram
1 stalk =	5-7 hands
	= 6 kilograms

Indonesian currency was converted to U.S. dollars at the rate of 415 rupiah = U.S. $1.00.

Thailand

In Thailand, the metric system has been officially in use since 1947. Distances are given in kilometers and weight generally in kilograms. A unique unit of land area, the rai, is used.

1 rai =	1600 m^2
6.25 rai =	1 hectare

Thai currency was converted to U.S. dollar equivalents at the rate of 20 Baht = U.S. $1.000.

APPENDIX D
METHODOLOGY FOR ASSESSING INCOME DISTRIBUTION IMPACTS

APPENDIX D

METHODOLOGY FOR ASSESSING INCOME DISTRIBUTION IMPACTS

In order to assess the impact of an investment on income distribution patterns in a region, it is first necessary to know the existing levels of income in the region both before and after the investment, and the proportion of the population represented at each income level at each point in time. To do this, a representative sample of the population is selected and income levels are established for each member of the sample. The resulting values represent a range of incomes which can then be divided into any number of segments of equivalent length: e.g., quartiles, quintiles or deciles. The proportion of the population in each income category is then estimated on the basis of the sample distribution.

The accuracy with which this sample distribution reflects the actual pattern of income distribution within the target population is a function of two major factors: (1) the accuracy and completeness of the sampling procedures employed, and (2) the accuracy and completeness of the information provided by survey respondents. By selecting a sufficiently large number of respondents at random from a defined population, the risk of results deviating from the actual income levels of the population by a given amount or proportion can be made as small as desired. A standard error of as much as 10% may be accepted for research purposes, while an error level of 5% or less is generally required for studies in support of policy decisions or program planning that will directly affect the lives of people in the target population.

Obtaining accurate and complete income information from respondents is one of the most difficult aspects of any income distribution study. Apart from a natural disinclination to reveal the full extent of their economic activities (especially if some of these are illegal or subject to government control), respondents in remote areas are often unprepared to deal with the quantitative precision of the information requested of them. They rarely have written records of their income or their expenditures, unless they receive wages or salaries through the formal employment system. Domestic consumption of home-grown crops is difficult to estimate. To complicate matters further, the SEATAC study found that informal barter or exchange, as well as communal sharing of surplus produce, still plays a large part in the only partially monetized economies of remote areas.

Measuring Income Levels

Anticipating some of these problems, the SEATAC study participants constructed a questionnaire designed to assess income at the household level in remote areas. The methodology takes into account a variety of possible income sources, including income contributed by household members other than the head of household. It focuses on farm production as the principal source of income for remote area residents, both in cash and in kind. It also includes in the "farm" sector, income from hunting, fishing, gathering, manufacture of craft products, and seasonal farm labor. In the nonfarm sector are included wages for nonfarm labor, salaries, pensions, contributions from children or other relatives, and income from a private business such as a shop or a rice mill.

Quantitative information was obtained concerning farm production and sales and wages for labor (both farm and nonfarm). However, due to the anticipated unreliability of reporting and the impossibility, in the field work situation, of verifying responses, no quantitative information was sought on the value of salaries, pensions, support from children, or business income. Thus, income levels for groups having these types of nonfarm income are understated.

Household income was defined as the sum of three quantities: (1) value of cash sales, (2) value of domestic consumption, and (3) wage labor income. Where a respondent was a renter or tenant instead of (or as well as) a landowner, the value of his land rent was then subtracted from his total household income.

The value of cash sales was determined by multiplying the reported sales of each farm product (including livestock, fish, forest products, and craft products, as well as up to 14 possible crops) by a standard producer price for each product in each project area, determined through the commercial surveys. This avoided the necessity to ask individual respondents to report the actual amount of their income from sales. However, it masks possible micro variations in the prices actually received by project area residents, particularly where these vary with accessibility and/or information levels.

The value of domestic consumption was estimated by subtracting the reported quantities of each product sold from the reported quantities produced, and multiplying the remainder by the same standard prices. Wage labor income was estimated by multiplying the reported number of months worked times 25 (an estimate of the number of work days per month) times the reported average daily wage. Where laborers were paid in crops, the labor income was

estimated by multiplying reported production times the reported laborer's share times the standard price for the crop involved. Where "other" products were specified, the production and price was assumed to be that of food crops other than rice (maize, cassava, and vegetables).

The value of land rent for sharecroppers was computed by multiplying the reported landlord's share times the production of the principal crop times the price of that crop. Where rent was paid in cash, no cash value was assigned. (This is a deficiency of the questionnaire which could be easily remedied in future studies by ascertaining a standard unit value for land rent in the project area and multiplying this value times the amount of land rented by each individual household.) In actual fact, relatively few cash renters were found in the remote areas of the SEATAC study.

Determining Income Distribution

Through these operations on data obtained from the household survey questionnaires, a value for household income (exclusive of salaries, pensions, support from children, and business income) was computed for each survey respondent. These values defined a range of household incomes for each data set. A computer program was prepared to display the distribution of each data set in a histogram composed of twenty intervals along the range. Inspection of these histograms leads to the following conclusions:

1. In all project areas, the vast majority of households are in the lowest income brackets. In other words, the median income for the project area population is far below the mean or average income.

2. In all project areas, the household income level equivalent to U.S. $300 provides a convenient break point to distinguish a significant number of relatively well-off households from those which are relatively poorer. Note that this cutoff point in every case falls within the lowest income bracket (i.e., is less than one-twentieth of the maximum income found in the sample).

3. The income pyramids for Thailand and the Philippines are slightly less steep than those for Indonesia and Malaysia. This is the basis for our preliminary conclusion that rural society in the former countries is slightly less stratified (from an income point of view) than in the latter countries.

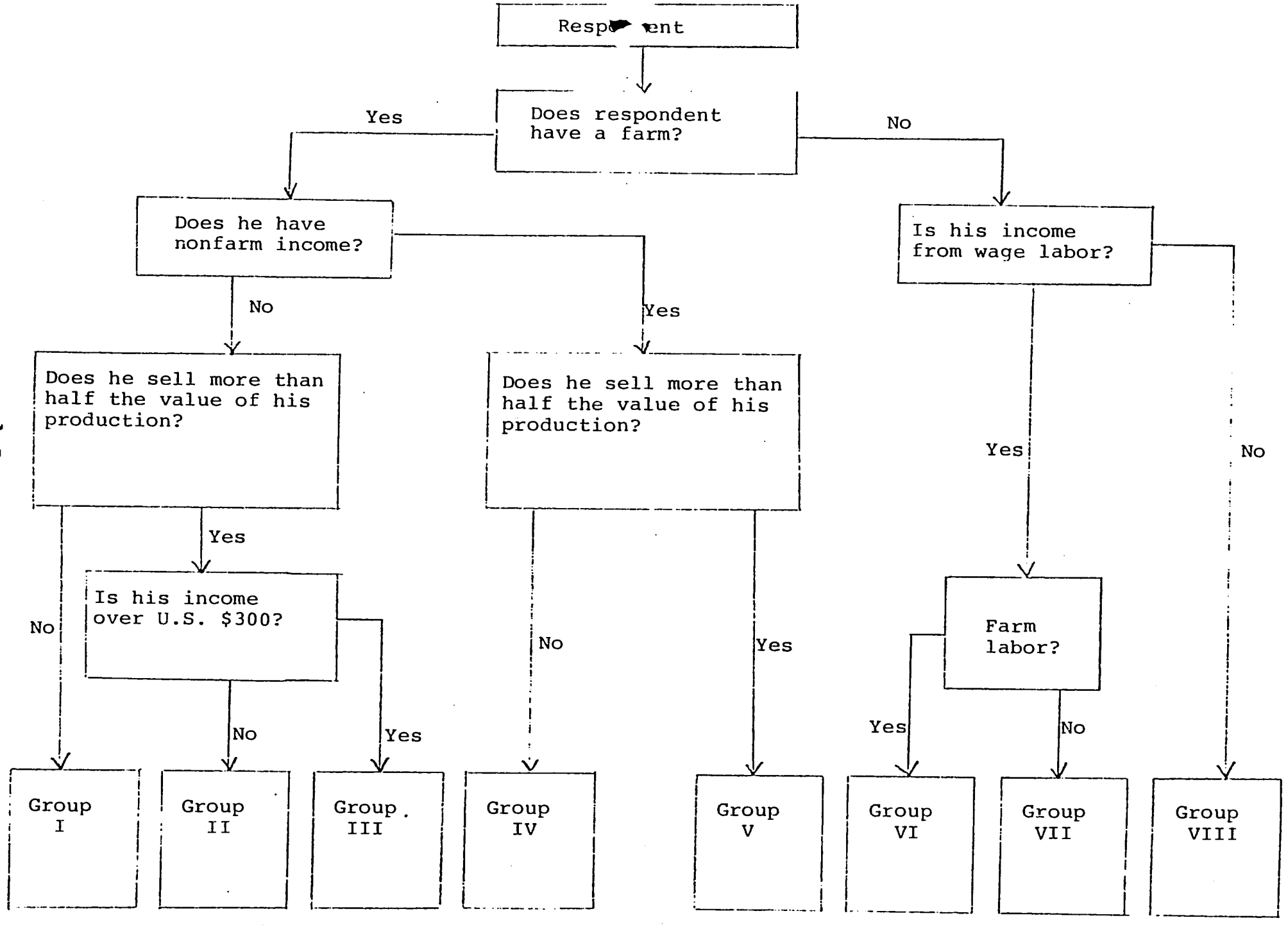
It was clear from the histograms that a strictly numerical allocation of the surveyed households to socio-economic groups based on equal intervals along the income range would not be productive for our study from an analytic point of view. In addition to the amount of income received by a household, it was felt that the source of income might be an important indicator of a propensity to participate in certain key forms of behavioral change. Furthermore, it was felt that certain tenure and employment characteristics were as important as income levels in defining socio-economic status in the project areas. Finally, the method of measuring income levels was clearly inadequate when it came to describing the socio-economic status of households with a significant nonfarm income source.

Therefore, for research purposes only, a set of eight socio-economic groups was defined through the use of a three-way classification system. The decision process is depicted in the flow chart of Figure D-1. The share of the population in each socio-economic group, its average household income and per capita income were then estimated on the basis of the sample distribution (see Table 6.9 in the text). This distribution showed that landless laborers (farm and nonfarm) and low-income cashcropping farmers (often sharecroppers) are generally on the bottom of the income pyramid, with subsistence farmers in the middle and commercial farmers (with or without nonfarm income) at the upper end of the range.

Measuring Change in Income Levels

The SEATAC study participants decided, in developing the household questionnaire, that it would not be possible to obtain a reliable estimate of pre-project household income based on respondent recall. A variety of qualitative change measures were incorporated into the questionnaire, which could be loosely interpreted as reflecting a change in income levels: increase or decrease in area planted for different crops, in livestock inventories, and in household assets, as well as changes in consumption of various goods (fertilizer, seeds) and services (education, health care, travel). However, these changes could in many cases be equally well attributed to an alternate cause; survey responses reveal that increasing wealth is rarely cited as a reason for making such changes in behavior. In contrast, increasing cash incomes from a growing monetization of the rural economy both permits and in some cases requires such behavioral change as a response to the pressures for specialization of production activities within the local community and the region.

FIGURE D-1


Respondent
Does respondent have a farm?
Yes
No
Does he have nonfarm income?
Is his income from wage labor?
No
Yes
Does he sell more than half the value of his production?
Does he sell more than half the value of his production?
Yes
No
Is his income over U.S. $300?
No
Yes
Farm labor?
Yes
No
Group I
Group II
Group III
Group IV
Group V
Group VI
Group VII
Group VIII

Thus, although there is a substantial amount of qualitative evidence leading to the belief that household incomes have risen in real terms in the project areas over the study period, the SEATAC study provides no quantitative estimate of pre-project income levels. Since only area planted data were collected for the pre-project year, not production or sales, making even a gross estimate of the value of production would require making assumptions about changes in yields and prices that cannot be documented or determined with confidence. Furthermore, the effect of inflation in each of the project areas over the project period is not well known.

In the absence of quantitative evidence concerning pre-project income levels, the SEATAC study focused on several types of behavioral change as they affected different socio-economic groups in the project areas. The key items were change in the source of income, change in tenure status, and change in patterns of production and marketing.

With respect to change in source of income, the study examined the proportion of respondents in each socio-economic group which reported shifting into or out of nonfarm income sources over the study period, as well as the proportion of households which showed a rise or decline in the number of income sources by socio-economic group. The meaning of these figures is open to interpretation in specific situations, but the anticipated general pattern is an increase in nonfarm activity and a greater variety of income sources becoming available to households over the project period. Since the reported increases were in fact small, it is difficult to assert a statistically valid finding concerning the distribution of this income impact over the socio-economic groups.

Change in tenure status was tabulated in two ways: change in land ownership and changes in patterns of renting or sharecropping. Both showed relatively little change over the project period, and the changes that occurred could often be attributed to in-migration or to life cycle changes. Renting or sharecropping, except in the Philippines, became a way for landowners to extend their farm enterprises, and the extent of such activity varied from year to year with the relative value of the crops produced. Both high income and low income farmers participated in this pattern.

A number of variables were to be examined in order to determine the distribution of changes in production and marketing patterns by socio-economic group.* They included, for production: change in total area cultivated, change in area planted by crop, change in fertilizer use, and change in the use of high yielding varieties

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* The computer programs to implement this methodology were not completed during Phase I.

of seeds. For marketing, the following variables were to be analyzed: change in transport mode, change in commercializtion by crop, and change in the point of sale by crop. After constructing change measures (by computer) from the household survey, the incidence of these changes by socio-economic group would be reported as a function of the number of producers of each crop in each group.

Interpretation of any of these findings in terms of income distribution impacts depends on a detailed knowledge of local circumstances. For example, an increase in area cultivated may not necessarily mean an increase in income; it may be a response to worn-out soils or erosion, causing a household to invest more labor for the same economic return. Conversely, a decrease in area cultivated may well imply a shift into high value vine or tree crops rather than a decline in productivity. The important issue, once a meaning has been attached to behavioral changes in the local context, is to see which groups have benefitted from these changes, which ones have been penalized, and which ones have failed to respond to new opportunities. Only a qualitative analysis of this type can lead to the formulation of policy recommendations for improving the income distribution impacts of transport investments.

Measuring Income Distribution Impacts for Policy Planning Purposes

The methodology adopted in the SEATAC study for research purposes is not necessarily the most appropriate methodology for policy analysis or planning purposes. Specifically, it is probably not necessary to consider so many different socio-economic groups, if one is looking at the single issue of income distribution. The survey instruments used in the SEATAC study could be adapted to serve this purpose, chiefly by asking (or attributing) a financial value for the various nonfarm income sources, as well as for land rent. This would lead to a more accurate representation of the real range of household incomes (despite the probability of systematic under-reporting) and would permit the use of mathematically defined units of analysis, such as, for example, deciles on the income scale.

The deficiency of this approach is that it fails to account for the nature of income shifts and therefore makes it difficult to understand the linkages involved in translating a transport (or other) investment into a changed pattern of income distribution. For planning purposes, however, an objective can be simply stated in terms of a desired pattern of income distribution, and progress toward achieving this objective can be measured at intervals using the appropriate parts of the SEATAC methodology and materials. It should be noted that the information provided in the SEATAC study,

especially if numerical values are attributed to nonfarm income sources, constitute a valuable set of baseline data for future income impact studies related to investment in the project areas.

A second difference between the SEATAC study and a regional planning study is the fact that the SEATAC household survey focused exclusively on rural residents. A somewhat different income distribution pattern would have been found if urban households had been included in the samples. Although these are a small minority of the population in remote areas, their incomes are generally substantially greater than those of rural households, and the social structure of urban communities is markedly different (more single-person households, more institutional and group living, more opportunities for employment, etc.)

If the SEATAC materials were to be used in a study of income distribution encompassing urban households, they would require substantial revision. Also, of course, the baseline data provided by the SEATAC study would not be wholly comparable with the results. Nevertheless, the general approach used in this study could be carried over to future planning studies, particularly those intended to have an impact on the material welfare and the quality of life of the majority of residents in remote areas.

ACKNOWLEDGMENTS

ACKNOWLEDGMENTS

The following lists note the major participants in the present study and the attendees of the workshop in Kuala Lumpur.

The Consultants would like to express their gratitude to all those whose generous devotion of time and skills enabled the completion of the study.

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