Research Project on the Socio—Economic Impact of Roads in Sarawak

Volume 1

MAIN REPORT

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PART I

I. INTRODUCTION

The project was conceived when the authors' attention was drawn to the relatively large amount of allocation in the development plans for road development in the developing countries citing road development as a determining factor in rural modernisation.

The authors decided to select the state of Sarawak in East Malaysia as a case study to look into the social and economic impact of road development within the context of a developing country. Thanks to the sponsorship of the International Development and Research Centre of Canada and the assistance of the administration of Nanyang University, the project was launched and completed.

1. OBJECTIVES

The main objective of the study is to understand and explain the comprehensive interrelationship of road development with other key variables and to find out ways in which the settlement schemes and land use have been affected in terms of economic reorientation in response to development of highways and secondary networks such as feeder roads. Hopefully, a comprehensive picture could be built up on the impact of roads on a largely agricultural and traditional society made up of different ethnic groups operating at different economic levels.

The study also attempts to work within the conceptual and theoretical framework that as the economy evolves; there is increasing complexity in the transportation network with a corresponding mode of transportation in each stage of economic development forming a modal continuum over time and space; and that the increased complexity of the network interacts with the existing system of spatial economic structure resulting in an adaptation and learning process whereby the rural system becomes more open and links itself to the modern economic system through intensified energy flow between the rural areas and the service centres, the sea ports and eventually the world economic, political and cultural system.
The last objective of the study is to evolve policy oriented recommendations as a guide for problem solving. These include ways on combating declining service centres, and the planning of viable rural settlements supported by a comprehensive range of infrastructure facilities and environmental qualities.

2. METHODOLOGY

(a) **Hypotheses** The various hypotheses could be stated as:

(i) The growth of a region is a simple function of road investment,

(ii) The mode of transportation of a region is a function of the level of regional development and that a transport modal continuum exists in all regions.

(iii) The rate of rural-urban migration is a complex function of road investment and other factors in the region.

Generally our view which is supported from the field data is that "The transport/development relationship is essentially a two way interaction process, and the results of the interaction depend upon the type of economy involved and upon the level of development at which transport improvements are effected". (Hoyle, *Transport and Development*, p.11)

The corollary to the above is the hypotheses that there are two basic phases of transport development which affect the economic growth in different manners. The first phase, known as initial transport provision which is related to the construction of major modern roads in the case of Sarawak in theory should stimulate economic growth up to a certain point as the promotion of increased mobility is likely to widen the domestic market. The second phase, described as transport elaboration, is related to the extension of the basic system including improvements in its efficiency which permits, again in theory a higher level of economic growth. Both phases of transport development are present in the areas in Sarawak.

(b) **Approach** A simple time frame is adopted for the study by demarcating it into the time before the road is completed and the time after the road is completed. It is a "before and after" type of study
on a number of key variables which are listed below:

(i) changes in the social and demographic composition of the households over time,

(ii) changes in the housing type and related facilities over time,

(iii) changes in migration patterns over time,

(iv) changes in agricultural production over time,

(v) changes in marketing patterns over time,

(vi) changes in education and newspaper arrival over time.

(c) Sampling. In order to facilitate easier sampling at a later stage, the regions in Sarawak are categorised into three. One is the more advanced region with an early introduction of roads, with higher population density and higher regional products such as Division I; the next category is where roads have been introduced early but it is not accompanied by high regional growth such as Division II; the third category has been traditionally a backward region where there has been rapid economic growth due to the recent introduction of roads such as Division IV.

The sampling of towns and villages is stratified based on the above categories. In each category, the percentage of sample is selected to approach the percentage distribution of the state. The samples have also taken into consideration ethnic groups and land schemes. Among the regions, Division III has been left out due to security reasons and Division V is a frontier region which is also left out of the study area.

A number of sampling methods were considered, simple random sampling, stratified random sampling, cluster sampling and systematic sampling, etc. Due to the various problems outlined below, no particular one is favoured. Instead a combination of the methods were adopted to suit the local conditions.

One of the difficulties is the lack of reliable and up to date information of the population and their social and economic characteristics on a small area basis. This made sampling especially difficult in areas where statistics are not up to date and often non-
existent. Similar difficulties are faced with maps and plans.

As a result, the total sample quantity and quality is constrained by the availability of manpower, availability of published statistics, maps and knowledge on local conditions.

In view of the above, it was decided to select samples in a settlement by an arbitrary fraction which is a function of the settlement size. This was mainly done for urban service centres where the total number of shops are known beforehand. The number of samples were representative of the type of retail function. The selection of shop of a particular function is then done by systematic sampling.

For rural farm cases, samples are randomly selected along the feeder road leading to or between the settlements. Systematic sampling is adopted which is also representative of ethnic groups.

The sampling fraction ranges from 100% in small centres to 30% in large centres. Similar guide lines were used for longhouses where the number of doors are known. The selection of a long house is based on local knowledge on the type of crop planted and ethnic group.

(d) Field Survey A test questionnaire was designed and tested in the field on 60 cases between May and June 1975. The pilot survey has been very useful and it provided the necessary feedback in the final revision of the questionnaire at the later stage. The pilot survey concluded the First Phase of the study ending in late 1975.

The Phase II of the study was carried out in early 1976 culminating in the actual survey of a total of 1,031 samples which was completed on 25th May 1976. The field survey employed about 25 second and third year undergraduates of the University of Malaya and three Nanyang graduates. About 75% of the field workers are natives of Sarawak.

The field work covered 758 rural samples and 273 urban samples totalling 1,031 samples. However, only 992 cases are processed of which 28% are urban samples and 72% are rural samples covering 28 rural settlements and 11 urban centres.

The rural samples are distributed as follows: 40% in the First Division, 18% in the Second Division, 15% in the Third Division and 27% in the Fourth Division. The urban samples are distributed in
First, Second and Fourth Divisions with 37%, 19% and 44% respectively.

(e) **Difficulties** A number of problems encountered in the field are listed below. Most of these are of frequent occurrence in major surveys carried out in developing countries.

Many interviewees noted the low standard of education of natives as the major source of difficulties in the recent field work. Very often they failed to understand the need for surveys as surveys were new to most of them. Besides curiosity, the surveys planted fears among them. The lack of records on production statistics and income also added to the difficulties.

Psychologically, many suspect that the interviewees were sent by the Income Tax Department. Very often they do not like private matters to be disclosed. In Bintulu area, for example, most of the respondents were very cooperative until they were questioned on their income, age, number of workers employed and ownership of land properties. In some cases, workers were employed without Employment Provident Fund contributions, and hence the reluctance of the respondents to disclose the number of workers employed by them.

Local party politics also created some unnecessary misunderstanding. Many feared that the interviewees were sent by a certain political party to campaign for support for the election.

Communication between interviewees and respondents was generally good. However, in isolated cases, e.g., in Lambir Land Scheme, language was a problem as many natives cannot speak Malay.

In a traditional rural community, individual approach to the respondent generally did not work well. Especially in Batu Niah area, the usual procedure according to the local custom was to contact the community head first. In some cases, the interviewee had to waste almost the entire morning to search for the Headman, some of whom were only available at night. Once the headman was located, the job was straight forward and usually very smooth.

3. **REPORT**

(a) **Organisation of the report** The final report is presented in three volumes. Vol.I is the main report and is composed of three parts:
Part I is an introduction and in it presents a summary of the objectives and methodology of this study. Part II consists of reports on rural areas and urban centres and mainly on the analysis of a key variable in relation to the social and economic impact of roads in the sample areas. Part III is on findings, implications and policy recommendation. Vol II is an appendix of tables, charts and maps whereas Vol III is a collection of background papers related to the study.

(b) Analysis of Field Data In Volume I, Part II the field data are analysed according to seven major subsections. The social, demographic structure of households describes the household size, ethnic composition and level of education of sample households. The housing subsection analyses the house ownership, housing type, improvement of houses, sources of building material, mode of transportation, availability of electricity and water. The employment subsection studies the impact before and after the roads were completed on employment structure, place of work, mode of transport and household income. Migration forms the next subsection on migration history of settlers, and migration characteristics including number of family members who have left the settlement, relationship with head of household, age of migrants, destination, reasons for migration, and their present occupation.

Subsection V is on agricultural production, analysing the impact on work force, expenditure on production factors, sources of farm income, acreage under padi, rubber and pepper. The subsection VI deals with the marketing of goods and services, including their market, channel of distribution, frequency of marketing, modal split, reasons for modal choice and trip duration. The last subsection is on the impact of roads on education and transmission of information through newspapers.

(c) Findings, implications and policy recommendations The findings are also categorised into housing, population and social infrastructure, employment, migration, agricultural production, marketing, and education. The implications of each finding are discussed and correspondent policy recommendations are also put forward. The policy recommendations are general statements which
could lead to further indepth studies of related problems for working out programmes for live implementations.

(d) Appendices Following the findings and recommendations, all the relevant data, tables, charts and maps are attached in the appendix for those who are interested in more detailed information for more indepth studies.

(e) Background Papers The background papers consist of a collection on various topics related to the study. This could provide the general readers who are not familiar with the Sarawak situation a better understanding on the issues, background and history. The papers collected are on economic development, development planning and agricultural policy, history of road development, land tenure systems and demographic characteristics.
PART II
DATA ANALYSIS

The present part is divided into six sub-sections on social and demographic structure of households, housing, employment, migration, agricultural production, marketing, education and information transmission.

Owing to the limitation imposed by the type of data collected, the technique of analysis is confined to simple percentages. In each of the above sections, a comparison is made between situations before and after the roads were constructed. As far as possible, the data are analysed in relation to settlement size, ethnic composition, level of education, household income, settlement functions and characteristics, history of road development, proximity to urban centres and whether the settlement is a planned settlement.

I. SOCIAL DEMOGRAPHIC STRUCTURE OF HOUSEHOLDS

1. Household Size

A total of 700 households were interviewed in the rural farm survey of which 36% are in the First Division, 19% in the Second Division, 19% in the Third Division and 36% in the Fourth Division.

The average household size for all rural samples is 6.85 persons per household. There are some regional differences in household size with the economically more advanced regions having a higher household size of around 8 and less advanced regions having a lower mean household size of around 6.2. A possible explanation of this deviation is that the areas with smaller household size are areas where roads are introduced only recently. Those who gather to live along the roads are usually families without many children and young couples. Statistics in the First and Second Division also showed that in planned settlements such as land schemes, the household size is also smaller, ranging from 4.7 to 6.6 persons per household. (see Table I.1)

2. Ethnic Composition

There is a clear-cut concentration of certain ethnic groups in certain areas. The Bidayuh (Land Dayak) is mainly concentrated in the First Division in Kg. Pichin, Kg. Tebakang, Kg. Riih, Kg. Tunggak, Kg. Bunun, Kg. Trusenkrang and Kg. Kakai consisting of 100% of the population. The Iban is concentrated more in the Second Division and Triboh land scheme in the First Division consisting of 87% to 100% in
these areas. The Malays are found mainly in the First Division in Kg. Tebakang Melayu and Kg. Hilir consisting of 94% to 100% of the settlement population. The Chinese on the other hand clustered in areas closer to larger urban centres. They are found mainly in Kg. Tebakang China in the First Division and Bintulu, Batu Niah in the Fourth Division consisting of 80% to 100% of the population. The Kedayan is mainly found in Bekenu which consists of 44% of the settlement. (see Table I.2)

3. Level of Education

In general, the level of literacy is very low, the literacy rate for all rural samples is only 39%. It is generally higher in areas closer to larger service centres. The illiteracy rate can be as high as 90% in Kg. Piching and as low as 24% in Bintulu.

The statistics showed that in areas where Chinese are predominant, the illiteracy rate was only 30% and 24% before and after the roads respectively. This is attributed to the traditional emphasis of the Chinese in basic primary school education.

It is also observed that the illiteracy rate in land schemes is generally lower as evident in Sibintek and Lambir where the illiteracy rates are 65% and 51% respectively.

None of our samples indicated persons with tertiary level education. The percentage of people with secondary education ranges from 3% to 22% and primary school education from 4% to 67%. (see Table I.3)
II. HOUSING

1. House Ownership

In the context of rural areas in Sarawak, most of the households interviewed owned their houses. In areas where longhouses are the dominant housing type, the houses are built with collective efforts, and come under collective ownership.

The impact of roads on house ownership varies depending on the proximity to and the influence of larger urban centres, and whether it is a planned settlement. The impact can thus be placed into three categories.

The first category is those sample settlements which are located in the predominantly "rural" areas where "urban" influence is negligible. These rural settlements have a high percentage of house ownership ranging from 90% to 100% before the roads were completed and 95% to 100% after the roads were completed. Examples of these villages are Kg. Piching and Kg. Tanggak.

The second category is those sample settlements with greater influence of larger urban centres. The percentage of households owning houses ranges from 81% to 95% before the roads are completed and 70% to 90% after the roads were completed. Examples of these rural centres are Bintulu, Kg. Hilir, Kg. Baki. It is believed that as a rural centre is within those influence of larger service centres, due to competition among various land uses, some migrants from other settlements may have to rent houses from the local people together with the lands. This is especially true in areas where lands available for cultivation are scarce due to constraints imposed by the existing land tenure system in Sarawak.

The third category are those planned rural settlements such as land schemes. It is observed that most land schemes have almost 100% ownership rate. Although it may be argued that the house ownership of these schemes is not related to road development, it could also be argued that roads have in fact made the land scheme capable of its implementation. (see Table II.1)

2. Housing Type

The introduction of roads has the effect of increasing the sphere of influence of the urban service centres in the form of information
and material flows. The impact of these on the type and physical form of buildings are analysed here to see if the introduction and improvement of roads in the rural areas have any impact on the above.

The data obtained from the field and field observation confirmed the idea that the road has a considerable impact on type and form of housing of the settlements. The impact took several forms. Firstly, it may intensify the occurrence of certain traditional housing types such as the longhouse along the roads; secondly, the disintegration of the longhouse into terrace or detached houses; thirdly, in areas where longhouses are not in existence, attap houses give way to wooden houses with zinc, asbestos, and tiled-roofs and houses begin to use cement and bricks in their constructions. Each of these are described briefly below:

Of the total of 23 settlements studied, 18 or 87% are found to have longhouses. Except in 6 settlements or 30% of the total reported no changes in sample households living in longhouses before and after the roads were introduced; 45% reported a decrease in percentage of people living in longhouses while 25% reported a slight increase in percentages.

Settlement which reported an increase in relative importance of households living in longhouses are Kg. Riih from 75% to 83%; Roban from 59% to 73%; Betong from 55% to 60%. A possible reason for this could be that even if the roads were completed for quite some time in the Second Division, it is not accompanied by a correspondent improvement in economic development of settlements along the roads. Most households continued to rely on collective efforts for their living.

There are seven sample settlements reporting no change in their percentages in households living in longhouses. These settlements include Kg. Tebakang Dayak, Kg. Hilir, Kg. Bunau, Kg. Baki and Bintulu areas. These areas represent areas where people continued to prefer the traditional longhouses despite the influence brought about by the development roads. This reflects that the influence of roads have a cultural barrier to cross. Another possible factor could be their continued reliance on shifting cultivation in those areas.

About fifty percent of the total number of sample settlements reported a decrease in percentages of households living in the longhouses. About 70% of these settlements have decreased more than 30% and some could be as high as 70%. These settlements are Kg. Trusenkrang,
Kg. Tanggak, Bekenu, Kg. Piching, Lambir, Melugu and Triboh. The last three are land schemes and others either have the advantages of proximity to large service centres or enjoy rapid growth. Two others have less than a 30% reduction, viz Roban and Niah areas.

For the three settlements where there are no longhouses, there is a significant decrease in percentages of attap houses from 87% to 22% in Kakai, and a drop of 53% in Kg. Tebakang China. Most of these settlements are either Chinese, Malay or Bidayuh/Dayak settlements located very close to large service centres. In these settlements, there are significant increases in wooden houses with asbestos, tile and zinc roofs.

As for other more expensive type of houses, such as brick houses and bungalows, none were in existence before the roads were completed. The increase after the roads were completed could be as high as 15% in Kg. Kakai, 6% in Kg. Baki, 6% in Trusenkrang, and about 5% in Niah and Bintulu areas.

Evidence collected from the field supported the statement that roads have an impact on housing types of most of the settlements especially in those areas where economic improvements have taken place. However, in areas where growth is stagnant, despite the introduction of roads, most people continue to live in longhouses. We would argue in subsequent sections that roads have actually helped to transport certain bulky materials to make the occurrence of certain housing types possible, such as asbestos, zinc, brick and cement; especially in areas where there are traditionally no water transport facilities. (see Table II.2)

3. Improvement of Houses

Improvements to houses are generalised into (i) the physical extension of the building and (ii) repairs. The percentage of households who extended their buildings vary from settlement to settlement from 4% to 77% Kg. Piching and Kg. Kakai and Kg. Seratok have 77%, 44% and 42% respectively; all of these are close to large service centres. Of the three land schemes, two of them, i.e., Triboh and Lambir have 27% and 14% respectively. This reflects the variation among land schemes.
As far as repairs are concerned, most settlements in areas where houses were built for a longer period tend to have more repair work done. This is reflected in settlements in the First and Second Division, where over 40% of the sample settlements reported more than 40% of the households had taken repair work. Most of these settlements are along, or close to, the trunk roads e.g., Kg. Tebakang Melayu, Kg. Tebakang China, Melugu and areas around Roban, Betong. In the Third and Fourth Division where the roads were completed later, the percentage of repair is very low, generally less than 10%. This indicates that most of the houses are still relatively new.

With regard to when the buildings are extended, most of the settlements in the First, Second and Third Division reported the period between 1970 - 1974; whereas in the Fourth Division, the period is After 1975. Similarly, for those households which reported repair works, the period involved is after 1970 for the First, Second and Third Division, whereas the Fourth Division has less repair work done during the period. Out of six settlements in the Fourth Division, only two reported having done repair work during this period.

From the above, it is evident that the extension and repair work have a close relationship with the year the roads were completed. (see Table II,3)

4. Sources of Building Materials

Attempts are also made to find out if the introduction of roads have created changes in the spatial movement pattern of the area under study. The households are interviewed on where did/do they obtain their building materials from. In order to suit the local conditions in Sarawak, building materials refer to cement, wood, attap, zinc, tiles, brick and gravels.

From the data collected, it is found that most of the settlements have lessened their reliance on materials obtained from the settlement itself and usually from the nearby forests and increased their interaction with the nearby service centres to obtain materials such as cement, bricks and roofing materials which are bulky to move and are often not available from the nearby centres and not from the forests. The data
also showed that after the road was introduced, smaller centres such as Tebakang in the First Division, Roban in the Second Division and Niah in the Fourth Division are loosing out to larger service centres in providing the surrounding farmers with building materials.

The extent to which a settlement depends on the forest for materials also depends on the type of housing being extended. It is found that "richer" settlements rely less on the forest and more on the more distant service centres.

In the First Division, 12 out of 13 settlements indicated that they rely on the forest for materials. Almost all settlements indicated that the reliance has decreased by 3% in Kg. Baki and about 5% in Kg Tebakang Dayak. Three settlements are found to rely heavily on forest for materials before the roads were introduced with 83% in Kg. Rifih Which has dropped to 17%; 100% in Kg. Tebakang Dayak to 55%, and Triboh from 86% to 14%. Most other settlements have percentage above 10% before the road and dropped to less than 10% after the roads were introduced, e.g, Kg. Piching from 27% to 6%, Kg. Kakai from 22% to 6% and Kg. Baki from 11% to 8%.

There seems to be a heavy dependence from 30% to 90% on Serian for services and some even reaching as far as Kuching, e.g, Kg. Tebakang China and Kg. Baki along the Serian-Kuching Road. Most settlements reported 20% to 30% increase in interaction with Serian and some reaching 70%, e.g, in Kg. Kakai. Data also indicated that as Serian grows in dominance, Tebakang has been down graded. Kg. Piching, Kg. Tebakang Malayu and Kg. Trusenkrang have all shown a decrease in percentage from 8% to 0% 6% to 4%, and 10% to 4% respectively.

Similar events are observed in the Second Division, the Third and Fourth Division. In the Second Division, the dependence on the forest is 44% to 62% before the road and the drop averages about 40% (Range 40 - 60%). The dominant service centres in the Second Division are Saratok and Sarikei. Households from areas surrounding Roban and Betong Indicated that Saratok has become more popular. For Saratok, there is an increase of 12% from areas around Roban and 56% from areas around Betong. Households from Saratok and Roban reported an increase of 23% and 63% to Sarikei respectively. Before the roads were introduced, no households reported frequenting these service centres.
In the Fourth Division, Batu Niah is an expanding town at the expense of Niah after the road was completed. Miri is also an important centre capturing 40% from Batu Niah and 3.6% from Niah and 20% from Bekenu after the roads were completed. In Bekenu none reported going to Miri before the road was completed. (see Table II.4)

5. Mode of Transporting Building Materials

Besides finding out the changes in the spatial movement pattern, questions were also asked to find out the impact of roads on the mode of transportation of building materials. Generally, walking and water transport have shown a significant decline in importance and trucks and buses have become more important.

About 13 settlements or 60% of the settlements have reduced the modal split of walking and 21% indicated a slight increase and 21% indicated no changes. Before the roads were introduced, about 30% of the settlements studied have more than 50% on walking, and after the roads were completed, none of these settlements have more than 20% on foot. About 50% of the settlements have a modal split of households on foot with percentages ranging from 20% to 50%; and the rest, i.e., the last 20% of the settlements studied have less than 10% before the road and have less than 10% after the roads were completed.

As for water transport, i.e., those relying on boats for transporting their materials, 9 settlements or 40% of the sample settlements indicated relying on boats for transporting materials before the road, and only 3 settlements or 13% continued to rely on water transport. This means a reduction of 66% in the number of settlements who gave up water transport. In the First Division, the dependence on water transport is small (less than 10%) before the road and nil after the roads were completed. In the Second Division, a similar situation prevails, whereas in the Third and Fourth Division, the dependence is relatively greater with 26% in Sibintek and 80% in Batu Niah. However, after the roads were completed, none in Sibintek continued to use water transport and the percentage in Batu Niah has been reduced to 66%, i.e., a decline of 14%.

The decline in water transport means an increase in the modal split in trucks and buses after the roads were completed. All settlements studied except four showed an increase in truck transport.
And 12 or 63% of the settlements never knew of trucks before the roads were introduced. The number of households using trucks ranges from 10% to 60% with 28% of the settlements with a modal split of 40% and 70% of other settlements having less than 28% using trucks. However, after the roads were completed, the percentage increased to a range of 30% to 70% and 10% to 60% increase in areas where none used trucks before the roads were completed.

Similar situations are also observed for buses though the modal split percentage is much less, and mostly below 10% in the First division and Third Division and 35% to 40% in the Fourth Division. Most of these settlements did not have bus services before the roads were introduced.

Bus transport was only initiated in 8 out of the 23 settlements studied or 35% of the total. These settlements are Kg. Tanggak, Kg. Tebakang China, and Kg. Baki in the First Division; all settlements studied in the Second and Third Division were where the bus transport seems to be relatively well developed and none in the Fourth Division where people rely on cars instead. (see Table II.5)

6. Availability of Electricity

Most of the settlements studied still do not have an electricity supply despite the introduction of roads. However, there are a significant number of settlements indicating improvements on the availability of the electricity supply in areas in which electricity was available both before and after the roads were completed.

About 13 out of the 23 settlements or 57% did not have electricity before the road; the percentage dropped only slightly to 48% after the roads were completed. Eleven settlements or 48% reported an increasing number of households have electricity and 52% reported no changes. The extent of improvement varied from settlement to settlement. There are 35% indicating an improvement of over 50%, and 28; reported an increase of 20% to 48% and 36% reported an increase of only 1% to 19%.

In terms of spatial variation, the First Division has 30% of its settlement without electricity. In the Second and Third Division, all settlements studied do not have electricity; in the Fourth Division, 40% of the settlements did not have electricity at the time of survey.
7. Sources of Water Supply

Water supply is an infrastructure relating very closely to housing. This paragraph will analyse if the completion of roads have improved the provision of water sources to the rural people.

About 56% of the settlements studied do not have piped-in water supply before the road and it dropped to 35% after the roads were completed. There is an improvement of 21% as compared to only a 9% improvement for the supply of electricity.

In terms of spatial variation, in the First Division, 62% and 31% of the settlements studied did not have water supply from pipes before and after the introduction of roads respectively. This means an improvement of 31%. The percentage in the Second Division are 25% and 50% or an improvement of 25%; and in the Fourth Division, the figure has been 40% both before and after the roads were completed which means no improvement. This is in terms of the number of settlements with piped water, the improvement is greatest in the First Division followed by the Second and Fourth Division.

Piped water is provided after the roads were completed in the following areas where there are no such services before, in Kg. Simpok, Kg. Riih, Kg. Baki in the First Division; Melugu which is a land scheme in the Second Division. The establishment of the land scheme is a factor which reflected the government's spatial priority policy in allocating investment in the rural areas; the other have the benefits of increased population density and proximity to large service and administrative centres where the decisions regarding infrastructure are made at the local level.

The degree of improvement is relatively small. Except in two cases, e.g, Kg. Riih and Melugu which are almost completely provided with piped water, all others have less than 20% of the total households with piped-water after the roads were completed.

Besides those settlements which did not have any piped water before the road, the other settlements have some degree of provision.
before the roads were completed. Forty four percent of the total settlements studied are under this category of which about 50% have less than 10% of the households equipped with piped water supply before the road. The balance, 40% and 10% of the settlements, had less than 40% and 60% respectively before the roads were completed. However, after the roads were completed, about 60% of the settlements under this category had over 90% of the total households in each settlement with piped water supply. The improvement is thus very clear.

The extent of the improvement in these settlements varies from place to place. Settlements reporting a jump of over 60% are land schemes such as Triboh (+86%), Sibintek (+89%) and Lambir (+77%), and larger and more wealthy rural areas such as Kg. Kakai and Kg. Tebakang China. These have jumped of 94% and 62% respectively. However, two settlements may be very close to each other spatially although the degree of improvement varies greatly; e.g, in Kg. Tebakang China the jump is 62% whereas Kg. Tebakang Malay has only a 4% jump from 12% to 16%. In Kg. Tebakang Dayak, there is no water supply at all (see Table II.7.1 & Table II.7.2)

It is thus clear that the provision of basic infrastructure facilities such as water supply is often the effort of local government except in the case of land schemes where direct state government planning is involved. It is also clear that road completion is only a basic condition to the provision of infrastructure, and whether or not the improvement would be there depends on the efforts of the state and local government in their respective decisions on the allocation of funds in their areas. Basic to these are other related factors such as population density and size, the labour skill and resource base of the settlement, cultural attributes of the farmers, proximity to the larger urban service centres and a two way flow of information, people, materials and spatial priority placed by the state and local administrations.

III. EMPLOYMENT

1. Changes in Employment

Occupation is classified into eight categories, i.e, agriculture; administrative, managerial, sales; personal services; professional and
technical; Government services; transportation; industry and others not classified elsewhere. The table below shows what each category consist of in the context of the rural settlements studied in Sarawak.

Table III 1.1 Classification of Employment

<table>
<thead>
<tr>
<th>Category</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Padi farmers, rubber planters, pepper planters, oil palm workers and agricultural workers.</td>
</tr>
<tr>
<td>Administrative, managerial and sales</td>
<td>Proprietors, clerical and related workers, sales, shopkeepers, managers, and contractors,</td>
</tr>
<tr>
<td>Personal services</td>
<td>Cooks, food preparation, waiters, hawkers, domestic services, tailors.</td>
</tr>
<tr>
<td>Professional and technical</td>
<td>Teachers, auditors, accountant, technician, land surveyors.</td>
</tr>
<tr>
<td>Government services</td>
<td>Penghulu, government clerks, protective services, and supervisors.</td>
</tr>
<tr>
<td>Transportation</td>
<td>PWD workers, ship crews, boatmen, drivers.</td>
</tr>
<tr>
<td>Industry</td>
<td>Carpenters, plant operators, Shell employees, saw-mill workers, blacksmiths.</td>
</tr>
<tr>
<td>Other NEC</td>
<td>Odd jobs, priests.</td>
</tr>
</tbody>
</table>

Sarawak is basically an agricultural state. Before the roads were completed, 30% of the settlements studied were entirely dependent on agriculture, 55% have 80 - 99% of the people engaging in agriculture, and only 13% have less than 80% of the people involved in farming. After the roads were completed, 22% were entirely agricultural, 61% were having 30 – 99% of their settlers in farming, and 17% with less than 80% of the people engaged in farming activities.

The heavy reliance on farming is also reflected in the distribution of the economically active population into various types of employment as given in Table III.1.2. For all the settlements studied, before the roads were completed about 91% of the workers were engaged in agriculture; the percentage decreased slightly to 86% after the roads were completed. All other types of employment have less than 3% of the total number of workers. Comparing percentage before and after the roads were completed, almost all these categories showed a
slight increase, e.g. administrative, managerial and sales from 2.8% to 3%, transportation from 1.7% to 2.4%; Government services from 0.7% to 2.2%/ Industry does not show much increase; the low percentage in industry of 1% indicated that manufacturing and even handicrafts and cottage industry are almost non-existent in these rural areas in Sarawak; the improvement of roads did not seem to have any impact on its development. As expected, the percentage in agriculture has decreased from about 91% to 86%; however, the drop is still quite insignificant.

By looking into each settlement one by one, about 40% have reported a drop in percentage in agriculture, 30% reported a slight increase, and the remaining 30% reported no changes have occurred.

The nine settlements that reported a drop in percentage are Piching, Tebakang Melayu, Kakai, Tebakang China, Hilir, Trusenkrang, Baki, Betong, and Bintulu. Most of these are located in close proximity to service centres. Of the seven settlements reporting an increase in percentage, four are land schemes. This reflected the impact of planned intervention rather than a direct impact of road development.

A quick glance at employment other than agriculture shows that some settlements have a higher concentration in certain types of employment, and many have increased their percentages after the completion of the roads.

A concentration in transportation services mainly in PWD is found in Kg. Tebakang Melayu which had only 4% before the road and increased to 44% after the roads were completed. Kg. Tebakang China has a larger concentration in personal services which has increased from 8% to 31% and in industry which has 15% both before and after the roads were completed. There is more employment in government services in Betong which had none before the road but had 26% after the roads were completed. In Bintulu, the concentration is in administrative, managerial and sales which has 12% and 18% between the two periods respectively.

The above have reflected that those close to a service centre tend to have more non-agricultural employment, reflecting the influence of the structure of the regional settlement systems more than the direct impact of the road development.
2. Changes in the Place of Work

Attempts are made to find out how the road improvement/completion has affected the number of persons working in each settlement and, if they work outside the settlement, where do they work. "Place of work" refers to the name of the settlement where he works.

The percentage of settlers working within the settlement varies from 10% to 99% before the road and 5% to 100% after the roads were completed. The changes by Division are shown in Table III.2.1.

For all the settlements studied, 71% are within the range of 80% - 100% showing a relatively closed system. However, after the roads were completed, it dropped to 58% indicating more energy flow between the subsystems created by the road development.

The relatively high percentage in the less than 39% range before the roads were completed is due to land schemes and so is its reduction to 7% after the road because in land schemes there are less people working outside the settlement. An exception is Kg. Hilir. Here there are only 10% of the people working within the settlement, and it is reduced to only 5% after the road. This is due to its proximity to Serian and the pace of rapid development in Serian town.

A general reflection shows that 61% of the settlement have a reduction in the percentage of people working within the settlement. 17% reported no changes have occurred and 22% say that there are improvements.

Those settlements reporting a reduction in percentage are those settlements where the roads have created a different pattern of accessibility, infrastructure improvement, increase in resource exploitation and increase in production which have created changes in the balance of the settlement systems. The percentage reduction differs from place to place. However, the changes are less than 10% in all cases.

Those settlements reporting no changes have occurred are those where settlement size is small and located in areas hardly affected by the changing balance of settlement systems, e.g, Kg. Riih, Tanggak. Other settlements indicated an increase instead. The percentage increase ranges from 2% to 75%. It is found that land schemes have a
higher percentage of increase, e.g., Melugu (+80%), Sibintek (+65%),
and Lambir (+75%), except Triboh which is located very near to Serian
town, where the change is 5%.

The settlements that reported a reduction have increased their
interaction with other closer smaller settlements and nearby larger
service centres. Kg. Simpok has increased its interaction with Kg.
Annah from 8% to 13%, Kg. Tebakang Melayu has a shift from Kg. Mapu,
Kakai, Tebedu which accounted for 12% before the roads are completed to
Tarat (+8%), Serian (+16%), Batu Kawah and Sarak (+8%). Kg. Kakai has
also increased its interaction with Serian from 11% to 22%; Kg. Hilir,
Trusenkrang, Triboh to Serian have a 5%, 13% and 5% increase respectively.
Other new settlements for Kg. Trusenkrang are Pelanu, Bidak, Simbok and
Biwan after the roads were completed. In Kg. Bunau, the percentage
increase of 15% and 8% go to Bedang and Naymuh respectively. For Kg.
Kakai which is located along the Kuching-Serian road, it increased
its interaction with Tarat from 3% to 6% and Panchor from 15% to 22%.

In the Second Division, Saratok has increased its interaction
with Brangan from 4% to 15%, and Gambai from 0% to 8%. In the Fourth
Division Bekenu's interaction with Sg. Subak has an increase of 10%.

For the land schemes, Melugu has 50% of the workers living in
Labak Tabang, 13% in Seuan Bazaar and 17% from Rih before the roads
were completed. In Sibintek, the places where they came from before
the roads were completed are Kg. Mapu, Tarat, Sarak, Batu Kawah and
Rih. (see Table III.2.2)

3. Mode of Transport to Work

The changes in the means of transport are good indications on
how people have changed their means of movement as a result of changing
structure of the spatial system brought about by changes in the
accessibility patterns.

Seven modes are indentified for analysis. They are walking, bus,
truck, boat, bicycle, car, motorcycle. Walking would first be analysed
and then we would see how the introduction of the road network has
changed the relative importance of the water transport in Sarawak.
Walking is an important way of moving between places in Sarawak. In many places, it is still a major mode of movement. Before the roads were completed, 35% of the settlements studied relied entirely on walking. Its percentage has dropped to 17% after the road has been completed. It is noted that 52% of the settlements have 70% - 90% of their inhabitants walking to work. This percentage has, however, dropped from 52% to 43% after the roads were completed.

The changes between two periods have indicated that the percentages relying on walking have decreased within the 70% - 100 range and increased a great deal within the 0% - 69% range. Those settlements with less than 40% of the people relying on walking to work have increased from 5% - 23% after the roads were completed. This supports the statement that in general, roads construction has decreased the percentage of people moving on foot, especially for long distance travel. In the Sarawak context, it is uncommon even today to find people carrying a sack of rice and travelling day and night on foot to the service centres.

Three settlements have a low percentage of people walking to work; one is in Saratok (45% before and 20% after the roads were completed), the other is Sibintek (before 74% and after 60%), and Batu Niah (before 14% after 8%). These settlements were still using water transport to go to work, e.g., Saratok's percentage using boats before the road was 46% and 0% after the road. Batu Niah has 80% and 66% using water transport before and after the roads were completed respectively. (see Table III.3)

The decrease in number of people walking to work has increased the number of people using buses, trucks, bicycles, cars and motorcycles; and on the other hand, it has also affected the number of people who used to go by water transport.

Taking buses, for example, only 13 settlements or 57% of the total number of settlements indicated using buses, the percentage is rather low ranging between 3% and 8%. (Tebakang Dayak, Baki and Saratok) before the roads were completed. After the roads were completed, 13 settlements or 56% reported using buses to work. The percentage of people using buses has increased from 3% to 8% to 3% - 80% after the roads were completed.

This shows that the number of people using buses have increased. However, after the roads were completed, only 5 settlements or 22%
have more than 20% of the people using buses. The other 35% have less than 10% of the people using buses and the rest 47% do not use buses at all, especially in the Fourth Division, as there are still no bus services to these areas.

In the Fourth Division, people are found to use trucks instead. In this Division, only two settlements reported using trucks, and 2% of the people are using them before the roads were completed. After the roads were completed, 4 out of 5 settlements reported using trucks, and the percentage of people using them have increased from 11% - 20%.

Besides trucks, there are 5 settlements or 22% before as against 35% after the roads were completed which reported using bicycles to work. Before the roads, there were only 3% - 18% using bicycles whereas after the road, the percentage has increased from 5% - 33%. There are more bicycles in richer settlements such as Kakai, Tebakang China, Baki, Sibintek, Batu Niah and Bintulu areas. This supports the statement that most of the farmers are too poor even to own a bicycle. The bicycle, however, is the first step towards owning a humble means of transportation. The number of people using cars and motorcycles are even smaller, ranging from 2% to 12%.

Water transport has been an important mode of movement in Sarawak where most settlements are located in proximity to the rivers. The introduction of roads have reduced substantially the percentage of people using water transport from 43% before to 22% after the roads were completed. In Tebakang China, Saratok, Roban, Betong, Sibintek, Bekenu, and Bintulu, people have almost stopped using boats to move around.

However, Tebakang Melayu (22% before and 22% after), and Batu Niah (80% before and 66% after) still relies a great deal on water transport. It is thus observed that having built the road, suitable transport systems such as buses have to be introduced as if not people would continue to use the traditional mode of transportation. This is true in the Fourth Division where the bus system is almost non-existent.

From the above analysis, it is clear that the introduction of roads has changed the mode of transport of the people quite substantially. However, unless the decision and efforts are made to introduce alternative systems of movement and to increase their income, the
potential of roads are often not optimised. A possible way of optimising the potential of the road is through proper economic and physical planning. (see Table III.3)

4. Mean Monthly Household Income

The collection of data on household income is always a very difficult task, especially when the respondents are required to tell what was his income some years ago, e.g., before the roads were completed. The mean monthly household income in the present study is adopting a "production approach" where respondents are encouraged to review his quantity of product produced by him either in volume or weight. The prices obtained are counter checked and other data on acreage of lands, type of crops extent of harvest etc are also collected for conversion purposes. The income figure obtained is thus a rather rough estimate of the financial performance of the households and is used for relative comparison and analysis only.

The statistics showed that 20 settlements or 86% indicated an increase in household income, one settlement or 5% showing no improvement (Kg. Tebakang Melayu) and two others or 9% showing a decline in income. There is thus a general improvement over the past.

In terms of mean household monthly income, the average for all the samples for the two periods i.e., before and after the completion of the roads is $169 and $246 respectively. Division-wise, the highest average is found in the Fourth Division with $249 and $300 for the two study periods respectively. Second Division ranks second with $169 and $286, followed by Third Division with $229 and $206, and First Division ranks last with $121 and $175 for the two study periods.

It is surprising to note that the First Division has the lowest income average and the Fourth Division has the highest. A possible explanation could be that most of the farmers in the former are still relying on subsistence agriculture and shifting cultivation, whereas the latter concentrates on cash crop production, such as rubber, pepper, oil palm and timber. See Table III.4.1 for the average income by Divisions in the settlements studied. In order to have an idea of the relative income performance of the settlements, the following classification scheme is used:

- 25 -
Mean Monthly Household Income | Performance Measurement
--- | ---
Less than $100 | Very low
$ 100 - $ 169 | Low
$ 170 - $ 249 | Medium
$ 250 - $ 399 | High
Over $ 399 | Very High

The changes in average household income before and after the roads were completed differ from place to place. It is found that for those settlements under study, the average increase is $75 per month. Most of them or 65% of the settlement have an increase of less than 100%, and 22% and 13% are within the range $100 - $199 per month and over $200 per month respectively. See Table III.4.2 for the changes between the two study periods.

In comparing each division in turn, settlements studied in the First, Third and Fourth Division have an increase of between $50 and $76 per month. Only settlements in the Second Division have rather large amount of increase, i.e, $177 per month over the study periods. The findings are contrary to the general belief that the Second Division is the poorest and has the least improvement after the completion of the roads. Owing to the difficulty in collecting reliable income data in a poorly developed area, the above give us some scope for further study in this aspect.

IV MIGRATION

1. Migration History of Settlers

The migration history of settlers include finding out their places of original residence, date of migration, reasons for migrating into their present settlements and if there are any plans of moving out of the present settlement.

a. Place of Original Residence The former residence of the settlers are mainly from nearby forests and small dispersed villages. Only a handful reported migrating from larger service centres such as Serian, Miri, Sibu, Bintulu, Simunjan and Mukah. This indicated that the first stage of migration before the roads were completed is the voluntary concentration of settlers, some wondering and some sedantary, from vast forests and small village longhouses in a particular location.
As population increased, service facilities are available and linkage is made with larger service centres where the villagers who had settled down for some years are opened more and more to the sub-systems of other settlements; the relatively closed system becomes more open, and as a result of information flow, material flow and with man as agents, more and more settlers are more outward looking and more tends to migrate to larger service centres or at the proximity to larger service centres especially the state capital or district centres.

The data collected show that settlements closer to the trunk roads have more interaction with larger service centres along the road as some reported coming from larger service centres such as those listed above whereas those settlements located off the trunk roads, almost all of them do not have migrants from larger service centres. This to a certain extent reflects the influence of the road as a catalyst in inter-settlement migration.

In the First Division, three settlements along the Kuching-Serian-Simanggang Road reported 12% to 70% of the migrants coming from large service centres along the road such as Serian, Simanggang and Kuching. These settlements are Kakai, Baki and Hilir. In the Second Division, two settlements, i.e., Saratok and Melugu reported having migrants from Serian and Simunjan. In the Fourth Division all settlements reported having migrants from large service centres which are mainly from Miri and Kuching accounting for 6% to 34% of the population. For all the rural samples, 9 settlements or 39% reported having more than 10% migrants from larger service centres.

Besides having migrants from larger service centres, the majority of the people are from nearby forests, longhouses and villages. There are 11 settlements or 48% of the total having more than 80% of their settlers from nearby areas, and 4 settlements or 77% of the total reported having less than 50% of their settlers from nearby areas. These four settlements are Tebakang China (21%), Hilir (6%), Baki (14%), and Melugu (17%). Of the four, one is a land scheme, one is dominated by Chinese population and the other two are located either along the Kuching Serian Trunk Road or very close to a large service centre, i.e., Serian. The balance of 8 settlements or 35% of the total have 50% - 80% of their settlers from the nearby areas. Some of these areas have migrants mainly along the trunk road, a good example is Baki where 34%
of the settlers are from 24th to 39th Milestone along the Kuching Serian Road.

The above analysis has shown that most of the existing settlers are those living in the settlement not because of changing accessibility due to road development, because during the period when the settlements are formed, road are still not developed. Travelling on foot and boat was the dominant mode of movement. A two stage process of migration is also identified, and the first stage has been analysed and supported by field data given above. The second stage will be elaborated in the later sections. (see Table IV 1.a)

b. Date of Migration From the date of migration of settlers, there seems to be a positive correlation with the date roads were completed in each division. For example, in the First Division, 54% of the settlements have settlers migrating into the settlement during prewar days, and 23% of the settlements have settlers migrating during 1960 - 1970 when the roads are further improved. (see Table IV 1.b.1)

In the Second Division, 75% of the settlements have their settlers migrating into the area during the pre-war days. In the Third Division, most settlers came in during the period 1960 - 1970, and in the Fourth Division, 40% of the settlers came during the late 1960s and 40% after 1970. This reflected the rather late introduction of roads in the Fourth Division. Settlers grouped under the pre-war periods are Pching, Tebakang, Dayak, Simpok, Riih, Tanggak, Tebakang, Melugu, Trusenkrang, Saratok, Roaban and Betong. Most of these settlements have more than 50% of their settlers who came in before 1945.

During the period 1945 - 1960, more migrants are coming into the areas. Kakai with 28% in 1945, Baki with 60% and Bintulu with 36% during this period.

In the years 1960 - 1970, more migrants are found going to Kg. Tebakang China with 46%, Triboh with 55%, Melugu with 71%, Sibintek with 49%, Batu Niah with 34%, and Lambir with 72% of the settlers moving in during this period. (see Table IV 1.b.2)

c. Reasons of Migration The reasons for migration can be grouped into "open up new lands", "religious, family disputes", "seek jobs/assigned jobs", "start business", "marriage", "relocated by Government projects", "security reasons".
The major reasons for moving into the area are to "open up new lands". Almost all settlements except the land schemes accounted for 80% of the settlers' reason for migration. All the four land schemes give "relocated by government projects" as the reason which accounted for 80 - 100% of the settlers of land schemes who migrated into the areas.

"To seek jobs" is another reason given by 44% of settlers in Tebakang Melayu, 56% in Tebakang China, 20% in Hilir and 10% in Bintulu.

All other reasons are given by less than 20% of the settlers in each settlement. Sibintek also gave security as a reason for migration. (see Table IV 1.c.1)

d. Any Plan of Moving Out? Of the 23 settlements studied, about half or 48% have 1% - 44% of the respondents who wish to move out of the settlements they are staying by then, i.e., at the time of survey. Of these 48%, 59% are from the First Division, 10% from the Third Division and 35% from the Fourth Division.

The number of settlers in terms of percentage who have plans to move out of the area are shown in Table IV 1.d.1

Most of the settlements have less than 10% of their settlers wishing to move out, i.e., 36% of the settlements have less than 5% of the settlers wishing to move out, 45% with 6% - 10% of the settlers wishing to migrate; there are only about 10% each in the 11% - 20% range.

The settlements reporting having less than 10% of the inhabitants wishing to migrate are Kakai, Tebakang China, Hilir, Baki, Triboh, Batu Niah, Niah, Bintulu and Lambir. Only Sibintek and Tebakang Melayu have 12% and 44% respectively. The exceptionally high percentage in Tebakang Melayu is probably due to the fact that most of the settlers are related to the public service, and as the district administration shifted to Serian, most of them expressed a desire to migrate to Serian. (see Table IV 1.d.2)

2. Migration Characteristics of Settlers

a. Out Migration of Family Members In the last section, we have described the migration history of the older generation in the rural areas. In this section, attention will be focused on the
characteristics and factors affecting migration of the younger generation and their relationship to road development.

In responding to a question, "has any member of your family left the settlement?", all settlements gave a positive response. Please refer to Table IV 2a 1 for details.

It is evident from the Table that migration is a part of the experience in the family life. About 5% of the settlements reported having 20% - 30% of their household with family members who migrated outside the area.

Of the total 700 households surveyed, 32% reported having an average of 1.56 persons from the family as out-migrants. This figure is quite consistent from division to division, as the average household size at present is 6.8 persons and the out migrants comprise 18% of the household size.

The degree each settlement is losing its settlers could be seen from the number of migrants expressed as the percentage of total number of settlers.

There are 9 settlements or 39% found to have above average of 7.0% of the total population. These are Tebakang Melayu (11.2%), Kakai (11%), Baki (9.2%), Saratok (9.2%), Batu Niah (9.5%), Bekenu (8.5%), and Bintulu (12.6%).

In the First Division, most of the settlements are along the trunk road except Tebakang which is suffering from losing its customers to Serian Town after the improvement of the road. Sibintek and Saratok are two settlements located close to Sibu. All four settlements in the Fourth Division are attracted towards Miri. The larger percentage in some settlements also reflects the fact that as the settlement becomes bigger, having better education, income and transportation linkages, there tends to be more migration and movement of people between these settlements and the larger service centres.

b. Relation of Out-migration settlers with Head of Households
Most of the emigrants are sons and daughters of heads of households, consisting of at least 66% of the total emigrants.

Six out of 23 settlements or 26% have equal numbers of sons and daughters who have migrated out, 65% of the settlements have son as
the dominant emigrant, and 9% have more daughters than sons as emigrants. These are Trusenkrang and Saratok with 46% and 61% of daughters respectively. This indicated that in some cases where the settlements are closer to the larger service centres such as Sibu, Serian and Miri, there tends to be more female emigrants. However, there is still insufficient evidence to support the statement that most of the female emigrants ended up in the bars and night clubs in Divisional Capitals such as Kuching, Miri, and Sibu as we shall see later on in the sections describing the present occupation of the emigrants.

Besides sons and daughters, the others—which range from 4% to 20%—consist of daughters-in-law, nephew, grandson, granddaughters, brothers, sister-in-law, husband, wife and brother-in-law. Grandson and grand daughters only appear in the second generation of the head of households. (see Table IV 2.b)

c. Age of Migrants The average age of emigrants at the time of survey was computed. The average for all settlements is 24.6 years. The differenced between Divisions are not very great, with 22 years in the Third Division, 22.5 years in the Fourth Division, 23.8 years in the Second Division and 25 years in the First Division. (see Table IV 2.c)

The higher average in the First Division and the lowest in the Fourth Division reflect generally the date and sequence of introduction of roads, thus reviewing the impacts of roads on migration.

d. Year of Settlers Migrating Outside the Settlement The year when the members of the family left the settlement is also recorded. This is to see if the year a member left the settlement is related to the date when the roads were completed.

It is found that the introduction of roads has in fact encouraged settlers to migrate to the settlement as evident in our earlier analysis on the history of migrants, and the improvement of roads at a later stage in addition to growing service centres have generated the second wave of out migration towards these service centres.

The data reviewed that most of the emigrants migrated during the period 1970 - 1974 and considerable numbers migrated during 1975 - 1977. Settlements that continued to lose members of their families are Piching where 57% left during 1975. During the same period, 40% are recorded in Tebakang Dayak, 29% in Tebakang Melayu, 75% in Bunau, and
33% in Triboh in the First Division.

In the Second Division, Melugu had 33% of migrants leaving the settlement during 1975 - 1977. In Fourth Division, 28% and 50% are recorded in Niah and Lambir respectively.

Two aspects are noteworthy. One is the high percentage of losses in settlements affected by road developments, such as Tebakang and Niah. The other is the high percentage in almost all land schemes. Please refer to Table IV 2d for details.

By relating the year the member of family left the settlements and their present age, it is estimated that most settlers left the settlement at the age of 17 to 21.

e. Destination of Emigrants There are more than 60 settlements picked by the emigrants as their destinations. By categorising their migration using percentage to different destinations using the following criteria, a hierarchical order of destinations could be easily seen.

Table IV 2.e.1 Classification of Migration Destinations

<table>
<thead>
<tr>
<th>Order</th>
<th>Percentage of all Migrant Destinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Order</td>
<td>Over 40%</td>
</tr>
<tr>
<td>Inter-state, state, Divisional capital</td>
<td></td>
</tr>
<tr>
<td>Second Order</td>
<td>20% - 39%</td>
</tr>
<tr>
<td>Divisional capital</td>
<td></td>
</tr>
<tr>
<td>Third Order</td>
<td>10% - 19%</td>
</tr>
<tr>
<td>District capital</td>
<td></td>
</tr>
<tr>
<td>Fourth Order</td>
<td>Less than 10%</td>
</tr>
<tr>
<td>Local service centres</td>
<td></td>
</tr>
</tbody>
</table>

The highest in the order of migration patterns is the state capital of Kuching. The major settlements attracted to it cross beyond the Divisional boundary; as we move northwards, the degree becomes lower. There is almost none in Lambir, Batu Niah and Niah except Bintulu where linkage by sea and air to Kuching is convenient. The settlements which have greater extent of linkage with Kuching are Pichin, Tebakang, Riih, Tanggak, Tebakang Melayu and Triboh.
The Second in the order of migration pattern is the divisional capitals, e.g., Sibu, Miri and District capital such as Serian. Owing to the limitation of samples around Sibu, it is found that only Sibintek has a stronger migration link with Sibu. In the Second Division only Roban reports having emigrants to Sibu, although more are expected from areas around Saratok and Betong. Instead these settlements indicated stronger linkage with Kuching which could have been brought about by the Kuching-Serian-Simanggang-Sibu Trunk Road; and the rapid expansion of Kuching. The attraction of Miri is mainly confined to areas surrounding Miri, such as Batu Niah, Niah, Bekenu, Bintulu and Lambir which all have at least 20% reporting having emigrated to Miri.

The pattern of road development has a lot to do with the emigration pattern. Although the Miri-Bintulu Road has been completed, the orientation of Niah areas is still towards Miri. It is easier and faster to travel to Miri than to Bintulu. Serian, although it is a district centre, attracts migrants from surrounding areas and completes heavily with Tebakang which is loosing its attractiveness due to the completion of the road and the transfer of the administrative functions to Serian. Most of these areas along the Serian-Tebakang-Mongkos Road, especially those slightly further away from Serian, all come basically under the sphere of influence of Tebakang, e.g., Tebakang Melayu, Tebakang China, Trusenkrang and others located closer to Serian such as Hilir and Kakai. It is also noted that people in some settlements, although located closer to Serian, are more attracted by Kuching. This indicates that the faster growth and amounts of funds invested in the state capital are the more decisive factor than just the physical development and availability of roads.

In the Tebakang area, a town just next to Serian in terms of hierarchy along the Serian-Mongkos Road, a link towards Tebakang is expected to be stronger than the data have show. Only two settlements reported people having migrated to Tebakang, i.e., Piching and Tebakang Malayu. This reflected the adverse impact of road development on a small service centre.

The lowest in the order is other towns having less than 10% share of the emigrants in each settlement. These include minor settlements around the towns and smaller service centres along the trunk road.
Outside of the national boundary, a noteworthy destination of the migrants is Brunei. The attraction of Brunei seems to have a distance decay function. There are more migrants to Brunei from Miri area and decreasing in importance in the sequence of Sibintek, Second Division and lastly the First Division. In the Miri area, Batu Niah Bekenu and Lambir have all reported having more than 20% of their emigrants moved to Brunei. This indicated that road facilitates migration, but do not necessarily generate migration, the determining factor in the case of Brunei is obviously resource development. (see Tables IV 2.e.1 and IV 2.e.2)

f. Reasons of Migration The reasons given for leaving the settlements are employment, marriage, studies; other minor reasons given are the present house is too small, bought new houses and start business.

All settlements except Bunah reported more than 45% of the migrants in each settlement cited employment as the major reason for migration. As we have seen in the earlier section a majority of them migrated to towns and Divisional capitals where plenty of employment opportunities are generated due to urban growth. Of these settlements, 55% of the total have more than 70% of the migrants in each settlements citing employment as the reason; the rest 45% are within the range of 45% - 69%. It is noted that most land schemes have a lower percentage which means that most settlers are generally happy about employment provided for them in the land schemes.

The second major reason given is marriage. Most of the settlements are within the range of 12% - 30%. A possible by-product of road development could be that more people are marrying the opposite sex from more distant places than ever before; and this in turn generated more social trips from one settlement to another as a number of social trips are generally generated by inter-settlement marriages, after the marriage.

The last category are minor reasons described earlier. Most of the reasons accounted for only 3% - 9% of the total, except "further studies" in Bintulu which accounted for 35% of Bintulu's total migrants. (see Table IV.2.f)
Table IV 2.e2 Classification of migrants destinations

<table>
<thead>
<tr>
<th>Notation</th>
<th>First Order</th>
<th>Second Order</th>
<th>Third Order</th>
<th>Fourth Order</th>
<th>Local</th>
<th>% of all destinations</th>
</tr>
</thead>
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<tr>
<td>Classifications</td>
<td>Interstate/State/Divisional</td>
<td>Divisional</td>
<td>District</td>
<td>Fourth Order</td>
<td>Local</td>
<td>Over 40%</td>
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<td></td>
<td>20</td>
<td>10</td>
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<td>Less than 10%</td>
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<table>
<thead>
<tr>
<th>Kuching</th>
<th>Serian</th>
<th>Tebakang</th>
<th>Sibu</th>
<th>Sarikai</th>
<th>Simanggang</th>
<th>Miri</th>
<th>Niah</th>
<th>Brunei</th>
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<td>Pichin</td>
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<td>Sibintek</td>
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g. Present Occupation of Migrants

Of the total number of settlers who had migrated outside the settlement, 65.76% are economically active population and 34.24% are dependent population such as housewives, students etc after their migration to urban centres. There seems to be a heavy concentration of people working in the public sector which accounts for 32.45% of the total emigrants. The percentage in the public sector is higher in the Third and Second Division accounting for 53% and 46% of the total respectively. First Division has above 34% and Fourth Division has only 17% working in the public sector. In the second and third division, most of them are government labourers, civil servants and personnel in the protective services such as police and army.

In the private sector, it accounts for 33.31% of the total. The percentage is higher in the First Division with 39.3% and Third Division with 37.4%, followed by Fourth Division and Second Division with 33% and 22% respectively.

In the First Division, besides those working in the public sector, the private sector personal services ranks next with 8% followed by transport and communication with 6%, agriculture 6%, commerce 5%; finance, insurance and business services 3.5% and manufacturing which accounted also for 3.5% of the total emigrants of all settlements. The types of personal services found are barbers, domestic servants, and tailors. In Pishing, 14% are reported working as barbers, in Trusenkrang 9% are domestic servants; Baki and Triboh also reported 33% as servants respectively. All settlements except Baki and Triboh reported that Government Services and public administration ranks highest in terms of percentage in each settlement and most settlements have a score of more than 30% working in the public sector.

In the Second Division, similar domination of the public sector also occurs. Most of them are teachers, medical and health workers and in the protective service. In Saratok, 17% are teachers and 6% are medical workers and assistants such as nurses. In Roban 15% are in the protective service, and for Betong, 12% are teachers, 29% in the protective service. In the private sector, most of them are in the personal services, amanufacturing and commerce. In Saratok, 5% are domestic servants, 10% in technical services such as car-servicing. In Roban 5% are office workers. In Sibintek
in the Third Division, 53% are in the public sector and 37% are in the private sector. In the public sector, 22% are government labourers, 19% are in the protective services and 7% in electricity services. The rest who are in the private sector are mainly in personal services.

The Fourth Division has 17% in the public sector and 33% in the private sector. Most of them in the public sector are engaged as labourers (18% in Lambir), medical assistants (7% in Niah, 3% in Bekenu), Public Works Department (14% in Niah and 22% in Bekenu), electricity (5% in Bintulu). As far as the private sector is concerned, most of them are in agriculture (padi, pepper and rubber planters with 21% in Niah, 11% in Bintulu and 9% in Lambir), manufacturing (Timber workers: 5% in Bekenu and Bintulu, 7% in Batu Niah; Rice Mills: 9% in Lambir, Oil Drilling: 9% in Lambir), commerce (10% are shopkeepers in Batu Niah). (see Table IV.2.g)

The above facts have shown that besides social reasons such as marriage, the major "pull" from the service centres are ironically enough the Government, or the employment opportunities provided by the state in the urban areas to ensure that there are proper supporting services in the urban areas. Private investment decisions in the urban areas also attracted the other one third of the emigrants to the urban areas. Most of the people migrated and few retained their original occupation as farmers. We have observed that dates of migration happen to relate closely with the construction and improvement of roads and some longhouses are found along the new roads instead of in the forest interior. It is therefore clear that roads have provided a basic condition for migration and working together with other factors such as urban growth and development in the service centres helps to generate the pattern of migrations towards the urban areas.

V. AGRICULTURAL PRODUCTION

1. Lands for Agricultural Production

We have seen in earlier descriptions that the majority of the respondents are engaged in farming and other agricultural activities. The data collected show that the average household cultivates about 8.8 acres or about 3.5 hectares of land. The Third Division ranks first with 23.1 acres or 9.3 hectares followed by Fourth division with 11.2 acres or 4.5 hectares; Second Division with 10.8 acres or 4.4 hectares,
and lastly First Division with only 6.8 acres or 2.8 hectares of lands per household.

The size distribution also varies from place to place. On the whole, 13% are less than 5 acres or 2.0 hectares, 39% are between 5 - 8 acres (2 to 3.2 ha.) and 9 - 13 acres (3.6 - 5.3 ha.) respectively. There are only 9% above 14 acres or 5.7 hectares.

The First Division has the smaller plot size, and 85% are less than 8.0 acres or 3.2 hectares. In the Second Division, 100% are within 9 - 13 acres (3.6 - 5.3 ha.) and in Sibintek in the Third Division, the average is 23.1 acres or 9.3 hectares. The Fourth Division has 60% in the 9 - 13 acre range.

On the whole, about 45% of the plots are larger than 8.0 acres or 3.2 hectares which is sufficiently economic for agricultural production for small holders. The plot size is smaller in the First Division which probably reflects the population pressure on the availability of lands and the constraints on its availability imposed by the existing land tenure system. (see Table V.1.1)

2. Work Force on the Farm

The work force on the farms are distinguished into full time and part-time workers. The frequency distribution of workers on the farm is shown in Table V 2.1. The percentage having 3-4 workers as full time and part-time workers are 35% and 3% respectively.

The number of workers hired by the farm is very small, only two settlements out of 23 settlements or 9% reported hiring workers to work on the farm. These are Tebakang China and Baki.

The work force reflected the fact that agriculture in the settlements studied still relies mainly on family labour and so the hiring of workers is almost non-existent. (see Table V 2.1)

3. Expenditure on Production Factors

Three basic factors of production have been chosen in order to gain an idea of the extent to which these factors affect productivity. The three factors are fertiliser, transport, and agricultural equipment.
Table V 3.0  Expenditure on Selected Items

<table>
<thead>
<tr>
<th>Location</th>
<th>Mean expenditure/household/year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>fertiliser</td>
</tr>
<tr>
<td>First Division</td>
<td>$663</td>
</tr>
<tr>
<td>Second Division</td>
<td>550</td>
</tr>
<tr>
<td>Third Division</td>
<td>618</td>
</tr>
<tr>
<td>Fourth Division</td>
<td>714</td>
</tr>
<tr>
<td>Total</td>
<td>632</td>
</tr>
</tbody>
</table>

The Table V 3.0 shows the mean expenditure per household per year. The average expenditure for fertiliser ranks first with $632, followed by transport with $123 and $88 for agricultural equipment. The amount spent on fertiliser, transport and equipment is still small at present. The small amount on transport indicated that most rural areas do not move as much as the potential of the road would attract them to. Roads have not generated much expenditure on fertilisers, transport and agricultural equipment as roads and accessibility are not the only determinating factors. (see Table V 3.1)

4. Sources of income from the farm

The sources of farm income refer to the number of households indicating that they carried out the production of a particular type of crop. As more than one crop is cultivated on a farm, the sources are analysed on a crop by crop basis. Four crops have been selected— they are swamp padi, hill padi, rubber and pepper.

It is noted that more than 78% of the respondents cultivated hill padi before and after the study periods. The percentages are 91% and 96% and 91%, 84% and 87% for hill padi, rubber and pepper respectively. The details are given in Table V 4.1.

The changes before and after the roads in the percentages of respondents reporting cultivating a particular crop is computed as shown in Tables V 4.2-V4.6 and Figures V 4.1-4.3. It is found that for swamp padi, 12% have no changes between the two study periods, and 22% reported a reduction and 57% reported an increase. For Hill
Fig. 4.1. Percentage of settlers in a settlement based on their source of income by percentage change before and after the roads were completed.
padi 13% have no changes, 33% have reduction and 38% have an increase. By comparing these two crops, it is clear that hill padi is slowly becoming less important, and more respondents are switching to swamp padi. In terms of percentage, swamp padi suffers a 4% reduction and hill padi recorded an increase of 19.9%. A possible factor could be the introduction of a more Sedantary type of farming against shifting cultivation. However, as obvious from the statistics, a considerable proportion of the respondents still carry out hill padi farming.

There is also a trend that the cash crop is becoming more important. This is shown by a 52% increase for rubber and 71% increase for pepper in terms of number of respondents and 44% and 26% increase for rubber and pepper respectively in terms of acreage between the two study periods.

The relative importance of each crop in terms of acreage as a percentage of total of the four crops are also computed. It is noted that there is a drop of about 1% for hill padi, and 5% for swamp padi, whereas for rubber there is an increase of 6% and almost no changes in the case of pepper, which in terms of absolute acreage has recorded an increase of 26%.

The slow decline of hill padi and the rapid increase in acreage of rubber and pepper revealed the fact that roads have provided the basic conditions for transporting more produce to the market in lesser time. However, the extent of impact depends on the initiative of the state and the local farmers in the policy decision on crop mix, and other development factors such as capital, technology etc.

5. Acreage and productivity of lands

The total acreage of respondents under the four major crops is 3,015 and 3,946 acres between the two study periods. This represents an increase of 31%. However, the total number of households reported engaging in these activities are 868 and 1,086 respectively. This gives an average of 3.5 acres per household and 3.7 acres per household between the study periods. This is because the increase in household is only 23% as against the increase in acreage which is 31%. Of the total of 3,015 acres before the roads were completed, 13% is hill padi, 18% is swamp padi, 59% is rubber, and 9% is pepper. The relative position of each crop is relatively stable, i.e., the percentage change
Fig. V 4.2. Percentage of settlers in a settlement based on their source of income by percentage change before and after the roads were completed.
is not excessive. Only rubber increased by 7%, hill padi had a marginal decrease of 1% and swamp padi suffered a 5% decrease while pepper remained constant. As indicated earlier, hill padi reflected that shifting cultivation is still not adversely affected by road development. Perhaps the roads give more benefits to the service centres than to the sparsely populated rural areas.

Although the relative percentage of each crop remains relatively unchanged, with rubber ranking first followed by hill padi, swamp padi and pepper. There are significant increases in number of households total acreage and average cultivated area per household. The changes between the two study periods also vary with the type of crop and locations. Each of these crops will be described briefly. (see Table V 5.1)

a. **Hill Padi** Hill padi ranks second to rubber which consists of 12% of the total of the four major crops. There is a decrease of 9% in the number of households planting hill padi from 180 to 163 households, and a 20% increase in acreage from 404 to 484 acres. The average per household has an increase of 0.8 acres in mean acreage per household from 2.2 acres to 3.0 acres.

The increase in number of households occurs only in the First Division with a 10% increase and Sibintek in the Third Division with a 36% increase. The largest reduction is in the Second Division with a decrease of 48%, due to the land scheme in Melugu switching mainly to rubber planting.

The changes in land area under hill padi are mainly a reduction in most divisions except the First Division which had an increase of 8%. The increase is due to the rapid increase in Trusenkrang and Kakai. In other Divisions, the reduction ranges from 7% in Sibintek to 33% in the Fourth Division. The decrease in Sibintek is relatively small, from 68 acres to 63 acres, showing that not all land schemes have totally abandoned the cultivation of hill padi and confined only to cash crops. In the other settlements such as Saratok, Betong, Melugu suffers a reduction in acreage except Roban which is relatively stable. In the fourth division, all settlements suffer a reduction in acreage, with the greatest decrease in Niah from 74 acres to 40 acres and Lambir land schemes from 10 acres to only 2 acres. Niah has mainly switched
Fig V 4.3. Percentage of settlers in a settlement based on their source of income by percentage change before and after the roads were completed.
off to pepper cultivation and Lambir seems to concentrate on rubber as it is a land scheme.

Owing to population increase, acreage may increase correspondingly. However, from the average land area under hill padi per household most settlements have decreased from 2.9 acres to 2.3 acres in the First Division, from 4.9 acres to 3.3 acres in Sibintek and 3.3 acres to 2.8 acres in the fourth division. The following settlements show an increase: Trusenkran from 2.7 acres to 3.0 acres, Saratok from 3.2 acres to 3.4 acres, Roban from 2.6 acres to 2.8 acres, Melugu from 3.7 acres to 4.0 acres. (see Table 5.2)

b. Swamp Padi Swamp padi ranks third in terms of acreage among the four major crops. There is an increase of 16% in the number of households from 192 to 224 households between the two study periods, and a 4% drop in acreage from 551 acres to 527 acres. The average land area under swamp padi per household cultivating padi has also drop of 0.5 acres from 2.9 acres to 2.4 acres.

There is an increase in the number of households in all settlements except those in the third division which had a drop of 84% from 19 to only 3 households. The highest increase is recorded in the second division with 67% increase, followed by fourth division and first division with 22% and 16% respectively. In the second division, there are higher rates of increase in Melugu from 46 acres to 28 acres, Saratok from 3 acres to 16 acres. In the first division, 3 out of 13 settlements or 23% recorded a drop. These are Piching from 24 acres to 18 acres, Bunun from 12 acres to 10 acres, and Triboh from 16 acres to 12 acres. The drops in 2 out of 3 land schemes indicated that in a subsistence economy, the introduction of cash crops could not totally eliminate the settler's involvement in subsistence food production in a very short time.

The impact of road development on the acreage of lands under swamp padi cultivation has in most cases increase the acreage of lands. However, planning policy and governmental intervention have an important impact on the amounts of lands for padi cultivation, an example is the land schemes. We shall see below if this increase is due mainly to population increase or due to other factors related to road development.
The average land area under cultivation per household is 2.9 acres and 2.4 acres with a drop of 0.5 acre per household for all settlements. The greatest decrease is found in Sibintek land scheme with 1.6 acres followed by 0.4 acre, 0.1 acres and 0.1 acres in second, fourth and first divisions respectively. On the whole, the average productivity is 4.3 pikuls and 5.0 pikuls and 5.0 pikuls before and after the roads were completed. This smaller plot size and higher productivity together with expenditures on fertilisers, transport and agricultural equipment, though small by standards of more advanced countries, supported the fact that road development together with agricultural extension efforts has contributed to increased production in swamp padi cultivation. Roads have obviously opened the relatively closed system of the subsistence economy with district markets, state capital markets and eventually the modern world economy. Besides increased market size which makes possible the transportation of large amounts of bulky goods, the increased use of fertiliser is also an important fact though it is small in magnitude. (see Table 5.3)

c. Rubber Rubber ranks first in terms of acreage of the total of the four major crops. Its relative importance has increased from 59% to 66%. The total number of households planting rubber increased by 17% from 386 to 452 households and a 45% increase in acreage from 1784 to 2586 acres. The average land area under rubber per household recorded an increase of 1.1 acres from 4.6 acres to 5.7 acres per household before and after the roads were completed.

The number of households recorded an increase of 12% to 91% in three divisions except the second division which has a drop of 5% from 118 to 112 acres. The third division or the Sibintek land scheme has the largest rate of increase, i.e., 91% from 23 acres to 44 acres followed by fourth division and first division.

Unlike the number of households, the acreage figure indicated an across the board increase with the fourth division ranking first which has an increase of 318 acres or 71%, followed by the first division (+52%), Sibintek (+50%), and second division (+19%).

In the fourth division, the largest increase is in Lambir from 6 acres to 429 acres. In fact Batu Niah, Bintulu, recorded a drop of 15 acres and 76 acres respectively. Most of the households switched to pepper planting as they left the original longhouses located near the mountain rivers to the flat lands closer to the roads and picked up
knowledge of pepper planting from the Chinese farmers. This clearly is an impact of road development.

In the first division, all settlements recorded an increase except Tebakang Dayak, Tebakang Melayu which dropped from 65 acres to 17 acres and 64 acres to 37 acres respectively. The large increase is recorded in Trusenkrang from 36 acres to 125 acres and Triboh land schemes from 87 acres to 199 acres respectively. Besides the fourth and first division, considerable increase is also recorded in Sibintek land scheme where the acreage increased from 271 acres to 407 acres in between the two study periods.

The average land area under rubber has an increase of 1.1 acres per household from 4.6 acres to 5.7 acres. The increase is quite consistent between divisions ranging from 1.2 to 1.3 acres except Sibintok where this is a drop of 2.6 acres per household instead. The average of the non land schemes are usually smaller than 6 acres and those of land schemes are greater than 9 acres rounded to nearest figures. In many areas in the First division, the average is between 2 to 4 acres such as in Tebakang Dayak with 2.8 acres, Simpok with 2.7 acres and Bunan with 3.6 acres.

The above facts have shown that rubber is still the dominant cash crop. There is a significant increase in the number of households engaging in rubber planting and a 45% increase in acreage and 1.1 acre increase in land area per household. This all round increase has made possible the opening up of new markets and bulky transportation of rubber as a result of road improvements and developments. (see Table V 5.4)

d. Pepper Pepper ranks fourth in terms of acreage of the four major crops in the area studied, i.e 9% of the total and there is no change between the two study periods. The total number of households planting pepper have increased from 110 to 229 households or an increase of 108% and an increase of 26% in acreage from 276 acres to 349 acres between the two study periods. The average land area under pepper per household recorded a decrease of 1.0 acre from 2.5 acres to 1.5 acres per household.

The number of households recording an across the board increase were from 43% to 433%. The order of ranking and their percentage increase are Sibintek (+433%), Second Division (+356%), first division
(+68%) and Fourth Division (+43%).

Although there is an increase of 68% in the number of households in the First Division, there is a drop in acreage by 55% resulting a low average of 0.8 acre per household as compared with 3.2 acres per household before the roads were completed. In the Third Division or Sibintek, the increase in number of households is much higher than acreage, i.e., household increased by over 400%, land only increased by 65%. As a result, the average land area per household has been reduced by 3.7 acres per household from 5.5 acres to 1.8 acres per household. The Second Division has an increase of 505% in land area, resulting in an increase of 0.4 acres per household from 1.2 acres to 1.6 acres per household. In the fourth division, the increase in land area is 35 acres or 31% and results in the area of lands having a slight decrease of 0.1 acre per household from 2.2 acres to 2.1 acres per household.

Besides Sibintek, in the First Division, the average land area per household is only 0.8 acre, as compared with 2.1 acres per household after the completion of the roads. The following settlements recorded a drop in land area per household. They are Tebakang, Dayak from 4 to 2.3 acres, Kakai from 4 to 1.8 acres, Tebakang China from 5.2 to 2.5 acres, Baki from 3.2 to 2.5 acres. Tebakang is a declining town whereas Kakai and Baki being very close to the Kuching Serian Road is within close influence of the service centre. It is thus profitable to engage in poultry, pigs, fruits and vegetable farming than padi, rubber and pepper. It is thus observed that the road has opened up the once relatively inaccessible areas to the urban influence of service centres. Therefore changes in urban function, spatial organisation and dynamics are other factors besides road development.

In the fourth division, only Bekenu experiences a slight drop in the total area per household from 3.5 to 3.3 acres per household. In terms of land area, Niah experienced the highest increase from 36 acres to 70 acres. This indicated the fact that the road has created a changing pattern of accessibility and created a stretch of higher population density zone within the five mile distance from the service centre. Most of the lands in Niah and Batu Niah areas are newly opened up for pepper planting. As described before, most of the farmers came from the forest interior and lived along the rivers in their longhouses. After
the roads were completed, they gathered along the road to engage in cash
crop production while at the same time continued to engaged in the cul-
tivation of swamp and hill padi. (See Table V 5.5)

VI CHARACTERISTICS OF MARKETING AND SHOPPING TRIPS

1. Car Ownership

The cheapest means of transport the rural farmers could afford is
probably bicycles. There are 74% of the settlements reported owning at
least one bicycle, followed by motorcycles owned by 48% of the settle-
ments and car by 43%, trucks by 26% and boats by 17% of the settlements.

In terms of percentage of households, 32% owned at least one bic-
cycle, 10% owned cars, 4% owned motorcycles, 2.5% owned trucks. In terms
of car ownership, the average is 12.9 households per car or 95 persons
per car. The rate of car ownership is still very low compared with some
more advanced developing countries.

The low vehicle ownership is also reflected in the average number of
vehicles owned per 100 households. On the average, the number of bicycles
per 100 households is 32.04. The average of other vehicles is 7.19 for
cars, 4.05 for motorcycles, 1.13 for boats, 0.81 for trucks. For all
types of vehicles, the average is 48.22 per 100 households. This means
that not even all households could afford a bicycle; 68% of the house-
holds have to rely on foot for movement between origin and destination.
(See Table VI 1.1)

The name of settlements without even a single bicycle are Riik, Tanggak, Tebakang Melayu, Hilir, Trusenkarang, Bunan. All of these are
in the First Division. Only 10% of the total households studied owned
cars. They are mostly in Simpok, Kakai, Tebakang China, Baki, Betong,
Batu Niah, Bekenu, Bintulu, Lambir.

The figures show that the division best equipped with transport is
Fourth Division with only 39% of households without any means of trans-
port on foot, followed by First Division with 65%, Second Division with
68% and Sibintek in the Third Division with 72%. The average for all
samples is 52%. (See Table VI 1.3)
2. **Marketing of Agricultural Produce**

(a) **Markets for Agricultural Produce.** Three major types of agricultural produce are selected for analysis: padi, rubber and pepper. A number of characteristics are found common to the three types of crops. The systems of marketing have a very simple structure and competition between centres is relatively small and often non-existent. There is limited choice for the farmers in their markets; and all service centres either consumed most of the produce or all oriented towards Kuching, Bintulu, Miri for export. The interaction between regions is still small.

It is also noted that before the roads were completed or improved a number of small settlements have direct linkage with large service centres, e.g., Kuching, Sibu, Miri. However, after the roads were completed, more produce is sold to the settlement under study and the percentage selling direct to larger service centres is much reduced. The extension of the market is done through an intermediate service centre or the settlement itself. An important implication is that this provides the basis for the growth and development of smaller service centres and rural centres in areas where there is not excessive "spatial competition" between service centres. In areas where roads have created an imbalance in the division of labour of service centres, some settlements would be adversely affected. Examples are found in Tebakang, Roban and Niah.

Intervention by the state through planning efforts has also affected some large service centres. Serian, Simmanggang and Sibu, have less trading in rubber than before. Most settlers sell their produce direct to the land schemes. Although a certain degree of black market trading is known, this is not reflected in the data.

The type of crops also affect the market; padi is still a subsistence crop and the percentage involved in transaction is still very small, usually less than 12%. However, for rubber and pepper, markets are found in more distant places than padi.

The position of each settlement before and after the roads were completed vary from place to place and type of crop. Kuching is relatively stable throughout the three crops. Serian is stable only as padi and pepper are concerned, and for rubber the decrease is quite tremendous. Of six settlements with trade linkages with Serian in Rubber, 4
settlements reported decreases in their trade with Serian. Tebakang is one of the worst, it managed only to maintain its transaction in padi; rubber and pepper, it is loosing fast to Serian. Miri and Sibu do not have as much direct linkage as before. Roban is another negatively affected settlement. There is an across the board decrease in all the three crops. Saratok and Betong also suffered a decrease in transaction in rubber and pepper. They are loosing fast due to competition from Sarikei which recorded an all round increase in all the three crops.

Most land schemes have increased their trades in rubber and pepper, except padi. This is due to the shift from padi cultivation to rubber planting. As for others such as vegetable, oil palm, birds nests etc., most of these are related to only a very small number of settlements.

(b) To whom is the agricultural produce sold?

The above question is asked to find out if it is affected by road development. For all the three type of crops, it is found that majority of the farmers still sell direct to shops in the service centres which are usually within 5 to 10 miles distance from the farms. Nevertheless its percentage dropped by 11% from 59% to 44% during the two study periods. Middlemen from the service centres ranked second before the roads. However, there is also a drop of 3% from 19% to 16%. Middlemen from the service centres have given way to selling to government marketing agencies or cooperatives which ranked almost last before the roads to an increase to second position after the roads are developed from 5% to 22%. (See Table VI 2.b)

By comparing the agency of marketing between different crops, a common characteristic is the increased share by the government agencies and cooperatives which has recorded an increase for all the three crops and direct to the market place within the settlement which recorded a slight increase for padi and rubber. Another common point is the dominant role played by "sell direct to shops in service centres." It ranks first in all crops; however, there is an across the board decrease with padi suffering the highest drop of 23%, followed by rubber (21%) and pepper (8%). This is mainly due to the setting up of public marketing agencies made possible by the availability of easier transportation. Pepper is the only crop where there is an 1% increase of middlemen from the village and 7% for middlemen from the towns for marketing their pepper. Although households reporting marketing through middlemen from
the village shows a drop of 2 percent, the absolute number of households actually increased from 76 to 82.

In terms of divisions, the marketing of padi in the First Division was dominated by selling direct to market (32% before and 28% after) and middlemen from town (46% - 28%). However, after the roads were completed, there is a sharp increase of number of households selling direct to shops in the service centres from 0% to 28%. This shows an increased number of marketing trips towards the service centre due to improved accessibility. Similar importance is maintained in the Fourth Division with 95% and 90% before and after the roads were completed respectively. It is only in the second division where middlemen from the village have decreased in importance and been replaced almost completely by middlemen from the town.

The marketing of rubber in different divisions has the common characteristic of selling more to the public marketing agencies. It has increased from 0.5% to 22% in the First Division, 0% to 12% in the Second Division, 3.4% to 100% in Sibintek, and except Fourth Division where there is a drop from 14% to 10%. There is also an increase in the percentage selling direct to the market in the village; it increased from 17.5% to 22% in the First Division and 0% to 42% in the Fourth Division. A possible factor for the higher percentage in "direct to market" and "middlemen from village" indicated that the roads have generated more movements from the village to the service centres and less from the service centres to the rural areas. This also supported earlier observation that the village has now a marketing function instead of purely a production centre. This is also supported by the decrease in percentage in "middlemen from town" and "selling direct to shops in town".

The increase in middlemen from the village is noted in Piching (83% to 72% but number of households from 15 to 16), Simpok (75% to 94%) Trusenkrang (0% - 39%), Baki (16% to 17%).

As far as the marketing of pepper is concerned, most households still sell direct to shops in the service centres. It was 72% before the roads and 64% after the roads were completed. The percentage is higher in Sibintek and Fourth Division with 100% and 94%, 96% and 98% respectively between the two study periods. In the Second Division, there are 25% and 41% respectively relying on middlemen from Service centres between the two study periods. The middlemen from the village
recorded an increase in First Division from 10% to 25%. The increase in percentage represents an increase in spatial competition between traders in the service centres and functional differentiation in the rural areas. The intervention by the state in the marketing process is also seen, mainly in the First Division where there is a 5% increase from 10% to 21%. The percentage increase in all other divisions is small being between 1% to 6%.

Government agencies in the marketing process are reported in Piching, (0% - 21%), Riih (91% - 83%), Trusenkrang (0% - 33%), Triboh (0% - 100%), and Lambir (0% - 100%). It takes mainly the form of cooperatives or through land schemes.

The increase in middlemen from service Centres is reported in Saratok (15% - 37%), Roban (20% to 28%), Betong (71% - 58% and number of households increased from 7%-25%). See Table VI 2b (1) to (5).

(c) Frequency of Marketing

The frequency of marketing has been classified as "daily", "alternative day", "weekly", "twice monthly", and "less often".

The average for the three crops showed that about 20% and 7% of the respondents market their produce "weekly" and "twice monthly" and 34% and 44% of the respondents market their produce "less often" between the two study periods. Owing to road developments, goods are sold in a more bulky manner than before the roads were completed. However, as we could see from the statistics and earlier analysis, most of the farmers still rely a great deal on foot in some areas and buses and cars in others. These are the means of transport which produce are not marketed in the real "bulky" sense. Thus the percentage of "less often" is lower than expected. This also reflects that it takes a longer time before more cash crops are grown and produce in commercial scale for cash economy to be introduced more fully in the rural areas where the degree of subsistence is great, and transactions in cash with the urban systems are taking place in a small piecemeal manner.

The frequency of marketing also varies with the type of crops to be marketed. Fadi has a higher percentage in "weekly" and "less often" category with 18% and 22%, 67% and 66% before and after the roads were completed respectively. For rubber, 24% of the respondents market "weekly" during the two periods and 31% and 28% "twice monthly" before
and after the roads are completed respectively, Pepper is marketed "less often" with 62% and 84% during the two study periods respectively. It is thus noted that padi and pepper are sold less often and rubber is sold more often either weekly or twice monthly. For padi and rubber, produce is sold more frequently after the roads were completed and less often for pepper. The padi harvested and stored could be marketed whenever the needs for other commodities arise and padi is sold or exchanged for the goods in small quantities. As for rubber, after the introduction of land schemes, production is marketed through the land schemes. With the introduction of roads, it encouraged a certain degree of black market operation as settlers sell their rubber to the service centres rather than the land schemes. Pepper is not harvested frequently, and it is usually marketed in bulk which is made possible by the road development and the availability of modern modes of transportation. See Table VI 2(c) 1

The frequency of marketing also varies by areas. The frequency for padi is less often in First and Third Division and more often in the Second and Fourth Division. In the First Division, a number of settlements studied are located very far off the Kuching-Serian trunk road, whereas in the Second and Fourth Division, most of the settlements are located very close to the trunk roads, and it also shown that these remote settlements are more of a subsistence nature than their counterparts along the trunk roads. (See Table VI 2(c) 2)

The marketing frequency for rubber shares certain common characteristics with padi. In the First Division, however, more are sold daily (32% - 26%) through decreased after the roads were constructed and an increase from 23% to 30% for "weekly" marketing. The Second Division has a slight increase in the weekly frequency range from 30% - 31% and a slight decrease in the "twice monthly" frequency range from 34% to 27%. The Fourth Division has a drop in the weekly range from 22% to 10% and twice weekly from 45% to 37%. There have been increase in the daily and alternative day range from 6% to 42%. The Sibintek land scheme has decreased its percentage in the weekly frequency from 49% to 75%. See Table VI 2(c) 3)

Pepper is a cash crop which is harvested less often, and the frequency of marketing is usually less often too. These seems to be a tendency for bulk selling or bulk purchase after the completion of the
road. Before the roads were completed the harvested pepper could be stored and sold to the market as the farmers' wish to market them. After the road, the distribution system of agricultural produce, e.g. the emergence of middlemen as a result of roads and expansion in the service centres, also caused the frequency of marketing to change. In areas where roads are more developed, e.g. First Division, and Fourth Division, the percentage under "less often" are 81% and 91%, 89% and 91% respectively between the study periods. The percentage in Sibintek is high with 88% at the end of the study period whereas in the Second Division, the frequency is more often than in other divisions with 64% and 66% under the "less often" category between the study periods. See Table VI 2(c) 4

As far as individual settlements are concerned, the differences between settlements are not really significant as the variation is quite small.

The above data showed that roads play a role in either increasing the frequency of transactions in small quantities or reduce the frequency when the transactions are in bulk. However, other factors are also involved in the cause of frequency change, e.g. the changing pattern of distributary system, the urban developments in service centres, the type of crops, frequency of harvests, ease of storage, the degree of participation in cash economy and the degree of subsistence, level of income and the availability of alternative mode of transportation. See Tables VI 2(c) 1 - 2(c)4

(d) Modal Split of Market Trips

There is a clear transitional jump in terms of modal split from walking and water transport to trucks, buses and cars. It is found that there are two transition gaps between walking and trucks/buses and cars. These are bicycles and motorcycle. This reflects the fact that the level of income is still too low to own any means of transport and modal split is seriously constrained by the lack of modal choice. Taking the road development into consideration, there are sharp drops in walking from 35% before the roads and 16% after the roads were completed; another drop in water transport by boats from 46% to only 3% between the two study periods. These are obviously the impact of the road development in modal split of marketing trip.
The same phenomena are seen for each crop. The percentage of walking is surprisingly consistent between crops at around 31% to 39% before the roads were completed. However, after the roads were completed, padi has the greatest drop from 33% to 6%, rubber from 39% to 20% and pepper from 31% to 15%. The drop in padi is replaced by the increase in "car" mode from 0% to 33% and "buses" from 3% to 46%. It is observed that rice is sold or exchanged for other items in small quantities which can be conveniently transported using car and buses. However, there are still 5% of the respondents using water transport.

For rubber, the drops go to trucks which have increased from 19% to 49% and buses from 0.8% to 22%. Water transport dropped from 31% to 15%, which go to trucks increasing from 14% to 43%, buses from 1% to 19% and "car" from 1% to 16%. The reliance on buses and cars reflected that pepper is marketed in smaller quantities and in the Fourth Division the people are limited by the mode of transport available, with less buses and more cars.

The differences in each division also vary from crop to crop. Starting with padi, before the roads were completed, the First and Second Division relied heavily on walking which is 71% to 95% respectively. The First Division drops to 54% and, in the Second Division, almost nil reported relying on walking after the roads were completed. In the Fourth Division, the reliance on foot is less i.e. 16% and 4% respectively during the two study periods. However, in Second Division, Sibintek and Fourth Division, there was a heavy reliance on water transport with 100% in Sibintek, and 78% in the Fourth Division. However, after the roads were completed, the percentage drops to nil in others and 12% in the Fourth Division. The continued reliance on water transport is due to the relatively late introduction of roads in these areas.

The percentage drops in Division One are: trucks from 0% to 16% and buses from 29% to 30% between the two periods. It is noted that buses as a mode of transport are more advanced in the First than other divisions. The Second Division has a higher percentage change in buses from 0% to 84%, and with 0% to 100% in Sibintek using buses. However, in the Fourth Division, buses are almost non-existent; instead cars are more frequently used. This is another interesting case of modal jump from walking to cars without passing through the modal stage of
buses, due to the rapid introduction of roads in the Fourth Division.

For rubber as a cash crop, obviously more trips are expected to be generated than padi. The percentage relying on walking has been decreased after the completion of the roads from 87% to 49% in the First Division, 57% to 4% in the Second Division and 20% to 0% in Sibintek. In the Fourth Division, there is a slight increase in percentage. However, the number of respondents has increased only by one from 7 to 8 households. The relatively large percentage of walking in the First Division after the roads were completed indicated a different spatial structure in the more densely populated First Division and the shorter distance between rural settlements and rural service centres. Water transport has also a sharp decline from 4% to 0% in the First Division, 38% to 0% in the Second Division, 38% to 0% in Sibintek 60% to 5% in Fourth Division. The Fourth Division has the duality characteristic of a more advance mode by "car" which consists of 35% of the total after the roads were completed and the traditional water transport which is still used by 5% of the total households.

The percentage drop in "walking" and "boats" go to trucks, buses and cars. The percentage using trucks has increased from 8% to 45% in the First Division, 2% to 41% in the Second, 42% to 99% in the Third and 19% to 32% in the Fourth Division. Thus for rubber, the majority of the households presently use trucks for transportation. Buses and cars played a lesser role, although there are 35% using cars in the Fourth Division. The constraint here is modal choice.

Pepper is a less heavy unit per volume of goods. It is often transported in smaller quantities. Relatively, more are still using "walking". In the First Division, it drops from 46% to 26%. The drops are 35% to 13% and 12% to 5% respectively in the Second and Third Division. For "boats" all divisions dropped to zero percent after the roads except the Fourth Division which still has 18% relying on boats. The percentage before the roads from First to Fourth Divisions in that order is 4%, 61%, 100% and 65% respectively.

The decline in walking and boats is caused by the introduction of roads and resulted in the increase in percentage in trucks and buses and cars. After the roads, more pepper was transported using trucks than other means. For trucks, a higher rate of increase is seen in
the First Division from 38% to 68%, Second Division from 1% to 30%, Third Division from 0% to 100%. For buses, Second Division has a larger margin of increase from 2% to 48%, and in the Fourth Division, the percentage using cars increased from 0% to 53%.

The above facts indicated that the modal split changes are due to road developments, the degree of impact depending on the type of crop, the level of regional development and the date roads were introduced. A transition gap is identified which could lead to policy recommendations to formulate vehicle ownership goals and targets relative to the income to exploit fully the potential of the roads. See Tables VI 2d(1) to (?).

(e) Reasons for Modal Choice

Nine reasons for why a certain mode of transport are chosen are "cheap", "fast", "proximity to market", "goods are not bulky", "goods are bulky", "arranged by buyers", "goods are perishable", "own vehicle" and "no alternatives". These reasons take into consideration the factors of cost, in dollar terms, time, distance, volume weight methods of marketing, deteriorating conditions of goods, vehicle ownership and choice.

For all the sample study areas as a whole and for these major types of crops, the reasons are ranked in order of importance. It is found that four factors have moved from lower ranks to higher ranks, methods of marketing (middlemen), volume/weight and speed, whereas the others have a drop in rank from high to low. These are cost in dollar terms, proximity, vehicle ownership and choice. See Table VI 2e.

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<th>%</th>
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<th>Reasons</th>
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It is thus clear that changes in accessibility usually mean increases in cost of transport, shorter travel time, and transportation of more bulky goods over longer distances, increased in vehicle ownership, increase in choice of modal split and changing methods of marketing and distribution. It is however, not surprising to note that car ownership ranks low both before and after the study periods. The high percentage of "arranged by buyers" indicates that after the roads were completed, although the goods are moving towards the service centres, more users are in fact from the service centres. Before the roads, most rural people have more control over means of transport as a large percentage travel on foot and boats. However, after the roads were completed, most means of transport are controlled by the service centres.

As far as padi is concerned, the reasons ranking 1 to 3 before the roads are "no choice", "heavy" and "own means of transport" which is usually on foot, and after the roads, the reasons are heavy, cheap, and close to market. This obviously reflects the fact that padi is transported by simple means of transport which is less costly and over very short distances despite the introduction of the roads.

For rubber as a cash crop, the reasons before the roads were completed in order of importance are cheap, no choice and bulky; after the roads were completed, the reasons given are arranged by "buyers", "speed", and "close to markets". The reasons reflected the role of middlemen and land schemes and location in relation to service centres.

Pepper is another cash crop; the reasons before the roads were completed are bulky, not bulky and no choice. However, after the roads were completed, the reasons are bulky, arranged by buyers and speed. These show the role of middlemen in the marketing process and the convenience provided by roads in transporting more and bulky goods in lesser time. It also shows that before the roads were completed, most farmers carried their goods to the service centres whereas now, the middlemen come to the rural areas. Before the roads were completed, many walk days and nights to the service centre, stay there for one or two night, get whatever they want and then walk home which takes another a few days and nights. After the roads were completed, the maximum distance a middlemen is willing to drive would be a point where he can reach, collect the produce and return to the service centre. See Table VI 2(e) 1
Coming down to the division level, it is found that the reasons given vary from place to place; among the factors are the choice of mode available, mode of transport, volume/weight of goods, methods of marketing and date when roads were introduced.

Taking padi, for example, "inexpensive" was given as the reason in the Second and Third Divisions with 50% and 66%, 100% and 100% before and after the roads for the two divisions respectively. In the Second Division, 74% gave speed as the reason after the road, this is probably due to the availability of bus transport. Middlemen play a slightly lesser role in the marketing of padi. The First and Fourth Division have 22% and 6% respectively from middlemen after the roads. This shows that these divisions market more rice and to more distant centres, whereas the others are marketed to nearby service centres. The high percentage of "no alternative" e.g. 63% in the Fourth Division before the roads were completed reflects the late introduction of roads in the division.

The reasons for modal choice for rubber and pepper have certain common characteristics at the divisional level. This is a higher percentage in "arranged by buyers" in the Third Division with 93% for pepper and 87% for rubber after the road. There are higher percentages in the First Division giving proximity to market as the reason with 28% and 27% for rubber and 16% and 20% for pepper before and after the roads. There is an equally high percentage in "fast" as the reason given in Second Division after the roads which is 32% for rubber and 52% for pepper. See Tables VI 2(e)2 - 2(e) 8.

3. Shopping & Other Trip Characteristics of Selected Items

(a) Destination of Trips

The catchment areas of various service centres in relation to the sample rural areas for their shopping trips for "foods" could be seen easily from the map. In the First Division, Kuching ranks highest in the list; however, in terms of direct purchases, there are less trips ending in Kuching direct after the roads were completed. This, however, means that there would be more direct linkages between service centres with Kuching and shoppers now go more to their nearest or selected large service centres such as Bau and Serian. Next on the hierarchy is Serian. Almost all the trips originating from rural samples have
at least one trip ending in Serian. The importance of Serian is increased by the completion of roads and the introduction of bus services between Mongkos and Serian. This adversely affected Tebakang, a service centre along the bus route. Even the three villages at its proximity, e.g. Kg. Tebakang Dayak, the percentage going to Tebakang have reduced from 90% to 40% and percentage to Serian have increased from 0% to 50% before and after the roads were completed; for Kg. Tebakang Melayu, the percentages are 82% reduced to 64% to Tebakang and 6% increased to 20% to Serian; for Kg. Tabakang China, the percentage has increased from 61% to 92% between the two study periods. Kg. Rih which is between Tebakang and Serian indicates a decrease of 100% from 25% to 12.5% to Tebakang and an increase from 50% to 88% to Serian. Similarly for Trusenkrang, the percentage is reduced from 87% to 14% to Tebakang and the percentage to Serian has increased from 3% to 61%. Kg. Bunan, however, is the only rural area reporting a slight increase to Tebakang from 30% to 38% between the two study periods. For Kg. Baki, the destinations are scattered along the Kuching/Serian roads and Kg. Simpok has become more self-sufficient as the percentage increased slightly from 60% to 65% to Kg. Simpok itself.

In the Second Division, Melugu still goes to Simanggang and Betong has increased its self-sufficiency slightly from 92% to 97%. However, for Saratok and Roban, the impact is an adverse one. The number of persons from the area around Saratok to Saratok town has decreased from 77% to 65% and almost all people around Roban have now gone to Sarikei with 95% to Saratok before the roads the percentage has dropped to almost zero after the roads were completed. On the other hand, Sarikei as a major service centre now has obviously benefited by the completion of the road. Sarikei being a confluence and centre of catchment from Roban, Saratok and Betong has now a larger service base and it developed quickly with more diversity and choice which adds further to the adverse impact of Roban, Saratok and Betong.

In the Third Division, Sibintek has more people going to Sibu which has increased from 57% to 67% between the study periods. In the Fourth division, areas around Bintulu have more people going to Bintulu town than before with the increase from 55% to 98% between the study periods. Most other settlements come under the catchment area of Miri. Lambir has increased its interaction with Miri from 19% to 71% whereas before
the roads, the settlers go to other minor settlements before shifting into the land scheme. Bekenu is rather self-sufficient with 96% and 100% between the study periods. For Niah, although it own percentage has increased slightly from 12% to 17%, the percentage of farmers going to Batu Niah has increased from 67% to 87%. Batu Niah has been growing rapidly due to the completion of the road at the expense of Niah. Its own percentage has increased from 80% to 93% between the study periods.

The above analysis shows that with changing pattern of accessibility, more shoppers have now gone to larger service centres. This increased the service base of the urban centre which grows more rapidly than before and thus attracts more shoppers from even more distant places.

The distination for shopping trips for Clothing are generally the same as the food trips except that the trip length is greater. In the First Division, Baki has increased the percentage to Kuching from 62% to 66% and Simpok to Tapah from 19% to 41%, and the trips to Kuching have also been decreased from 28% to 17%. Tebang has the same fate as in the case of shopping trip for goods. Most settlements have a decrease in the percentage going to Tebakang, e.g. Tebakang Melayu (86% - 72%), Riih (16% - 0%), Tebakang Dayak (90% - 15%), Piching (63% to 40%), except Kg. Bunau (15% to 31%). Serian is capturing settlers from Tanggak (100%), Riih (100%), Tebakang China (54% to 85%), Kakai (67% - 83%), Triboh (86% to 100%), Tebakang Dayak (0% - 75%), Tebakang Melayu (2% - 20%), and Bunau (0% - 15%). Figures in paraenthesis are percentages before and after the roads were completed.

In the Second Division, 100% from Melugu go to Simanggang. Betong has 92% and 100% between two study periods. Saratok is suffering a drop from 80% to 72% and Roban is the most adversely affected being the nearest to Sarakei, its percentage dropped from 95% to 0% and its percentage to Sarakei increased by the same amount. Settlers from Sibintek go mainly to Sibu with 73% and 100% between the two study periods respectively.

The Fourth Division gives a negative picture on the adverse impact on Niah and the positive impact on Batu Niah and the increased interaction of Batu Niah with Miri. The impact of roads is therefore seen transmitted upwards through the settlement hierarchy with the
larger settlements benefiting more from the smaller ones. Settlers from Niah area have increased their visits to Batu Niah from 68% to 91%, and from Batu Niah to Miri from 0% to 7% between the two study periods, and similarly from Lambir to Miri from 18% to 83%.

For farm tools, in the First Division, the destinations for Baki are the same as those for clothing and foods, except the emergence of Panchor Bazaar and Serian. Kg. Bunun has increased its percentage from 7.7% to 15% to Serian and reduced the percentage to Tebakang from 46% to 38% between the two study periods. Kg. Tebakang China has increased its linkage with Kuching from 8% to 15%. The interactions are much less in term of numbers to Tebakang and Serian as compared to the interaction between settlements for foods and clothing.

In the Second Division, Melugu patronises mainly Simanggang and Betong patronises Kuching (0% - 2.6%) and Sarakei (0% - 2.6%). The greatest loss is still in Roban mainly to Sarakei. The percentage in Roban dropped from 75% to 0%, and for Saratok the drop is slight from 80% to 73% whereas settlers around Roban increased tremendously their patronage to Sarakei increasing from 0% to 95%.

Sibintek patronises mainly Sibu (65% - 100%) and Bintulu itself has an increase from 25% to 37%. In the Fourth Division, Niah continued to lose shoppers to Batu Niah which increased from 64% to 84%. However, there are less people in the proximity of Batu Niah buying tools from Batu Niah town where there is a drop from 40% to 27%.

Manure is an important factor in agricultural productivity. The purchase trip for manure has lesser interaction with other service centres. One of the reasons is that manure is still not very commonly used in agricultural production.

In the First Division, there are less farmers going to Tabakang for manure with a drop from 15% to 0% and trips to Serian have increased by the same percentage. Tanggak has 10% and 20% to Serian between the two study periods. Tebakang China has 23% to Serian which is the same for two study periods and an increase from 7% to 15% to Kuching. Baki farmers have a slight decrease in their percentage to Kuching from 47% between the two study periods.

In the Second Division, Sarakei continues to dominate the market. Roban itself suffers a decrease from 14% to 0% and increased its per-
centage to Sarakei from 0% to 10% before and after the roads were completed. Betong too has a slight increase to Sarakei from 0% to 42% before and after the roads were completed respectively.

In the Third Division, 82% and 100% of Sibintek's farmers go to Sibu to purchase manure before and after the roads were completed respectively.

In the Fourth Division, only 1.8% of farmers around Niah go to Niah town to purchase manure as compared with 3.6% before the road. The percentage going to Batu Niah on the other hand have increased greatly from 3% to 64% between the two study periods. In Bekenu and Lambir, most farmers obtain manure from the same settlement.

The above data indicated that smaller service centres are affected more adversely than the larger centres and compared with foods and clothing, the adverse impact on smaller service centres like Tebakang and Niah is much more serious.

The Movie is the only commercialised form of recreation in the rural areas. People often go to nearby settlements where there are cinemas or watch a movie when it is shown in the land schemes.

In the First Division, Trusenkrang have less farmers going to Tebakang with a drop from 34% to 31%, and Riih has also a drop of 8.3% to 0% to Tebakang. Again Tebakang suffers adversely. Piching has an increase from 0% to 19% of farmers around Piching going to Piching town for movie and the percentage to Serian remained stable at 58% before and after the roads were completed. Tanggak (0% - 0%), Riih (41% - 47%), Kakai (33% to 67%), Tebakang China (30% -77%) continued to be dominated by Serian. Triboh remained to have 59% and Baki 12% to Serian between the two study periods. Baki and Simpok have 3% to 6% and 4% to 30% respectively between the two study periods to Kuching.

In the Second Division, from Saratok, there are no respondents going to Roban after the roads as compared with 2% before the roads completed. Instead there is a 2% increase to Sarakei.

In the Fourth Division, Niah has an increase from 2% to 14% to Batu Niah town and areas around Batu Niah have an increase from 20% to 40% to Batu Niah between the study periods. For Lambir, there is 12% increase to Miri as compared with 0% before the roads were completed.
The percentage of settlers in the rural areas going to various settlements for different trip purposes must be understood in the context of Sarawak, especially its level of regional economic development.

The data on trip destinations by trip purpose indicated that the impact of road development varies with the trip purpose, size and diversity of urban service centres and the resource base or rural areas. The higher the order of goods purchased, the more the larger service centre benefits from the increased "service base" of the rural areas. As a result, the road encourages the rapid growth of larger service centres at the expense of smaller service centres.

(b) Mode of shopping, recreation and other trips

There are five types of trips in connection with shopping recreation and others, viz food, clothing, manure, tools and movie. The modal split of these trips before and after the roads were completed are "walking" having decreased from 56% to 20%, "boats" decreased from 20% to 6%, "buses" increased from 10% to 47% and "car" also increased from 6.4% to 19.5%. It is thus seen that walking and water transport have dropped sharply and buses and cars have increased tremendously. On the other hand, bicycles and motorcycles are rarely used.

The percentage of settlers on "foot" varies with the trip purpose. The lower the hierarchy of trip purpose, the greater the percentage on foot. The order in relation to percentage between the two study periods are foods, having decreased from 54.5% to 30.5%, movie, from 56% to 20%, farm tools, from 39% to 17%, clothing, from 48% to 16% and manure, from 17% to 7%. In comparing the percentage change between two periods, it is found that the movie has dropped 49% and clothing by 32%. Foods, farm tools and manure have lesser drops. This indicates that settlers have been able to travel longer for movies and clothing and less so for food and manure.

The percentage of modal split by boat after the road has a drop to around 2% to 3% for all trip purposes except manure which is still about 30% which is due to the large number of settlers in Bekenu who still rely greatly on boats for transporting manure. This shows a possible alternative use of water transport in Sarawak which does not
necessarily mean that the adverse impact on water transport should lead to the conclusion that water transport would disappear almost completely.

The percentage of farmers going by bus is between 7% to 8% except for movie trips before the roads were completed. However, after the roads were completed, there is at least an increase of 30% to 44%. Clothing has a greater jump of 44%, followed by movies with 41%, manure and farm tools with 37% and lastly food with 33%.

The percentage going by car was around 2% before the roads and 18% to 20% after the roads are completed. There are more farmers using car for farm tools than for other purposes. Foods, clothing and manure have a percentage of around 20% and movie has only 13%. See Table VI 3b (1).

The modal split for a particular trip purpose also varies with areas and locations. The modal split for food is an example. The four divisions could be categorised into three types. Type I are settlements closer to trunk roads, these areas have a sharp drop in modal split on foot, and water transport, a heavy reliance on buses and minimal on cars. These are in the Second and Third Division. Type II are areas where there are more settlements off the trunk roads such as areas in the First Division. The characteristics of these areas are that there is a heavy reliance on foot although there is a drop in water transport and the increase in buses is only half of the first category. The reliance on car is also small. Type III is in an area with fast economic development and closer to the trunk road than type II. There is minimal reliance on foot, a sharp drop in water transport, a medium rate of increase in buses and rapid increase in cars and thus heavy reliance on cars rather than buses. See Table VI 3b (2).

The shopping trip for clothing has the same characteristics of type I, II, and III; however, type I has on foot (0% - 15%), and higher percentage on foot (68%) than food trips which have only 52%. Type III is the same as the food trip. At the settlement level, only two settlements in the First Division, all settlements except Lambir rely more on cars than buses. Lambir relies heavily on buses rather than cars. See Table VI 3b (3).
The pattern for manure trips is slightly different with more on trucks (42% - 37%), buses (22% - 23%), walking (32% - 33%) in the First Division, heavy reliance on buses in Type I areas and exceptionally high percentage in water transport (93% - 56%) in type III areas. At the settlement level, Baki has a higher percentage using trucks and in the Fourth Division, Niah and Batu Niah rely on water transport for manure because a large amount of organic manure from birds is produce in Niah cave and the only means of transport is on foot and by boats. Although Niah has a drop from 80% to 10%, Bekenu's modal split by boat remains at 100% between the two study periods. See Table VI 3. b (4).

The purchase of farm tools follow the same category of types I, II and III patterns. However, for type II areas, the percentage of foot is smaller, i.e., 35% compared with 52% for foods after the roads were completed and higher percentage on trucks than food trips and less than that of manure trips, i.e. 12% as compared with 2% and 37% for food and manure trips respectively. Type I areas have less percentage on foot and higher on truck (12%) and buses (94%). The type III areas have higher percentage on cars which is 52% as compared with 44% for food trips, 46% for clothing and 33% for manure trips. At the settlement level, most are consistent with the general patterns by Division. See Table VI 3 b (5).

The modal split pattern for movie trip is rather different. After the roads were completed, more trips are performed on foot although there is a drop from 69% to 20%. More trips are also performed using buses (20% before and 61% after), and cars (0% before and 13% after). At the division level, the Second and Third Divisions have less using buses than expected (0% before and 33% after) and more are performing their trips on foot than expected (50% before and 33% after), there are also 33% travelling in jeeps after the roads were completed.

In the First Division, there is an exceptionally high percentage of trips performed by buses (21% before and 68% after) which is comparable with the "clothing trip" in the same division. This indicated the relative larger trip length of the movie trip. In the Fourth Division, the pattern is characterised also by higher percentage of trips performed by buses from 0% before and 32% after the roads were completed.
(c) **Trip Frequency by trip purpose**

The frequency of trips is categorised into daily, alternative day, weekly, twice monthly, monthly and less often. The trip frequency data were collected for five types of trips. The trip purposes are ranked in order of frequency of performance, i.e. the more frequent trip purpose is ranked first. We have food, movie, clothing, farm tools and manure in that order. See Table VI 3c (1). The overall trip frequency for all types of trips has a slight decrease in the "less often" category from 60% to 53%, "monthly" category from 12% to 11%, and an increase for "twice monthly" from 5% to 7%, "weekly" remains at 13%, alternative day increases from 6% to 7% and "daily" from 4% to 9%. These indicate that the introduction of roads have made a certain type of trip possible to more distant places and back in the same day. As a result settlers travel slightly more frequently than before.

In analysing the trip frequency by type of trips, it is found that "food trips" are performed weekly although there is a drop from 38% to 33%, and daily where the percentage has increased from 13% to 24%. About 17% to 18% of the trips are performed in every alternative day. This shows that settlers are travelling more often for food trips as the journey could be done in shorter time. However, the large percentage in weekly trip shows that many settlers are still walking to the service centres from the forest interior where roads are not available. Although roads are seen to generate higher density settlement along the roads, many settlers still live in longhouses rather far away from the roads.

"Movie trips" are performed more frequently just next to food trip. The weekly range has increased from 4% to 11% and twice monthly have increased from 8% to 16%. There is little change in the "monthly" range which remains at 18% and a 15% drop in "less often" category from 70% to 55% before and after the roads were completed.

The trip length is slightly greater for clothing trips as a majority of the settlers travel to larger service centres where diversity in shopping goods is one of the major attractions. As far as frequency is concerned, there is only a slight increase in the "twice monthly" category from 2% to 5% where as the "monthly" category remains at 18% and there is a slight drop in the less often category from 80% to 77%.
"Farm tool" trips are performed even less frequently with 84% before and 90% after the roads were completed. There is a slight drop in the "monthly" category from 13% to 5% and a slight increase in the "twice monthly" category from 3% to 5%. This reflects more on the level of sophistication of farm production. It seems to indicate that roads do not automatically bring out more frequent "farm tool trips" unless there is corresponding agricultural extension work and investment.

"Manure trips" are performed less often with a slight drop from 97% to 85% and a slight increase in the monthly category from 3% to 15% between the study periods.

The trip frequency varies only slightly by division. "Food Trips" are performed more on a weekly basis. In the First Division, trips are performed more frequently than other divisions. This is due to the proximity to markets and relatively high network complexity in the First Division. About 15% of the trips are performed less frequently than weekly trips. In the Second and Third Division, although the majority are on a weekly basis, it is more biased towards less frequent categories, e.g. the percentage less frequent than weekly trips are 48% and 30% before and after the roads were completed respectively.

In the Fourth Division, the same pattern in the Second and Third Divisions prevails; however, there are slightly higher percentages in the "less often" category. The twice monthly, monthly and less often categories added up to 43% and 39% between the two study periods. The frequency variation between divisions reflects the complexity of the road network, proximity to service centres, settlements and population density. See Table VI 3 c (8).

"Movie trips" are still small in magnitude, although the frequency has increased, the impact in term of magnitude is still small. It consist of 6% and 8% of the total trips before and after the roads were completed respectively. The First and Fourth Divisions are similar to the average pattern though there are "less often" trips in the First Division, (67% before and 62% after), and in the Fourth Division there is a sharp drop in the "less often" category from 86% to 32%, and the "twice monthly" category has increased from 6% to 40%. This is an
obvious impact of roads as the expenditure on movie trip is much less than other trips. See Table VI 3 c (3).

"Clothing trips" The average for all divisions showed that the "less often" category has 80% and 77% before and after the roads respectively. This average is reflected in Division One and Three. Division Two has more in the "monthly" category which has increased from 29% to 36% and in the Fourth Division there is a slight decrease in the "less often" category from 87% to 89%. This showed that the changes for clothing trips are relatively less than other trips. In terms of magnitude, clothing trip consists of 30% of the trip total after the roads were completed. See Table VI 3 c (4).

"Farm tool" trips consists of 23% before and 19% of the total trips after the roads were completed. The average pattern is characterised by the high percentage of "less often" category, and in fact, this is a negative impact in the sense that roads do not manage to increase the frequency of farm tool trips. This is not because the road is not a useful instrument but rather it is not attacked simultaneously by rural investment and technology transfer.

At the division level, the First and Fourth Divisions have higher percentages in "less often" category, and smaller percentages in the Second and Third Division. See Table VI 3 c (5).

"Manure Trips" consist of 8% and 6% of the total trips before and after the roads were completed respectively. There are significant increases in trip frequency. On the average, the "less often" category decreased from 97% to 85%. In the First Division, there is a larger drop from 90% to 75%, followed by Fourth Division from 98% to 83% and Second Division from 100% to 96% between the two study periods. See Table VI 3 c (6).

The data for all trip purposes indicated that roads have a greater impact on trips such as food and movies than clothing, farm tools and manure trips. This also indicates that productivity and level of income seriously constrain the exploitation of the full potential of the road. The impact also varies by different settlements and population density. The impact of roads is therefore not a straightforward one, the positive and negative impact is simultaneously present in the settlement system.
(d) Trip Duration  The average trip duration in minutes of travel between home and market as computed. There is a sharp drop of travel time by 70% from 83.31 minutes to 22.29 minutes for all the rural samples. The average travel times vary with division before the roads from 152.4 minutes in Second Division to 59.77 minutes in the Fourth Division. The Third and First Division have an average of 95 and 60 minutes respectively. However, after the roads were completed, the averages are quite consistent between different divisions, except Third Division which has an average of 51.7 minutes. The travel time for First, Second and Fourth Divisions are 18.76, 19.56 and 21.09 minutes respectively. From the point of view of travel time, roads have definitely reduced the time duration by a very great margin.

The frequency distribution shows that there is a sharp drop in the "over 60 minutes" range from 51% to only 2%, and there are increases in all the other four ranges, i.e. 40 - 60 minutes from 5% to 11%, 31 - 45 minutes remains stable at 5%, 16 - 30 minutes from 15% - 39% and 0 - 15 minutes from 24 to 43%. The cut off point seems to be the 32 - 45 minutes range where there is an increase in the less than 30 minutes range and 46 - 60 minutes range.

At the division level, the only exception seems to be at Sibintek where it only increases in the 46 - 60 minute range from 8% to 90%. All other ranges suffered a decrease. Other divisions follow the average pattern. The First Division has more trips recorded in the 0 - 15 minute range and the Second Division has more trips in the 16 - 30 minute range whereas Fourth Division has the same percentage of around 42% in these two ranges. The data of First and Fourth Division reflects the complexity of network structure in these divisions. (See Table VI 3 (d) 1.
1 School Attendance

The percentage of households with school attendance has an average of 71% for all samples. Second Division ranks first with 82%, followed by Sibintek with 73%, Fourth Division with 70%, and First Division with 66%. It is found that the percentage is relatively high in land schemes e.g. Triboh with 77%, Melugu with 71%, Sibintek with 73% and Lambir with 77%.

The average number of school-going children per household averaged 2.93 for all samples, with 3.05 in the Second Division, 2.86 in the First Division, 2.85 in the Fourth Division and 2.27 in Sibintek. The number of school attendances is considered low relative to the household size and number of children in the school-going age.

In the Fourth Division, it is recorded that due to the clustering of longhouses along new roads, there is a heavy pressure on school facilities as more people are within the service radius of a school now. In Batu Niah, the primary school there is packed with students and there is clearly an urgent need for more schools to be constructed in the area.

2 Mode of Transport to School

The mode of school trip is still dominated by walking. The percentage, however, has declined from 85% to 62%. Water transport has also declined from 6% to 3%. The number of children going by bicycle is still very small, only 5%. After the roads have been completed, the dominating mode besides "walking" is by "bus", which has increased from 3% to 24% and "car" from 1% to 5%. (See Table VII 2.1)

The differences between divisions vary slightly. In the First Division the two dominant modes are "walking" and "buses" with "water transport" having declined slightly. The Second Division has less children walking after the road from 98% to 32%, and it has an extraordinary high percentage in buses from 0% to 64%. In Sibintek, the important mode is walking and buses. In the Fourth Division, the dominant modes are walking (59% - 60%), bicycle (19% - 12%), car (2% - 13%). Water transport declined from 19% - 5%. This shows that
in areas closer to the river, the boat is still used for relatively short distance movement. (See Table VII 2.2).

3 Information Transmission

(a) Mode of Transport In general, the percentage of households reading newspapers have increased substantially relative to the rural context in Sarawak. Only 4% of the total households read newspapers regularly before the road; the percentage has increased to 21.1% after the road. However, the rate of increase is also constrained by the level of education in the rural areas.

The mode of transportation of newspapers was mainly by water transport before the roads were completed, 71% are transported by boats and it is only 7% after the roads were completed. The major mode of transport after the roads were completed is buses with 10% before and 50% after the roads were completed; car ranks next with 9% before and 37% after the roads were completed.

The differences at the division level are minor and most divisions have a large percentage using buses. In the First Division, only 25% were using buses before the roads. After the roads were completed it was 66%. In the Second Division, none were using buses before the road and 53% were using buses after the roads were completed. In Sibintek, the percentage was 27% before and 90% after the roads were completed. Only the Fourth Division has a different pattern where only 5% relied on buses and 95% are using cars after the roads were completed. There was only 1% of people using cars before the roads were completed. (See Table VII 3 (a)

The changes in mode of transport for newspapers has many common characteristics with other trip purposes. The sharp drop in water means a faster delivery service of newspapers to the rural areas. This is an indirect effect on the changes in the outlook of the rural people and it has great impact on rural development and possibly also on rural-urban migration.

(b) Delivery of Newspapers The difference in days between the date printed on the newspaper and the day it is received is asked and recorded. The results show that 59% of the households received their newspapers more than a week later before the roads and none is report-
ed after the roads were completed. The impact of road development on the delivery of newspapers is indicated by the rapid increase of households reading their newspapers on the same day from 22% to 77% before and after the roads were completed respectively.

At the division level, 100% of the households who read newspapers had a time lag of 7 days and more. After the roads were completed, none reported having a lag of 7 days and more and 74% received their newspaper on the same day. In the Second Division, 100% received their newspapers with a lag of 3 days. However, it has now reduced to 36% after the roads whilst the number of households receiving newspapers on the same day has increased to 64%. The Third Division being closer to Sibu, 28% had a time lag of 1 day before the road and 100% within the same day after the road was completed. The Fourth Division has 88% — a time lag of 7 days and more. However, after the roads were completed, none reported having a time lag of 7 days and more and 80% received their papers on the same day as against only 10% before the roads were completed. (See Table VII 3 (b)).

The above indicated that the road is not a direct factor in the percentage increase in the number of households reading newspapers. However, it did shorten the time lag between the date newspapers are printed and the day they are received.
PART III FINDINGS, IMPLICATIONS & POLICY RECOMMENDATIONS

1 FINDINGS

(a) Housing, population and Social Infrastructure The study found that there is a change in the pattern of house ownership from the collective to the individual for those living in the longhouses which take the form of the disintegration of traditional longhouses. It is believed that this phenomenon has a direct relationship with the development of roads resulting in rural population clustering along the roads from the forest interior, and very often in a disorganised manner without proper supporting infrastructure facilities. The poor development or total absence of infrastructure is often not surprising, e.g. 48% do not have electricity supply and 35% of the settlements do not have piped in water; there are also signs of poor extension of medical services.

Besides infrastructure development, there is also less reliance by the local people in using local materials for their houses after the roads were completed.

(b) Employment Other than population, employment is an important factor in the growth of rural areas. It is found that agricultural employment has decreased only marginally from 91% to 86% as a result of road construction and the growth of industry is also minimal. In the rural areas, there is only 1% of the total employment in the manufacturing sector.

In terms of diversification of the rural economy, road development in general has had little impact on hill padi cultivation; however, in some areas, there are significant changes from the traditional cultivation to rubber and pepper cultivation. This finding is comparable with that of Grijpstra (1973) where road development gathers labour resources for the rubber estates and pepper farms who need labourers and these labourers subsequently set up their own farm after obtaining the necessary know how.

(c) Migration The road is found to provide a basic condition for rural-urban migration, which has been caused partly by imbalanced public investment in the urban centres which in turn generates a large number of jobs for the rural people not in the rural areas but in the
Socially, roads also encouraged social intercourse for rural people with more distant urban centres, mainly in the form of marriages and return social visits.

(d) Agricultural Production Agricultural production is related to employment described earlier such as the marginal impact of roads on shifting cultivation as a whole and the changes from subsistence cultivation to cash crop cultivation.

From the expenditure point of view, roads alone do not manage to stimulate the more frequent use of fertilisers and more frequent use of the transportation network. The utilisation of roads are related to the development of other sectors such as rural technology transfer, rural extension etc.

(e) Marketing The marketing aspect could be divided into two, i.e. the marketing of agricultural produce to urban centres and other rural areas; and the marketing of goods and services from the urban or service centres to the rural areas. It is found that in terms of marketing agricultural produce, there is an increase in the frequency of marketing a small quantity of produce over a short distance. Other goods which used to be marketed in small quantities on foot are now marketed in bulk but with reduced frequencies. The problem of magnitude, i.e. how much has the road development stimulated the outflow of agricultural produce from the rural areas to the service centres, depends greatly to what extent the public sector and the rural people are successful in stimulating agricultural production.

The roads have resulted in relatively less farmers buying direct from these large service centres such as Kuching, Sibu and Miri. On the other hand, there are more people going to the second and third order service centres.

This phenomenon has in fact increased the "service base" of the large service centres resulting in the growth of some such as Sarakei and Batu Niah; and the decline of others such as Niah, Roban and Tebakang.
(f) **Modal Split and Travel Time**  Firstly, there is a sharp drop in the use of water transport for long and short distance movements of goods and services directly as a result of road development, in some settlements the drop is as high as 60% - 90%.

In Sarawak, roads have been introduced without proper planning and action in some cases, without introducing a suitable mode of transportation, ways of implementing and financing these modes of transport in relation to the local conditions in different divisions.

Directly, this has resulted in the identification of three transport modal continuum gaps which are bicycles, motorcycles and buses.

The roads have also caused a tremendous drop of travel time from an average of 83 minutes to only 22 minutes per trip or a drop of 70%.

(g) **Education and Information Transmission**  The level of illiteracy is quite high about 70% and in some areas reaching 90%. This shows that in spite of the completion of roads, the level of education over the years is till very low.

Information, on the other hand, is transmitted faster and is more timely. It is found that 22% as compared with 77% of the newspaper readers are reading newspapers published on the same day between the two study periods before and after the roads were completed.

2  **IMPLICATIONS**

(a) **Resistance to rural development**  Owing to a low level of education, projects initiated by the government suffered difficulties. These include receptance of government efforts and ability to learn to adapt and willingness to change. The traditional shifting cultivation pattern and ways of life in the rural areas have created a cultural pattern and value which takes time to change. A high illiteracy rate has resulted in resistance to change, low productivity and low growth.

(b) **Demands of lands and squatter problems**  Roads have brought people from longhouses in the interior to areas along the roads. These increased population concentration and resulted in increased demand for lands for housing and cultivation along the roads. It has also lead to
squatter problems on state lands and acute land shortage for some rural farmers due to the constraints imposed by the existing land tenure system. This also means the unnecessary constraints on the potential of rural development.

(c) **Loss of manpower and potential skill** Urban rural migration has resulted in the heavy loss of manpower and potential skill required for the modernisation of rural areas.

(d) **Poor and uneconomic use of resources** Road construction is expensive and the construction of roads without fully exploiting their potential is an uneconomic use of scarce resources, e.g. although the roads are completed, rural people are not provided with suitable means of transport or mode of public transport and many still travel on foot on a road instead of a jungle path.

(e) **Alternative use of water transport** The roles of water transport have changed tremendously. However, the shift to road transport has resulted in the unnecessary abandonment of water transport. Water transport as an inexpensive means of movement is not fully exploited for alternative uses.

(f) **Shortage of Storage Space** Owing to the changing pattern of marketing and as more goods are marketed in bulk, more storage spaces are required for storage before bulk transportation to the market.

(g) **Imbalanced growth in large service centres.** There is a trend towards increasing concentration of people in three large cities which have benefited from the construction of roads in the rural areas.

3 **POLICY RECOMMENDATIONS**

(a) **A livable rural environment** It is recommended that the state authority could conceptualise goals, targets and objectives of a livable rural environment within the context of the rural area in Sarawak. A livable environment criteria could include population size, employment structure and target income, supporting infrastructure such as roads, schools, medical and health facilities, rural extension and technology transfer, open spaces, housing type and modes
of transportation.

(b) Co-ordination of transport and various sectorial plans
It is recommended that there should be co-ordination between transport and road development plans with other plans such as education, medical and health, rural extension, technology transfer etc.

(c) Community Participation The rural community should be encouraged to participate in the development plans in the form of community management and financing the projects through self-reliance and utilising local manpower, skill and resources. This may include self-help feeder road projects or obtaining the assistance of timber companies to contribute machines and manpower for the community where extraction is carried out.

Another example is to encourage the learning process through community interaction rather than the usual "spoon feeding" approach. Field workers of the present study have reported that native people who turned to pepper cultivation after working in the Chinese pepper farms and learned the necessary know how from the Chinese farmers. A possible tool could be "model farms" of these native people.

(d) Retain useful communal spirit in development plans To ensure success of public projects, it is recommended that useful communal spirit and ways of life be retained. A possible example is to retain or modify the longhouse ways of life in public projects such as retaining or modifying their traditional longhouses, instead of an adrupt change to detached houses.

(e) Increase population density It is recommended to increase the population density of settlements along strategic nodes along the transportation network. This need not be in the form of new land schemes but to group two or more longhouses together and to inject the necessary supporting facilities such as electricity, water, health. This is possible as by increasing the population density, it is now more economical to provide these facilities.

(f) A flexible and adapting land tenure system It is seen that road development generated demand for lands. Unless there is
a flexible and adapting land tenure system, the benefit of road development would not be fully exploited. Or alternatively, the road could be aligned in such a way as to maximise the possibility of maximal exploitation of lands along the new roads.

(g) **Set up key rural industries**  Key rural industries could be set up in the rural areas close to the source of raw materials such as timber factory, cane factory, rice mill, brick works, fertiliser factory, pepper, oil palm and rubber factories.

(h) **Alternative use of water transport**  It is seen that as a result of road development, water transport has almost disappeared. As water is a cheap means of transport, alternative uses of water transport should be encouraged, such as using it for timber and the transportation of bulky goods and it could be used as a tourist attraction.

(i) **Modal Split policies**  It is recommended that roads should be introduced together with the relevant mode of transportation, such as buses, trucks, or bicycles. The appropriate mode of transport could be loaned through the state government and financed and managed by the local authorities.

(j) **Growth of Second and Third Order Towns**  It is believed that rural areas will benefit more from the facilities in the second and third order towns than those in the three large cities. There should be a spatial policy on the selection and encouragement of second and third order towns in Sarawak.

(k) **Mass Media**  The mass media such as radio and newspapers should be fully exploited to encourage more investment into the rural areas, to educate the rural people on their roles in national development, to transfer technology, to report prices of agricultural produce, and to mould the attitudes and values of the rural people.
## Summary of Findings, Implications and Policy Recommendations

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<td>1. Housing, Population and Social Infrastructure</td>
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<td>a) House ownership from collective to individual and disintegration of traditional longhouses; and as a result of road development, population clusters along roads in an unorganised manner.</td>
<td>1) Increasing domination of individualism</td>
<td>To increase the population density of settlement at strategic modes along the transportation networks.</td>
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<td>2) More lands are required for housing and farming</td>
<td>To encourage community participation in the planning and implementation of new generation settlements with comprehensive social facilities made possible by higher density of planned settlements.</td>
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<td>3) Squatter problems on State Lands</td>
<td>To work out new design for houses that incorporates the advantages of longhouses and helps to sustain the traditional community spirit in the longhouses, e.g. injection of modern sanitary and electricity facilities.</td>
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<td>b) Decreased reliance on forest for building materials</td>
<td>1) Houses likely to be more costly and facilities in the houses improved</td>
<td>To design model houses that would encourages the use of local building materials and work out incentives for using local materials.</td>
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<td>2) Neglected the usefulness of local materials from the forests.</td>
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| **c)** Needy infrastructure poorly developed. 48% of the settlements do not have electricity, 35% do not have piped in water. Roads alone do not help greatly. Poor extension of medical services. | i) Extension of infrastructure hindered by low population density.  
ii) Rural settlements deprived of needy social services given rise to low productivity and health problems. | To formulate and coordinate infrastructure plan with road development plan.  
To establish targets for rural infrastructure facilities and medical services. |
| 2. Employment | | |
| Marginal decrease of people engaged in agriculture from 91% to 86% and minimal increase in rural industry which is only 1% of the total employment. Marginal increase in farm income despite the introduction of the roads. | i) Low rural productivity, low farm income and thus low growth.  
ii) Rural economy vulnerable to changes in world economy for agricultural produce.  
iii) Potential of the roads not fully exploited results in stagnant or low growth. | To formulate and co-ordinate rural industrialization plan with road plan and to work out priority settlement for pilot schemes in injecting industrial employment to diversity rural employment. A 5% target in industry may be established.  
A set of comprehensive policies are required to coordinate transport and other development plans. |
<p>| 3. Migration | | |
| (a) Road has provided a basic condition for rural-urban migration. This is intensified by imbalanced Public Investment in the urban centres which generated a large number of jobs for the rural people, not in the | Intensified rural-urban migration will effect adversely the manpower requirement and skills for rural development. | To adopt a comprehensive approach to rural development establishment of rural development targets, phasing and programming in close co-ordination with road development plans in priority action areas. |</p>
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<td>rural areas but in the service centres</td>
<td>i) Depopulation of youthful population of fertility age. ii) Return social visits resulted in increased linkage between rural and urban centres. iii) Provide transitional accommodation for rural people in the urban centres thus speeding up rural depopulation.</td>
<td>To provide incentives for educated couples from urban to stay in the rural areas, e.g. housing and tax incentives.</td>
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<td>(b) Roads encouraged social intercourse for rural people with more distant urban centres, mainly in the form of marriages and return social visits</td>
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4. Agricultural Production

(a) Road development has only a marginal impact on shifting cultivation as a whole. However, in some areas, shifting cultivators are moving to cash crop cultivation such as pepper and rubber.

(b) Road do not manage to stimulate the more frequent use of fertilisers and more frequent use of transportation network.

Continued dominance of hill padi cultivation, low productivity and low income.

To allow a transitional policy on crop mix, allowing padi to be grown together with cash crops.

i) Investment in road development is not optimised.

ii) Low productivity in agriculture.

To step up rural extension work.

To set up fertilizer plants and provide fertilizer at low cost or encourage the frequent use of local organic fertilizers.
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<td>5. Marketing</td>
<td>i) Relatively more trips with lesser trip lengths are generated.</td>
<td>To plan and provide rural storage space for bulk storage of agricultural produce.</td>
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<td>(a) Frequency of marketing of goods on small quantities has increased, but other goods are marketed less frequently although in bulk.</td>
<td>ii) Less frequent marketing of some produce in bulk require better storage facilities.</td>
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<td>(b) Relatively less farmers are now buying goods direct from Kuching and more are buying through service centres.</td>
<td>The emergence of second and third order towns and functional differentiation between Kuching and towns of lower hierarchies.</td>
<td>To encourage the growth of second and third order towns in the form of growth nodes to lessen the heavy concentration of urban population in only three major cities (i.e. Kuching, Sibu and Miri).</td>
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<td>(c) Road has increased the &quot;Service base&quot; of many large service centres.</td>
<td>Intensified rural-urban migration and concentration in only three major cities</td>
<td>To encourage the growth of smaller towns and to create a livable rural environment and to increase the productivity of rural areas.</td>
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<td>6. Modal Split Policy</td>
<td>i) Exert more pressure for road construction, improvement and maintenance.</td>
<td>To encourage the use of water transport for bulky and durable agricultural and forest produce, as water transport is more economical.</td>
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<td>(a) There is a sharp drop in the use of water transport for movement of goods and services.</td>
<td>ii) Potentials of water transport are not optimised.</td>
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<td>The potential of road investment is not optimised. As a result, there is still a large percentage of people who move on foot on the road instead of a traditional foot path, and it is found that only 35% of the sample settlements are served by public transport such as buses.</td>
<td>To encourage public transport in areas with sufficient population base by either government agencies such as MARA or private transport companies.</td>
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<td>(c) Three transport modal continuum gap are identified: bicycles, motorcycles and buses.</td>
<td>Potential of transportation network not optimised; inefficient use of capital and resources.</td>
<td>To encourage ownership of bicycles and to form bus companies with the assistance of government.</td>
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<td>(d) There is a tremendous drop of travel time from an average of 83 minutes to only 22 minutes i.e. a drop by 70%.</td>
<td>More trips are generated and more produce is marketed.</td>
<td>A modal split policy should be worked out for implementation.</td>
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<td>7. Education &amp; Information Transmission</td>
<td>Resist attempts at rural modernization</td>
<td>To have a correspondence education programme to coordinate with road development.</td>
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<td>(a) Low literacy rate of 30%</td>
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<td>(b) Information is transmitted faster, 22% as compared with 77% of the newspaper readers are reading papers published in the same day</td>
<td>More information is transmitted so reaching a larger area. Information about towns and cities generates intensified rural urban migration.</td>
<td>Mass media we mobilised to assist in the modernization of rural sector and rural development, in coordination with a comprehensive rural education programme.</td>
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