Chapter-2

Review of Literature and Methodology of the Study,
Collection of Data

2.1. Introduction

In Meghalaya, road network is the only form of transportation that connects the state with the rest of the country and also areas within the state to one another. The importance of developing an efficient road network is imperative for linking the villages to markets in the state and outside. Not only is the development of road network a pre requisite for the development of the local economy, it is also necessary to provide people in the villages access to medical treatment and higher education facilities that are available at the block and district headquarters. Road connectivity and its quality vary across the districts and villages in Meghalaya. Besides, there is variation in socio-economic development across many villages in different districts in terms of agricultural and non-farm activities, health and education, prices of the various products and wages of the rural households. Most of these villages are identical in many aspects, except the accessibility to various facilities through well-developed road networks or communication facilities.

Thus, these variations in socio-economic development across many villages in Meghalaya need to be examined alongside the variation in road accessibility in order to understand whether provision of adequate and efficient rural road network helps in improving the socio-economic conditions of the rural masses in the state that may be possible through (1) reduction in transportation costs, travel time and enhancing different modes of transportation (2) increase volume of agricultural production, agricultural prices and wages, reducing wastage of perishable agricultural products.
(3) enhanced mobility and diversification of income through non-farm employment
(4) enhancement of accessibility to schools and healthcare facilities, increase in
benefit more from different healthcare programmes and delivery of child in healthcare
centres and finally (5) enhancement of accessibility and benefit obtained from several
rural development schemes or Poverty alleviation programmes specifically designed
to improve the economic conditions of the rural masses (like creation of employment
opportunities and earning).

2.2. Rural Road Infrastructure and Socio-Economic Development

Rural roads are essential for development of rural economy (United Nation
Centre for Human Settlement (UNCHS), 1985; and United Nation Environmental
Programme (UNEP), 1986). Extensive, adequate and efficient rural feeder road
network serves as one of the channels for the collection and movement of goods and
services, movement of people and dissemination of information. It helps in the
exchange of rural products as well as strengthening the socio-economic, cultural and
political fabrics and processes of the rural communities. In other words, rural roads
provision form an intrinsic part of rural development strategies, serves as a
mechanism and catalyst for rural transformation through the reinforcement of rural
development efforts. According to Hodder (1971), William (1978) improvement of
transportation, including rural roads, is the most valuable aspect of rural development.

Study by World Bank (2001) showed that investment in rural roads had a
significant impact on the socio-economic conditions of the rural masses and exhibited
through improved accessibility to social infrastructure (schools and health centres),
social interaction and mobility. Increased access to markets, where perishable goods
could be marketed faster and at a cheaper transportation costs, it helped in enhancement of rural income and additional employment opportunities.

Africon (2006) had a contingent survey on a proposed rural road investment in the rural mountain areas of Lesotho to obtain the views of communities with respect to the expected impact of the rural road investment on overall socio-economic conditions. The survey indicated that the proposed road investment could potentially create several short-term employment opportunities through road construction, and also long term employment opportunities through continuous road maintenance throughout the lifespan of the road. Besides, the survey indicated that there would be a positive impact on the living conditions of communities in the project road area like improved accessibility to work opportunities and social services.

Khandker, Levy, and Filmer (1994) reviewed the possible impact of a road project financed by the World Bank in Morocco and found a potential increase in agricultural production and land productivity as well as in the use of agricultural inputs and extension services. The road project also led to a shift towards the production of high-value crops and an increase in off-farm employment opportunities. On the social front, benefits included improvements in access to healthcare services and increased attendance at schools and overall development of socio economic conditions of the rural communities.

The above studies asserted the importance of rural roads in facilitating movement of goods and services, strengthening the socio-economic fabrics of rural communities through accessibility, enhancing agricultural productivity, off-farm employment opportunities and accessibility to social services. But they did not highlight the effect of rural roads on certain variables like transportation costs, mode of transportation and travel time, which can affect wages and prices etc.
There are some other studies related to the effects of rural roads on the socio-economic development. Levy (1996) highlighted the impacts of rural road on socio-economic conditions of the rural communes in Morocco. According to Levy, despite urbanization efforts launched in the country during 1990s, a sizeable number of populations remained rural. The author tried to show that rural road project had a massive impact on socio-economic conditions of the rural masses through reduction in transportation cost, lower operating costs of vehicles, elimination of road closure and increased ownership of vehicles. Further, road project led to diversification of crops from lower to higher value, increased volume of agricultural production, enhanced agricultural prices and wages. Also off-farm employment grew at a faster rate and so were the uses of modern agricultural inputs.

Besides, improved rural road project enhanced enrolment in primary schools especially for girls. People used more of healthcare facilities and benefited more from immunization programs. It facilitated regional integration through rural-urban interaction. Paudel (2014) emphasized how rural road influenced livelihood constraints of poor people in Toli and Bhawani VDCs of Dailekh district, Nepal. According to the author, rural road infrastructure played an important role in socio-economic and cultural development of any region. The study revealed that rural communities who had better road transportation were exposed to new and dynamic flow of opportunities and hence, enhanced livelihood through better access to education, market, health facilities and reduction of geographical isolation, which was a critical component of poverty. Further, the study showed that rural road connectivity enhanced farm and income diversification, increased marketability of perishable goods, reduced transportation costs and travel time, improved regional and inter-regional integration. Besides, rural road transportation enhanced access to social
infrastructure, increased employment opportunities and alleviated poverty by sustaining isolated rural communities.

However, the above mentioned studies, which had been done in Morocco and Nepal emphasized the impacts of improvements of rural roads on socio-economic conditions of rural masses through various economic and social variables in terms of lower transportation costs, travel time and better modes of transportation. It enhanced income diversification through off-farm employment, increase marketability of perishable goods, diversification of crops to higher value, increased volume of agricultural production, prices and wages. Thus, increased use of modern agricultural inputs, better access to education, market, health facilities and reduction of geographical isolation were critical component of poverty reduction. These studies however have significant policy implication for Meghalaya, having poor rural connectivity and improvements of rural road network in the state would help in addressing similar issues and bring an overall improvement in socio-economic conditions of the rural people. Besides, Button (1993) aptly remarked that inadequacy of transport facilities was one of the bottlenecks to socio-economic development and national integration in many developing countries without mentioning the different parameters that were affected by deficiency of rural connectivity.

2.3. Rural Roads on Agricultural Productivity and Development

Khandker (1989) used a reduced-form technique and a panel data set covering 85 districts in India for the period 1961–81 and found significant positive impact of government investment in roads on crop output, rural non-farm employment, and agricultural wages, all of which were beneficial to the poor. Similar studies by Malmberg, Ryan, and Pouliquen (1997); Escobal (2001), and Fan and Rao (2002) also
found significant impact of roads on non-farm employment and the consequences for the poor. Malmberg et al. (1997) observed that investment in infrastructure especially on road and other communication led to economic growth in farm and non-farm sectors, generated economic opportunities for the rural population in general, including that of the poor. However, those studies did not find significant positive effects of rural roads on accessibility to social services.

Price variation of agricultural produce and consumption goods is a major issue in most of the low income countries. Minten and Kyle (1999) in their paper on food price variation in rural Zaire demonstrated the role of traders’ marketing margins and its interaction with the physical infrastructure that were responsible for such massive variation in food prices. According to them, two factors determined the producers’ wholesale margin - (a) Transportation Costs and (b) Transaction Costs. Both were influenced by quality of road infrastructure. The incidence of transportation costs determined how the benefits (costs) of road quality were shared between producers, transporters, middlemen and finally consumers.

The study revealed that transportation cost had a major influence on variation of food prices in rural Zaire, where transport costs was on an average, two times more expensive on bad roads than on paved roads and as such producers’ share declined drastically on bad roads as compared to paved roads. Thus, the study concluded that rural road improvement would reduce transportation costs and transaction costs thus, increased producer’s share. Besides, better roads reduced regional price dispersion, enhanced market integration where producer would have a fair share of benefits from their agricultural produce.

Kingombe and Falco (2012) showed the dynamic impact of rural road improvement on agricultural productivity and diversification of crops in Zambia’s
Eastern province. Poverty is a rural phenomenon of Zambia’s Eastern Province and agriculture is an important occupation of many rural households. Scholars frequently argue that agricultural growth is a pre-requisite for widespread poverty reduction in the country. However, the fact is that agricultural productivity is limited by poor rural infrastructure. Kingombe and Falco (2012) also showed that improvement in rural roads enhanced agricultural productivity through increased market accessibility, lower transportation costs and reduced transaction farm production cost. Further, the short run effects of rural road improvement is increased productivity of cotton, which was widely grown in that province, through better access to modern inputs and fertilizers at low cost, creation of direct employment through labour-based technology and timely accessed to market centres. However, the long term effects of rural road improvement were on wide crop diversification, enhancement of size of local market in terms of availability of inputs, outputs and credit, and, finally access to different agricultural and cotton related schemes. Thus, improvement and maintenance of the feeder road network in Zambia’s East Province had contributed to the stimulation of production of cotton and yield. However, the study did not highlight the contribution of rural roads improvement on accessibility to schools and health care services etc.

Road accessibility was a major factor that influenced rural households’ access to and participation in market (Arethun and Bhatta, 2012). Ethiopia has the lowest road density in the world and development of road network in the country is imperative. The study revealed the impact of rural road improvement in Tigray, one of the provinces in Ethiopia, where improvement of access to road and transport services reduced travel time, provided better modes of transportation and as such enhanced labour mobility and increased job opportunities, where more labour was available for other productive activities.
Good connectivity facilitated access to market for inputs, goods and services and market contributed to division of labour and product specialization. Further, the study revealed that good connectivity has reduced variation in price of manufactured goods and agricultural produce, hence, stabilized prices. Besides, good road access and better transport services had enabled farmers to use improved seeds, fertilizers and modern inputs at a larger scale both in quantity and value. Finally, connectivity provided credit facilities to poor rural farmers. But the impact of changed travel time with better mode of transportation on social services was not examined.

Hine and Riverson (1982) showed that poor road had adversely affected agricultural development in Ghana. Kumasi the capital of Ashanti region in Ghana has poor rural network facilities. About ninety eight percent of the rural population lives more than 2 km away from a motorable track with deplorable condition of rural road. Using cross section data from 491 households of 33 villages they highlighted the impact of road accessibility on many parameters of agricultural development in the region. The study showed that the villages having accessibility were better off than those without accessibility in terms of farmers’ income, labour input per hectare and in the use of modern inputs and fertilizers. The study also revealed that accessible villages could get good prices for their agricultural produce, due to low transportation costs and less travel time and hence enhanced production. Besides, the size of allied activities like poultry increased more in villages with accessibility as these products could be marketed faster and as such created more job opportunities. As expected, most accessible villages demonstrated higher level of mobility and accessibility to social services. The most noted impact of road improvement was that accessible villages had more accessibility to agricultural credit facilities and that subsequently
increased agricultural productivity. The study however, confined only to effect of rural roads improvement on agricultural productivity and not on social services.

Tunde and Adeniyi (2012), Usman et al. (2013) and Yaro, Okon and Bisong (2014) examined the positive impact of rural roads and transport services on agricultural production in Ilorin East and Boki, L.G.A. (Local Government Area) of Kwara state, Nigeria. In Nigeria, about 70 percent of the population resides in rural areas whose main occupation is agriculture. The studies tried to highlight the effect of rural road transport on farmers’ income, agricultural productivity and different modes of transportation of agricultural produce. It revealed that road transport enhanced agricultural productivity and generated employment opportunities. Increased farmers’ income and reduced spoilage and wastage of farm produce. Further, these studies showed that remote households had variety of consumption items through improved rural roads and the value of farm outputs was found to increase with higher frequency of transport services, where reduction in travel time promoted other economic and social services and increased accessibility to basic facilities. Households’ income increased more in accessible communities, as well as farm size and employment opportunities in non-farm services. Thus, road transport improved the standard of living of farmers and all rural communities due to rising availability of food and thus ensuring food security in those areas.

The studies concluded that rural road transportation had direct consequences on the generation of income, agricultural productivity, and potentiality for using local resources, support local economy and social development, particularly if development and maintenance of rural road were targeted of local based method. However, the studies, did not analyze the impact of rural roads improvement on accessibility to
social services in terms of school enrolments, availability of basic healthcare services, immunization and other community development programs.

2.4. **Rural Roads on Poverty Reduction**

Using a sample of 129 villages in Bangladesh, Ahmed and Hossain (1990) showed significant positive impact of rehabilitated rural road infrastructure on the incomes of the poor. Villages with better road access were significantly better off. For example, the used of fertilizer was 92 per cent higher in these villages than in those with poorer road infrastructure facilities. Further, they estimated that infrastructure endowment increased household income by 33 per cent, wages by 100 per cent and increased income from business and industries by 17 per cent. Thus, better infrastructure was associated with greater agricultural output, higher incomes, better indicators of access to health services, and greater wage income opportunities. The paper concluded that the development of rural infrastructure like road and communication had important implications for the alleviation of poverty.

Fan et al. (1999) used a general equilibrium model to evaluate the effects of government expenditures in a number of sectors - agricultural research and development, irrigation, roads, education, rural and community development, power, health, and soil/water conservation - and found that the greatest effect on poverty reduction came from roads. The study of Balisacan (2001) in 73 rural provinces of Philippines also suggested that road infrastructure endowment was the strongest predictor of successful poverty reduction.

According to Khander, Bakht and Koolwal (2009), availability of rural roads had reduced the poverty in rural Bangladesh, where provision of adequate roads had reduced the transportation cost, increased production and consumption of goods,
diversified employment opportunities and enhanced accessibility to education and healthcare services. Thus, road improvement had an overall distributional effect.

The study used as quasi-experimental panel households’ survey to assess the impact of road improvement projects in rural Bangladesh. Survey was conducted prior to and following the implementation of the two road projects, Rural Development Project (RDP) and Rural Roads and Markets Improvement Maintenance Project (RRMIMP) funded by World Bank in Bangladesh.

The findings revealed that road improvement projects had significant impact on project areas against control areas in terms of employment opportunities, agricultural and non-agricultural wages, accessibility to social services and availability of credit. Besides, road improvement has led to an average poverty reduction of 3-4 per cent in RDP villages and 5-6 per cent in RRMIMP villages over a period of five years.

Fan and Chang Kang (2004) tried to access the impact of public infrastructure on growth and poverty reduction in China by paying special attention to roads and their beneficial effects on production and productivity. China has witnessed a rapid economic growth and poverty reduction since 1978, when it adopted a series of economic reforms. With transportation infrastructure thrust after 1985 China could improve quality of road connecting major industrial centres in coastal areas and its Gross Domestic Product (GDP) has grown by about 9 per cent per annum.

The results of the study had important implications for future road project investments in China. However, the most significant finding of the study was that improvement of roads in rural areas had contributed to the national GDP by four times. Again, the study revealed that improvement of road in rural areas had raised
more people out of poverty. Since then, the government had started giving top priority on rural roads in its future investment strategy.

Kwon (ADB 2004) highlighted the role of rural road in economic development and poverty reduction in Indonesia by using Indonesian data for a period of twenty years (1976-1996), where the biggest chunk of investment in the country went to the road sector. The study showed that poor communities were often concentrated in remote mountain terrain with difficult inaccessibility. Due to geographical isolation and high transportation costs, most people in the mountainous villages had limited access to market centres and other social services and as such agricultural productivity was less and income remained stagnant because of limited employment opportunities.

Better roads had reduced regional imbalance, enhanced non-farm employment and income. The incidence of poverty had also declined to less than 50 per cent. Enrolment in primary school had increased drastically and literacy rate had jumped to 87 per cent in 1996. Further, number of farmers who adopted new HYVs seeds as part of the Green revolution programme in cultivation of rice had increased. Besides, remote mountainous villages had accessed to various community health centres and immunization programs. Finally, the study showed that the accumulation of road capital had a non-linear contribution to poverty alleviation.

Based on case studies related to rural road investments and their impact on socio-economic development, Lombard and Coetzer (2007) showed the importance of rural road investment in Africa as a mechanism to reduce poverty by enhancing equitable opportunities to all rural masses. The connectivity enhanced mobility, accessibility and regional integration and subsequently improved the day-to-day living standard of rural communities. The study concluded that rural road
infrastructure was an essential service to stimulate rural socio-economic growth and development by adopting appropriate methods to estimate such impact through existing techniques or exploring new techniques that could be applied accurately.

In the southern part of Africa road transport carried about 80 percent of the region’s goods and services (Pinard 2004). About only 2,84,000 km of total 1.8 million km roads in Sub-Saharan Africa were paved during 2007 (Lombard and Coetzer 2007). One of the major constraints was the non-availability of sufficient funds. This resulted in lack of capital funds to develop and expand the road network and also lack of funds for routine and periodic maintenance of existing roads. External investment in economic infrastructure during 1990 to 1996 for Sub-Saharan Africa was of US$26.7 billion, as compared to US$ 41.4 billion for Latin America and the Caribbean and US$ 101.9 for Asia (FAO, 2002). The challenges therefore were the determination of road financing needs, through the execution of an accurate assessment of the nature and extent of a region’s road network and identification of financing sources and accordingly to attract sound and sustainable road investment.

Besides, the above studies emphasized the importance of rural roads in regions of Africa in enhancing incomes of the poor through diversification of agricultural output, higher agricultural wages and prices as well as increased accessibility to social services in terms of school enrolments and healthcare services. However, these studies did not specify different parameters measuring poverty and how rural roads affected the important variables like transportation costs, modes of transportation and reduction in travel time that ultimately had positive effects on income of rural households. Similarly, Bryceson et al. (2006) stressed the importance of rural road in developing countries particularly the remote areas of Ethiopia, Zambia and Vietnam to reduce enormous poverty through enhanced mobility and accessibility.
The study found that average distance travelled per capita was positively correlated to income. Besides, in all these three countries, rural road facilitated mobility and accessibility to various social and distant market towns through reduction in travel time and better modes of transportation. However, in Ethiopia, the benefits of rural roads was in terms of ‘Accessibility Enhancement’ rather than ‘Mobility Enhancement’ in which good road connections in the country enhanced accessibility to many social and economic services. The main limitation of the study is that different parameters like changes in agricultural prices, output and wages as well as reduction in transportation costs were not considered for the analysis.

Considering the budget constraint faces by many developing countries, it is imperative that selection of rural road project should be based more on benefits that have a larger impact on poverty reduction. Thus, Walle (2000) in her study emphasized the importance of selecting rural road project investment that helps in reducing poverty. Traditionally, many methods like Cost-Benefit Analysis, Cost-Effective Analysis and Hybrid Methods were used to analyze the impact of road infrastructure on the development, but these studies suffer from certain lapses as they failed to measure the social benefits of rural road project in monetary values.

The study tried to show how rural road project could reduce poverty by identifying the places where poverty and economic potential are high and access is low. The proposed method was selected from the angle of poverty reduction, given both the information and financial constraint. However, the study did not clearly specify the different economic potentials that would help in reducing poverty with rural roads projects.

Poverty reduction is a burning issue that most of the developing countries are struggling. Gibson and Rozelle (2003) studied the effect of access to rural road
infrastructure on poverty reduction in Papua New Guinea, a developing country which remained isolated from the rest of the world for a long time. The study examined the relationship between incidence of poverty and access to rural road, identified determinants of poverty in the country and testing whether or not inaccessibility to rural road infrastructure is a significant factor of household’s poverty.

Results of the study had shown that the region of the country where the poverty was massive had poorest access to roads. In the region educational attainment was the lowest, illiteracy rates were high and access to health and services was limited. Further, the study demonstrated a strong correlation between poverty, school attainment and access to road. Besides, the study revealed that access to road had a major impact on consumption pattern, variation of agricultural prices, travel time, transportation cost, employment opportunities and attainment of other social services. The study concluded that the government should have selected that type of investment on rural road that would have maximized the benefits favoring the poor. The study simply highlighted the relationship between poverty and road accessibility without showing the different determinants of poverty in the country and how accessibility acted as one of the determinants of poverty reduction.

Sinha (2014) showed that most of the rural habitants in North-Eastern states of India were not well connected by all weather roads and remained isolated. According to him adequate rural road connectivity was the basic infrastructure needed for reducing poverty and accelerating economic growth and development. However his study did not mention the socio-economic variables that will benefit out of improved connectivity in enhancing rural income and accessibility to basic social infrastructure in the region.
2.5. Impact of Rural Roads on Accessibility and Development of Local Market and Transportation Costs

Mu and Van de Walle (2011) highlighted the impact of rural road quality on development of local market in Vietnam on two dimensions. Firstly, improvement of road in villages where local market was already in existence, provided an instigating factor in diversification of economic activity to high value activities, enhanced access to various services, thus stimulating off-farm and new income opportunities. Secondly, road development promoted local market development in backward areas.

Numerous observers of rural Vietnam setting remarked on the correlations between the road infrastructure, local markets, and non-farm income diversification (Kerkvliet and Porter, 1995; Bryceson et al., 2008; Minot et al., 2006). The objectives of the World Bank aided road development project during 1997-2001 were to develop local market activity and, hence, economic development through targeting road improvements to poor communes.

The Vietnam Rural Transport Project I (RTPI) aimed to link commune centres to markets, stimulate market development and reduce poverty through the rehabilitation of 5,000 kilometers of rural roads (World Bank, 1996). Many of the targeted roads were in very bad condition and some with impassable sections year round. A rehabilitation standard of ‘reliable access’ was enforced that provides relatively consistent and safe access with only short-term road closures (due to bad weather). The result of the study revealed that road improvement project had a larger impact on local market development in poor areas, where initially there was lower market development in earlier time. The study gave qualified support for the hypothesis of Transport-Induced-Local Market Development (TILD). However, the study stressed only on the correlation between road infrastructure, local market and
non-farm income diversification in rural Vietnam. It did not mention much on the effects of rural roads in enhancing agricultural development through increase in agricultural output, wages and prices as a result of local market development.

The study ‘Access to market and the benefits of Rural Roads’ by Jacoby (2000) emphasized the importance of roads as a form of rural infrastructure in providing cheap access to marketable agricultural produce and procuring inputs in Nepal using household survey data. According to him rural roads had positive distributional effects in lowering transportation costs, travel time, increased land value and wages and subsequently enhanced households’ expenditure and income.

Jacoby has also developed two approaches in estimating the benefits of rural roads. Firstly, the relationship between farm profits and distance to markets reflected in income gains of the household. Secondly, between household consumption expenditure and distance to markets through varying prices of consumption goods. Besides, cheap transportation costs enhanced accessibility to markets, schools and healthcare facilities that led to overall welfare gain of the society.

Jacoby limited his study on the distributional effects of rural roads on market accessibility, through lowering transportation costs, travel time and increasing land value and wages. But, impact on accessibility to schools and healthcare services, effect of reduced transportation cost on agricultural output and prices, remained unaddressed.

World Bank (2007) has recognized the link between high transportation cost and poverty in developing countries. Similarly, Jacoby and Minten (2008) tried to measure the benefits of rural road projects to rural communities through reduction in transportation cost in increasing household income and expenditure. A reduction in transportation costs would enable the villagers to sell their agricultural produce at
profitable prices, getting a variety of consumption goods at lower prices. Besides, a lower price for inputs enhanced land value and productivity.

However they asserted that lower transportation costs through road projects would benefit more to remote household with limited accessibility in terms of increasing household income and generating more employment opportunities, without emphasizing the effect of lower transportation costs on accessibility to social services.

Escobar et al. (2002) highlighted the importance of rural road network in the national road system of developing countries in enhancing household welfare in rural areas in terms of household consumption and income. The study pointed out that many related studies have shown the effects of rural road improvement on accessibility to markets, healthcare centres, institutions and also on the benefits of lower transportation costs, employment opportunities for rural masses. Thus, the study tried to measure benefits of rural road rehabilitation on household welfare through household per capita income and consumption by considering the four possible sources of income namely (a) agricultural self employment income (b) agricultural wage income (c) Non-agricultural self employment income (d) Non-agricultural wage income.

The result of the study showed the short term impacts of rural road rehabilitation on changes in income generation sources, in terms of off-farm employment opportunities and an increase of non agricultural wages. Besides, household near motorized roads tended to benefit more from road rehabilitation than those in non-motorized roads, in respect of higher education, larger farm land size and greater access to public infrastructure. But non-agricultural wages were benefited by both. The result also highlighted the changes in crop pattern; technological changes both agricultural and non-agricultural activities and consumption pattern due to rural
road rehabilitation. Further, the study revealed the importance of rural road network in enhancing household welfare in rural areas in terms of off-farm employment opportunities, increased non-agricultural wages and greater access to social and public infrastructure. But changes in income generation sources of the rural households would depend on reduction on transportation costs and travel time which was neglected in the study.

Various studies have already been done to assess the role of road infrastructure on the socio-economic development of various countries and many of the analyses were concentrated on the rural development in connection with infrastructure, particularly with road connectivity. There are however very few studies on impact of road infrastructure on poverty alleviation, agricultural productivity and development and the impact of rural roads on accessibility and development of local market and transportation costs. Besides, a study on the importance of rural road network in the national road system of developing countries in enhancing household welfare in rural areas in terms of household consumption and income is essential for policy formulation. However, no such study has been done in Meghalaya.

2.6. Data Collection and Methodology of the Study

2.6.1 Data

Both primary and secondary data have been used for the purpose of analysis. Information of status and growth of road infrastructure across the districts, growth of net district domestic product and other aspects of development like basic amenities, sanitation, educational qualification of respondents and households members, health indicators, employment generation through various rural development programmes, agricultural wages and prices and prices of major products have been collected from
various published reports and government offices like PWD (Public Work Department), Government of Meghalaya, Directorate of Statistics, Department of Health and Family Welfare, Department of Education, DRDA (District Rural Development Agency), Government of Meghalaya, local bodies like Dorbar Shnong and Syiem of the districts and village headman.

Multi-stage sampling procedure has been followed for primary data collection. At first two districts East Khasi Hills District and West Khasi Hills District* have been selected. As on 2010 both districts have the highest total length of village roads, 439.66 km and 478.99 km, respectively. In the next stage, six Blocks have been identified, from both districts, four from East Khasi Hills district and two from West Khasi Hills District* purposively on the basis of size of the two districts. Four Blocks under East Khasi Hills District are (1) Mylliem Block (2) Mawphlang Block (3) Pynursla Block and (4) Shella Bholaganj Block, where Shillong is the district headquarter. Two Blocks under West Khasi Hills District* are (1) Mawkyrwat Block and (2) Ranikor Block, where, Mawkyrwat is the district headquarter. Again, ten villages have been selected from the six Blocks purposively on the basis of road connectivity.

Five villages were chosen which are well connected to various destinations through roads and the other five which are poor in terms of connectivity. From each village fifty families have been chosen by simple random sampling without replacement for investigation i.e., all together 500 households are selected. The sample size is approximated by using Cochran’s (1963:75) formula: 

\[ n_0 = \frac{\sigma^2 pq}{e^2} \]

* Blocks and villages falling previously under erstwhile West Khasi Hills District are now under the newly created district of South West Khasi Hills.
Where, \( n_0 \) is sample size, \( z^2 \) is the desired confidence level, \( p \) is the estimated proportion of an attribute that is present in the population and it is assumed to be 0.5 for maximum variability, \( q \) is 1 - \( p \). The value of \( z \) is found in statistical tables. Here, 95% level of confidence has been considered and on the basis of the above formula, \( e^2 \) or margin error or confidence interval is 4.38%. Thus, 500 can be the size of a valid representative sample.

Tables 2.1, 2.2 and 2.3 describe the profiles of chosen districts, blocks and villages under investigation.

**Table 2.1: Districts Profile as on 2011**

<table>
<thead>
<tr>
<th>District</th>
<th>No. of Blocks</th>
<th>Area of the District (sq km)</th>
<th>Population of the District</th>
<th>No. of Villages/Wards</th>
<th>No. of Household</th>
<th>District Headquarter</th>
<th>Literacy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Khasi Hills</td>
<td>4</td>
<td>2748</td>
<td>824059</td>
<td>975</td>
<td>160832</td>
<td>Shillong</td>
<td>84.70</td>
</tr>
<tr>
<td>West Khasi Hills*</td>
<td>2</td>
<td>1341</td>
<td>110152</td>
<td>216</td>
<td>16809</td>
<td>Mawkyrwat</td>
<td>76.84</td>
</tr>
</tbody>
</table>

*Sources*: retrieved from google.com on 16th March 2016.

*Note*: * Indicates South West Khasi Hills formed recently after the survey was conducted.

**Table 2.2: Blocks and Distance from District Headquarter (DHQ)**

<table>
<thead>
<tr>
<th>Districts</th>
<th>Name of Blocks</th>
<th>Distance (Km) DHQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Khasi Hills District</td>
<td>Mylliem Block</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Mawphlang Block</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Pynursla Block</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Shella Bholaganj Block</td>
<td>60</td>
</tr>
<tr>
<td>West Khasi Hills*</td>
<td>Mawkyrwat Block</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Ranikor Block</td>
<td>60</td>
</tr>
</tbody>
</table>

*Sources*: Deputy Commissioners East Khasi Hills District, Shillong and South West Khasi Hills District, Mawkyrwat, Government of Meghalaya.

*Note*: * Indicates South West Khasi Hills formed recently after the survey was conducted.

**Table 2.3: Village Profiles of East Khasi Hills District and West Khasi Hills District*\n
<table>
<thead>
<tr>
<th>District</th>
<th>Blocks</th>
<th>Villages</th>
<th>Population</th>
<th>No. of household</th>
<th>Distance BHQ (Km)</th>
<th>Distance DHQ (Km)</th>
<th>No. of HHs</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Khasi Hills</td>
<td>Myliem</td>
<td>Mawsiatkhnam</td>
<td>600</td>
<td>130</td>
<td>35</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Madan Mawkhar</td>
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<td>50</td>
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<tr>
<td></td>
<td>Mawphlang</td>
<td>NongrumMawphlang</td>
<td>610</td>
<td>130</td>
<td>4</td>
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<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wahlyngkien</td>
<td>660</td>
<td>72</td>
<td>6</td>
<td>27</td>
<td>50</td>
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<tr>
<td></td>
<td>Pynursla</td>
<td>Nongsder</td>
<td>880</td>
<td>110</td>
<td>12</td>
<td>61</td>
<td>50</td>
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<tr>
<td></td>
<td></td>
<td>Nongkewai</td>
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<td>200</td>
<td>13</td>
<td>67</td>
<td>50</td>
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<td></td>
<td>Shella Bholaganj</td>
<td>Disong</td>
<td>340</td>
<td>70</td>
<td>46</td>
<td>95</td>
<td>50</td>
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<td></td>
<td></td>
<td>Mawryngkong</td>
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<td>54</td>
<td>49</td>
<td>98</td>
<td>50</td>
</tr>
<tr>
<td>West Khasi Hills*</td>
<td>Mawkyrwat</td>
<td>Rangblang</td>
<td>300</td>
<td>55</td>
<td>25</td>
<td>28</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Ranikor</td>
<td>Nongkynbah</td>
<td>320</td>
<td>68</td>
<td>45</td>
<td>30</td>
<td>50</td>
</tr>
</tbody>
</table>

*Source*: Field Survey by the Researcher.

*Note*: * Indicates South West Khasi Hills formed recently after the survey was conducted. HHs = Households, BHQ = Block headquarters, DHQ = District headquarters, Km = Kilometers.
Map 2.6.1: Districts of Meghalaya and Sample Villages

Map 2.6.2: East Khasi Hills District
Map 2.6.3: West Khasi Hills District* (*indicate South West Khasi Hills District formed recently after the survey was conducted)

Source: Retrieved from Google images on 17th August, 2016
East Khasi Hills District inhabited 824059 lakh of population in 975 villages and wards under 160832 households with literacy rate of 84.70 per cent. West Khasi Hills is the home of 110152 lakh people inhabited in 216 villages and 16809 households with 79.84 per cent of literacy rate (2011 census).

Among the four blocks of East Khasi Hills District, Mylliem is close to the district headquarter (about 10 km), whereas, Shella Bhaloganj is far from the district headquarter (about 60 km). Villages under investigation are Mawsiatkhnam and Madan Mawkhar under Mylliem Block; Nongrum Mawphlang and Wahlyngkien under Mawphlang Block; Nongsdier and Nongkwai under Pynursla Block and Disong and Mawryngkhong under Shella Bhaloganj Block respectively.

Between the two blocks of West Khasi Hills*, Mawkyrwat Block is close to the district headquarter (10 km) and Ranikor Block is far from the district headquarter (60 km). Villages under study are Rangblang from Mawkyrwat block and Nongkynbah from Ranikor block (Table 2.2).

From both the districts, villages which are relatively well connected by roads are Mawsiatkhnam, Nongrum Mawphlang, Nongsder, Disong and Rangblang. However, the chosen poorly connected villages are Madan Mawkhar, Wahlyngkien, Nongkwai, Mawryngkhong and Nongkynbah.

Mawsiatkhnam village has 600 population, 130 households and distance from Block headquarter (Mylliem) is 35 km and from District headquarter (Shillong) is 30 km. Madan Mawkhar village also has 600 population, 60 households and distance from Block headquarter (Mylliem) is 40 km and from District headquarter (Shillong) is 35 km. Nongrum Mawphlang village has 610 population in 130 households and

*Blocks and villages falling previously under erstwhile West Khasi Hills District are now under the newly created district of South West Khasi Hills.
distance from Block headquarter (Mawphlang) is only 4 km and from District headquarter (Shillong) is 25 km. Similarly, Wahlyngkien village has 660 population, 72 households and distance from Block headquarter (Mawphlang) is 6 km and from District headquarter (Shillong) is 27 km. Nongsder village has 880 population, 110 households and distance from Block headquarter (Pynursla) is 12 Km and District headquarter (Shillong) is 61 km. Nongkwai village has 1500 population, 200 households and distance from Block headquarter (Pynursla) is 13 km and District headquarter (Shillong) is 67 km (Table 2.3).

Disong village on the other hand, has 340 population, 70 households and distance from Block headquarter (Shella Bhaloganj) is 46 km and District headquarter (Shillong) is 95 km, while Mawryngkhong village has 364 population, 54 households and distance from Block headquarter (Shella Bhaloganj) is 49 km and District headquarter (Shillong) is 98 km (Table 2.3).

Rangblang village in West Khasi Hills has 300 population, 55 households and distance from Block headquarter (Mawkyrwat) is 25 km and District headquarter (Mawkyrwat) is 28 km. Nongkynbah has 320 population, 68 households and distance from Block headquarter (Ranikor) is 45 km and District headquarter (Mawkyrwat) is 30 km (Table 2.3). The study area is shown in Map 1, Map 2 and Map 3, respectively.

2.6.2. Mode of Analysis

First of all, spatio-temporal variation in road infrastructure in Meghalaya has been described. Thereafter, the impact of road infrastructure on the socio-economic development of rural masses in Meghalaya is examined. Here, in this study mostly roads connecting various villages to regular destinations of people for various purposes like local Block headquarters, district headquarters, markets, government
offices, educational institutions and healthcare centres etc. considered and therefore it covers mostly major district roads and rural roads or village roads.

Variations in socio-economic conditions of the villagers in terms of household income, educational qualification, types of employment across different villages are examined in connection with the conditions of road infrastructure. Besides, standard of living based on types of houses, household assets, electricity and accessibility to basic sanitation facilities, is again linked to conditions of road connectivity.

Thus, how conditions of road infrastructure can facilitate mobility of people and goods to various destinations are examined, like time to commute, transportation cost, modes of transportation used, prices of agricultural produce and inputs faced by the farmers, wages and income. Also, earning, contribution to family income by agriculture, diversification of employment opportunities are checked with the accessibility to different market centres and other targeted destinations for daily activities. Further, accessibility to various healthcare services and health programmes available in the neighbourhood, local blocks and district headquarters are examined vide use of such centres for birth delivery, along with variation in incidence of illness, changing transportation cost, and modes of transportation for availing such facilities are compared with the quality of road connectivity. Similar analysis is followed in case of educational progress in the villages; amenities enjoyed by the families and avail various development programmes.

2.6.3. Technique of Analysis

Here technique of Principal Component analysis (PCA) has been used. By this technique, a large number of variables in a data set are transformed into a smaller number of uncorrelated factors. Since the status of connectivity of the same village or
family may vary for different destination, it is difficult to have a clear cut idea to overall connectivity standard. Thus the variables of different types of road connectivity to various destinations in all sample villages have been combined into a single Road Development Index (RDI), which helps us to correlate with the agricultural and other performance. The detail of derivation of the Index has been discussed in subsequent Chapter-5, section 5:2:1.

Thereafter the Road Development Index has been divided into five categories, namely, (a) Poor road (b) Below average road (c) Average road (d) Above average road and (e) Very good road and the distribution of households in all sample villages with RDI has been carried out through extraction method by using software SPSS 20.

Similarly, Price index and spoilage index are constructed by using Principal component analysis (PCA) and selecting prices and spoilage of major agricultural products of households across sample villages. The details of derivation of both the Index have been discussed in subsequent Chapter-5, Section 5:11. Besides, overall amenity index is constructed by selecting variables like house types, types of cooking fuels used, sources of drinking water, toilet arrangement and electricity in all the study area (as mentioned in Chapter-5, Section 5:8).

Demographic profile and distribution of households of sample villages as per various socio-economic variables like accessibility to various amenities, sanitation, and assets of households, educational qualification of respondents and household members, types of employment, primary sources of income, average monthly income from different sources, allied activities are highlighted in Chapter-4.

Again, distribution of households across surveyed villages in relation to various socio-economic variables and Road Development Index like agricultural earning, transportation costs on agricultural output and input, agricultural prices of
major products and spoilage, educational qualification of respondents and households member, various health indicators and accessibility to basic amenities and developmental schemes are shown in Chapter-5, Section 5:3 and subsequent sections.

Further, bivariate correlations are computed to examine the strength of relationship between the agricultural variables like agricultural earning, percentage of transportation cost out of total cost on agriculture, average transportation costs of output and input, agricultural prices and agricultural spoilage and Road Development Index (Detail discussed in Chapter-5, Tables 5.8(a), 5.19 and 5.24).

Besides, correlation of educational variables like educational qualification of respondents and household members with Road Development Index in surveyed villages is highlighted. Similarly, correlation of health variables and Road Development Index are examined for the respondents of sample villages. Variables like incidence of illness, transportation cost on accessing healthcare programmes and accessing medical help during sickness, including birth delivery and accessibility of Immunization facility are also correlated with the Road Development Index (Detail discussed in Chapter-5, Tables 5.27 and 5.33). Simultaneously, correlation between accessibility to various amenities and developmental schemes with Road Development Index are computed (Chapter-5, Tables 5.34 and 5.35).

In order to explain the impact of road conditions on various developmental variables a simple regression of various variables on Road Development Index has been done. Here, regression equation of the type $Y = \alpha + \beta X$ is estimated where, $X$ is the Road Development Index (RDI) and $Y$ represents any of the various socio-economic developmental indicators. Six simple regression models on the effect of Road Development Index on various dependent agricultural variables have been estimated.
\[ Y_{ij} = C_i + \beta_{ij}X_j + \mu_j \]

Where, \( Y_1 = \) Price index

\( Y_2 = \) Spoilage index

\( Y_3 = \) Total agricultural earning

\( Y_4 = \) Total transportation cost on agricultural produce

\( Y_5 = \) Total transportation cost on input

\( Y_6 = \) Total earning from allied activities

\( X = \) Road Development Index.

Similarly, seven simple regression models on the effect of Road Development Index on dependent variables related to Education and Health have been estimated

\[ Y_{ij} = C_i + \beta_{ij}X_j + \mu_j \]

Where, \( Y_1 = \) Educational qualification of respondent

\( Y_2 = \) Maximum Educational qualification of households members

\( Y_3 = \) Incidence of Sickness

\( Y_4 = \) Total Transportation cost on accessing health programmes

\( Y_5 = \) Total Transportation cost on accessing medical help on sickness

\( Y_6 = \) Health centre on birth delivery of maximum children

\( Y_7 = \) Accessing Immunization

(Details of the analysis are discussed in Chapter-5, Section 5.10).

2.7. Limitations of the Study

Here, both primary and secondary data are used for analysis. However, most of the secondary data are not updated and inadequate at local Blocks and districts level. The non availability of some updated information is mainly due to the creation
of new districts in the state for the last four years, like South West Khasi Hills District. Necessary information pertaining to socio-economic variables as well as on various economic activities, income, education, health and others of newly created districts are mostly not available and insufficient. Thus, we have to depend mostly on primary data. However, there is scope for further improvement of the study by either increasing sample size or incorporating other variables which the study did not take into consideration while analyzing the impact of road conditions on the socio-economic activities of the sample households in the study area.

References


