

**YANGON UNIVERSITY OF ECONOMICS
DEPARTMENT OF ECONOMICS
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**A STUDY ON THE EFFECT OF RURAL ROAD
INFRASTRUCTURE IMPROVEMENT ON RURAL
DEVELOPMENT
(A Case Study in Twantay Township)**

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EMDevS-26(16th Batch)**

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(A Case Study in Twantay Township)

A thesis submitted as a partial fulfilment towards the requirement of the
Degree of Master of Development Studies (EMDevS)

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This is to certify that this thesis entitled “**A Study on the Effect of Rural Road Infrastructure Improvement on Rural Development (A Case Study in Twantay Township)**” submitted as the requirement for the Degree of Master of Development Studies has been accepted by the Board of Examiners.

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ABSTRACT

The construction of rural roads is commonly recognized as a necessary precondition for rural development. Access to health and education services can help you develop economic prospects. The study's goals are to determine the current state of rural road infrastructure development in Twantay Township and to assess the impact of rural road development on the living conditions of Twantay Township households. The descriptive method is applied in this investigation. In the municipality of Twantay, it was discovered that a considerable number of rural roads were created between 2000 and 2019. The development of rural roads improved the living conditions of households in the study areas' communities. Rural roads in Twantay Township, however, still need to be improved. It is advised that the local government expand the scope of the concrete-paved country road surface by increasing capital investment in order to meet the development strategy's goal.

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LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ADB	Asia Development Bank
CRRN	Core Rural Road Network
DRD	Department of Rural Development
DRRD	Department of Rural Road Development
GAD	General Administrative Department
GDP	Gross Domestic Product
HDM	Highway Development and Management
MOBA	Ministry of Border Affairs
PW	Public Work
RAI	Rural Access Index
RAMS	Road Assets Management System
SDG	Sustainable Development Goals
UK	United Kingdom
US	United State
USA	United State of America
VAR	Vector Regression Approach

CHAPTER I

INTRODUCTION

1.1 Rationale of the Study

In a growing country's rural areas, infrastructure is critical for economic growth and development. Rural infrastructure development could boost economic growth, raise people's living standards, and eliminate poverty by creating agricultural and non-agricultural jobs. It is expanding its horizons, improving productivity, and supplying essential products and services. It also has a positive impact on people's health and fitness. Rural infrastructure also helps to shape markets by lowering transportation and transaction costs and increasing market integration across space. Marketing integration is viable if transportation and transaction costs are low. To ensure that medical professionals and supplies are available at health institutions, good infrastructure and transportation services are required.

40% of Myanmar's rural population lives in villages with no year-round access to roadways. According to research conducted by the Asian Development Bank (ADB) on rural access in Myanmar, 4 million people live in the 8,200 villages that are not connected by roads. Another 20,000 settlements, with a population of 10 million people, are linked by impassable roads during the wet season.

Myanmar needs to build or upgrade more than 50,000 km of rural roads by 2030. It has a 95,000 km rural road network, of which 6% is paved and 28% has an improved (gravel or stone macadam) surface, typically in poor condition. In July 2018, the National Strategy for Rural Roads and Access was published, which defines the core rural road network (CRRN) to ensure better connectivity for rural areas. To meet the national target to connect 80% of registered villages by 2030, the government estimates that Myanmar needs to upgrade about 42,000 km of existing rural roads and construct 10,000 km of new roads. The development of transportation infrastructure is a priority area in Myanmar's Sustainable Development Policy 2018-30. Three strategies focused on developing or building transport infrastructure in rural and urban regions are the National Strategy for Rural Roads and Access 2016,

Myanmar National Transport Master Plan 2016, and the National Export Strategy 2015-2019.

Twantay Township is a township in Yangon Region, located in Yangon Region's South District. There are 8 districts, 65 village districts, and 235 villages in Twantay Township. Prior to the improvement of rural infrastructure, most households in Tawntay Township relied heavily on bicycles for mobility. After 2000, many new or wider roads as well as numerous bridges even spanning creeks emerged rapidly through the township. Moreover, inter-villages and inter-township roads are intended to network with regional linkages in order to improve transportation facilities and the economy. Thus, it is intended to study of rural infrastructure improvement and how such improvement effect to rural development of Twantay Township between the period 2000 to 2015.

1.2 Objectives of the Study

This thesis intends: -

- to identify the current status of rural road infrastructure development in Twantay Township
- to analysis the effect of rural road development on condition of the household in Twantay Township

1.3 Method of Study

A descriptive method and quantitative method are used in this study. The secondary data obtaining from libraries, internet websites and official documents issued by Ministry of Construction and Department of Rural Road Development (Head Office), Department of Rural Road Development in Twantay Township, General Administration Department (GAD) of Twantay Township and The National Strategy for Rural Roads and Access 2016. The primary data source is based on collecting data from survey.

1.4 Scope and Limitations of the Study

This study is focused on rural road development in Twantay township and the effect of this improvement on the condition of the household in Twantay Township within period from 2000-2019. There are 235 villages and 8 wards in Twantay Township. Among them, 6 villages are randomly selected to analysis the effect of

rural road infrastructure development on the condition of the household in Twantay Township, Yangon Region. Total household of this 6 villages are 1217. Among them primary data will be collected from 100 household out of 1217 total household due to global pandemic.

1.5 Organization of the Study

This study is included five chapters. Chapter one is the introduction which consists the outline of the rationale, objectives, scope and limitation of the study and organization of the study. Chapter two is the Literature Review on definition of infrastructure, definition of rural development, road infrastructure and rural development, benefit of improve rural road and review on previous studies. Chapter three is current status of rural road infrastructure in Twantay Township, Chapter four describes survey analysis, it included survey profile, survey design and effects of rural road development on condition of Household. Chapter five is concerned with findings and suggestions.

CHAPTER II

LITERATURE REVIEW

2.1 Definition of Infrastructure

Infrastructure is a term for fundamental services and facilities required by cities and countries for sustainable growth in the social, economical, political factors and so on. A good infrastructure is made up of proper transportation systems, communication networks (telecommunication, internet connectivity, etc.), electrical system, sewage, water and many more. However, to build a proper infrastructure is highly capital intensive and requires high level investments. These capitals and investments may come from the public sector, publicly regulated monopolies and sometimes from private firms or local collective action. Although, infrastructure can be less volatile than other asset classes and is sometimes sought as an investment.

Infrastructures are vital to a country's growth although it may be expensive to build. Transportation such as roads, railways, bridges and tunnels are essential for delivering goods and services from one place to another. This in turn supports the economic growth of the country. There are two types of infrastructure: hard and soft. Fixed assets, control systems, software to operate, manage, and monitor the systems, as well as any ancillary buildings, plants, and vehicles that operate on a schedule, such as public transportation buses and trains, and waste collection, are all considered hard infrastructure. Basic energy and communication facilities required to run all of the above systems, such as fuels and electricity production are also a part of the hard infrastructure.

In contrast to hard infrastructure, soft infrastructure encompasses all services required to maintain a population's economic, health, cultural, and social norms. Physical assets and highly specialized equipment are also included, as well as non-physical assets including communication, laws and regulations controlling various systems, financing, and institutions that train professionals to manage various systems. Financial, educational and health care systems, government systems, law enforcements and emergency systems are also a part of the soft infrastructure. The

purpose of soft infrastructure is to deliver the specialized services to the people and these delivery services are dependent on the highly developed systems, facilities, fleets of specialized vehicles and institutions.

Infrastructure is important because it is paid and used by the public. Infrastructure financing can be equally as difficult as the infrastructure itself. However, the majority of people rely on transportation infrastructure and public services, which are equally critical to our businesses' economic viability.

2.2 Definition of Rural Development

"An integrated development of area and people through optimal development and usage of local physical, biological, and human resources, as well as bringing about required institutional, structural, and attitudinal changes in the rural public," according to the definition. The ultimate goal is to improve the quality of life for the country's "rural poor" and "rural weak." As a result, rural development is defined as the "process of enhancing basic necessities, expanding productivity and job opportunities, and developing the potential of rural resources by integrating geographical, functional, and temporal dimensions". Through the implementation of various rural development initiatives, the development of rural areas includes the development of people living in rural areas.

The steady increase in output and income per capita, the expansion of productive employment, and more justice in the distribution of the benefits of growth are all goals of development. Over time, rural development has come to be defined as "a strategy aimed at improving the economic, social, and cultural well-being of a specific group of people living in rural areas." The major goals of rural development are to increase employment, productivity, and income, as well as to guarantee minimum acceptable levels of food, clothes, housing, education, and health. "If it is to help a bigger percentage of the most vulnerable, rural development must be an integral aspect of the development strategy."

Traditional rural development has depended on the extraction of land-intensive natural resources like agriculture and forestry. However, changes in the global production network and rising urbanization have displaced resource extraction and agriculture as the primary economic drivers, with the emergence of tourism, specialty manufacturers, and recreational activities. The necessity for rural areas to approach development from a broader viewpoint has resulted in a stronger focus on a

wide range of development goals rather than just agricultural or resource-based companies.

Rural development requires crucial components such as education, entrepreneurship, physical infrastructure, and social infrastructure. The emphasis on locally produced economic development techniques is another feature of rural development. Rural places are highly diverse from each other, in contrast to metropolitan areas, which have numerous commonalities. Rural development is a wide word that refers to efforts to develop places outside of the main urban economic system.

2.3 Rural Road Infrastructure

People who live in rural areas benefit from rural road infrastructure because it gives mobility and connectivity. It also gives agricultural activities a much-needed boost by making water, seeds, and other raw materials available to farmers. Rural roads promote connectivity and consequently increase livelihood chances for the rural population by increasing work prospects in the non-agricultural sector. Rural roads also ensure that rural areas receive better public services and that all of the state's benefits are conveniently accessible in outlying locations. They may also provide educational and health-care services.

Any country's infrastructure is its backbone. It is critical to the nation's economic progress, and the same is true for India. When it comes to the country's rural infrastructure, it is critical for agriculture, agribusiness, and poverty reduction in rural areas. Rural roads, significant dams and canal works for irrigation and drainage, rural housing, rural water supply, rural electrification, and rural telecommunications connectivity are all part of the country's rural infrastructure.

Rural infrastructure, in general, has the capacity to provide people with essential amenities that will improve their quality of life. For example, the improvement of rural infrastructure can lead to improved access to market hubs for rural producers, lower prices for inputs and raw materials, and more mobility.

The rural road is critical to the overall development of these communities. It provides economic, physical, social, and political connections to rural residents, as well as promoting the trade of products from urban areas and raw resources from rural areas. Despite the fact that different projects yield varying results, rural roads have a bigger economic impact than education, agriculture, and health.

A rural road network is one that is not found in an urban setting. These are roads with low traffic volumes that connect villages, provide market access to farms and fields, and are designed to travel at a slower speed. Local governments own the majority of rural roads.

Lower-volume rural roads account for 85% of the world's 33.8 million kilometers of categorized roads, with average daily traffic of less than 1,000 cars. The United States, China, India, Brazil, Japan, Canada, France, and Russia are responsible for 59% of these road networks, with each country having at least one million kilometers of rural roads. These rural road networks have a global value of US\$7.6 trillion, which is over half of the US's predicted 2010 GDP. A rural road is 0.23 kilometers per square kilometer of land surface (Earth's land mass area is 148.9 million square kilometers) (Faiz, Faiz, Wang & Bennett, 2012)

One billion people, or 31% of the global rural population, live more than 2 kilometers from a year-round road, cut off from markets and services. Accessibility varies substantially between developed and developing countries, as measured by the "Rural Access Index (RAI), which is the population within 2 km of a year-round motorable road (World Highways, 2013). For rich countries like the United States, the RAI is 86 percent, Germany 89 percent, Italy 98 percent, Japan 99 percent, France 99 percent, Austria 95 percent, and the United Kingdom 96 percent.

Less developed countries, on the other hand, have an extremely low RAI (e.g. Sudan 5%, Chad 5%, Nepal 17 percent, Burundi 19 percent, Afghanistan 22 percent, Bangladesh 37 percent, Bhutan 47 percent) (World Bank, 2006).

Rural road infrastructure development will affect to the increase in rural incomes and reduce poverty significantly. Infrastructure is actually a key to sustainable growth in the way that it can improve productivity as well as competitiveness (Fay and Toman, 2010). Good and sufficient infrastructure can reduce transport time (road infrastructure), creating fast communication (information technology and communication infrastructure), and reliable energy support and water supply. Infrastructures will also accelerate economic activities by giving accessibility of people to local and larger markets, means that it creates more opportunities to access economic activities. Given those strategic function, infrastructure framework then shall be supported by a policy framework, regulatory framework, and institutional framework (Soedjito, 1998). According to planning theory, road infrastructure has a significant role in supporting economic activity. Good quality of

road infrastructure can support mobility of people and goods as well as connecting certain center of activity with other spot activity in different areas. Naturally there is no single region that can stand on its own without support from other. Whether like it or not, to be growth a particular region should depends on other regions. Similarly, other regions have a dependency on that specific area. Among these areas, there are certain areas which have developed and growth than other. These areas have the advantage over the other so that these area has larger and more facilities making it capable of serving the needs of the population in a wider radius. This will make the population at a certain radius will visit the region to obtain the necessary requirements. Here is how the certain network is developed between places in a territory and region. One region becomes the centre and the others become nodes (usually rural areas).

Because of that dependency, Tacolli (2004) suggested that due to the different levels of resource in those areas and the limited ability of the region in supporting the needs of the population, there will be a compensation of activity in the form of the exchange of goods, persons as well as services between those connected regions. This process of exchange will be triggered with process of supply and demand negotiation. This process of supply and demand can be happened only when there is a tool connecting the regions. The linking tool is the necessary means of transport, meaning the kind of road infrastructure which makes it possible to serve the mobility between regions. Some research indicates the positive effect of roads on poverty alleviation through economic growth, the kind of influence called by indirect transmission (Ravallion, 26 1996).

The influence can also in the form the direct transmission in which the contribution of infrastructure development will effect to personal welfare of the poor through productivity and income (Gannon, 1997). In term of connectivity, decent road infrastructure will help economic growth center for sharing of larger benefits, broadening economic opportunity, improving the income and standard lives of all members of society, especially for the poor. At the end, it makes the development more inclusive for every citizen. Specifically for farmer and rural people who mainly engage in agricultural activity, access to road will have direct impact on the price of the yields. It will also determine the price they should pay for purchasing their food (Jacoby, 1998).

Moreover, according to Reungsri, (2010), development of road infrastructure will directly affect society in term of economic and social. In addition to accelerate the economic growth, it also has impact on improving social welfare for society of a whole such as decreasing poverty, promoting redistribution of income and also mitigating degradation of environmental (Reungsri, 2010). Road infrastructure has an important role in reducing poverty by providing easier access to basic services. Here, conceptually, the connecting role of infrastructure reinforces relationships that connects economic growth and poverty reduction by providing people with the services they need (Loayza and Odawara, 2010). This connecting role will also bring impacts on the activities through which people earn their livings. Meaning that better access to enter the market can help them to participate in wider kind of money earning activities to increase their household's income (Gibson and Rozelle, 2003) and reduce income inequality among citizen.

Furthermore, it can be said that rural road infrastructure will support rural development and poverty alleviation in the way it improve economic and develop social activities in rural area (Jacoby, 1998). Decent rural road will help certain undeveloped rural into developing one by increasing ease of mobility people and goods (in this case agriculture product) from the production centre to the market. Meanwhile, larger mobility to and from production sites (agriculture farm), to and from city centre or even just to the neighborhood will require high quality road infrastructure. However, conflicting views regarding the relation of economic growth and road infrastructure development remain within researchers. Some scholars argue that economic growth will initiate road infrastructure development while other argues that there should be rural road development first before achieving economic growth (Fan and Chan-Kang, 2005). Corresponding to these arguments, there is no need to contend one another. The fact is whatever the cause or the consequence, the relationship between those aspects is just like iteration cycle. The process could be uncertain which one is before the other however, the most important thing is that many empirical evidence have suggest the contribution of rural road infrastructure to economic growth as well as poverty alleviation is significant enough.

2.4 Road Infrastructure and Rural Development

The majority of the world's poor reside in rural areas with insufficient public infrastructure, particularly roads. Inadequate roads and lack of highway access raise transportation costs, limit the usage of local marketplaces for buying and selling consumer products, and limit job options outside of agriculture. However, the rural poor's access to essential social infrastructure, including as education and health services, has been limited due to a lack of roadways.

Because roads connect places, people, and social and economic activity, they have a social and economic influence on the recipients. The extension and development of the road network improves access and mobility while lowering costs and saving time for road users. According to the ADB 2012 report, p.13, the construction of new roads, the rehabilitation of existing roads, and the enhancement of road infrastructure all need a significant amount of economic resources, which must be considered when planning and making road development decisions. Through the dynamic externalities that such development frequently generates, road infrastructure plays a major role in modifying the socioeconomic situations of individuals in a region (Atsushi, Eric, Isabela, and Satoshi, 2015).

Rural communities perceive remoteness and lack of mobility as characteristics that heighten vulnerability and prolong poverty, and rural roads are widely acknowledged as a crucial requirement for rural development. Investment in transportation can provide economic opportunities for the poor directly through employment in infrastructure construction and maintenance and the provision of rural transportation services, as well as indirectly through improved conditions and opportunities for the commercialization of goods and services, lower input prices, the opening of new markets, and the provision of seasonal labor opportunities.

Everyone needs access to health care and other fundamental necessities. A rural road allows the poor and very poor to access their necessities while also giving the government the opportunity to help them. This influence lessens the vulnerability of the poor and can be expressed in terms of multidimensional poverty reduction, even if it is not recorded in terms of income. Furthermore, various socioeconomic groups may have varied transportation needs. Impacts that diminish or increase this lack of time and energy have a significant impact on the poor, who lack both time and money. High-income persons may have a better chance of extending their livelihood and well-being options since they have more resources.

Investments in roads have had a considerable indirect impact on overall economic development. Improved roads and the ability to transport goods allow people with the financial means to open a modest shop in the village, buy produce from the hamlet, or make their own and sell it in adjacent market places. This shows that the improvement of road infrastructure is essential for rural development.

2.5 Benefit of Improvement in Rural Road

Development depends on these rural roads as does the local economy. The general level of economic development was significantly influenced by investments in rural roads. Improved roads and the ability to move goods create options for investment in the village, such as opening a small shop, buying produce from the village, or making your own and selling it in adjacent market places. The following are the effects: in transportation, agriculture, health, and education. Improvements to rural roads have a considerable indirect impact on overall economic development.

Improvements to rural roads have a considerable indirect impact on overall economic development. Improved roads and the ability to move goods create opportunities for investment in the village, such as opening a small shop, purchasing products from the village, or owning the village and selling in surrounding market areas (Asian Development Bank, 2006)

Even if they are responsible for establishing and administering the programs, local governments are effectively involved in the planning process for rural road initiatives. The improved condition of feeder roads supported rural communities in enhancing their accessibility to healthcare services, education and market. The road users benefited in several other ways are traffic on the project roads increased at higher rated than before the improvement services than in the roads not improved, they supply of interurban passenger services increased and ownership of motorized vehicle increased.

Rural roads presented a unique problem, and it is a difficult task. People use roads to get to social services and markets. Food, materials, and agricultural supplies, as well as spare parts for water and administrative services, require a road link. Improved roads have reduced the cost of operating vehicles significantly, resulting in lower transportation rates offered by commercial trucking companies. A rise in the quality and frequency of commercial transportation services was another advantage.

Gaining access to necessary roads and infrastructure for the rural population has been a significant component of this endeavour (Jill Windle, R.A Cramb, 2002).

2.6 Review on Previous Studies

Khin Than Naing, (2011) studied the transport infrastructure development in Rakhine State for Master of Public Administration thesis. The main objective of this study is to study the current status of transport infrastructure development in Rakhine State. It was recommended in this thesis is to get adequate transport facilities in both rural and urban areas.

Win Zaw Htoon, (2009) studied transportation development in Myanmar with special reference to road and rail sections for Master of Development Studies thesis. The main objective of this study is to conduct an assessment on development of road transport and rail transport and then influences on the economy. It was recommended in this thesis is to improve and upgrade the transportation facilities.

Ba Hlaing, (2011) studied the transportation development of Rakhine State for Master of Development Studies thesis. The main objective of this study is to explore the development of transportation infrastructure and to analyze the relation of transportation improvement and community development in Rakhine State. It was recommended in this thesis is to encourage private investment for transport improvement.

Thida Kyu, (2008) studied the role of infrastructure in economic development of Myanmar between 1988 and 2004 for PhD Thesis, Yangon University of Economics. The study found that in Myanmar, total economic infrastructure investment is only 2.44% of GDP in 2003-04 even computed using market exchange rate under the assumption of 75% infrastructure investment is imported. Economic infrastructure has both direct and indirect effects on output/productivity, and it is strongly linked to economic growth. Furthermore, for future economic growth, the Myanmar economy requires greater infrastructure and economic investment, and infrastructure investment crowds out economic investment.

The relationship between road construction, economic growth, and poverty reduction in China was investigated by Fan and Chan-Kang (2005). When measured in terms of national GDP, benefit-cost ratios for rural areas are nearly four times higher than for high-quality roads, according to the study. Rural roads raise many

more poor rural and urban people above the poverty line for every yuan invested than high-quality roads in terms of poverty reduction.

S. Tripathi and V. Gautam (2010) investigated the relationship between road transport infrastructure and economic growth in India, employing a vector regression (VAR) approach to examine the impact of road transport infrastructure on macroeconomic variables. He discovered that the dynamic network externalities of road transport networks and GDP, as well as the VAR approach's estimations of the long-term influence of public infrastructure on output and employment, had a long-term link. He claimed that the long-run elasticity of output in relation to public capital is positive, implying that public capital is productive.

"The benefits of rural roads that boost income chances for the rural poor," Javier Escobal and Carmen Ponce San (2003) examined. The benefits of restored rural roads were quantified in this study by focusing on the reduction in monetary or time expenditures required to access product and factor markets.

Deborah Fahy Bryceson, Annable Bradbury, and Trevor Bradbury researched "Pathways to Poverty Reduction?" in June 2008. Investigating the effects of rural roads on mobility in Africa and Asia." According to this study, road upgrades could enable the extension of social service delivery, as demonstrated in Ethiopia. Given the poor's relative lack of motorized cars and ability to pay for public transportation, however, this is a sufficient requirement to enhance rural poor mobility.

"Rural Infrastructure Development in the Volta Region of Ghana: Barriers and Interventions," by Edward Badu, De-Graft Owusu-Manu, David J Edward, Michael Adesi, and Scott Lichtenstein, was examined in 2013. The absence of financial institutions willing to fund projects, a lack of clean water, a lack of good health care systems, and a lack of a commodity market to source materials were highlighted as the major problems facing rural construction in this study.

Dr. Pradeepta Kumar Samanta researched "Rural Road Infrastructure Development in India" in May 2015. The development of rural road infrastructure in general, and rural transport infrastructure in particular, is critical in India, according to this report. Access to key services and opportunities is ensured by rural road connectivity, which promotes long-term poverty reduction.

"Remoteness and Rural Development: Economic Impact of Rural Roads on Upland Farmers in Sarawak, Malaysia," by Jill Windle and R. A. Cramb, was published in December 2002. The influence of roads varies within an area (depending

on remoteness) and between places, according to this study (also depending on remoteness). When highways connected settlements to a major urban center rather than a small town, the effects were much stronger.

"Improved Road Accessibility and Spillover Effects of Development: Evidence from the Rural Philippines," by Jerry Olsson, was published in September 2008. The benefits of the road repair were significant, according to this analysis, and benefited a huge portion of the fishing community's population. A variety of complementing elements, in addition to the broad direct impacts of the improved road, resulted in significant direct effects.

Marcela Alondra Chamorro Gine (2012) conducted research on the "creation of a sustainable management system for rural road networks in developing nations." The construction of all the components required by the suggested management system 23 as well as rural road networks was discovered to support local road agencies in developing nations, according to this study.

CHAPTER III

OVERVIEW OF RURAL ROAD INFRASTRUCTURE

3.1 Rural Road Infrastructure in Myanmar

Myanmar, a Southeast Asian country, is bordered to the south by the Andaman Sea and the Bay of Bengal. China borders it on the north and northeast, Laos and Thailand on the east, Bangladesh on the west, and the Indian states of Nagaland, Manipur, and Mizoram on the east. The country has a population of 51.4 million people and occupies an area of 676,578 km² (2014 census). Yangon is Myanmar's largest city, former capital, and economic center. The major economies of Myanmar are agriculture, industries, emergency and tourism. There are 14 regions/states, Nay Pyi Taw Council area & self-administrative zone, 67 districts, 291 Townships, 57228 villages in Myanmar. Total population of 34,727,159 people are living in rural areas.

Myanmar has many diversities of modes of transport and transport services. Particularly in hilly areas, there is no road and therefore, people use porters, mules, horses and walking as of common transportation access. Ox carts are essential for getting from the field to the hamlet, as well as for the first mile of agricultural transit. Tractors are extremely useful in flat, dry locations for rural transportation and access to small marketplaces. As soon as village roads are established, motorcycles are the most common vehicle on them. They can go to towns off the beaten path and are frequently hired to transport passengers and small merchandise. In flat locations such as the Ayeyarwady delta and much of the dry zone, bicycles and tricycles are extensively utilized for personal mobility. Small boats supplement road transportation and provide critical rural services in the Ayeyarwady Delta area.

40% of Myanmar's rural population lives in villages with no year-round access to roadways. According to research conducted by the Asian Development Bank (ADB) on rural access in Myanmar, 4 million people live in the 8,200 villages that are not connected by roads. Another 20,000 settlements, with a population of 10 million people, are linked by impassable roads during the wet season. Myanmar has a

serious rural access problem by international standards, with a Rural Access Index (RAI) of 36 percent, the lowest in Asia. This lack of access constrains mobility and job opportunities during a large part of the year.

Myanmar needs to build or upgrade more than 50,000 km of rural roads by 2030. It has a 95,000 km rural road network, of which 6% is paved and 28% has an improved (gravel or stone macadam) surface, typically in poor condition. In July 2018, the National Strategy for Rural Roads and Access was published, which defines the core rural road network (CRRN) to ensure better connectivity for rural areas. To meet the national target to connect 80% of registered villages by 2030, the government estimates that Myanmar needs to upgrade about 42,000 km of existing rural roads and construct 10,000 km of new roads. The total cost of this program is estimated at \$2.5 billion, considering only the most basic improvements needed to make the roads all-season.

The sustainability of Myanmar's rural road network is generally low because of lack of adequate maintenance. Rural road maintenance funding was introduced in 2014, but has only increased marginally since then, providing about \$150 per km for the existing CRRN. Much of this funding is concentrated on a limited portion of the rural road network, leaving most of the network without any maintenance. The implementation modalities for maintenance are not well developed, leading to delays in implementation and putting a high burden on the Department of Rural Road Development (DRRD) for supervision and inspection.

As per August 2016, there are just under 60,000 miles of registered rural roads in Myanmar, jointly managed by DRD and MOBA. Only 6% of the rural road network has a sealed cement concrete or bituminous surface, while 28% has an improved dry-bound or water-bound macadam, gravel or laterite surface. Only a third of the rural roads currently have an improved surface, and most of these are likely to be passable all year round. The remaining two-thirds of the registered rural road network consist of earthen roads that are generally only passable in the dry season.

In addition to the 60,000 miles of registered rural roads, there are nearly 6,000 miles of registered jeep and motorcycle tracks, ox-cart tracks and footpaths (these are mainly located in Chin State, where they form three-quarters of the registered network).

The development of transportation infrastructure is a priority area in Myanmar's Sustainable Development Policy 2018-30. Three strategies focused on

developing or building transport infrastructure in rural and urban regions are the National Strategy for Rural Roads and Access 2016, Myanmar National Transport Master Plan 2016, and the National Export Strategy 2015-2019.

Table (3.1) Rural Road Standards and Specification

Standard	Surface Type	Carriage Way Width	Side Drains	Bridges	Bridges Carrying Capacity
Class A	Sealed Type	12 feet	Earthen/Lined	Steel/concrete	AASHTO HS20-44 (36 Tons)
Class B	Improved Unsealed Surface	12 feet	Earthen/Lined	Steel/concrete	AASHTO HS20-44 (20 Tons)
Class C	Earthen	6-12 feet	Earthen/Lined	Timber	-
Traffic > NRRSS threshold	Sealed surface	18 feet		Steel/concrete	AASHTO HS20-44 (36 Tons)

Source: National Strategy for Rural Roads and Access, February,2017

According to table (3.1), rural road standard and specification was divided into three class such as Class A, Class B and Class C. In class A, the surface type is sealed type, carriage way width is 12 feet, side drains are earthen/lined and bridge carrying capacity is AASHTOHS20-44 (36 Tons). The type of bridge is Steel/concrete structure. In class B, the surface type is improved unsealed surface, carriage way width is 12 feet, side drains are earthen/lined and bridge carrying capacity is AASHTOH 20-44 (20 Tons). The type of bridge is Steel/concrete. In class C, the surface type is earthen, carriage way width is 6-12 feet, side drains are earthen/lined, and it is not mention bridges carrying capacity. The type of bridge is Timber.

3.2 Rural Roads Strategy in Myanmar

Roads are critical to Myanmar's economic and social growth, particularly in rural and remote areas, which account for around two-thirds of the population. Roads are the primary means of transporting products, people, and information to where they are required. A robust road network can help individuals enhance their quality of life by making it easier to access and participate in markets, as well as expanding access to important services like health care and education (Limi et al., 2015). It is also a critical component of Myanmar's economic structural transformation, assisting in the increase of agricultural productivity and the transition from subsistence farming to market-oriented diversified agriculture, as well as higher value-added manufacturing and services (World Bank, 2017, p 46; Khandker R. Shahidur et al., 2009; Mu and Van De Walle, 2011).

Myanmar's road network is currently large, although of relatively low quality (ADB, 2016). There are several challenges of various kind. Only about half of the trunk road network is paved, according to the Asian Development Bank (2016), and half of the paved trunk roads were in poor condition in 2015. Around 40% of Myanmar's population (more than half of the rural population) still lives in locations where year-round roads are not available. The current state of road access reflects decades of underinvestment as well as the unique problems posed by diverse geography. Community attitudes of roads in war areas can be mixed, according to a recent landmark study by The Asia Foundation, as new long-distance motorways can lead to further militarization, land seizures, or forced displacement (Burke, et al., 2017). This emphasizes the significance of community involvement in deciding the type of road infrastructure investment.

To eliminate rural poverty and promote social and economic development, rural roads and rural transportation services are critical. Access to markets and services is critical for enhancing productivity and rural development, according to evidence from Myanmar and around the world. Furthermore, enhanced rural road development makes it easier for rural residents to access education and health facilities. The Ministry of Agriculture, Livestock, and Irrigation's Rural Development Department (DRD) is currently the primary government department in charge of village roads.

Under the National Strategy for Rural Roads and Access and the national rural road program, the government plans to address the overall needs of rural roads

improvement and the safety of selected high-priority townships in a phased manner. The government has requested ADB to support its pilot project and to assist the government in planning future phases.

Rural people cannot access the services and facilities they require to improve their lives and participate in the national economy without suitable roadways. Myanmar's government feels that building rural roads is critical to strengthening rural areas and tackling rural poverty and inequity. This is in keeping with the Government of Myanmar's commitment to achieve the Sustainable Development Goals (SDGs) by 2030. The SDGs are projected to be aided by the development of rural roads and the resulting enhanced access to services and infrastructure.

- SDG #1: Poverty Reduction: Rural roads have been proved to provide access to work opportunities outside of villages, as well as to marketplaces for selling food and purchasing inputs, and to education for improving future income-generating chances.
- Rural roads have been found to contribute to better incomes and related food consumption, as well as facilitating access to the information and inputs needed to boost agricultural production, according to SDG #2.
- SDG #3: Higher health: It has been demonstrated that rural roads give access to health facilities and services, as well as health education, resulting in improved health standards in rural regions.
- Rural roads have been found to improve year-round access to educational facilities and lead to higher educational standards, lowering the prices and difficulties of receiving an education, and lowering school dropout rates, according to SDG #4 on improving education.
- Rural roads have been shown to boost and facilitate access to work options outside of the village, as well as increase income-generating opportunities within the village, as part of SDG #8.
- SDG # 9, rural roads are being built to an all-season standard, providing year-round access, while sustainability is assured by appropriate designs that account for climate changes and enough maintenance to prevent road deterioration as well as damage.
- SDG #10, which is concerned with decreasing inequalities: Rural roads have been found to decrease inequities between rural (remote) communities and the

rest of the country by increasing access to services and infrastructure. (Ministries of Agriculture and Livestock and Border Protection, 2017)

3.3 Rural Transport Services

Rural transport sector consists of roads, railway, foot path and inland waterways. Transportation is critical for economic development and the delivery of fundamental services. In rural areas, low-volume roadways are the primary mode of transportation. People need basic services as well as a variety of economic and social opportunities. People in rural areas, on the other hand, could not access it from a year-round usable route. Isolated villages are notorious for lagging behind in terms of development. According to the Myanmar Comprehensive Transport Survey conducted in 1993, roughly 50% of passenger trips were made by road and 44% by rail. Approximately 20% of freight was moved by road, 30% by rail, and 40% by inland water transportation. Myanmar's transport policy, to the degree that it exists, is part of the country's overall strategy for regional integration and economic development, including commerce and tourism with neighboring nations. The major method of transportation, road transport, plays a critical role in achieving these policy goals. Road transportation is critical at the local level to support agriculture and give rural communities with access to markets and other services. A total of 48% of the 34,000 km core network is paved with an all-weather surface. Only 8% of the secondary local and secondary road network, as it exists, has any form of all-weather surface, and much of it is in bad shape. The implications of this low level of access for economic and social activity are grim.

Poverty and poor rural transportation can create a vicious cycle that must be overcome. Low mobility rates and little interaction with markets and services are the result of infrequent and high-cost transportation services. There is very little mobility of products and resource development. People put up significant personal effort to move things and get transportation in the absence of economical alternatives, with women generally bearing the brunt of the task. As a result of these variables, people have bad health, poor educational outcomes, and live in poverty. The social and economic benefits of connecting villages to the road network have been demonstrated in numerous nations. The expense of upgrading roads to passable roads is considerably reduced, with a high cost-benefit ratio. Basic access boosts economic growth while also reducing rural isolation and poverty. Villages, on the other hand,

are not all same, and those with more resources may gain more from improved access. Because transportation measures alone cannot tackle all of poverty's chronic problems, they must be paired with other strategies to eradicate poverty and reduce disparities.

The main roads that travel through rural areas are not the same as village roads. When discussing about rural transportation with national, state, or regional stakeholders, most seem to think in terms of relatively accessible communities because that is what they are familiar with. People frequently think of major roads (national, state, and/or regional intercity highways) that run through rural areas and pass through some small towns, both on and off the road, when they talk about rural roads and rural transportation services. The modes of transportation and traffic volumes that people remember are all tied to intercity travel on those roads. Because they have little experience with them, urban decision makers rarely consider small town-to-town thoroughfares with little transportation. They may be petitioned or requested by village leaders in remote communities with no road access, but they are significantly more likely to respond to the concerns of individuals living in villages near cities where farmers and village leaders push for better roads.

3.3.1 Operation and Function of Different Rural Transport Types

Individual transportation entrepreneurs provide the majority of rural transportation services, employing passenger trucks such as "Dyna" or "Hilux" and a smaller number of tricycles, horse and carriages, or mules. Motorcycles, tractor-trailers, ox carts, and bicycles supplement these modes of transportation, which are generally owned for personal usage, however rental income from informal transportation can be important. Buses and minibuses that run on intercity routes assist certain rural residents. The Dyna and Hilux passenger trucks are popular with both operators and villages since they can carry a variety of people and cargo. On rural roads, motorcycles are the most prevalent vehicle and can be the primary mode of transportation for people and small freight.

3.3.2 Regulation of Transport Services

All passenger and freight vehicles must be licensed by the Department of Highway Transportation Administration, and high tax compliance is accomplished at the state and regional levels. Other than freight and passenger weight limits, rural

transport vehicles have little operational requirements. Despite some overcrowding, most rural transportation services tend to be convenient, inexpensive, and well-liked. At this time, it does not appear that greater regulatory application is required, as such regulation could have unforeseen negative implications. Periodic reviews that are sensitive to the demands of local transportation are proposed. Interurban highways must have safety measures in place to allow rural people to utilize and cross them safely.

3.4 Maintenance of Road Infrastructure in Myanmar

Myanmar has 157,000 kilometers of roads, resulting in a road density of 0.23 kilometers per square kilometer, which is substantially lower than its neighbors. Road transport, on the other hand, has become the major mode of transportation, accounting for nearly 80% of all passenger and freight travel. The development of the road sector has been extremely slow due to a lack of international cooperation and funding, which has also resulted in the deterioration of the existing road network. To satisfy the country's expanding transportation needs and avoid the road network becoming a hindrance to Myanmar's economic development, the capacity and efficiency of the road network must be improved urgently.

In 2014, the Myanmar government collaborated with all of the country's transportation ministries to develop the Myanmar National Transport Development Master Plan (MYT-Plan), which covers all modes of transportation, including road and rail traffic, water transportation, ports, maritime, and aviation. Furthermore, the Ministry of Construction is in the process of upgrading its long-term network development plan by integrating its projects with this Corridor-based Master Plan. The Ministry of Public Works/Ministry of Construction (PW/MOC) is in charge of developing and maintaining Myanmar's main road network, which spans 40,000 kilometers.

PW has gathered comprehensive road network information and begun developing the Road Asset Management System (RAMS) for improved management of its road and bridge assets in order to carry out effective and sufficient road network management. PW will design long-term maintenance strategies and schedules using RAMS and HDM4. The Road Asset Management System will be used to create annual budgets for normal and periodic maintenance, as well as to prioritize the rehabilitation and reconstruction projects that are required.

Sustainable and climate-resilient design principles will be used to ensure the long-term viability of the main rural road network and to protect against climatic impacts. Following the completion of the building and improvement work, maintenance will be performed on all CRRN roads with the goal of extending the roads' durability and lifespan. This will include annual routine maintenance targeted at preventing damage, as well as periodic maintenance to resurface the road and do spot repairs every few years.

Cleaning and clearing of the various elements of the track to maintain appropriate functioning, as well as minor repairs to the track's surface and superstructure, are all part of routine maintenance. Clearing the drainage system and avoiding erosion, cleaning up landslides or other road barriers, and restoring minor damage to the road surface and any buildings that may cause more substantial damage will receive special attention.

The routine maintenance of rural roads will be outsourced out to community road maintenance groups that have been formed and trained to perform these tasks. These road repair organizations will be compensated for their efforts. Routine repairs will be outsourced to private sector contractors with the requisite skills and equipment in the case of paved roads or damage to concrete or steel buildings. Contracts will often be paid on a performance basis, based on the resultant state of the road and its compliance with set performance requirements, to decrease administrative expenses and the need for frequent inspections. Forward contracts that cover one or more years and employ agreed unit costs, with work orders to identify the particular activities to be performed, can be used to minimize difficulties with maintenance contracting.

Every few years, routine maintenance will be performed to restore and revitalize the road, particularly the road surface. Retrofitting, spot repairs to macadam or concrete driveways, bituminous sealants, and overlays are examples of this. Spot repairs, such as reinforcing road sections that are sensitive to climatic changes, will be used to supplement this. Periodic maintenance will be outsourced to private companies with the requisite experience and equipment. Contracts will generally be paid on a volume basis, against the volume of work completed.

3.5 Future Plans for Rural Road Infrastructure in Myanmar

The Government of Myanmar wants to improve rural people's access to services and facilities by providing road connectivity to rural villages in support of the Sustainable Development Goals (SDGs). To ensure that the rural population has access to this route throughout the year, the Myanmar government will construct and renovate rural roads connecting these communities to ensure that they are operational all year.

The long-term development objective of the Government of Myanmar is to provide all-season access to all villages in Myanmar. In support of this long-term development objective, this *National Strategy for Rural Roads and Access* targets the next 15 years up to 2030, during which the Government of Myanmar aims to provide all-season road access to at least 80% of the villages in each state/region in Myanmar. To maximize the number of rural people benefitting from all-season road access, the Government of Myanmar will give priority to providing road access to villages with larger populations. The Government of Myanmar will prioritize villages with more than 1,000 people, all of which will be connected by all-season roads by 2022. The second priority for the Government of Myanmar will be villages with more than 500 people, with at least 95% of these villages to be connected by all-season road by 2025. The third priority for the Government of Myanmar will be to target villages with more than 250 people, connecting at least 75% of these villages by all-season roads by 2030. Villages with less than 250 people will also be included, with at least 50% of these villages connected by all-season road by 2030. To ensure that all states and regions will benefit equally, irrespective of their population size, the Government of Myanmar will connect at least 80% of all registered villages in each state/region by all-season road.

By prioritizing villages with higher populations, Myanmar's government expects to connect an additional 10 million rural people to year-round roads by 2030, bringing year-round road access to around 90% of the country's rural population. During the dry season, the Myanmar government will offer road access to another 6,700 villages, guaranteeing that at least 90% of villages in each state/region and up to 95% of the country's rural population have some type of shelter. By 2030, there will be road access.

By 2020, all communities with a population of more than 1,000 people will be connected by year-round country roads or higher-level roads. Year-round country

roads or higher-level highways will connect at least 95 percent of registered communities with more than 500 residents by 2025. By 2030, roads will connect 80 percent of registered towns in each state/region year-round, including at least 75 percent of all registered towns with more than 250 inhabitants and about 50 percent of registered towns with more than 250 people staying small.

The enormous number of villages that do not exist demonstrates the necessity to update the GAD's village record. Furthermore, due to security concerns in the areas where they are located, numerous towns have not been properly registered by GAD. The Myanmar government is unable to adequately assist these villages in developing their rural road networks due to security concerns. There is also a scarcity of accurate data on these folks. As a result, these personnel have yet to be included in the strategy's scope. The Myanmar government, on the other hand, will continue to work to fix security difficulties so that these villages can be properly registered. The villages to be included in the scope of this strategy will be adjusted after the formal village registry has been updated.

3.6 Current Status of Rural Road Infrastructure in Twantay Township

The people living in Twantay Township depend on waterways and roads. Twantay has the longest man-made canal in Myanmar. It also gives a shortcut water way to Ayeyarwaddy river to Yangon river which divides Twantay Township with its length of 35 km and there is one bridge that spans the canal is called Twantay bridge. After 2009, many new intra-township roads, intra-villages and numerous bridges emerged rapidly through the Township. Moreover, intra-township and intra-villages roads are intended to network with regional linkages in order to improve transportation facilities and the economy.

3.6.1 Profile of Twantay Township

Twantay Township is located beside the Twantay canal in Yangon Division. It was called Ta La (DaLa) in the Bagan era, according to the new history of the Tan dynasty, it was called La Tha Pu Ra for doing pot industry. In the Bagab ara, it was under the Bangan Dynasty but when it came to the Inwa era, it was ruled by Han Thar Wadi king. The old city Da La was the city of citadel with might walls. In 1952, under the British colony, it was the city where offices located as subdivisions of Tan Lwin. Twantay Township is composed of 45 Townships. The location of Twantay

Township is between from South to North Latitude 16 degree 33 minutes and from East to West longitude 96 degree and 96 degree 16 minutes. It has an area of 279.09 miles.

The neighboring Townships are Kyi Myint Daing, Seik Kyi Ka Naung Doe and Dala in east, Kawhmu Township in South, Ma-ubin and Nyaung Done Township in West, Htantabin and Hlaing Tharyar Township in North. 90% of entire Township are plain land. There are some hilly regions and a few deep-water areas. There is no mountainous landscape in Twantay Township. There are a lot of creeks in Twantay Township. Pan Hlaing River flows from west to east, Twantay canal flows from west to east, Toe River and Kha Hti Ya Creek flow from North to South into Twantay Township. Twantay Township is located above 15 °C. The Climate of Twantay Township is hot and humid. The highest temperature is 42 °C and the lowest one is 15 °C.

Twantay has Myanmar's longest man-made waterway. It also provides a 35-kilometer water shortcut from the Ayawaddy River to the Yangon River, which separates Twantay Township. The canal is crossed by the Twantay Bridge. The British established the Twantay Canal in 1881, providing not only an important commercial link to the country's biggest city, but also a convenient form of transportation for travelers and visitors wishing to get away from the Big Smoke. One of the notable pagodas is the Baungdawgyoke monastery in Twantay township, which includes a replica of the Mahabodi Temple. Twantay Township's 220 settlements are divided into 65 village districts and eight urban districts. Twantay Township is well-known for its long-standing pottery business, which has been passed down through the generations. It also has fishing and farming operations in the Yangon area. Agriculture is the primary source of income. Rice is the municipality of Twantay's principal product, which is shipped to other parts of the country.

According to 2014 Myanmar Population & Housing Census, Yangon Region, Southern District, Twantay Township report, the total population in Twantay Township is 226,836. 43099 (19%) population are living in urban area and 183737 (81%) people are living in rural areas. Twantay Township have different ethnic groups such as Karen, Chin, Mon, Burmese, Rakhine, Shan and among them, the Burmese ethnic group is the highest population with a total number of 176441. Karen stands as the second highest population with 52118 while Shan is the third highest in total number of 297 people. The common religions in Twantay region are Buddhist,

Christian, Islam and Hindu. The number of Buddhist is the largest with Christian following second. The majority of the people in the Township live in rural areas with only 19.0% living in urban areas. The population density of Twantay Township is 313 persons per square kilometer.

3..6.2 Road Transportation in Twantay Township

Prior to the construction of the Twantay Bridge, the only way to get to Twantay Township from Yangon was to take a commuter ferry from Bohtataung Jetty in downtown Yangon to Dala. The ships convey products and passengers between Yangon and Dala on a regular basis. After arriving, hire a motorcycle or taxi and travel the 25 kilometers to Twantay along the Dala-Twantay Road, stopping at various points along the way. At that time, most of the products such as paddy, cash crops and fishes from Twantay Township were sent to Yangon and other regions through water way.

With the aim of improving public transportation and commodity flow, inter-township roads and inter-villages roads are being conducted in Twantay Township, Yangon Southern District after year 2000. As of intra-township roads, there are four intra-township roads in Twantay Township. These are the road which connected from Twantay to Dala Township (17 miles long), from Twantay Township to Hlaing Tharyar Township (18 miles), from Twantay Township to Kawhmu Township-Kungyan Kone Township (28 miles) and the road which connected from Twantay Township to Maubin Township (30 miles long).

Inter-village and inter-Township bridges are intended to network with regional linkages in order to improve transportation facilities and the economy. The bridges which constructed after year 2000 are shown in below tables.

Table (3.2) Above 180 feet's Bridges

No	Name of the Bridge	Feet	Type of Bridge	Constructed Year
1	Twantay bridge	3570	Reinforce concrete bridge	2006
2	Yay Kyaw	240	Concrete bridge	2011-2012
3	Zee Phyu Kone bridge	232	Concrete bridge	2009-2010
4	Dagalae bridge	220	Concrete bridge	2009-2010
5	Pan Hlaing bridge	1940	Reinforce cement concrete	2004

Source: Township Profiles GAD Twantay, 2019

Table (3.3) Under 180 feet's Bridges

No	Name of the Bridge	Feet	Type of Bridge	Constructed Year
1	Kyae Lan bridge	161	RC	2009-2010
2	Yangon Bauk bridge	60	RC	2003-2004
3	Tamarta Kaw bridge	50	RC	2003-2004
4	Sat Tu Myaung bridge	86	RC	2003-2004
5	Kyi Tan bridge	60	RC	2013-2014
6	Ma Dine Chaung bridge	86	RC	2009
7	Yay Kyaw Lay bridge	60	RC	2016

Source: Township Profiles GAD Twantay, 2019

The Twantay Canal is being crossed by the Twantay Bridge. It measures 840 feet in length and has a 2730-foot access road. The 28-foot-wide two-lane bridge has a four-foot pedestrian lane on both sides. It has a clearance of 45 feet high and 700 feet wide and can support loads of 60 tons. The Public Works Road Construction Task Force 16 is constructing a road connecting Highway No. 5 of the Hlaing Tharyar Industrial Zone and the Dala-Twantay Road via the Twantay Bridge. It measures 11 miles and one furlong in length.

Following the completion of the Twantay Bridge, the second alternative for reaching Twantay Township by road from Yangon is via Hlaing Tharyar on the Yangon-Pathain Road. By producing agricultural and non-agricultural jobs, the expansion of road infrastructure could enhance job possibilities, improve the population's standard of life, and reduce the occurrence of poverty. It also boosts

productivity by ensuring that everyone has access to basic commodities and services. People's health and fitness will be improved.

3.6.3 Waterway Transportation in Twantay Township

Taking a boat from Mawtin Jetty in downtown Yangon is one alternative for getting to Twantay Township via the Twantay Canal from Yangon. Boats leave from this wharf for Myaungmya in the Ayeyarwaddy region, stopping in Twantay along the route. In Myanmar, the Twantay Canal connects the Irrawaddy River with the Yangon River. The Twantay Canal is a 34-kilometer man-made canal in Myanmar that connects the Ayeyarwady Delta and the Yangon River. Since its completion in 1883 by England, it has been heavily used for interior shipping between the Ayeyarwady Delta and Yangon. The canal is called for the town of Twantay, which is located near the canal's midway. Until the 1990s, when the roads between Yangon and the Irrawaddy Divide could be utilized all year, the canal was the fastest way to get from Yangon to the Irrawaddy Delta.

There are three inter-village and one inter-Township waterways in Twantay Township. These are the waterway from Twantay to Kayin Chaung village (7 miles), from Twantay to Twantay Wa (6 miles), from Twantay to Than Phyu Yon (7 miles) and from Twantay to Yangon (17 miles). Before year 2000, people who live along the Twantay canal relied only on the waterways to ferry goods, access to market, health, and education services. Passengers' boats were leaving once per day and they board village by village to ferry goods and passengers. Relying on waterway takes so many times to reach the destination.

During 2019, with the collaboration of the Department of Rural Development and communities, inter-village roads were constructed within Twantay Township. Due to rural road improvement, people living in rural areas could travel any time and it can also reduce travel time and easy access to health and education services. At present time, people who lives along the Twantay canal use waterway specially to ferry goods and they mostly use inter-village roads to travel to nearby villages and to Town for socio economic purposes.

CHAPTER IV

SURVEY ANALYSIS

4.1 Survey Profile

Twantay Township is located in Southern Part of Yangon Region. Yangon Region is composed of 45 Townships. The location of Twantay Township is between from South to North Latitude 16 degree 33 minutes and from East to West longitude 96 degree and 96 degree 16 minutes. It has an area of 279.09 miles. The 220 villages of Twantay Township are organized into 65 village tracts and 8 urban wards. Twantay Township is well known for its traditional pottery business which continued through generations. It also holds fishing and farming businesses of Yangon region. The inter-villages road network which was constructed in Twantay Township during 2019 is shown in table (4.1).

Table (4.1) Constructed Intra-villages Roads during 2019

No	Name of the Road	Type of the Road	Length (Feet)
1	Kone Wat Chaung road	Concrete	255x9
2	Kyeik Thalae- Tauk Tan road	Concrete	700 x 10
3	Lar Ka Pone – Pauk Taw road	Concrete	550 x 10
4	Daw Taw road	Concrete	250 x 10
5	Nga Khone Ma San – Myo Shaung Lan road	Concrete	289 x 6
6	Nyaung Htauk – Bounng Daw Gyoke road	Concrete	230 x 6
7	Ma Myo Su village road	Concrete	190 x 90
8	Hpa Yar Ngu village entrance road	Concrete	145 x 10
9	Kayin Chaung inter village road	Concrete	500 x 4
10	Ta Khun Taing village road	Concrete	330 x 7
11	Ma Yan Tabin village road	Concrete	281 x 7
12	Ywar Thit village road	Earthen	2110 x 6

Source: Township Profiles GAD Twantay, 2019

The constructed roads between 2000-2019 were reviewed and among them 6 villages which are located around the roads are selected randomly. The selected villages and their number of households are shown in table (4.2).

Table (4.2) List of Survey Villages

No	Name of the Village	Number of Household	Number of Sample Household
1	Mee Thway Kyin	202	10
2	Zaw Ti	195	9
3	San Pya Myaing	134	23
4	Sae Eain Su	120	22
5	Hpa Yar Gyi	435	24
6	Pan Pin San	131	12
	Total	1217	100

Source: Survey data 2020

The required total sample size was calculated by using the formula of systemic sampling method. According to the sample size calculation, the required sample size was over 300. But in this study, only 100 households were participated because the type of questionnaires and global pandemic crisis. Therefore, a total of one hundred set of questionnaires were administered in six randomly selected villages in the study area.

4.2 Survey Design

Both quantitative and qualitative methods were used. A questionnaire survey was carried out on selected with quota sampling method. The survey questionnaire was designed especially for effects of rural road development on living standard of households and contains five parts. Part I is included about characteristics of sample households, Part II is education of households and the access to high school education, Part III is Labor and employment including major job and income, Part IV is living standard of household including type of the house, main source of water and lightning, Part V is household assets/durable including type of assets of household and durable to access to social services.

4.3 Effects of Rural Infrastructure Development on Condition of the Households

Rural road development is important for rural area for its holistic development. Rural road improvement plays an important role in promoting economic, social, access to higher education, health services and market. So that, effects of rural road development on living standard of households related situations are occupation of households, household's income, electricity and water usage, household's assets, and travel time to access higher level education and social services.

I. Roster

Characteristics of 100 sample households were classified according to the age of households by sex, education level of the household and size of household and sex. The percentage of household head by sex is shown in table (4.3).

Table (4.3) Characteristics of Respondents

Variable	Mean	St. Dev	Description
Age	40.43	14.3	Age of respondents in year
Gender	0.79	0.41	Binary number taking vale 1 if male and otherwise 0.
Education by categories			
Primary School	0.67	0.47	Respondent with primary school education
Middle School	0.18	0.39	Respondent with middle school education
High School	0.11	0.31	Respondent with high school education
Higher Education	0.04	0.17	Respondent with higher education
Family member	3.26	1.6	Number of family member

Source: Survey data 2020

Table (4.3) presents the summary statistics of characteristics of respondents. According to this table, sample respondents are at the age of 40 years in average and about 79 percent of sample respondents are male. According to education categories of primary school, middle school, high school and higher education, 67 percent of the

sample respondents complete only primary education while 18 percent, 11 percent and 4 percent of sample respondents can complete middle, high school and higher education respectively. According to above table, number of family members are 3 in average.

II. Education Status

Education status of survey villages are shown in table (4.4).

Table (4.4) Availability of School

Variable	Mean	St. Dev	Description
Primary School	0.76	0.43	Household lives where primary school is available
Middle School	0	0	
High School	0.24	0.43	Household lives where high school is available

Source: Survey data 2020

As in Table (4.4), there are 2 types of school available in survey villages. They are primary school and high school. Among these types of school, in average 76% of households lives where primary school is available and 24 % of households lives where high school is available.

III. Labor and Employment

During the data collection period, head of household's occupation status was based on household's answers. The kinds of group are shown in the following table (4.).

Table (4.5) Occupation of Respondents

Variable	Mean	St. Dev	Description
Farmer	0.06	0.24	Respondent works as a farmer
Daily worker	0.28	0.45	Respondent works as a daily worker
Vendor	0.07	0.26	Respondent works as a vendor
Other	0.59	0.49	Respondent works as other from above

Source: Survey data 2020

Table (4.5) presents the summary statistics of respondents' occupation categories, 59% of the sample respondents work as others while 28% of sample respondents work as daily worker, 7% of sample respondents work as vendor and 6% of sample respondent work as farmer. In survey questionnaires, there was a question to assess the changing of occupation during last five year and current period of respondents. According to respondents' answer, there was no occupation changes. The income status of respondents is shown in below table (4.6).

Table (4.6) Income of the Respondents

Type of Occupation	Respondents	Average Income (Kyats)	
		Last 5 Years	Current Period
Farmer	6	180000	240000
Daily worker	38	144000	180000
Vendor	17	90000	135000
Other	59	105000	150000

Source: Survey data 2020

Table (4.6) shows average monthly income of sample households' last five years and during survey period. The average monthly income of each type of occupation was increased during survey period. For the farmer, last five years ago, their products were sold to the outside collectors who travel to their villages and collect the products. The collectors paid a low price to the farmer due to the cost of their travel to the villages. However, at present time, farmers can go directly to the market and receive better prices for their goods. For daily worker and vendors, they may raise their income because they have lot of job opportunities to work not only in their villages but also in nearby villages and Townships.

IV. Housing

Living standard of 100 sample households were classified according to the type of house, source of light and source of water. The living standard of respondents were shown in table (4.7).

Table (4.7) Living Standard of Household

Variable	Mean	St. Dev	Description
I. Type of house			
Zinc and concrete wall	0.10	0.30	Household lives in zinc roofs with concrete wall
Zinc and wooden wall	0.20	0.40	Household lives in zinc roofs with wooden wall
Thatch and wooden	0.02	0.14	Household lives in thatch roofs and wooden wall
Thatch and bamboo	0.64	0.82	Household lives in thatch roofs and bamboo walls
Other	0.04	0.20	Households lives in other than above
II. Source of Light			
Candle	0.03	0.17	Household uses candle for their light
Generator	0.01	0.10	Household used generator for their light
Solar power	0.55	0.50	Household used solar power for their light
Electricity	0.39	0.49	Household used electricity for their light
Other	0.02	0.02	
III. Source of water			
Dig well	0.77	0.42	Household use water from dig well
Tube well	0.21	0.41	Households use water from tube well
Rain water	0	0	
Lake	0.02	0.14	Household use water from lake
Purified water	0	0	

Source: Survey data 2020

Applying three dimensions, living standard of respondents' household are measured in this study. Three dimensions use in this study are type of house, source of light and sources of water. As in Table 4.7, there are five main types of house in which respondents' household are living. They are house with zinc roofs and concrete wall, house zinc roofs and wooden wall, house with thatch roof and wooden wall, house with thatch roof and bamboo wall and other. Among these types, in average 64 percent of households are living in a house with thatch roof and bamboo wall. Only 2 percent of household are living in a house with thatch roof and wooden wall, while 20 percent, 10 percent and 4 percent of households are living in house with zinc roof and wooden wall, house with zinc roof and concrete and other types respectively.

Related with source of light, there are 5 main types of sources of light in which respondents are using. They are candlelight, generator, solar power, electricity and other. Among these sources, in average 55% of households are using Solar power, 39% of household are using electricity while 3%, 2% and 1% of households are using Candle, other and generator.

Related with source of water, there are 5 main types of sources of water in which respondents are suing. They are water from dig well, tube well, tube well, rainwater, lake and purified water. Among these sources, in average 77% of households are using water source from dig well, 21% of households are using from tube well and only 2% of households are using water from lake.

V. Household Assets/ Durable

(i) Household Assets

Household's assets including household appliances, electronic equipment, livestock reared on commercial basic are treated as enterprise assets. Most of the people of the household have farmed, cattle, chicken, Television, mobile phone, etc. The assets of sample household last five years ago and current period of survey villages are shown in table (4.8).

Table (4.8) The Assets of Sample Households

No	Type of Assets	Assets	
		Last 5 Years Ago	Current Period
1	Farm	48	49
2	Cattle/Buffalo	45	19
3	Pig/Chicken/Duck	23	28
4	Tractor	3	26
5	Mobile Phone	24	79
6	Bicycle	35	20
7	Motorcycle	21	72
8	Television	32	79
9	Refrigerator	4	37

Source: Survey data 2020

Table (4.8) shows that current period, the assets of sample households are increased more than last five years ago. The sample households in study areas' economic status have increased according to the household's assets. Therefore, increase the number of assets of households because increase income of households.

Last five years ago, farm assets of households are 48 percent, cattle and buffalo are 45 percent, pig and chicken are 23 percent, tractor is 3 percent, mobile phone is 24 percent, bicycle is 35 percent, motorcycle is 21 percent, Television is 32 percent, refrigerator is 4 percent. At present time, farm assets of households are 49 percent, cattle and buffalo are 19 percent, pig and chicken is 28 percent, tractor is 26 percent, mobile phone is 79 percent, bicycle is 20 percent, motorcycle is 72 percent, Television is 79 percent, and refrigerator is 37 percent.

(ii) Travel Time to Twantay Township

The average travel time to Twantay Township last five years ago and current period are shown in table (4.9).

Table (4.9) Average Travel Time to Twantay Township

Village name	Mode of transport		Travel time (minus)	
	Five Years Ago	Current Period	Five Years Ago	Current Period
Mee Thway Kyin	On foot, bicycle	Motorcycle, Trolargy	60	30
Pan Pin San	On foot, bicycle	Motorcycle, Trolargy	45	20
Zaw Ti	On foot, bicycle	Motorcycle, Trolargy, Car	60	30
San Pya Mying	On foot, bicycle, cow cart	Motorcycle, Trolargy, Car	45	20
Sae Eain Su	On foot, bicycle, cow cart	Motorcycle, Trolargy	45	20
Hpa Yar Gyi	Motorcycle, Trolargy	Motorcycle, Trolargy, Car	30	15

Source: Survey data 2020

According to table (4.9), all the survey villages using small vehicle (motorcycle, hta la gye and bicycle) and on foot last five years ago. But at present, the average travel time to Twantay Township by half of travel time decreased from all villages due to the improvement of inter village roads access. From Hpa Yar Gyi village, the average travel time to decrease from 60 minutes to 30 minutes and from Pan Pin San, Sae Eain Su and San Pya Myaing villages, a decrease of 20 mins after rural road improvement. In Pan Pin San village, the average travel time decrease to 15 mins due to better road access.

Before rural road improvement in survey villages, communities were facing too many challenges related with economic, health, education and other emergency situation. Rural road accessibility especially improved the access to health care services, higher level education services and the average travel time to Twantay

Township and nearest hospital. Moreover, for the vendors, they can buy modern inputs from the market and resell in their own villages as well as other villages. Before rural road improvement, communities are solving their problems with difficult alternatives for travel, using cart transportation or walking on foot to arrive to their destination. Communities are spending a lot of time due to bad transportation. Now, communities have more convenient choices of travel such as motorcycle and car.

CHAPTER V

CONCLUSION

5.1 Findings

Findings from this study are the same with what was found in other studies relating to the rural road development that it has both positive and negative impacts. However, positive impacts have outweighed the negative impacts. As of positive impacts, people could travel easily to town, schooling students could access high school education level, communities could access health care services. Accessing high school education level, health care services and access to market lead to communities to improve their socio-economic life.

This study found that easy accessibility has changed the main sources of income. Access to roads reduced travel time and better roads provide access for the motorcycle, truck, three wheelers directly to the villages. The better accessibility increased the other employment opportunities like going to work at convenience stores, garment factories, export products from village and import products from other places to sell in the villages.

Rural roads provided better access to high school level education. The development of rural road infrastructure contributed schooling children to access middle and high school level education smoothly. Better roads reduce the travel time to school and provided access to school all year round. Without development of rural road, the education level of schooling children in rural areas will be ended in primary school education level. Improving in education level also leads communities to improve their socio-economic life. Even though the parent generation could not complete primary school, middle school and high school education level due to the difficult accessibility, they are eager to upgrade the status of the school and send their children to school.

The study found that communities could access health services easily due to rural road development. The patients can reach to Township hospital within 30 mins

and even the hospital in Yangon can be reached within one to two hours. Before rural road development in villages, villagers who were bitten by snake has lost their lives on the way to hospital because they could not arrive to hospital on time but now this can be improved. Children can also access regular vaccination program monthly due to easy access of rural road infrastructure.

In conclusion, rural road development is important to improve socio-economic of people who are living in rural areas. villagers could access job opportunities nearby towns to increase their incomes and villagers can access health services on time due to rural road development. Therefore, rural road development leads communities in rural area to improve their socio-economic life.

5.2 Suggestions

This study found that a large numbers of rural road have been constructed within Twantay Township period of 2000-2019. It has been discovered that as rural road building improves in the Twantay municipality, the interaction between villages improves. These impacts occur when the government invests in rural road infrastructure, resulting in improved labor income prospects for the poor. and it's affordable to get there on foot. Improving roads has a lot of advantages, including reduced travel time, lower road costs, and improved access to higher education and health services. In each of the research areas, the construction of rural roads had a considerable indirect impact on the overall level of economic development.

Access to rural roads can be critical for raising rural earnings in areas that are poorly linked. National roads are currently receiving more investment than rural roads, and the total length of paved national roads is far greater than that of rural roads. Improvements to rural roads have a considerable indirect impact on overall economic development. To optimize the efficacy of rural road infrastructure development and raise income levels, it will be necessary to streamline the current rural road policy.

According to these research, the government should enhance capital investment in the next development strategy to increase the amount of concrete-paved rural road surface. It is vital to develop and implement relevant policies and strategies in order to increase rural connectivity. Authorities must make rural connectivity a priority and implement suitable regulations and innovative technologies to support it.

As a result, Twantay Municipality has to invest more in transportation and communications infrastructure. Because the majority of people reside in rural regions, promoting the benefits of the rural population is critical.

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APPENDIX

Survey Questionnaires

I. Roster

Township	Village tract	Village

1. Respondent name:
2. Age:
3. Gender (Male-1, Female-0)

Male:

Female:

4. How many family members are in your family?
5. Respondent education

Primary School	Middle School	High School	Graduate

6. Have you always live in this village? (Yes-1, No-0)

Yes:

No:

II. Education Status

1. Is there government school in your village?
2. What level of school is available in your village?
3. Can you access high school level education in your village?
4. If no, where do you go to access the high school level education?
5. What type of mode to use to reach high school?
6. How long does it take to reach the high school?

III. Labor and employment

1. What is your main occupation in the last 5 year?
2. For this main occupation of the last 5 year, what was your employment status?
3. How much did you receive income per month?
4. What is your current job? (Same-0, Change-1)
5. How much did you receive income per month?

IV. Housing

1. Type of dwelling

Brick house	Wooden house	Bamboo house

2. Major construction materials of the external wall of dwelling? Major construction materials of the floor of the dwelling?

Dhani	Bamboo	Wood	Brick

3. Major construction material of the floor of the dwelling

Bamboo	Earth	Wood	Concrete

4. Major construction material of the roof of the dwelling?

Dhani	Zinc Sheet	Concrete	Others

5. What is the main source of water used by the household for drinking water?
(Score: Tube well-1, Protected well-2, Unprotected well-3, Pond-4)

Tube well	Protected well	Unprotected well	Pond

6. How many minutes does it take to get the source of drinking water, get water and come back?

7. What is the main source of lighting for your dwelling in the last year?

Electricity	Candle	Battery	Solar system	Others

8. What is the main source of lighting for your dwelling currently?

Electricity	Candle	Battery	Solar system	Others

V. Household Assets/Durable

(i) Household Assets

No	Types of Assets	Last 5 year	Current
1	Farm		
2	Cattle/Bufalo		
3	Pig/Chicken/Duck		
4	Tractor		
5	Mobile Phone		
6	Bicycle		
7	Motorcycle		
8	TV		
9	Refrigerator		

(ii) Travel Condition to Twantay Township

Village name	Mode of transport		Travel time (minus)	
	Five years ago	Current period	Five years ago,	Current period