THE IMPACT OF RAIL TRANSPORTATION ON REGIONAL ECONOMIC DEVELOPMENT OF MYANMAR

By

Moe Nwet Nwet Aung

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

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Abstract

The transport sector has a vital role in fostering economic growth and advancing social development particularly in rail infrastructure. The railroads have been developed in many developed countries in terms of improving the land transport technology and positively changing the movement of freights and passengers.

Myanmar is currently dependent upon commodity exports and imports with limited in-country manufacturing and assembly being coupled with an abundant mix of extractive industries. National rail infrastructure is very important for economic development in terms of income and employment opportunities. Rail transportation, which, has been already developed in some countries such as Korea and Japan will be reviewed to understand how rail transportation impact on economic development. Myanmar will get the latecomer advantage by practicing these two countries experiences in terms of improving rail infrastructure.

Chapter 1: Introduction

Myanmar has, since 2010, embarked upon a rapid and far-reaching reform program that was designed around four broad public policy areas. The ambitious transitional reform program recognized the need to sustainably reduce poverty in an inclusive manner so that all citizens could benefit from the opening of the country and the associated projected rapid economic growth. Since 2012 the government has been developing a long-term (20 year) national development plan known as the National Comprehensive Development Plan (hereafter NCDP). The NCDP, which has been finalized (2014), sets out a detailed development framework that is built around seven interconnecting strategic thrusts to achieve the long-term goals; (1) to build a growing, diversified and sustainable economy and (2) to ensure that inclusive growth and development is people centered.

The NCDP proposes a holistic inter-connected pro-growth export-led development model that takes its basis from China and other Asian Tiger economies to promote the transformation of the broad sectors of the economy utilizing comparative advantage and competitiveness. To support this process, the government is adopting a corridor development policy through efficient transportation that links key growth centers internally and externally and in particular allowing connection to the Greater Mekong Sub-region (GMS) road systems.

As Myanmar progresses towards graduation from its status as a Least Developed Country, poverty reduction becomes central to development policy. Although the country is witnessing significant growth (7.7%), Myanmar's GDP per capita remains amongst the lowest in Asia (8,000 PPP) compared to an average of 14,700 PPP for South East Asia. According to McKinsey Global Institute report, It is estimated by the government that

Myanmar requires 650$ billion of investment by 2030 to support growth potential, 320$ billion in infrastructure alone.

1.1 Rail Transportation, Myanmar

The transport sector has a vital role in fostering economic growth and advancing social development. Today new transport infrastructure is needed to capitalize on regional trade and production opportunities that will expedite Myanmar's integration into the regional production networks and global value chains and to provide essential transport for Myanmar's growing working population.

Among Myanmar's variety of transport modes, rail transport is suggested to provide the most efficient system in terms of energy saving, capacity i.e. transport of people and freight, and for optimizing transport costs thereby maximizing public budget efficiency and in-building competitiveness into Myanmar.

National rail infrastructure is very important for economic development in terms of income and employment opportunities. "[Rail transportation] can be either a catalyst for cities in transition (CiTs) by attracting new businesses and facilitation for international service cities (competitive, attractive, and highly accessible cities) by accommodating future growth" (Puga 2001)). In this regard, future public investments in rail transport at the national and state and regional level should be developed with analyzing the demand forecast for rail transportation and for fostering an environment to support private sector engagement. In the context of development, infrastructure – especially in transport – is considered by many commentators as being one of the most important components that enables a country to connect across states and regions to transport commodities.

Myanmar is currently dependent upon commodity exports and imports with limited in-country manufacturing and assembly being coupled with an abundant mix of extractive industries. As can be understood one of the most efficient and practiced methods for transporting bulk commodities is rail transportation. Thus, as a priority public policy, the government is "heavily" investing to develop new modern rail transportation interlinkages between Myanmar's states and regions. In the short term, (2015 to 2025) Yangon and southern Bago will see major investments in infrastructure and industry which in-turn will lead to the attraction of new workforces resulting in internal economic migration from rural areas to the new economic centers. The rapid economic growth will be driven in part by new infrastructure development.

In the medium term (i.e. after 2025) it is expected that agglomeration that is supported with new investments will move most of the early rapid economic growth away from Yangon towards the Mandalay metropolitan area (including Sagaing City), as well as to designated Special Economic Zones (SEZ) such as Kyaukphyu (Rakhine State) and Dawei (Tanintharyi Region), where the bulk of these investments are expected to be made. Thus, a medium term migration process is expected with these particular cities potentially facing raid increases of their population and a higher requirement to deliver quality public services, particularly in transportation.

This study will examine how a modern and effective rail transportation system strongly impacts on economic development. Myanmar has railway network length of 5933.9km of tracks (including single-track and double-track), with 939 stations and a fleet of 436 locomotives. The state-run system's 412 trains lug 1281 passenger coaches and 3240 wagons. However, most of the railway network is old and very inefficient and needs to be modernized and upgraded as a matter of urgency.

1.2 Statement of Problem

Traffic congestion and associated incurred costs are one of the key constraining issues that is associated with increasing economic development in terms of Myanmar engaging in regional production networks. Extending the time of a specific product, assembly or component to reach from production center to another reduces competiveness. To minimize transport time and thereby increasing competiveness Myanmar is placing public policy focus on connectivity which includes the construction of a efficient quality of rail transportation system that removes redundancies and optimizes passenger and freight transport. In order to determine whether a rail network should be constructed or rehabilitated, population sizes, industrial outputs in specific region and associated investments are being forecasted. Consequently, injecting a suitable level of fixed capital investment in infrastructure, it can contribute to the achievement of targeted GDP growth in the longer term. Investment in rail transport needs to be considered as a long-term public policy continuum given the timesclaes and size of investments needed.

As a short term solution to improving connectivity Myanmar bus transportation has rapidly increased through public private investments. This has negatively impacted rail transportation as passenger demand and use has dramatically decreased. However too much reliance on bus transportation will have consequent issue in regarding higher congestion rates energy, land use and air pollution. From 2008 to 2011, bus accounted for more than 90% of passenger trips (Table 7.10). The modernized city to city road transportation business that has rapidly emerged is also having a knock-on effect in the context of urban congestion and pollution.

Table 1.1 Number of Passengers by Transport Mode (million trips)

Mode	2008		2009		2010		2011	
Road	1,632	94%	1,997	95%	1,294	93%	1,233	93%
Rail	75	4%	72	3%	69	5%	67	5%
River	27	2%	27	1%	28	2%	23	2%
Air	1	0%	1	0%	1	0%	1	0%
Total	1,735	100%	2,098	100%	1,391	100%	1,325	100%

Source: TPD/RTAD, MR, IWT, DCA (http://www.ajtpweb.org/)

Poverty is wide spread over the entire country with high concentrations found within remote and lagging areas where there is inefficient of a total absence of transportation. Due to poor infrastructure, inter-city rail based travelling time is two times more than the new buses for the same distance. Indeed, in many cases rail transport does not reach a majority of the country. Therefore, as can be understood road has become the norm for inter-city passenger transport due to cost, efficiency in terms of travel times, and reliability.

The backbone of the rail network (passenger and freight) Yangon- Mandalay- Myitkyina provides an opportunity to effectively and quickly transport major commodities and people. However this backbone of the rail network system is not well- developed relying upon old technologies that reduce transport speed and efficiency and increase transportation related damage to perishable and non- perishable products. As a result of this, internal markets remain uncompetitive and cannot expand. Since damage to perishable goods is common the price of most Myanmar produced commodities are volatile, and it leads to negative effect on economic development.

Table 1.2 Traveling Time of Passenger Express Trains on Main Lines; Source: JICA Study Team

Line	Distance (km)	Train No.	Section		Traveling Time	Commercial speed
			From	To		
Yangon - Mandalay	620.3	11 Up	Yangon	Mandalay	16:30	37.6 km/h
Yangon - Pyay	259.0	71Up	Yangon	Pyay	8:30	30.5km/h
Yangon - Mawlamyine	293.2	89Dn	Yangon	Mawlamyine	9:35	30.6km/h
Manadalay - Myitkyina	551.5	55Up	Manadalay	Myitkyina	21:45	25.4km/h

Improving the rail network can create new opportunities through improving competiveness that can result in wider industrialization, provide more employment opportunity and generate income. Myanmar, though effective public transport policies can better integrate into the regional production networks as improved competiveness can be attained through decreasing transport times and reducing transport associated damage and losses. Improved access and transport between a developed region and a less developed one allows firms in the latter to have better access to inputs and markets of the former (Puga, D, 2001).

This paper will examine the impacts of the rail transportation and infrastructure on economic development in terms of trade, productivity, employment opportunities and income distribution. To ascertain the quality of rail transport system, private and public sector will be attracted through effective transport policies. Thus, policy design has a crucial role in influencing and strengthening potential impact of transport investment on local economic development (Banister, D., & Berechman, Y, 2001).

1.3 Research Questions

1. Should a modern backbone rail network be developed?
2. Can rail transportation enhance the socio economic development in rural and urban areas?

1.4 Research Method and Data Collection

This study will use a quantitative approach by analysis on level of income distribution and employment level to prove how rail transportation can impact on economic development. To measure the increasing income level, the other controlled variables such as reduction in transportation costs (passenger and freight), productivity, as well as macroeconomic variables such as GDP growth, per capita income and investment on rail

infrastructure will be applied. The qualitative methodology will also be used in reviewing rail transportation which have been already developed in some countries such as Korea and Japan to understand how rail transportation impact on economic development. Data will be collected from the Transport Master Plan (Myanmar), Ministry of Rail Transportation and Ministry of National Planning and Economic Development. This paper will deliver specific findings related to the linkages of rail transportation and economic development in Myanmar that offer evidence to provide public policy support within the sector.

1.5 Structure of Thesis

The thesis presents an informational background analysis related to Myanmar with focus on the issue of transportation, specifically Yangon- Mandalay Myitkyina backbone rail network in Chapter 1. Research questions and methodology will be provided. Literature review includes a series of paper reviews that were conducted for the formation in chapter 2. Experiences of rail transportation development in Korea and Japan will be studied in Chapter 3. Data analysis with the suggestion of a method for use to enhance government public policy making is provided in Chapter 4. Chapter 5 presents the conclusion of thesis suggesting a direction for future research.

Chapter 2: Literature Review

Myanmar's public services and public service delivery is considered as limited and weak being associated with low revenue collection that impeding on the ability of the government to fiscally address service delivery. Low delivery services in terms of health, education and transport are found in most of the areas of Myanmar. The ability of the government to reach these groups is also restricted, given the large population size and the physical size of the territory. These factors contribute to the high transaction costs for public services in the country and the limited attractiveness of the public sector for would be private and commercial investors. Most natural resources and commodities transported between regions, states and export destinations are reliant on road transport. Inbuilt inefficiencies related to costs associated with time, scale of economy and loss of goods can be reduced through use of railway based freight. Additionally, lower service provision costs will be incurred by national and local governments as heavy load capacities which rapidly damage road systems can be minimized. Therefore, in the case of Myanmar it can be considered that if rail infrastructure is not of an adequate level, its results will be reflected in the performance of national and local economies. An efficient rail networks that combines containerized freight and passenger services enhances international competitiveness and supports regeneration and development of regional economies. It also reduces pressure on land use and is a major industrial sector in its own, thus being an important component in tourism (Gleave, Steer Davies, 2002).

Most resources and commodities transported between regions and states and passenger transport (social and economic) rely on the emerging road transport industry because of the minimal costs, ease of use, reliability, and travel time. Although Myanmar has and extensive railway stock including tracks, engines and rolling stock a majority of businesses, large commercial enterprises and people are using bus or car transportation modalities. To day

the future of Myanmar's rail transport system remains in the balance. In order to reduce pressures on a limited public budget system new PPP types of investment at the national, state and regional level need be encouraged that reduces inefficiencies and redundancies and which promotes systems and process that in turn improve the competiveness of Myanmar. However, caution must be paid to ensure that the rail networks are fit for purpose in the context of socio-economic development, with perhaps the UK Beeching report[1] and now the resultant impacts providing an idea reference basis for the discussion and being, in the opinion of the author, very pertinent to the future development of Myanmar's railways.

The purpose of the study is to examine the impact of the rail transportation and infrastructure on economic development in terms of trade, productivity, employment opportunities and income distribution. Many similar studies related to the rail transportation and economic development has been completed. This paper will contribute to the study by Zettel (2005) who has identified the rail transit as a source of economic development. and Rodrigue's study (2013) on the rail transportation. Moreover, other studies and reports that support this paper will be reviewed.

2.1 Potential Impact on Economic Development

In terms of development, infrastructure – especially in transport – is an essential factor that enables a country to connect internally and externally for trade purposes and engagement with the global economy. One of the most efficient ways for transporting large supplies of commodities, manufactured goods and providing economies of scale for passenger transport is rail modalities. According to Puga (2001),"[Rail transportation] can

[1] The Beeching Reports covered the following topics in relation to the modernization of the British Railways Network; (a) The reshaping of British railways (1963), (b) the development of the major railway trunk routes (1965)

be either a catalyst for cities in transition (CiTs) by attracting new businesses and facilitation for international service cities (competitive, attractive, and highly accessible cities) by accommodating future growth". Improved access and transport between a developed region and a less developed one allows firms in the latter to have a better access to inputs and markets of the former (Puga 2001). In the context of Myanmar this concept can be expanded into a subregional ASEAN context, whereby through improved connectivity will allow Myanmar to gain from cross-border factor endowments that include advanced technologies and access to global value chains. In this context an efficient modern backbone rail network enhances international competitiveness and supports regeneration and development of Myanmar's economy. It also reduces pressure on land use, pollution emissions as well as functioning as a major industrial sector on its own. Given the emerging imporaynce of Myanmar's tourism industry, the rail network offers to be an essential component of tourism industry (Gleave 2002). Thus, policy design plays a crucial role in influencing and strengthening the potential impact of transport investment on local economic development (Banister and Berechman 2001).

According to Zettel (2005), with growing populations, the major cities have to reinvent their urban transport systems looking towards mass transit and interlinked rail transportation to accommodate the current and future populations. City land uses are commonly fixed and in a majority of cases cannot be extend further beyond urban Expansion of peri-urban territories is now fast becoming a development feature in all developing countries, thus a multi-model systems need be developed. With the onset of the new sustainable development goals SDG 3 which calls for a reduction of air contamination (especially in urban areas) a "[rail network] provides an alternative to the automobile, allowing more people in specified areas without increasing demand for roadways and parking" Zettel (2005).

Transit efficiency is regarded as an economic development tool due to its ability to provide higher densities and create activity centers. Zettel (2005) states that the expansion and improvement of rail network could create more jobs by connecting labors and business and activity centers in an efficient way. Furthermore, rail transport reduces air borne pollution, saves energy, minimizes the costs, eases congestion and carries more people and freights. It leads to decreased transition costs and expansion of the market, which leads to less volatility in terms of price commodities.

Zettel (2005) argues that rail transport can spur the economic growth by increasing income due to the better access to work and amenities. Finally Zettel (2005) suggests that rail transport can play a valuable role in shaping and increasing the economic activity of the location since it uses little land, which is important for long- term economic development.

2.2 Importance for several economic transactions

According to Rodrigue (2013), rail transportation has been playing a crucial role in economic development in terms of improving the land transport technology and positively changing the movement of freights and passengers. Rail can carry heavy mineral resources, which improve the performance of economy in terms of increasing the productivity, distribution. He argues that rail transportation has a low level of space consumption along lines and its terminals can occupy large portions of real estate, especially in urban areas and thus increase operation costs substantially (Rodrigue 2013).

Although governments have to experience high costs for the construction of rail network, countries like China, Japan and India continue to improve their rail transportation in order to provide their populations with access to various services. Moreover, by carrying heavy bulk freight over long distances, rail transport minimizes production and commercial costs. Consequently, economies of scale will be achieved (tonnage transported) while the

use of road transport is limited. Rodrigue's (2005) research indicated that rail transportation has a significant impact on national economies by enhancing and uplifting the services sector. Growth in this sector spurs the development of integrated markets, improving industrialization, creating job opportunities, and increasing the income. Among all of the transport modes, rail transportation is the most efficient for economic development in several economic transactions.

2.3 Agglomeration Benefit

Rail is considered as being one of the most eco-friendly modes of travel since it has advantages in relation to energy and sustainability issues (Radopoulou 2008). Radopoulou studied the rail transportation in regards to the energy efficiency, suggesting that rail is two to five times more efficient than other modes and produces low levels of CO2 emissions. Within the study it is claimed that the capacity of rail networks will increase the economic benefits and that substantial agglomeration benefits will occur. Unbalanced economic growth across the region will be mitigated with the efficiency of transport system and interaction between regions will result in an increase in terms of economic activities. By having a modern efficient transport system a city which is already prosperous in natural resources will witness an acceleration in economic growth k as the most cost effective mode in transporting people and freights are utilized. Although these considerations appear to err toward an over-dependence of the transport to economic growth relationship in relation to urban development. However, given the case of Myanmar and the emergence of the SDGs the requirement to connect to the regional production networks modern urban transport and interlinked city to city rail is valid in the context of economic development

According to Impact of Rail Transport on Economic Growth in Nigerian (2013), rail transport has made varying degrees of impact on the development of the countries where

they exist (Kolarsand Malin, 1970). The rail lines have become zones of economic activity, and the rail were the focal points for the expansion of settlements and economic input and output (O'Connor, 1965). Haines and Margo (2006) used panel data set of counties for 1850 and 1860 to examine the economic impact of gaining access to a railroad on local economic development in the US. Atack et. al. (2009) investigated whether railroad induces or follows economic growth in the American Midwest in the period 1850-1860. The results showed that railroad improvement leads to economic growth in the region. Rowstow (1960) described rail transport as historically the most powerful single initiators of economic take off, being a main force in the widening of markets and a prerequisite to expanding the export sector. Several studies have been undertaken to gauge the impact of rail transportation on economic development in both developed and developing countries. Following the findings in literature, this paper will study the employment opportunity, level of rail transportation services in terms of passengers and freights, level of income, which can impact on economic development.

Graham R. Crampton (2003 suggested that if there are significant commercial benefits for investors or property owners located along light rail or rail corridors, then it becomes realistic to ask these stakeholders to make a financial contribution to support the new rail infrastructure. According to author's argument, construction of the rail roads are expensive and long term investments and governments alone cannot adequately finance rail transportation. Indeed, if we take the example of the UK rail network this was originally developed by private companies commonly associated with mining, steel, and manufacturing industries and only nationalized in 1948 through the merger of four large rail companies that were formed through previous acquisitions of smaller companies.

Thus in order to developed rail networks today a need arises to attract the external investments into the development of the railway system in terms of PPPs or Build Operate Transfer (BOT) modalities. As stated by (Radopoulou 2008) governments have to promote economic activities in the region, which rely only on rail transportation. Consequently, investors will see the importance of the railway transportation and invest into the development of the railway infrastructure.

This paper will also focus on the Cost Benefit Analysis Method to analsyise public policy options. In his study on Lausanne and San Diego, Crampton acknowledged that "the construction of the light rail system has given a real impetus to urban development by creating new housing, offices and shops." (Crampton 2003). Applying this pretext it is suggested that a modern railway network can create the employment opportunities and provide cost- effective transportation, which leads to economic growth. Rail lines are critical to the stimulation of settlement expansion and the growth of commercial agriculture sectors in countries whose economies heavily rely on agriculture. Hence the paper will consider the underlying factors, which contribute to the transformation of the economic structure of Myanmar in the context of potential impacts modernized rail systems will have on the agricultural industry and services sectors of the economy.

2.4 Market integration

Bogart and Chaudhary (2012) argue that the railway system was the most important infrastructure development in India from 1850 to 1947. In terms of the economy, railways played a major role in integrating markets and increasing trade. The authors examined the effects of railways on the broad economy by focusing on the two main themes. First, whether the introduction of railways increased market integration and price convergence. Second, whether railways substantially increased household incomes. According to their

research railways did spur the economic growth in India and identified that rail transportation had an effect on internal price convergence and internal market integration. The authors had shown that the previous studies on price convergence measured crop price variation across the railways and non- railway districts. They found out that the price of the crop was lower in districts, which had railways when compared to districts without the railway system. Andrabi and Kuehlwein (2010) used regression analysis to examine the price gap between wheat and rice between major Indian cities on an indicator variable in order to examine the impact of railways on the market integration. Although the existence of the railway system increased the market integration and national income, railways could have done more to aid Indian economic development (Bogart and Chaudhary 2012). The author notes that the data considered for the research was internal to various states of India and did not consider exports nor integration or access to into the regional and global economies and markets. The features of subregional and global connectivity (including impacts of rail on import and exports) is very important in the context of the challenges faced by Myanmar as it re-integrates and attempts to "leapfrog" its development scenario.

As discussed at the 10th Meed Rail and Metro Summit (2014), rail infrastructure plays a crucial role in achieving high economic growth. According to the report, railway operations themselves can generate revenue and create synergy with other industries (e.g. tourism, agriculture or mining). Railways can facilitate all forms of local development by providing access to people, information and employment opportunities. Similar models were adopted for the expansion of the US rail networks and the UK railways during the industrial revolution. The conference also noted that populations in general prefer rail transportation as to avoid the traffic congestion and to take advantage of improved travel time. Consequently, the public private partnership decided to develop the railway system in the region due to the potential economic benefits.

The paper will attempt to examine the impact of rail transportation on Regional economic development of Myanmar, and its effect on the transformation on living standards and quality of life. The paper will use the government datasets, review South Korea's and Japan's rail network system, which are already developed in order to analyze the level of income, employment opportunities and level of services.

Chapter 3: Experiences of rail transportation in Japan and Korea

This study will take a look at the rail transportation experiences in both Korea and Japan so as to have a better understanding of how these two countries have managed their

investment in rail transport and also to comprehend the role played by this transportation system in the social and economic development of these countries.

3.1 The Restructuring of the Rail transportation in Japan

The reformation of the rail transportation sector in Japan was based mainly on the boosting of rail routes and enhancing the effectiveness of operating facilities in order to permanently provide for the increasing demand from the customers and imminent users. The centered on increasing rail facilities, reducing liabilities, empowering its workforce, improving on management skills and the overall business plan.

The Japanese railway transportation business comprises of: track maintenance, which is automatically monopolistic by nature and train operations and commercial utilities, which are more competitive and management and ownership can change hands. The railway business here can be distinguished into two main operations according to the functions each of them perform. There is the passenger operation on the one hand and the freight on the other hand, with each of them possessing unique operational and geographical functions. The main objective for differentiating the passenger from the freight market is to permit the railway transport sector to respond to particular needs of the distinctive users.

The high population density along the main railway lines in Japan, has given rise to high and increasing demand for rail services especially in the metropolitan areas. The vertical integration and geographical separation has led to the need for the reconstruction of the railway transportation in Japan. This population concentration along major railway lines has attracted other economic activities such as retailing businesses and tourism. This has led to large economies of scale among railway and non-railway activities, who benefit from each other.

Worthy of note is the fact that most of the railway facilities in Japan are privately

owned but they do constitute a very well integrated national system. The greater part of Japan's success in railway transportation is ascribed to the geographical separation of its facilities according to the different functions they perform in accordance with customers' demands and needs. Also, main privately owned urban railway businesses have sort to increase their revenues by extending to incorporate different rail related activities which include: opening of hotels at railway stations, establishing departmental stores, promoting touristic activities and increasing residential functions along the railway line.

The railway sector in Japan is well planned from the national to the regional sub divisional level. However, the passenger railway services seem to be more performance at the regional subdivision due to huge individual efforts and the benchmark competition that has improved the general performance of Japan's railway transportation. Also, the increasing regional demand for railway transport facilities has been catered for due to the enhancement of the functioning of the passenger train services. Furthermore, the organization of the railway transportation services into various regional structures has been relatively successful. However, the number of inter-regional railway facilities has reduced within the past few years.

Japan's way of transforming the railway sector through privatization has been successful especially in increasing productivity, reducing operational shortages, cutting down transport fares and overall improvement in service provision. That notwithstanding, some difficulties do exist and need to be taken care of in order to get the most out of railway transportation. The privatization process led to the change of the power of monopoly from the State to the private entrepreneurs, which requires solid government regulation and strict intervention and supervision. This will help enhance rail transportation services thereby contributing to the improvement of the socioeconomic wellbeing of Japanese.

The government planning should make provision for investment in rural railway

transportation in the near future, so that the inhabitants of the rural areas can also benefit from low cost high quality rail services. This will permit the rural population to increase their access to urban services such as employment offers, high income levels, all of which will improve their wellbeing and lead to overall socioeconomic development.

3.2 Korea's railway transportation experience

Following Korea's rapid economic growth from the 1960s, the role of the railway transport sector to its economic development has been a great call for concern. The railway system of Korea is considered to be relatively more developed than those of other emerging countries. The provision of high speed rail transportation system has emerged as a very crucial development policy objective for Korea's government. The first railway line was constructed in 1899 linking the capital city: Seoul to Incheon. Subsequent links have been developed to form an excellent railway network that covers almost the whole country, linking cities to cities as well as connecting urban and rural settlements. This has facilitated the movement of both persons and goods throughout the country with cheap fares.

Even though heavy damages were inflicted on major railway lines during the Korean war, they were later reconstructed and improved upon, making railway transportation the most efficient means of public transport within Korea.

Following the economic growth of Korea and the increasingly high demand for transportation services, there is need for continuous investment in the rail transportation sector so as to meet up with the needs of the customers. To this effect, the government is putting in concentrated efforts in transforming the railway system into high-speed rail facilities and diversifying funding sources to include Public Private Partnership (PPP) options. This is somewhat different from the case of Japan where investment in railway

transport is solely supplied by the private sector.

Investment in rapid rail transit infrastructure seems expensive but then, it is important in expanding public transportation facilities and through lower fares, attract more users. It also leads to added value as it generates other connected businesses through inter connectivity with other regions. This promotes job creation and new opportunities thereby enhancing inter regional development and overall growth of the country's economy.

The government of Korea in order to strictly monitor and evaluate the huge government spending on railway infrastructure, underscored the use of the evidence based approach. Analyses of the relation between the development of urban rail transport system and Korea's economic growth showed a positive correlation between the two through the per capita GDP growth curve.

The second option to evaluate public expenditure in railway transportation facilities was centered on environmental concerns. The establishment of green technology approach was centered on comparing rail transport with other forms of transportation such as road, in terms of traffic safety, environmental pollution, and energy security. Successive evaluations and projections led the government to undertake policy tactics that check public spending and capitalize on the use of public transit systems. Such investment is cost effective, making it possible to increase the development of new rail infrastructures, increase the quality of its services, reduce travel time and increase public safety. Therefore, government expenditure on the development of modern rail transportation systems has been beneficial to the in socioeconomic development process Korea. The private sector's role in the transformation of the rail transport system into a modern network is very much important since government expenditure alone cannot be sufficient.

As seen the both Korean and Japanese experience, the public sector provided preliminary investment for the development of the rail way transportation system, through

concessional loans and later moved to the involvement of private investors through privatization and, or PPP funding.

In Myanmar, over 70% of the population are living in rural areas and subsequently have low household incomes. With very limited disposable income most rural families refrain from travelling even to their nearest large cities due to high transportation fares. Also, rural commodities, due to high transportation costs, cannot be brought to urban markets hence rural families are caught and remain in a poverty trap having to rely upon middle men and traders who buy their products at very cheap prices.

If government policy can provide more investment focused on rail transportation, in the long term, rural people can have access to high quality rail transportation facilities at an affordable price thereby granting them access to urban markets and access to other services offered by large urban centers. Through this approach, the rural population can benefit from job opportunities and higher income levels which will enhance their socioeconomic wellbeing and overall economic development.

3.3 A Backbone Rail Network Policy as a Potential Driver for Socio-Economic Growth in Myanmar.

In Myanmar, over 70% of population are living in rural areas and subsequently have low household incomes. With very limited disposable income most rural families refrain from travel even to their nearest large cities. In turn rural products, due to transport costs, do not have access to markets hence rural families are caught in a poverty trap having to rely upon middle men and traders

If government policy can provide more investment focus towards rail transportation, in the long term, rural people can access the quality of services with an affordable price gaining market access and access to other service offered by large urban centers. in other

words, income level and job opportunities will increase.

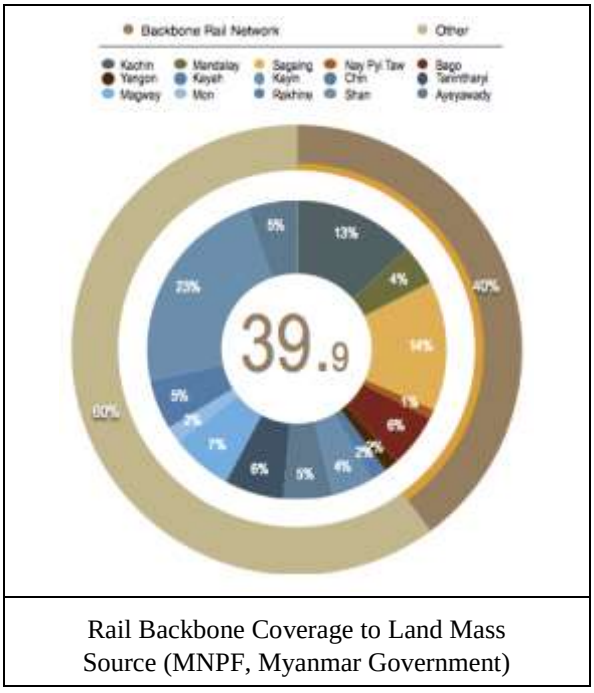
The concept of a backbone rail network follows a similar philosophy to the adoption of corridor approach to facilitate the socioeconomic development of Myanmar as distinguished in the National Comprehensive Development Plan (NCDP) that was passed into law by parliamentary approval in 2014.

The NCDP proposes a two polar growth strategy for the country with key investments supporting the development of the urban and production centers of Yangon and Mandalay. Transport corridors, which extend the GMS network will internally connect these two growth poles supporting production and technology agglomerations that provide spill-overs into local communities. The multi modal transport corridors will externally connect Myanmar to the regional production networks and sub regional trade mechanisms via Thailand and Western China and maritime routes.

The development of a backbone rail network, that optimizes freight and passenger transport between the two growth poles and the borders of China and Thailand will impact various development indicators. For the purpose of this research the following key impact development areas are examined; (a) population, (b) population density (c) GDP / capita contribution by State and Region, (d) forecasted GDP growth by State and Region and (e) poverty distribution. All data has been collected from official government sources or recognized publications made by international organizations. The analysis has been conducted by considering the states and regions that a backbone rail network will serve as a homogeneous region titled “backbone rail network” and comparing against the remaining data sets that are bundled as “other”. The principle concept deployed is based upon the optimal clustering rail services (freight and passenger) that best benefit Myanmar and its

development needs referencing the European Union's 2015 study on the Cost and Contribution of the Rail Sector.[2]

The Backbone Rail Network that is considered as a public policy imperative in the context of this study covers the following geographical area by state and region; (a) Yangon, (b) Bago, (c) Nay Pyi Taw, (d) Sagaing, (e) Mandalay and (f) Kachin (Fig 3.1). The total clustered land mass of the backbone rail network equating to 269,978.37 km^2 (39.9% of the total land mass). Land mass is an essential element to consider when determining passenger and freight clustering and strongly dominates all other variables (Steer Davis Gleave: 2015).

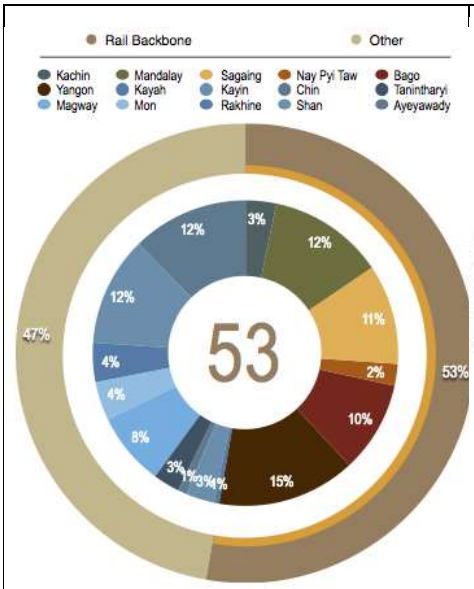


Rail Backbone Coverage to Land Mass
Source (MNPF, Myanmar Government)

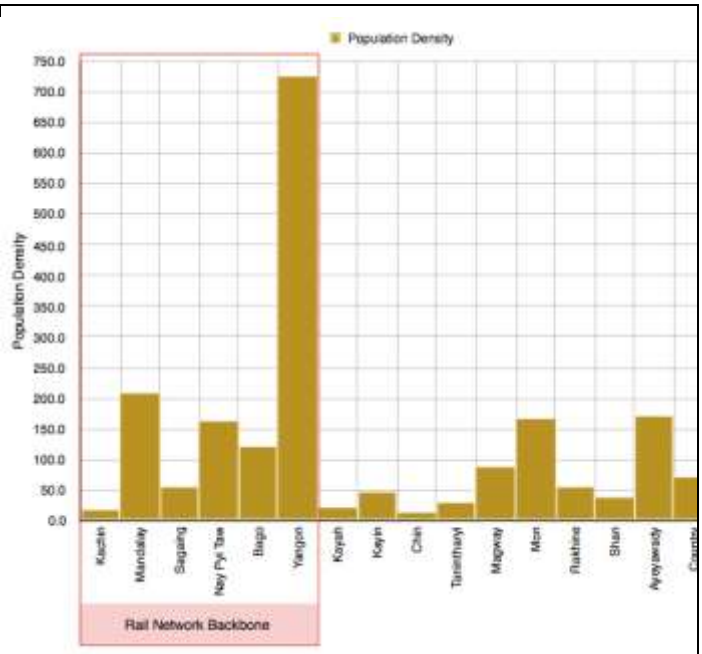
The proposed rail backbone has the possibility to connect to a large percentage of the urban and rural population. Current data (Myanmar Census 2014) indicates that the proposed main route (Yangon to Kachin State) will serve 53% of population (fig 3.1). This

[2] Reference: Steer Davis Gleave (2015): Study on the Cost of the Rail Sector, European Union Directorate General for Mobility and Transport, ref 22783801, European Union. http://ec.europa.eu/transport/modes/rail/studies/doc/2015-09-study-on-the-cost-and-contribution-of-the-rail-sector.pdf accessed September 01 2016 at 13:00 GMT

does not consider the extension of the backbone rail network that provides connectivity to Thailand via Kayin State (Myawaddy / Mae Sot). When considering population density as a key policy variable the backbone will cover areas that exhibit large population densities. Yangon has the highest population density in Myanmar (723.7 persons / km^2) and Mandalay the second (207.7 persons / km^2). Other major urban centers of Nay Pyi Taw and Bago have population densities in excess of (100 persons / km^2) compared to a county average of (74.3 persons / km^2).



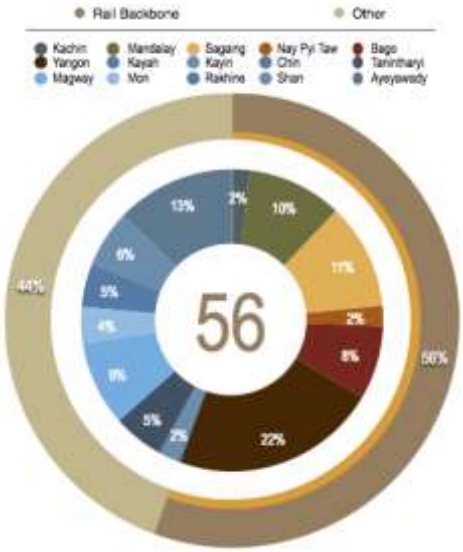
Population Actual
Source (Myanmar Census 2014)



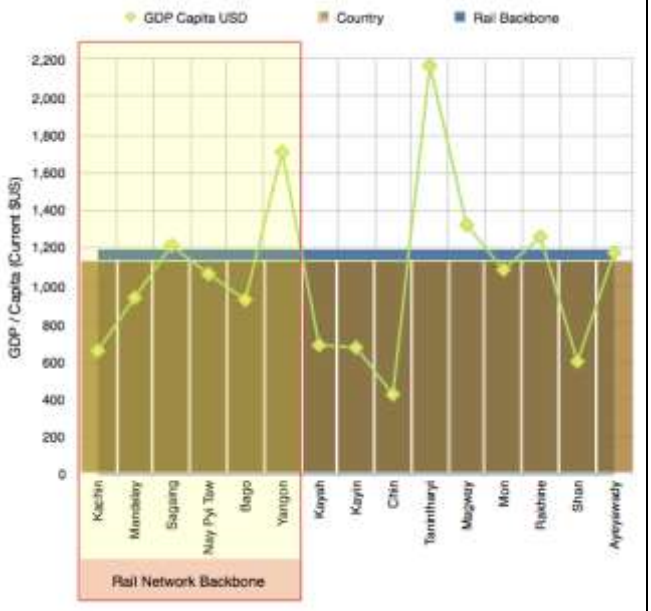
Population Density by State
Source (Myanmar Census 2014)

The concept of optimized rail transport (freight and passenger) must also consider the broader indicators of economic activity and potential growth. Myanmar is considered as a Least Developed Country (LDC) and according to World Bank data has a GDP per Capita of 1,203.5 (current $US). Utilizing current government data, a backbone rail network will link geographically to a large proportion of the country's total GDP (56%). In the context of linking the rail backbone to economic activity (as described by GDP / Capita - $US

constant) it can be verified that the backbone will link Yangon (est. GPD /Capita of $US 1,706) and Mandalay (est. GPD /Capita of $US 937), these being the two most productive urban centers. As illustrated the network will cover 2 regions that record higher GDP/Capita than the country average. In addition, given the increase in trade between Myanmar and China, a majority which will flow through Kachin State, higher GDP/Capita will be witnessed in the short to medium term.



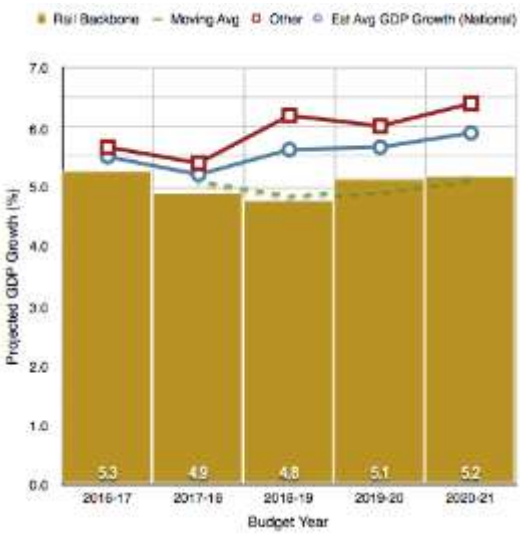
GDP Contribution by State and Region
Source (MNPF, Myanmar Government)



GDP/Capita by State and Region
Source (MNPF, Myanmar Government)

Myanmar's future growth will be highly dependent upon its integration in the regional production networks and the application of a sub-regional export led growth strategy. External connectivity that encompasses scale of economies, cost benefits, and efficient time based transport (inclusive of cross-border transits) thus becomes a core policy consideration for modernization of the rail system and network. Potential GDP growth (2016 to 2021) computed by the Ministry of Planning and Finance suggests that an average GDP growth of 5.6% will be achieved nationally. When extrapolating these growth figures

for the States and Regions covered by the backbone rail network an average growth rate of 5.1% is predicted, thereby suggesting that rail may have a critical role to play in boosting these growth figures.

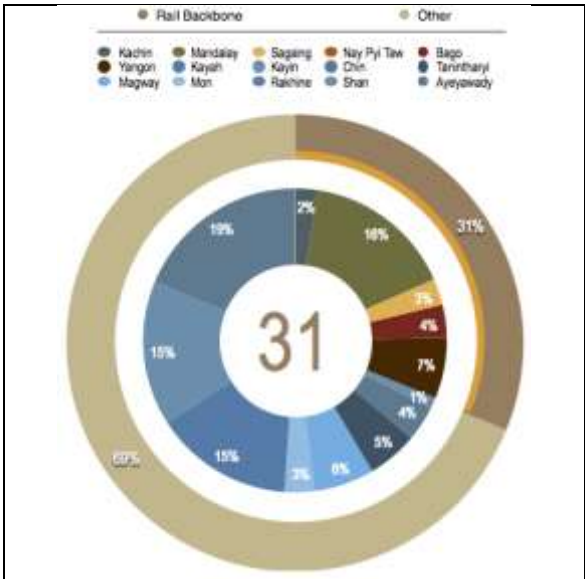


GDP Growth (Forecasted)
Source (MNPF, Myanmar Government)

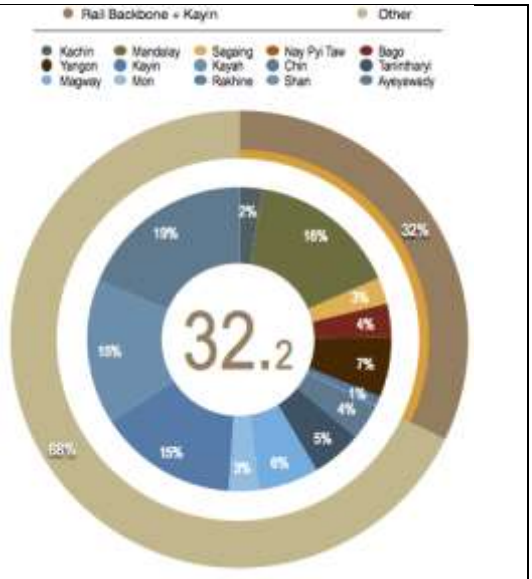
Modernized rail transport can also provide positive social benefits in terms of improved services, access to such services, mobility, creation of employment opportunity and enhanced social connectivity. To examine this phenomena data related to poverty contribution to national poverty levels by state and region are utilized, this being different from considering poverty incidence. In the context of national development, the author suggests that public policies, which address national levels of poverty as opposed to reducing geographical incidences of poverty have greater impact in a national context.

The proposed backbone rail network offers an opportunity to address 31% of the rural and urban poverty recorded by UNDP IHLCA survey (2010), although the data may be subjected to change the poverty distribution by state and region captured by the data set will remain more or less constant. As illustrated when connectivity to Thailand (i.e. an

extension fo rail backbone to connect via Kayin State) is considered the rail system will have a slightly more potential to address poverty (+1.2%).



Rail Backbone Contribution to Poverty
Source IHLCA (2010) UNDP Myanmar



Rail Backbone + Kayin Contribution to Poverty
Source IHLCA (2010) UNDP Myanmar

Whilst the data analysis for Myanmar is limited to official data, it clearly illustrates (for the purpose of informing public policy making) that a focused investment and modernization plan for the rail network using a backbone strategy can address specific socio economic issues.

With a geographical coverage that constitutes 39.9% of the land mass, selective route design has the potential to reach 53% of the population and combine areas that exhibit high economic activity in terms of GDP /Capita. Although the rail network will only have the possibility to address 32 % of the recorded urban and rural poverty contributions this does not consider urban migration that is predicted to rapidly rise as citizens move away from rural economic activities to take up non-farm employment.

Chapter 4: Structure of Myanmar Rail network

The first rail line in Myanmar was developed between the capital Yangon and Pyay with a total installed track of 161 miles through private capital by Irrawaddy State Railway in 1877. In 1896, Irrawaddy State Railway had transferred to Burma Railways, which was operating as a commercialized business. During this period (British colonial) the Indian Railway Board controlled the Burma Railways until 1937 prior to the separation of Myanmar and India. Between 1942 to 194 controlling authority of the railways was invested to the British Governor. After independence (1948) that railways became the state property of the Myanmar government who took over management and development of the railway system in terms of financial and administrative responsibility.

Basically the nationalized railways were maintained and expanded by the government. In 1972, the now Union of Burma Railway was subject to a form of corporatization forming the Burma Railways Corporation. After taking the authority by the State Law and Order Restoration Council, the Union of Burma Railway was changed again to Myanmar Railways, which is still remain unchanged named at present since 1st April, 1989. Historically although the initial railway network was developed with private capitial since 1896 is was operated as a national entity tied to government

4.1 Route Mileage and Stations among States and Regions

The successive governments since 1896 invested public finance to expand the railway networks. As a result, Myanmar boast an extensive connected rail network with

tracks being installed and operated across most of the country except Chin State, i.e. one state out of fourteen states and regions. Connectivity to Chin State is hampered due to the challenges of geological conditions exemplified by mountainous terrain. Although the network may be considered as being extensive due to the physical size of the country today 1 route mile only covers an area of 68.8 square miles in comparison to the total area of Myanmar[3]. In comparison Japan having 12,490 mi of installed track and a total land area of 145916.9 sq mi results in 1 mile of track covering 11.68 sq mi. Likewise in Korea which has 2268 mi of installed track and a total land area of 38691 sq mi results in 1 mile of track covering 17 sq mi.

As is illustrated no only is the Myanmar network antiquated it also covers far less of the country (in sq mi) that the profitable networks in Japan and Korea further compounding the need for new public policy related to the development of an efficient modern rail network system.

Although 3795 route miles have already been constructed, gauges and supporting systems are dated and do not comply with modern rail transport standards. Since focus was maintained on expansion of antiquate systems, in part due to the long lasting sanctions (1996 to 2014), and virtually no investments for modernization have been conducted since the 1990s most of the installed equipment will not be of future use as new trains, rolling stock, communications, and signaling systems will need to be installed to optimize the railway system.

[3] States and Regions, Route Mileage and Stations. In each state and region in comparison to the total area of Myanmar, there is only one route mile per an area of 68.8 square miles and the railways line connects thirteen states and regions out of the total fourteen. Ministry of Transport and Communications; Myanma Railways; up to June 2016

Today the following route mile and number of stations in Myanmar are in operation, illustrating the substantial investment requirement to bring the network to modern efficient standards.

Region	Area (Sq. Mile)	Number of Station	Route Mile
AyeyarwaddyRegion	13567	65	260.00
Bago Region	15214	116	461.09
Chin State	13907	-	-
Kachin State	34379	34	133.43
Karen State	11731	6	16.00
Kayah State	4538	3	8.59
Magway Region	17305	180	754.36
Mandalay Region	14295	183	657.43
Mon State	4748	59	220.70
Rakhaing State	14200	20	54.00
Sagaing Region	36535	90	451.51
Shan State	60155	103	501.86
Taninthayi Region	16735	25	106.78
Yangon Region	3927	76	169.58

Table 4-1 Route Mileage and Stations in State and Region Source; Facts about Myanmar, Ministry of Transport and Communication, Myanma Railways

The organizational and management structure of Myanmar Railways has been divided into groups according to Lower region and Upper regions, being split at Nay Pyi Taw). There are also three major national workshops which operate as sate owned enterprises (SOEs); Ywataung Locomotives Workshop, Insein Locomotives Workshop and Myitnge Carriages& Wagons Workshop. Although Myanmar Railway remains a state owned enterprise, the government has been trying to move towards more decentralized organization in terms of decision-making, financial accountability and providing of quality

services that introduce factors of market responsiveness. This type of re-organizing (establishing smaller rail corporations) can pave the way for the establishment of semi-private rail enterprises or inclusion of the private sector in the context of investing into small railway corporations.

4.2 Fixed Assets of Myanmar Railways

No	Classification	Amount in Million Kyats	Percentage
1	Land	121.2	0.01%
2	Building, Way and Structure	708003.0	84.42%
3	Electric, Signal, and Communication& Machinery	46094.0	5.50%
4	Motive Power and Rolling	84440.5	10.0%
	Total	838658.7	100.00%

Table (4.2) Myanmar Railways, Fixed Assets (2015-2016) Source; Facts about Myanmar, Ministry of Transport and Communication, Myanma Railways

Myanmar Railways is currently operating services across the country including suburban and long distance traffic (passenger and freight) with current fixed assets totaling 729.268 million USD. Moreover government planned investments into new rolling stock and track extensions are being made every year through the public budget to maintain the rail work and encourage the use of rail for freight and passenger transport.

However, since investments follow public policy of ensuring service provision to all areas of the country as opposed to focusing upon modernization Myanmar railways has been facing decreasing market share. This is being a direct consequence of antiquated public policy that foresees that all of Myanmar's cities and major are connected by rail resulting in the continued utilization of old technologies resulting in poor services for passenger and freight. The table below illustrates the performance of Myanma Railways (Passenger and freight) to verify this public policy issue.

Classification	2011-12	2012-13	2013-14	2014-15	2015-16
Main	31.227	23.577	21.834	19.733	16.919
Suburban	32.993	30.240	31.374	28.150	25.126
Passenger mile	30.927	23.659	22.268	21.227	19.470
Passenger/Day	0.18	0.15	0.15	0.13	0.11

Table 4-3 Passenger Traffic (In million)Source; Facts about Myanmar, Ministry of Transport and Communication, Myanma Railways

Classification	2011-12	2012-13	2013-14	2014-15	2015-16
Tons Carried	3.58	2.84	2.47	2.28	1.98
Ton/Day (000)	9.81	7.77	6.76	6.25	5.43
Ton Miles	72.19	60.19	51.323	50.47	47.56

Table 4-4 Freight Traffic Source; Facts about Myanmar, Ministry of Transport and Communication, Myanma Railways

4.3 Rail market, Competitiveness and performance

The market for transport services is expanding rapidly, but MR is not in good shape to meet the emerging demands as the county embarks on engaging with regional production networks. Twenty years ago, Myanmar Rail (MR) commanded a market share of 44% in the passenger market and 14% in the freight market. Today, its market share is only 10% for passengers, and 1.5% for commercial freight. In the next ten years, MR could equally disappear given these trends. Critical decisions are needed regarding MR's future direction and utilization of rail freight as a component of modern industrialization.

Current data suggests that MR's core passenger transport business is at risk of disappearing. MR offers lower quality services than buses, but at a lower fare prices between the same locations. By not addressing these basic structural issues through new lost cost policy directives, MR will only able to attract the lowest income end of the passenger market, which will decrease in size as the economy of Myanmar grows. The government estimates that MR's share of the transport passenger market could fall from 10% to 2-4% in the

coming 15 years. However, there is also considerable opportunity for growth. Myanmar's passenger transport business is growing fast. If MR was able to improve its services, it could triple its market share, and multiply passenger volumes by 7 times.

MR transported 2.5 million tons of freight in 2013/14 one third less than two years before. Volumes of "commercial" freight are only about 1 million tons per year, putting MR's market share at1.5%.

	Passengers (in 000)	Passenger mile (in 000)	Revenue (in 000)
Union	42405	1817940	31791057
Kachin State	1140	116756	4030095
Mandalay	2666	287107	7881005
Yangon	28457	561564	9030953

Table 4-5 Passenger Transportation (source; Ministry of Planning and Finance)

Freight transport could also disappear or through public policy and associated investments become a large viable business that services the connectivity needs of the country. MR is at risk of losing entirely its freight business to road and river transport competition. However, if it could seize the opportunity, its market share could rise to 7-15% and its commercial volumes multiply 12-25 times.

MR's track, rolling stock and signaling systems are outdated and in a critical condition. Half of locomotives, rolling stock and coaches need to be replaced. Most tracks were designed originally to very low axle bearing standards, and have not been renewed. Ballast is absent in many sections. At least 30% of bridges need major repair or replacement. Signaling systems are archaic, over 60 years old.

	Freight ton(in 000)	Ton mile (in 000)	Revenue (in 000)
Union	1994	452596	17653315
Kachin State	125	28279	840428
Mandalay	544	123340	4916933
Yangon	574	130730	8956913

Table 4-6: Freight transportation (Source; Ministry of Planning and Finance)

These basic infrastructure constraints severely limit MR's efficiency and the quality of its services. They limit operational speeds and cause frequent delays and accidents limiting the capacity of the lines, and the quantity of freight that can be carried. Poor rail infrastructure also impacts operational costs as poor rail standards and antiquated inefficient rolling stock returns high fuel consumption and other excessive operational and maintenance related expenses.

Despite the critical need for asset renewal, MR continues to invest network expansion, building new lines that have little market potential. Government investments reached $100 million average annually between 2008 and 2013. However, 88% of investments have been for network extension based upon a notion of connecting remote areas as opposed to analyzing the economics of such expansion.

MR's capacity to reverse current policy is limited by its status as a state-owned enterprise, and its complex organizational structure. In addition, weak institutional capacity is rendering MR to be unable to attract investments, design solutions, and formulate transformative policy to effectively use public budget. Lack of human capital is apparent and the organization is unable either to attract skilled managers and labor or train up current staff in-house. In part this is because of the low wages MR offers, and its training resources

are limited.

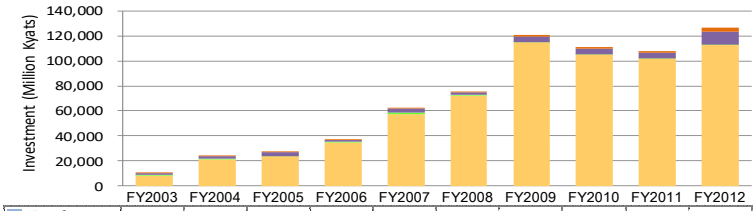
Although MR runs an impressive number of services it is forced to limit speeds and cannot ensure on-time performance due to inadequate infrastructure. MR does maximize the use of its main tracks despite the poor quality of its assets. However, systematic track and rolling stock failures force MR to halve speeds below potential, and constrain reliability to 60% on average. Train derailments and other accidents are very frequent. The accident rate is more than 400 times that of a modern rail system. While track condition is certainly a lead issue, MR also lacks a safety management system. It must operate many remote and light density lines (many of them new lines) without the financial and technical means to support this requirement.

MR is also responsible for providing a host social support to employees, including pensions, schools, housing and medical services. MR's assets are generally underutilized, but must be rehabilitated before they can be used more productively. Productivity per staff is low, and there may be scope for downsizing.

Compounding the operational constraints, most of MR's network has little traffic, and in many cases, little potential market. Network rationalization would improve productivity. MR has been running operational deficits since 2006. Operating expenses are increasing rapidly and MR's operating ratio is approaching 1.7. A sustainable operating ratio for a rail company is about 0.8. Revenues covered only 60% of operational costs in 2013-14. When taking into account depreciation at replacement value and cost of capital but not track costs, we estimate that MR's passenger revenues cover only 45% of their direct long-term costs. The ratio for freight is higher, at 80%.

Figure 4.1 shows MR's capital investment between 2003 and 2012 and highlights the significant increased investment and expansion of the rail network. Since FY 2007, annual investment has been more than double total revenues. During the last decade, 92.9%

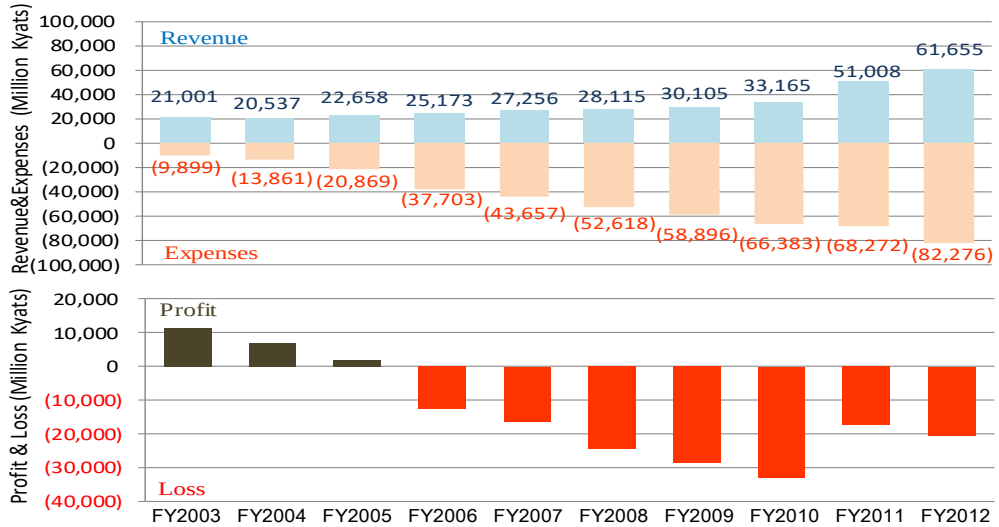
of MR's investments have been made in tracks, bridges and other structures while 6.4% has been invested in rolling stock, electrics, signals, communication and machinery.



	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012
Land		75								
	0.0%	*0.3%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Bridge way & Structure	8,609	20,907	23,729	34,900	57,350	72,537	114,723	104,961	101,822	112,618
	83.0%	*86.1%*	*88.3%*	*95.6%*	*91.3%*	*96.5%*	*95.3%*	*94.3%*	*94.3%*	*89.1%*
Equipment	602	912	403	656	1,621	399	226	223	175	58
	5.8%	*3.8%*	*1.5%*	*1.8%*	*2.6%*	*0.5%*	*0.2%*	*0.2%*	*0.2%*	*0.0%*
Rolling Stock	1,013	2,036	2,617	957	3,222	1,839	4,529	4,566	4,261	10,752
	9.8%	*8.4%*	*9.7%*	*2.6%*	*5.1%*	*2.4%*	*3.8%*	*4.1%*	*3.9%*	*8.5%*
Electric,Signal,Communication & Machinery	149	346	125	1	611	369	927	1,537	1,732	3,030
	1.4%	*1.4%*	*0.5%*	*0.0%*	*1.0%*	*0.5%*	*0.8%*	*1.4%*	*1.6%*	*2.4%*
Total	10,372	24,275	26,874	36,514	62,804	75,144	120,406	111,286	107,990	126,458

Figure 4-1; Investment (Source): JICA study team (2014)

MR's profits and losses between 2003 and 2012. Prior to 2005, MR had been profitable, though since then the Railway's revenues have fallen below expenditures leaving the MR in deficit by approximately 20,622 million kyats in 2012. The Myanmar government annually provides funds to cover MR losses, funding operating expenses, investment costs and funds reimbursement



	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012
Profit & Loss	11,101	6,676	1,788	-12,530	-16,401	-24,504	-28,791	-33,218	-17,264	-20,622
Operating ratio without interest	47.0%	67.4%	92.0%	149.7%	160.1%	187.1%	195.5%	200.1%	133.8%	126.6%

Figure 4-2 Profit and Loss(Source: JICA study team (2014))

4.4 Myanmar Railway Key Performance Indicators

Key Performance Indicators (KPIs) are used to access the performance of a public or private sector entity over a nominated time period. In the context of railway systems common criteria to establish KPIs focus towards economic and operational performance indicators. Reviews of trans-national railway networks in Europe have established the following KPIs to ascertain the operational and economic performance. It is noted that whilst the KPIs can be used to provide comparative evidence to support the rationalization of routes, no data pertaining to public service provision, quality, or development impacts are considered.

KPI	What it measures	Key issues
Train km – Track km	Infrastructure utilisation	Impacted by congestion and passenger /freight policies
Train km per staff	Labour productivity	Less impacted by government policy affected by outsourcing
Total cost per train km	Underlying costs of operations	Differences of accounting conventions and factor prices
Revenue per traffic unit	Revenue generation	Affected by government policy on fares
Revenue / operating costs	Cost recovery	Affected by fare and service obligations
Market share	Competiveness of rail	Ignores overall growth

Table 4-7 Key Performance Indicators. Source: Steer Davies Gleave analysis of Transport Benchmarking Methodologies, Applications and Data Needs – European Conference of Ministers of Transport, OECD, 2000

The tabulated KPIs provide key benchmark indicators that support comparative analysis of rail networks and routes in the context of a trans-national system such as integrated the rail networks found in Europe. Within the context of the study (Steer, Davis, Gleave: The Cost and Contribution of the Rail Sector – European Commission 2015) in which these KPIs were developed the core strategic aim of the research was to conduct analysis and present policy options related to route rationalisation based on total capital

productivity, determined through a combination of track and train utilization within each induvial network.

In a specific ADB funded study related to the rail sector in Myanmar (P Power, A Veron Okamoto 2014 Transport Sector Policy Note – Sector Note Railways) a wide variety of national data and additional comparisons were made with Canadian Railways to derive a set of Railway Performance Key Findings. These findings suggest that the overall performance of Myanmar railways is low due to (i) limited speeds that impact negatively on-time performance, (ii) train derailments and other accidents are very frequent due to track conditions and aspects of system design and maintenance, (iii) the legislative requirement to deliver on the governments' socio-economic objectives without financial means, i.e. Myanmar railways have to operate non-profitable routes as part of government policy. (iv) asset productivity is low with underutilisation of trains and track, high levels of staff and limited network traffic, especially on remote routes, (v) poor financial performance that has witnessed the railways running at a loss since 2006 and an operating ratio approaching 7:1 and (vi) service rates that only cover approximately 60% of operating costs (neglecting depreciation and capital costs)

For the purpose of this study the KPIs that will be considered to examine the performance of Myanmar railways will refer the Steer, Davis, Gleave study. In addition national data (Myanmar Railways) and the ADB sector note will be considered to assist to identify policy positions in the context of "Alternative Futures for Myanmar Railways"

KPI		What it measures	Key issues
Train km – Track km	285847.34	Infrastructure utilisation	Impacted by congestion and passenger /freight policies
Train km per staff	116641.12	Labour productivity	Less impacted by government policy

			affected by outsourcing
Revenue operating costs/(in million US$)	0.643	Cost recovery	Affected by fare and service obligations
Market share (Passenger&Freight)	10% / 1.5%	Competiveness of rail	Ignores overall growth

Table 4-8 Key Performance Indicator

The policy options that will be considered as alternative futures will examine (i) rationalization of railway networks taking into consideration internal and externa connectivity in alignment to the National Comprehensive Development Plan (ii) adopting a corporate strategy and developing Myanmar Railways along corporate and privatized principles similar to what has been adopted in Japan and the UK and (iii) Improved investments.

Chapter 5: Conclusion and Suggestion

5.1 Conclusion

Three development scenarios can be conceived:

Business as Usual. Should things keep on going as they are, MR's market share would dwindle, until the Yangon-Mandalay track is fully rehabilitated. Despite this investment, MR market share would not be sustainable; it would require permanent subsidies to survive.

Revival. A strategy to revive the railways, ensure in the long-term their market share, and make them financially sustainable is possible. It requires reorienting MR on a commercial basis, rationalizing its assets, a change in investment strategy, development of freight, recapitalization, and debt restructuring, reorganization of MR and revision of its relationship with the government. This strategy requires significant initial financial and political commitment from the government as well as donor assistance, but not in the long

term.

Extensive Growth. Alternatively, the government could choose to lower rail rates, increase volumes and invest massively into track and rolling stock. Such strategy would require a lasting commitment of the government to subsidize at $300 million+ a year most of rail investments as well as operational expenditures.

5.2 Suggestion

Myanmar Railway should have to reform the following reason according to increasing demand forecast;

- Passenger Traffic (in million)

Year	No. of Passenger	Passenger-mile
2016 – 2017	63.240	2856.000
2017 - 2018	64.505	2913.120
2018 – 2019	65.795	2971.382
2019 – 2020	67.111	3030.810
2020 - 2021	68.453	3091.426

Freight Traffic (in million)

Year	Ton	Ton-mile
2016 – 2017	2.400	532.560
2017 – 2018	2.437	540.770
2018 – 2019	2.470	548.093
2019 – 2020	2.510	556.969
2020 - 2021	2.547	565.179

- Private sector involvement
- Myanmar Rail units corporatized
- Modernization
- Better asset management, service improvements, containerization and investment in equipment.
- Market share for passenger and freight, 30% and 15% respectively in 2025.

The following results will come out if Myanmar railway system is improved in comparison with other transportation modes;

- Improving services (Passenger coaches, fleet, speed, containerize)
- Competitive prices with other modal

- Increase income
- Expanding market
- Create Job opportunities

Therefore, Rail network should be developed in order to contribute socio economic development in rural and urban areas and it lead to regional economic development in Myanmar.

5.3 Summary and Policy Options

Myanmar Railways faces a critical series of interlinked challenges that carry the potential to greatly impact the speed and depth of development. Within this context the over-riding policy objective will be to formulate rail sector policies that align to Myanmar's National Comprehensive Development Plan and in particular contribute to the strategic trust of connectivity. By adopting this policy objective, it can be shown that a modern backbone rail network in Myanmar can impact on the broader areas of development by introducing the rationale that effective and efficient rail transportation can enhance the socio economic development in rural and urban areas

The three policy options that can be proposed are: (i) rationalization of railway networks taking into consideration internal and externa connectivity in alignment to the National Comprehensive Development Plan (NCDP) (ii) adopting a corporate strategy and developing Myanmar Railways along corporate and privatized principles similar to what has been adopted in Japan and the UK and (iii) Improved investments.

5.4 Rationalization of railway networks

Review of Myanmar government policy and data, Myanmar railways data and relevant sector studies suggest that rationalization of the railways network be considered as a key policy option. In alignment to the NCDP, the integration of Myanmar into regional

production networks and global value chains provide the long term strategic development and growth model and development rationale. Successful integration will be directly correlated to the extent of the development of connectivity related services. To support development of the fast moving goods sector, automobile assembly, light manufacturing and assembly and labour intensive industries such as garments high volume low cost transport systems that provide scale of economies need be developed. This is especially the case in terms of participating in the regional production networks that utilise fragmentation as the preferred production method.

Linking these concepts to connectivity policies a verified need to develop containerised rail freight systems that provide internal and external connectivity becomes apparent. Such systems can connect Western China (Kunming, Yunnan Province) to Myanmar and Myanmar's maritime routes and Thailand's production centres (Rangist, Bangkok) enusirng external connectivity and utilisation of modern containerised systems.

Internally, as indicated within this paper, connectivity enhancements should be sought between the two NCDP identified growth poles of Yangon and Mandalay. By undertaking the development of a rail network backbone, that also extends to Kachin State, socio-economic benefits can be brought to rural and urban communities reaching 53% of the total population. In addition, based upon 2012 data sets the backbone rail system has the potential to reducing poverty in the context of addressing 32% of the recorded poverty contributions by geographical area.

The rationalization of Myanmar Railways will require a reduction of track length, labour, and the replacement of old rail systems including track, locomotives, rolling stock and control equipment's. Such activities will necessary be designed to optimise productivity, reduce operating costs across the network and increase service provision (quality and time) to induce growth in freight and passenger usage.

Modernisation of the backbone and external connectivity lines (Yangon to Maywaddy - South West and Mandalay to Myitkyina – North West) which introduce containerization will support increase of freight (tonnage), speed (rail system upgrades), reduced transit time and costs (containerization) increasing a scale of economy that is essential for Myanmar to integrate into the regional production networks.

5.5 Corporatization

The longer term alternative futures for the Myanmar Railways, by nature, have to consider corporatization and privatization following similar examples found in the Republic of Korea, Japan and the United Kingdom. Whereas the UK model provides an advanced scenario that for the short to medium term is not viable, the Korean experience of modernisation and development of a backbone main trunk system provides many relevant points for policy-makers.

Initial waves of corporatization can be examined in terms of re-organising the railways that allows the formation of entities that are responsible at service and operational levels. This will support the reconfiguration of management and employee arrangements helping to reduce staff hence improving the KPI Labour Productivity

Arrangement for corporatisation of the individual components of Myanmar Railways, applying regional experiences, suggest the adoption of the following principles. Operations to be divided into Track / Line (includes control equipment and inspection) and SOEs. Services which allow for a division based on either passenger and freight services or by geographical coverage.

Corporatization should address the enhancement of the economic performance of Myanmar Railways using the identified KPS as strategic indicators.

5.6 Improved Investments

One major issue facing the development of Myanmar railways and its future alternatives relates to the standardization of railway systems that can incorporate multiple suppliers of equipment. In this context national policy decisions relating to standardisation of rail gauge, control and signalling equipment, locomotives and rolling stock need be considered. In addition, if a backbone network is to be developed its inter-connectivity to existing secondary and rural rail networks needs to be factored into design specifications and procurement.

Therefore investments into railway components need be considered in the wider policy framework of connectivity. To enable effective transfer of passengers and freight in between modern lines and existing secondary and rural lines dual purpose multi-model dry-port facilities and dual service passenger terminals need be considered as being a component of an integrated system. Similar investments can be witnessed in Korea and Japan.

In this perspective investments in rail should anticipate not only standardisation of equipment but also support integration of the railway into a national multi modal transport plan.

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