inland water transport; road transport, cost; competitiveness

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COMPETITIVENESS BETWEEN ROAD AND INLAND WATER TRANSPORT: THE CASE OF MYANMAR

Summary. Among different transportation modes, inland water transport is recognized as a low-cost, environmentally friendly way of transporting. The use of this mode in Myanmar encounters many challenges and the chance of promoting this mode of transport comparing to other transport mode like road transport should be explored. Thus the competitiveness of the two modes are investigated from the operators' cost perspective. The time taken in each mode is also explored. The considerations are taken into account for the recommendations to improve transport performance in terms of time, cost, and reliability especially for inland water transport. Then it attempts to identify the potential and the challenges of respective modes.

КОНКУРЕНТОСПОСОБНОСТЬ ДОРОЖНОГО И ВНУТРЕННЕГО ВОДНОГО ТРАНСПОРТА НА ПРИМЕРЕ МЬЯНМЫ

Аннотация. Низкая стоимость и экологичность выделяет внутренний водный транспорт среди других видов и способов транспортировки. Использование этого вида транспорта в Мьянме сталкивается с большим количеством трудностей, и возможности его развития по сравнению с другими видами транспорта, такими как дорожный, должны быть исследованы. В данной статье конкурентоспособность этих двух видов транспорта рассмотрена с точки зрения операционных расходов. Исследованы также и затраты времени в каждом случае. С учетом различных факторов предоставлены рекомендации для увеличения производительности, внутреннего водного транспорта в особенности, с точки зрения времени, стоимости и надежности. Кроме того, в статье рассмотрены потенциал и сложности развития обоих видов транспорта.

1. INTRODUCTION

There are many different transportation modes in Myanmar including roads, railways, inland waterways, ports, civil aviation, and urban transport within a fragmented system. Among different transportation modes, inland water transport (IWT) is recognized as a low- cost, environmentally friendly way of transporting. In the age of global competition throughout supply chain, the sustainable and green transport logistics has become a primary concern. Given that, organizations like EU promoted the use of inland water transport in EU countries which possess great distances of inland navigation. Myanmar, the country in South East Asia, is endowed with inland rivers and creeks, which, since ancient times, have played a vital role in the economic development of remote rural areas and in the welfare of the inhabitants. Having naturally blessed infrastructure and little development in other inland transport systems, without rivers, many communities in the remote areas of the country would have difficulty accessing other modes of transport.

Over the past two decades, however, inland water transport sector has been lacking in investment and planning. National transport policy has focused on major highways and new railways, with little funding for the operation and maintenance of the existing networks, particularly for the lower-level road networks. During the last decade, the road network has doubled, 69,732 km in 2001 to 148,689 km in 2012 [1]. Out of the total length, the union highways accounts for only 13.12%, (19,503 km), township network road more or less the same percentage (19,580 km), and the major city road, village and boundary area roads are explained by about 74%. Road network expansion marches together with the construction of new bridges. These network expansions resulted in inland water transportation in a negative way, reducing the service routes of inland waterway, as will be seen in the later part of this paper. Since 1988, the inland water transport has seen no improvement in infrastructure in terms of national transport policy and investment.

On the contrary, as there are still inefficient services in road transport imposed by poor infrastructure, obsolete vehicles etc, there have been questions on whether there is room for the inland water transport to maintain and attract the freight it has carried in the past. Thus a rethink in transport planning is necessary and the competitiveness among the modes is worth investigating. After all, for the logisticians, it is important that they understand transportation matters especially the logistics costs for most firms. Freight movement has been observed to absorb between one-third and two-thirds of total logistics costs [2]. This paper attempts to investigate the cost aspect of inland water transport and road transport in Mandalay-Yangon corridor from the operators' perspective. The time taken in each mode is also explored. The considerations were taken into account for the recommendations to improve transport performance in terms of time, cost, and reliability especially for inland water transport within the available data. Then it attempts to identify the potential and challenges of respective modes. The final part concludes the paper.

2. GENERAL DESCRIPTION OF ROAD AND INLAND WATER TRANSPORT

2.1. Major road and water transport network

Road networks include 148,689 km in length of various categories of which the highways account for 19,503 km [1]. The inland waterway networks, on the other hand, cover a navigable network of over 6,000 km comprising major rivers- the Ayeyarwady, the Chindwin, the Thanlwin and Sittaung and other small rivers. The main navigable inland waterways are shown in Table 1 along with the number of service routes and stations. These services are mainly supplied by the state enterprise, Inland Water Transport Department, under Ministry of Transport. Private operators also provide the services. The rivers and creeks flows from north to south, which goes together with the country's long length and major cities. To be specific, the Ayeyarwady, the longest as well as the lifeblood of the country, lies in parallel with the major road and rail network as in Fig. 1.

The freight moved by inland water transport in terms of volume has dominated over other modes throughout the period with a sharp fall from 4.5 million tons in 2011 to about 3 million tons in 2012 (Fig. 2). It is twice as much as the cargo movement on road transport which accounts for around 2 million tons on average. However, in terms of average miles per ton, the two modes scored more or less the same over the period over 117 and 119 miles per ton respectively (Table 2). The difference is that the IWT carries more cargo whereas the road transport travels more than inland water mode.

Table 1

Navigable inland waterways (Year 2012)

Division	Routes	Station	Length of waterway (km)
Cargo division	1	20	-
Delta division	16	124	2152
Ayeyarwady division	9	125	1749
Chindwin division	1	54	1055
Thanlwin division	4	30	209
Rakhine division	4	46	920
The Mekong (Myanmar	-	2	265
Total	35	399	6350

Source: Inland Water Transport Department (IWT), [3].

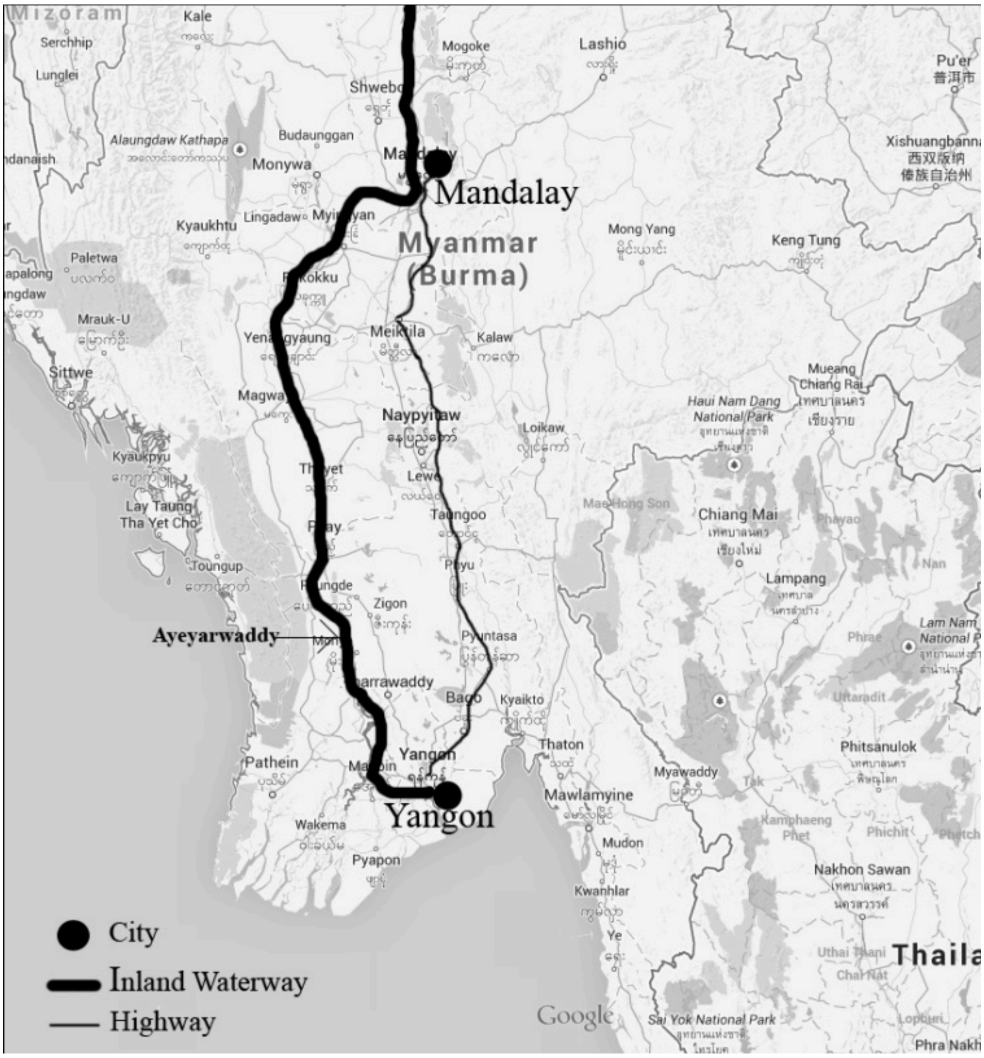

Fig. 1. Major river transport and road transport network linking Mandalay and Yangon

Рис. 1. Важнейшие водные и дорожные транспортные сети, соединяющие Мандалай и Янгон

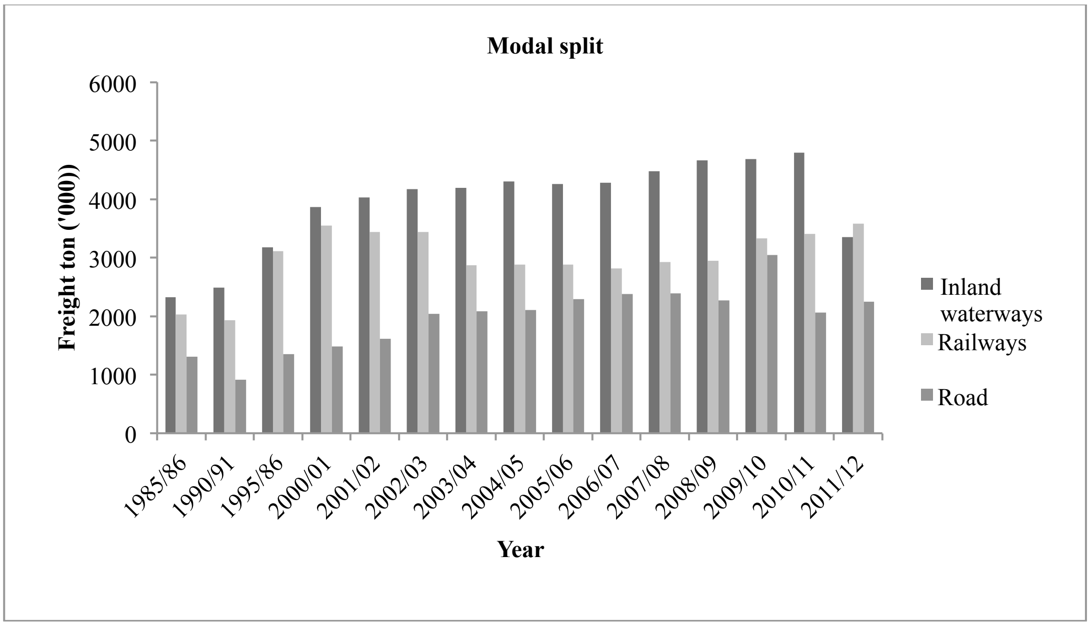

Fig. 2. Freight transport volume over the entire networks of inland waterways, railways and road. Source: Drawn by the author based on the AJTP web [4]

Рис. 2. Объём фрахтового грузопотока всех внутренних водных, железнодорожных и автомобильных транспортных путей. Источник: Составлен автором на основе AJTP интернет-ресурса [4]

2.2. The corridor between Mandalay and Yangon

As can be seen in Fig. 1, the networks of inland water and road are rather similar. Major highways are lengthy along the country's north south topography. The corridor selected for road transport, here is, National Highway No.1, which is the main highway for the freight transport in Mandalay –Yangon Corridor, 750 km away. Inland waterway, in this case, the Ayeyarwady River, runs from north to south, almost in parallel to highways. The waterway distance between Mandalay and Yangon is about 917 km. Table 3 gives a brief description of the two transport mode corridors.

Mandalay is also known as a base for manufacturing facilities with rich cultural tradition and modern agricultural equipment. From the industrial zones of Mandalay Region, the consumer products and capital goods have been distributed to the surrounding regions. It is about 750 km (450 miles) far from Yangon where the major port for international trade has long been in operation. Despite the new shorter 365 miles expressway between Yangon and Mandalay, the cargo Trucks and container trucks are not allowed to go on this road. Whenever the cargoes have to be exported, these cargoes have to be moved to Yangon or Yangon region first where all the documentation procedures are completed. Considering this situation, the corridor between Mandalay-Yangon is selected.

3. ANALYSIS OF THE CORRIDOR BETWEEN MANDALAY AND YANGON

3.1. Inland water transport

Importance of inland water transportation to integrate with other modes has been considered in Notteboom [6] and discusses an intermodal network development with particular reference to bundling system. Milewski (n.d) also highlighted the potential in specialized markets of inland navigation in the Baltic Sea Region. Mihic et al [7] present the overview of measures and suggestions in order to contribute to efficient management, development of a unique information system and promotion of Danube waterway, which will lead towards long-term sustainable development. Rangaraj and

Raghuram [8] also examine the viability of inland water transport in India. Babcock and Lu [9] also address a neglected area of inland water transportation for short term traffic forecasting for Mississippi River lock 27 using time series method, noting on lack of forecasting on inland water transportation rather than other means of transportation.

Table 2

The movements of cargo in inland water transport and road transport

Year	**Inland water transport**		**Road Haulage**	
	ton miles (000)	**Ton (000)**	**Ton miles (000)**	**Ton (000)**
1990-91	325643	2489	76840	914
1995-96	322601	3177	147393	1352
2000-01	344381	3863	189893	1485
2003-04	427125	4192	235367	2081
2004-05	453359	4307	246974	2108
2005-06	455175	4262	271079	2349
2006-07	519983	4284	282589	2380
2007-08	581840	4479	304252	2399
2008-09	639444	4658	314909	2416
2009-10	687207	4685	315614	2411
total	475675.8	4039.6	238491	1989.5
Average Miles per ton	**117.75**		**119.87**	

Source: Calculated from CSO [5].

Table 3

Comparison by mode from Mandalay to Yangon

	Road	Inland waterway
Distance	750 km (450 miles)	917 km (570 miles)
Speed	Less than 40 miles/hr	MDY-YGN 10 knots YGN-MDY 6 knots
Travel time	36-40 hours	7 days (estimate)

As reported in ADB [10], one of the strength of Myanmar transport infrastructure is that there are extensive network of navigable river network with inland water transport services. Also, the encouraging member states to promote a shift in passenger and freight traffic from roads to inland waterways and other more ecologically efficient modes of transport by UNESCAP Resolution 55/1 [11] for Sustainable development of inland water transport in the Asia and Pacific region. Those works in inland water transport indicates the need of review and assessment of inland waterway transport in Myanmar when the regional cooperation in Multimodal transport has been in progress.

3.2. Cost aspect

Generally, the competitiveness of a transport route or corridor is related to how well the route serves the purpose of moving cargo from an origin A to a destination B [12]. Their analysis on Panama Canal routes is focused on container ship operators view point. Similar concept is applied to this paper, taking barge operator's cost perspective approach. The competitiveness of a transport mode is influenced by a number of factors. Much has been existed in the literature with regard to mode choice. Classifying mode choice factors into cargo characteristics, cargo owner characteristics, and transport modes, Cook et al [13] found out that reliability and availability score highest, followed by price and the transit time. Rodrigue et al [14] stated that there can be competition or complementation between modes in terms of cost, speed, reliability, frequency, safety, comfort etc. Cost is the most important consideration in the choice of mode. Moreover, all transportation costs decisions are made from the operators' standpoint. Empirical studies emphasize that raising transport costs by 10% reduces trade volumes by more than 20%. By evaluating them, it is necessary to compare the cost of operators in each mode: inland water and road transport.

When it comes to cost, the general booking keeping practice is the classification of fixed and variable costs. Rodrigue et al [15] divided transport cost into fixed (infrastructure) and variable (operating) costs depending on a variety of conditions related to geography, infrastructure, administrative barriers, energy, and on how passengers and freight are carried. Ballou [2] defined fixed costs as being those for road way acquisition and maintenance, terminal facilities, transport equipment, and carrier administration. Variable costs usually include line-haul costs such as fuel and labour, equipment maintenance, handling, and pickup and delivery. However, a precise allocation between fixed and variable is difficult as each transportation mode has significant cost differences among them, and different allocations are possible depending on the dimension being examined. In most cases, costs are partly fixed and partly variable, thus allocation of cost elements into one class or the other is a matter of individual preference. Being stated, the cost allocation in this paper is simply divided into variable and fixed added by the reason that the cost characteristics of the transport modes are complex and the operators does not keep proper account.

In order to compare the cost aspect between road transport and inland water transportation, the connection of Mandalay and Yangon is selected. Most of the trade both domestic and international is centered on the two cities- Yangon and Mandalay. While Yangon generates significant trade in light industrial goods such as garments, the central part of Myanmar produces lots of agricultural products, which are then supplied to Mandalay, Yangon and international markets.

For the analysis, an 18 wheels semi-trailer is assumed for road transport as transport unit from Mandalay to Yangon. This is based on the consideration that 18 wheelers are of mostly used than other sizes of trucks and a barge of 1,000 ton carrying capacity with a tug is assumed for inland water transport which is the maximum capacity that are usually operated by the private operators. The maximum capacity of a barge in this navigation system is assumed here to compensate the advantage of inland water transport mode that is cheap and can carry higher volume than road transport. The cost division as variable and fixed costs for inland water transport is based on the Inland Water Transport Department accounts.

3.2.1. Road transport corridor

New truck costs include 6,500,000 Kyats[1] for a tractor and 2,000,000 Kyats for trailer. Table 4 presents the overall annual operating cost for running a transport service on Mandalay-Yangon route. The fixed cost of road transport service provision includes (1) drivers' payroll at around 1,700,000 kyats per month both for drivers and driver's assistant; (2) tax, 800,000 Kyats; (3) technical inspection 60,000 Kyats twice a year at 30,000 Kyats per vehicle; and (4) other costs such as communication and handling etc 200,000 Kyats. No insurance cost is incurred, as vehicles are not insured in Myanmar. Variable costs of truck transportation services include (1) diesel 43,200,000 Kyats at120 gallons per trip and the diesel price normalized at 3,600 Kyats per gallon; (2) lubricants 450,000 Kyats for 30 gallons per year at 15,000 Kyat per gallon; (3) maintenance costs 2,000,000 Kyats per vehicle per year; (4) toll fees 15,840,000 Kyats, and others 200,000 Kyats. The capacity of trailers (18 wheels) for 100 round trips at 39 tons for 75% carrying capacity would be 3,900 tons in a year. Thus the equivalent cost per round trip is 885,100 Kyat. Assuming 75% of carrying capacity in head and back haul, a ton of freight costs 22,695 Kyats. It can be found that the variable cost of the truck operators is more than 70% of the total costs, the largest being the diesel and the second largest amount being toll

[1] Kyat is the Myanmar Currency. 1USD=960 Kyats (based on the price of 2012).

fees. The high cost of diesel could have been explained by the age of the truck most of which are second hand and the rise in fuel price.

3.2.2. Inland water transport corridor

A typical 1,000 ton barge costs 250,000,000 Kyats and a tug costs 100,000,000 kyats. Table 5 presents the operating costs of a barge of 1,000 tons on Mandalay-Yangon corridor.

Table 4

Annual operating cost for a truck on road freight transport on Mandalay- Yangon corridor

Fixed cost (Kyats)	
Driver cost (drivers + driver's assistant)	20,000,000
Insurance	Nil
Tax	800,000
Technical inspection (Ministry of Rail)	60,000
Other costs (Admin etc)	200,000
Subtotal (1)	*21,060,000*
Variable cost (Kyats)	
Diesel (120 gallon*100 trips*3600)	43,200,000
Lubricants (Gallon 30 per year)*15,000	450,000
Tires (1 tires for each six months)	5,760,000
Repair and Maintenance	2,000,000
Toll fees (105.6 Kyats/km*1,500km*100)	15,840,000
Others	200,000
Subtotal (2)	*67,450,000*
Total (1+2)	*88,510,000*

The variable costs consist of (1) diesel costs 72,000,000 Kyats which is 40 drums per trip with a normalized price of 180,000 Kyats per drum; (2) lubricants 750,000 kyats (5 gallon on each trip at 15,000 Kyats per gallon); and (3) maintenance and repair costs5,700,000 Kyats. The fixed cost include crew payroll of 150,000 for two crew member which is the minimum for a barge, (2) personnel 3,000,000 Kyats and (3) other costs 150,000 Kyats. Like in road transport, the barge is not insured. Assuming 75% of the carrying capacity of a barge in 10 round trips, a total of 15,000 tons are carried in a year. Therefore, one round trip costs 9,015,000 Kyats on average and one ton costs 6,010 Kyats.

Table 5

A barge of 1,000 ton annual operating cost on Mandalay-Yangon corridor

Fixed cost (Kyats)	
Insurance	Nil
Crew cost (150,000*2*12)	7,200,000
Personnel cost	3,000,000
Other cost	1,500,000
Subtotal (1)	***11,700,000***
Variable cost (Kyats)	
Diesel (180,000*40 drums*10)	72,000,000
Lubricants (5 gallon*15,000*10)	750,000
Maintenance/repair	5,700,000
Subtotal (2)	*78,450,000*
Total (1+2)	*90,150,000*

3.3. Transit time

Delivery (transit) time is usually referred to as the average time it takes for a shipment to move from its point of origin to its destination [2]. In this case, the data obtaining for door to door is rather difficult, thus only the main line haul time is explored. The number of round trips per year for inland water is assumed to be 10 based on the interviews with operators although in terms of vessel speed it could have been travelled more than 10 round voyages. In fact, the sailing time can be calculated considering factors such as turnaround time, handling time, here for the sake of simplicity and difficulty in obtaining data, only the simple formula is used as follows:

$$\text{Actual Sailing Time} = \frac{\text{waterway distance between Mandaly and Yangon}}{\text{the speed of the vessel}} \quad (1)$$

Being a streaming river, there is a difference between the downstream and upstream speed: the downstream speed at 10 nautical miles per hour is faster than the upstream one which is about 6 nautical miles per hour. Therefore, it would take 3 days in downstream and 4 days upstream, technically. It is the maximum speed for the sailing between Mandalay and Yangon. In practice, it takes 4-6 days in downstream and 6-8 days in upstream. This is not always the case for the majority of the cargo because most of the general cargoes which do not go directly between Yangon and Mandalay will have to be laid down on the sandy beach (which is the terminals) and the handling of cargo is just by the labour, adding the delay in delivery time. It not only increases the handling time but also decreases the level of cargo safety, shippers only being responsible for the cargo safety.

Cargo handling time (Yangon Port only) depends on the stevedore: normally, one gang stevedore for one hook is 500 tons shifts and maximum 3 gangs can be requested from the Myanmar Port Authority. Assuming the minimum of one gang stevedores, a cargo of 1,000 tons will take about 16 hours. It is better to take one day at each origin and destination port as it is impossible to depart the port as the night navigation is limited along the rivers. Table 6 summarizes the time taken for line haul and handling in IWT based on the available information.

Table 6

Total time for inland water transport

Mandalay-Yangon (Downstream)		Yangon-Mandalay (Upstream)	
Loading at the port	1 day	Loading at the port	1 day
Actual sailing time	6 days	Actual sailing time	8 days
Discharging	1 day	Discharging time	1 day
Total	8 days	Total	10 days

Obstructions to delay also come from the bridges across the river. Possibly, the delay caused by those bridges originates from the lack of a coordinated plan in infrastructure development of the transport network due to the different responsibilities under different government departments. The Ministry of Construction is the government body to take care of the bridge-construction and road network, whereas the inland water transportation is under the control of Ministry of Transport.

For the road transport in the corridor of Mandalay-Yangon, the total number of round trips is taken as 100 assuming the smooth flow of traffic on highway (Table 7). This is probably too optimistic in reality. As summarized in Table 7, the fastest time a truck can take one round trip is in 5 days. In practice, a normal round trip would take 7 days. The most quoted problem by the operators was the speed limit in the road transport, which must not be more than 40 miles per hour. Usually, the truck drives around 30 miles per hour. Technically, the truck is supposed to drive about 12 hours for 450 miles at the speed of 40 mph. Even if the speed is reduced to 30 mph, it can be done in 15 hours, around half a day. The delays might come from the poor standard of road infrastructure and the weight limit regulations for safety reason of the bridges. The trucks have to queue for weighing causing delay in delivery time.

Table 7

The total time taken in road transport

Collecting the cargo at the factory	1 day
Line haul (head)	1.5 days
Line haul (back)	1.5 days
Collecting the cargo (backhaul)	1 day
Total	5 days

3.4. Limitations

3.4.1. Limitations in road transport

The logistics industry permanently struggles to balance time, cost, and reliability. Road transport offers many advantages over other modes of transport (water, air) such as door-to-door service, fast delivery times and high flexibility. These advantages, however, can only come into effect if transport is smooth, cost efficient, and without delays. Average annual mileage of a truck is 80,000-100,000 km which is comparatively lower than Thailand or other countries [16] The major barrier to road competitiveness might come from the poor infrastructure. As outlined above, a truck cannot drive faster than 30 come from the poor infrastructure. As outlined above, a truck cannot drive faster than 30 mph caused by the poor road network condition. The truck route is overloaded and in poor condition throughout its length. The two-lane tarmac road runs through villages and towns with several overloaded bridges. Although, 18 or 22 wheelers can operate over this highway, they do so with very low average speed which is around 35 miles maximum, high fuel consumption, and high wear and tear on trucks, tires, road and drivers.

Also the capacity of a truck is limited by the weight limits regulations, resulting in dismantling of superstructure of the trailers in order to minimize the tare weight of their trucks. Box trucks have disappeared completely. Ex-box trucks are now operating as flats or high sided open trucks. Cargo protection is by tarpaulin and lashing. Thus even for the perishable products cargo safety is not fully secure reducing the price competitiveness of the cargo. In terms of reliability, road transport, hampered by road congestion and overcrowded access to terminals, cannot guarantee delivery time .

3.4.2. Limitations in inland water transport

Navigable rivers become shortened due to the deterioration on account of artificial activities and natural processes. The constraints to navigation are characterized by insufficient depths, narrow channel width, sharpness of bends and high velocities that are caused braided channels, insufficient water depth in low water season, dangerous flood/serious erosion in wet season and large sediment. The most significant constraint is identified as insufficient depth during the low water season. For safety of navigation, the least available depth (LAD) for low water season is issued by the Directorate of Water Resources and Improvement River System (DWIR) annually from 15 November to 15 May. For example, the LAD in Sinbo-Myitkyinar during that period could reach to 0.8 meter. Inland Water Transport Department stated that the number of inland service routes offered has declined over the period from the year 1995 to 2012. The new bridges and development of road connections cause the decline in service routes. During the last two decades, the number of newly built bridges reached to more than 17 and the number of road extended were 22. As a result, IWT had to stop some of the services where the bridges were built. It is a dilemma for the transport planner in the face of public accessibility and its willingness to promote sustainable transport.

Poor terminal infrastructure of the river ports worsens the reliability of inland water transport mode. The river ports are mere the landing beaches without adequate handling equipment, which increase the handling time and the cost of handling cargo. For example, the lack of proper cargo storage area in every port is an additional concern for the cargo shippers. Multiple handling times incurred in the inland water transport could have contributed to the less competitive position of this transport mode. If a ton of rice, for instance, is transported from factory to warehouse in the destination, loading and unloading occurs a couple of times in both ends. Where the shippers today demand better services- speed, reliability, and safety etc, the inland water transport is able to compete only with low cost service.

4. DISCUSSIONS

The analysis reveals that, in terms of cost, road transport is more than three times (3.8 times) more expensive than the inland water mode. It is compatible with the advantages each transport mode owns. While a ton of cargo costs around 6,000 Kyats in inland water transport of Mandalay-Yangon corridor, it costs more than 22,000 Kyats in road for the same origin to destination. For the shippers, however, there will be additional costs incurred due to multiple handlings in inland water transport, which can impair the competitiveness of IWT in terms of total cost.

In addition to the cost not being so competitive, the overall performance of a barge, in terms of freight carriage, is relatively uncompetitive when the sizes of the assets in the corridor are taken into account, resulting in a very much slow transit time. Here in this study1,000 tons for a barge and 27 tons for a truck have been assumed for the analysis. Thus the size ratio of a barge and a truck is 37:1. However, the annual freight carried ratio of a barge and a truck in a year is only 3.84:1 (15,000: 3,900). This can be explained by the smaller number of round trips made in inland water transport corridor which is 10. If the number of round trips can be increased by reducing the cargo handling times and the sailing times, then the performance of a barge in a year will be improved.

Meanwhile, the major limitation in inland water transport, as have been mentioned, is the lack of cargo handling facilities and proper terminals. It is undeniable that considerable market share of inland waterway transport depends on adequate demand. However, the availability and quality of infrastructure in terms of waterways and ports are of most importance [17]. It is very likely that improving those facilities and infrastructure can bring two main advantages: one is the development of multimodal transport system, at least bimodal; and the other is the encouragement of sustainable transport in the country.

Multimodal transport system involves the use of more than one means of transport such as a combination of truck, railcar, airplane or ship in succession to each other. United Nations Economic Commission for Europe (ECE), the European Conference of Ministers (ECMT) and the European Commission (EC) define multimodal transport as carriage of goods by two or more modes of transport. In this case, at least two potential of multimodal transport network consisting of IWT can be identified. One is an inland water-road combination along the north south Yangon-Mandalay-Muse corridor. As Myanmar borders with China, Laos and Thailand in the east and north eastern part, India and Bangladesh in the west, the border trade with those countries is enormous. The access to the borders is through, Asian Highways, ASEAN Highways, Greater Mekong Sub-region (GMS) Highways, BIMSTEC Highways and so forth. Among the border trade partners (PRC, Thailand, India and Bangladesh, the PRC is the largest border trading partner of Myanmar with around 88% of border trade [18]. The second largest trading partner is Thailand with a little more than 10%. For the border trade with the PRC along the North South Corridor, the dominant transport mode has been the road transport, the National Highway 1 and Asian Highway 14 (AH 14). One viable transport alternative here can be *a combination of inland water and road transport mode* instead of using all the 1,200 km by truck (Fig. 3). Of course, this would increase the transit time, but this is a good opportunity for encouraging the use of sustainable transport as well as the multimodal transport. Where there is alternative, the inland waterway should get the higher share of the total transport [18]. Similar transport mode can be applied to border trade route with India.

Another corridor that can be expected as potential multimodal transport is *road inland water-sea corridor.* Inland Water Transport is possible to fit into the multimodal transport system, where bulk transport is tremendous [19]. Myanmar's export contains bulk cargoes as bean which is the largest amount exported about 1.5 million tons in 2011-2012 (Central Statistical Organization, 2013), timber, maize, mining products. The export growth is 11.2%. The export products are produced in the middle and upper part of Myanmar which is a good potential for promoting multimodal transport for the use of *road- inland waterway- international sea transport* (Fig. 2). It is highly possible because the inland waterway is connected with the Yangon River, where the Yangon gateway port is situated. In this case, the introduction of LASH (lighter aboard ship), where river barges placed directly on board sea-going ships, can be practiced. Import cargo can also be transported by sea-inland water-road combination, in the reverse.

Transport cannot be multimodal without careful planning to transport through a succession of at least two modes [19] (p.6). To be multimodal/intermodal transport network, modes needs to have common handling characteristics so that freight (or people) can be transferred between modes during a movement between an origin and a destination [15]. It necessitates the use of containers and pallets for the freight transportation. This in turn, requires proper terminal development and the waterways and the so-called supra- structure, the vessel in inland water transport mode. So far, there is no container transport in inland waterway. Basically the development of proper container handling terminals, good quay aprons, space to stack containers, a crane or a gantry are called for in the overall transport planning of container transport in inland waterways. Additionally, a hinterland and good connections with the terminal is required [19]. So far, there is no container transport in inland waterway of this corridor. If the decision makers of transport planning take the container transport in this mode into consideration, it will not only encourage the development of multimodal transport, but also will be a support for the measures of sustainable transport, reducing the use of road transport on shortest distances.

Fig. 3. Potential combined mode of transport
Рис. 3. Потенциальный комбинированный вид транспорта

5. CONCLUSION

The two modes have lower competitiveness due to poor infrastructure, resulting in high logistics costs for the shippers. This will again affect the competitiveness of the shippers the country as well as in the regional trade and in the international trade. Both of the modes are not competitive enough except what they naturally possess – inland water can carry high volume with low cost, but they cannot guarantee on frequency and reliability. In the same way, there are less reliable services in road transport especially for high value, time sensitive cargoes. It is the road transport that is highly recognized for faster delivery and safety services. If these services cannot be guaranteed, certainly its freight share will be lost to other modes. For the operators, the use of modern fleet and containers are required so that they can provide better services. The proper truck terminals are also needed.

For the inland water transport, the inefficiency could have been caused by apparently poor terminal infrastructure, and poor maintenance of navigable waterways and other additional factors. Having the potential to promote the multimodal and sustainable transport such as road-inland water, inland water-sea combination, a proper terminal development planning to handle container terminal development is recommendable in inland water transport as the container is at the heart of integrated transport system.

In this paper the competitiveness has been explored only from the cost perspective of the operators and has focused only on the operation costs and transit time on the main haulage route. Further study can be done from the total cost perspective of the shippers which will capture the full picture of competitiveness among road and inland water transport mode and transit time for door to door delivery. Moreover, as rail network is also in the similar state with road network, a comparison between rail and road will give more comprehensive information beneficial for transportation planning of the country.

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