

# Utilisation of Inland Water Transport System in South East Asian Region- An Overview of the Prospect

Ab Saman Abd Kader, Mohd zamani bin Ahmad  
Faculty of Mechanical Engineering  
University Technology Malaysia  
81310 Skudai, Johor

**Abstract:** The development and upgradation of river system for transportation activities has been significantly important in many countries due to their economic and environmental benefits. A proper integrated river management system has been formulated to address for the increasing demand for transport capacity. Besides transportation, human also use waterways for irrigation, drainage, hydropower generation, flood control, watershed treatment, water supply for industrial and domestic consumption, leisure and conservation of wildlife. Hence, the various relevant authorities rigorously involved direct or indirectly in river management system to cater for this needs. Thus, river management system can be regarded as a multipurpose management system aimed at providing and managing the river efficiently for transportation activity. Strategic partnership between different authorities will maximise the well being of the river system to operate effectively. Where possible, different river tributaries can be connected within the country or region to create a waterhighway for economic as well as environmental prosperity between bordering nations in the South East Asian region where the existing of many mighty rivers such as Irrawady in Myanmar, Mekong in Vietnam, Rajang in Malaysia, Menam Chao Phraya in Thailand, Mahakam in Indonesia etc can be connected together for creating a grand water highway for cargo movement, passenger transportation, leisure and tourism. The European experience in creating the integrated inland waterways system for the region have been considered as a successful the model to be adopted. This paper discusses briefly on the prospect of IWT in the South east region in future as an integrated IWT system that for the economic as well as social well being.

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## 1.0 Introduction

Inland waterways transportation system (IWTS) is one of the modes of transportation. Generally, waterways can be categorized into natural and artificial waterways. Rivers and lakes exist naturally

as the result of geographically terrain while the artificial canals were constructed by human. The inland waterway transportation systems comprise some facilities such as locks, inland port, weir, dock, navigation aids and bridges to facilitate navigation of the vessels. Various studies by different parties had shown that IWTS has some advantages compared to other modes of transport. Studies have also shown that IWTS is the cheapest and least costly in terms of land acquisition, energy, labour, resources and most beneficial form of all [1].

Managing waterways is a process of achieving certain objectives efficiently through planning, organizing, implementing and controlling. At present, the philosophy of management had been changed significantly adapting to the surrounding environment. Managing of natural water resources for IWTS will change the physical characteristic and natural behavior of the rivers, while changing the economic value of the river as well. A well-designed and developed IWTS requires an understanding of all pertinent facts and development of a rational plan [2].

## 2.0 Management Practices of IWTS

The present concept of waterways management is different from the previous concept of management. The one system is controlled by the quality of every single element contributing to that system. Taking all necessary consideration, the management of waterways should shift from reactive to proactive. Table 1 shows the comparison between old management practices on some quality elements in waterway management for transportation.

Table 1: Waterway management for transportation

<b>Management elements</b>	<b>Previous approach</b>	<b>Present approach</b>
Sedimentation	Dredging	Overall sediment management
Water Pollution	Treatment process to clean polluted water	Prevent pollution entering the waterways
Safety	Detection	Prevention
Integration (different mode)	Separate, lack of integration	Intermodal transportation system
Responsibility	Spread over a number of authority	Coordination of all authority
Information	Old data/information	Timely information, up-to-date accurate information, real time

## 3.0 Accepted Management Model in IWTS

Every country has different economic structure, level of development, political system, historical background, climate and geographical feature. Thus, the model for waterway management varies

from one country to the other. The set up of management model for various waterways must be formulated accordingly to accommodate the special requirement of each waterway in different countries. Table 2 shows various model of management for IWTS in other counties and the corresponding government policy.

Some of the management model in other countries has been successfully implemented until today. Some major aspects in management of IWTS had been identified such as environment standard, water quality, navigation requirement, safety standard, operation and maintenance of infrastructure etc. The following sections discuss several basic elements in the management model for IWTS.

Table 2: Model in management of IWTS and the corresponding policy

<b>Organization</b>	<b>Established</b>	<b>Government Policy</b>
British Waterways (UK)	1 January, 1963	Transport Act, 1962
Sarawak Rivers Board (Sarawak, Malaysia)	October, 1993	The Sarawak Rivers Ordinance, 1993
Inland Waterways Authority of India (IWAI)	October, 1986	IWAI Act, 1985
Waterways Authority (NSW, Australia)	1, July, 1995	Port Corporation and Waterways Management Act, 1995

Source: [BW, SRB, IWAI & Waterways Authority]

#### **4.0 Major Parameters of Management Model**

The management of a waterway system for transportation require some consideration of the following interrelated elements [4]:

- i. Estimation of potential commodity flows
- ii. Determination of cargo fleet characteristics
- iii. Location of inland ports and harbors
- iv. Determination of dimensions of channels and hydro technical construction facilities such as locks, canals, under bridge clearance, etc.

The management system for waterway transportation involves some major aspect such as planning, design and development of infrastructure, safety of passenger and freight, management of environment quality and operation of infrastructure. The following briefly discuss the aspects of waterways management in general [4]:

- i. Management of environment quality (water quality)  
For the quality of IWTS, management of boat sanitary waste discharges includes the installation and proper use of equipment onboard the vessels and onshore equipment for collection and disposal [5].
- ii. Managing safety aspect of IWTS

Safety of waterways user and freight should be achieved before considering the cost or economic factors. Maintaining a safe inland waterway system should start from design, planning, development, operation and maintenance of waterway track etc.

iii. Managing the plan, design and development of infrastructure

The development of IWTS incorporates engineering design, economic cost benefit and environmental impact evaluation from the beginning of planning stages. The maintenance and improvement of waterways should be planned to increase the safety, as well as the efficiency and reliability of IWTS.

iv. Managing operation of infrastructure

Management of the IWTS usually involved the operations of some infrastructures such as lock, navigation dam, inland port, turning basin, bridge etc. Lock operation should be coordinated to avoid delays.

v. Managing control of traffic

The main purpose of traffic control is to maintain smooth traffic condition and safety in waterways especially in busy waterways. Thus, in some particular area of waterways, anchorage, mooring and berthing area for water crafts should be clearly defined and informed.

vi. Managing sediment management

Reduction of sediment volume entering the waterway will reduce the frequency of dredging work. Maintenance dredging work and control of sediment for passages of vessels should be planned and managed accordingly.

## **5.0 IWTS in South East Asia**

Unlike in Europe, IWTS in most South East Asian countries planned, developed, operated and maintained independently by respective countries. Although the formation of ASEAN as a regional body for mutual co-operation in all respective related activities, inland water transport sector for the carriage of goods and passengers are still beyond recognition for their vast economic potentials.

Ironically, in this region, almost every member country possess a handful of inland waterway networks system which makes them prosperous economically in the past and at present. China, being the country with the longest waterway network system in the world, with the next top ten of the ranking belong to Asian countries of Indonesia in fourth, Vietnam in fifth and Burma in tenth.

With Indonesia possess almost 245 million population and in Indochina with almost 200 million population (1998 data), plus several more million in Malaysia, Philippines and Brunei, this region would certainly be blessed with a vast opportunity for tremendous economic social activities prompting the authorities to keep building basic infrastructures such as road and rail while inland waterways being the alternative mode of transport where feasible.

Table 3: Inland Waterways km 1993 (world ranking)

4	Indonesia	21,579
5	Vietnam	17,702
10	Burma	12,800
24	Laos	4,587
25	Thailand	3,999
28	Cambodia	3,700
30	Philippines	3,219
31	Malaysia	3,209
81	Brunei	209

SOURCE: 1993 CIA WORLD FACTBOOK

### 5.1 Inland water transport system in Malaysia

The roles of rivers in Malaysia that providing transport for various undertakings, still continue until today. In many part of Malaysia especially in the rural area of Sarawak, Sabah and Pahang, IWTS is still be significantly used as a transport system. IWTS has and will always play the roles for the social, economic and strategic requirements.

In Sarawak where inland IWTS is mostly thrived in Malaysia, the riverine transport system has a great significance to a large section of the population living in the interior and along the coast. This system is an important means of transportation to passengers and goods to a large proportions of the population of the State. Sarawak has a total of 55 navigable rivers with a combined length of 3,300 km. Of all the rivers in Sarawak, the Rejang is the most important with a total length of 773 km long and navigable up to 567 km. It is the longest river in Malaysia. Between 300-500 boats and vessels ply the river on daily basis.

About 50% of the traffic is engaged in passenger transportation, and the rest are mainly for the transportation of goods including logs and forest products. Sarawak boasts an economical yet efficient express boat service which connects the various coastal towns. Express boat services also utilize the many waterways inland to get to more rural areas inaccessible by road.

Sibu, the second largest city in Sarawak is the busiest riverine port in Sarawak. Other main rivers comprise Baram river system, Kemena, Tatu, Sg. Sarawak, Limbang, Lupar and Batang Sadong. Passenger and crgo traffic are the most important elements of IWTS in Sarawak and probably in other part of Malaysia too. In 1997, IWTS vessels transported almost 2.9 million passengers . According to Sarawak Rivers Board (SRB), about 2548 vessels where 1352 are crgo vessels, 715 tugboats and 481 passengers vessels have been issued with River Transport Permit by the year 2000.



Figure 1: Major river networks in Sarawak

## 5.2 Indochina's Mekong River System

The Mekong River (known in Tibet as *Dza-chu*, China as *Lancang Jiang* and Thailand as *ae Nam Khong*), is a major river in southeastern Asia (SEA). It is the longest river in the region. From its source in China's Qinghai Province near the border with Tibet, the Mekong flows generally southeast to the South China Sea, a distance of 4,200 km (2,610 mi). The Mekong crosses Yunnan Province, China, and forms the border between Myanmar (Burma) and Laos and most of the border between Laos and Thailand. It then flows across Cambodia and southern Vietnam into a rich delta before emptying into the South China Sea. In the upper course are steep descents and swift rapids, but the river is navigable south of Louangphrabang in Laos.

The natural resource management issues and priorities differ in each of the countries and the level of development and populations vary significantly. In north-east Thailand, with over 20 million people, the water resources are virtually fully developed and problems occurred as result of over-clearing of vegetation and poor irrigation, soil erosion, and declining water quality in the rivers and streams. In Laos, with 5 million people and a much poorer country from a GDP perspective, the water resources are largely undeveloped. Cambodia, with 10 million people, is recovering from decades of war, and in the Mekong delta some 20 million Vietnamese live on some of the most productive agricultural land in the world.

**Figure 2: Mekong river in neighbouring countries**



In short, the Thai want more water; the Laotians want capital and expertise to develop hydropower for export to Thailand and Vietnam; the Khmers need capital and infrastructure and to secure sustainable fishery resources in the Tonle Sap (Great Lake); and the Vietnamese, while in need of capital for the management of resources, do not want any upstream development to exacerbate salt water intrusion in the Mekong delta during the dry season.

**Table 4: The Mekong River Commission**

Length	4,200 km (2,610 mi)
Countries	China, Myanmar, Thailand, Laos, Cambodia and Vietnam
Basin population	60 Million
Country population total	242 Million
Per Capita GDP	Varies from US\$ 2,565 (Thailand) to US\$ 265 (Cambodia)
Uses	Irrigation, fisheries, power generation, transportation, industrial and domestic supply
Primary Legal Agreement	Agreement on the Cooperation for the Sustainable

	Development of the Mekong River Basin, Chiang Rai, Thailand, 5/4/95 - (Thailand, Laos, Cambodia and Vietnam)
Institutional arrangements	Mekong River Commission (Thailand, Laos, Cambodia and Vietnam)

The Tônlé Sap is a shallow lake in western Cambodia which is part of the Mekong River system. It is the largest lake of Southeast Asia and is fed by numerous streams. When the high waters of the Mekong River recede, the flow reverses. This natural mechanism provides a unique and important balance to the Mekong River down stream of the lake and ensures a flow of fresh water during the dry season into the Mekong delta in Vietnam which buffers the intrusion of salt water from the South China Sea into the rich agricultural lands of the delta.

In Thailand for instant, about 4,000 kilometers of inland waterways consisting of the rivers and canals of the central plain and the Chao Phraya Delta formed the backbone of the transportation system. Although in the twentieth century railroads and roads assumed a dominant position in the central plain, waterways still carried a sizable portion of the total traffic. Waterborne freight, chiefly consisting of rice, accounted for about 17 percent of total freight transported countrywide in the 1980s. Large numbers of small craft also transported passengers.



	<b>Myanmar</b>	<b>Thailand</b>	<b>Laos</b>	<b>Cambodia</b>	<b>Vietnam</b>
<b>Area</b>	676,552 sq km (261,218 sq mi).	513,115 sq km (198,115 sq mi)	236,800 sq km (91,400 sq mi)	181,035 sq km (69,898 sq mi)	331,690 sq km (128,066 sq mi)
<b>Average Annual Precipitation</b>	Tenasserim Coast 5,000 mm (200 in) Mandalay 760 mm (about 30 in)	Bangkok 1,400 mm (56 in) Songkhla 2,540 mm (100 in)	1,780 mm (about 70 in)	1,400 mm (about 55 in) central plain 3,800 mm (150 in) in the mountains	Hanoi 1,680 mm (66 in) Ho Chi Minh City 1,980 mm (78 in)
<b>Population</b>	47,305,319 (1998 estimate)	60,037,366 (1998 estimate)	5,260,842 (1998 estimate)	11,339,562 (1998 estimate)	76,236,259 (1998 estimate)
<b>Population Density</b>	70 persons per sq km (181 per sq mi)	117 persons per sq km (303 per sq mi) (1998 estimate)	22 persons per sq km (58 per sq mi)	63 persons per sq km (162 per sq mi)	230 persons per sq km (595 per sq mi) (1998 est.)
<b>Urban/Rural Breakdown</b>	27% Urban 73% Rural (1997 est.)	21% Urban 79% Rural (1997 estimate)	24% Urban 76% Rural (1997 estimate)	20% Urban 80% Rural (Estimate)	20% Urban 80% Rural (1997 est.)
<b>Gross Domestic Product</b>	US\$41.4 bil (1997)	US\$153.9 billion (1997)	US\$1.8 billion (1997)	US\$3 billion (1997)	US\$24.8 bil (1997 est.)
<b>Per capita GDP (per year)</b>	US\$ 875	US\$ 2,565	US\$ 342	US\$ 265	US\$ 326

Source: [http://www.thewaterpage.com/mekong\\_river.htm](http://www.thewaterpage.com/mekong_river.htm)

**Table 5: Indochina Population and economic status**

During the rainy season about 1,600 kilometers of waterways were navigable by barges of up to 80 tons and 1.8-meter draft, which could travel from the Gulf of Thailand to as far north as Uttaradit.

Navigation was reduced to about 1,100 kilometers of waterways in the dry season, and traffic could navigate only to Nakhon Sawan, roughly halfway to Uttaradit. Shallow-draft vessels could navigate the interconnected network of canals throughout the year, and Bangkok, Ayutthaya, and other towns had floating markets where a great deal of trading activity took place. Some sections of the Mekong River were also navigable.

### **5.3 Riverine Transport System in Indonesia**

In Indonesia, with almost 245 million population and a very large geographical area, rivers big and small have always been vital for social and economic development. In Sumatera, Java, Sulawesi, Irian Jaya and Kalimantan alike, there are still some significant river system thriving until at present for these activities. One of the them, Mahakam River still play an important transportation roles for the economic and social well being of the people.

It is located in the east of Kalimantan most popular with major activities of the river tourism movement specially in exploring the tribal culture. The east Kalimantan is nowadays know as the most industrially advanced province of Kalimantan. Its population is less than two million, and the density figure of seven people per kilometre is among the lowest of Indonesia, although relatively high for Kalimantan. More than 80 percent of the area, or over 17 million hectares is covered by forest.

The tremendous outspread of jungles and wilderness, which are so rich in natural resources as timber, gas, oil and coal as well as scenic beauty - are comparable to that of a continent alone. Focal point for most visitors is the mighty Mahakam river, which meanders through thousands of kilometers through one of the worlds largest tropical rainforests, from its head water near the center of the island.

A remarkable varieties of plants and animals life including the famous fresh water dolphins which often accompany boats along the river make a visit to Kalimantan an enthralling venture to a different world. In year to come the Mahakam river trips are most likely to have a more modern outlook with modern crafts and all possible amenities.

Tanjung Puting reserve, 415050 hectares is situated in an ecologically diverse area of wetland, lowlands, swamp and hardwood rain forest. Borneo and Sumatra are the only places left in the world where Orang Utans (the man of the forest) still survive in their natural habitat

Kalimantan is the world's second largest island. The North and North-western part of the island are the East Malaysian state of Serawak and Sabah, with the state of Brunei Darusalam between them. The rest of the island is part of Indonesia, divided into four provinces - East Kalimantan, West Kalimantan, Central Kalimantan and South Kalimantan. Kalimantan is the huge adventure travel destination. It is one the world's third largest island covering the area of 747,000 square kilometer and covered by one of the world's largest stretches of tropical rain forest through which flows tremendous mighty rivers which are the island's highway.



Figure 3: Map of Kalimantan's river networks

## 7.0 Opportunity of IWTS in Future in South East Asia Region

Many waterways worldwide are feasible and there exist a strong commercial cause for their remaining open and subject to further improvement and new development. Where similar conditions exist, in terms of geography, demand and potential development of trade, environmental enhancement, etc., the opportunity for a new development of waterways should be treated considerably than by road or rail

Local planning authorities should encourage the use of water transport by investing in the improvement of the system to provide a more efficient and economic system. In addition, waterways still have an important role far greater than most people can appreciate [45]. At a time of mounting concern for the environment, their potential should be exploited to the full.

In view to the various contribution of the waterways and with the current concern for energy conservation as a stimulus, more and more riverine countries (especially the developing countries) are becoming aware of the potential for the waterways development. The demand for inland water transport has risen steadily and is likely to continue. Many countries considered modern waterways as being a vital instrument for their economic prosperity. The launching of the Transport and Communications Decade for Asia Pacific in 1985-1994 for instance, has accelerated the development of this vision [46].

Whilst inland water transport will never supplant the ubiquitous lorry in terms of speed, efficiency and flexibility, there can be no doubt that the optimisation use of waterway system for the movement of bulk and finished products will benefit both the transport user and public at large financially and economically [2]. The important point is that the promotion of transport infrastructure should be

planned, assessed, and implemented in such a way that each mode of transport is allowed to compete on a merit basis.

## 8.0 Managing IWTS in SEA Countries

Riverine countries in ESCAP region which include Bangladesh, Cambodia, China, India, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, Korea, Papua New Guinea, Myanmar, Mongolia, Laos, Nepal, Indonesia and Malaysia has a potential to generate a combined inland waterways fleet estimated at 329,000 vessels, totaling approximately 33 million tonnes in capacity. This is a result of having almost 276,000 km of navigable length of inland waterways and estimated of 500 million passengers to be moved each year.

Therefore, to manage IWTS in ASEAN region individually and as in group like in Europe, a wide range of activities where a dedicated authorities should be established accordingly in order to plan, implement, manage and control the IWTS at all level of operation namely local, national as well as regional. These authorities is recommended to have some of the following consideration:

- i. A dedicated department under the Ministry of Transport to be set up in all respective countries.
- ii. Management and administration of IWTS will be separated from the deep sea transport entity.
- iii. The authority will involve in planning, development, operation and maintenance of IWTS. Besides, specific authority should focus on research and study to search for the most appropriate measures in waterways management in SEA.
- iv. The authority should also involve in promoting IWTS as one of the alternative mode of transportation and increase the utilization of IWTS for this purpose.
- v. The authority should ensure the sustainability of the IWTS by providing appropriate support including financial assistance where necessary.
- vi. The authority should introduce the local and regional classification of waterways like in Europe and the U.K. (please refer to table 6 and 7) to standardise the operating condition of inland vessels plying on a door to door transport system in member countries.

Table 6: Classification of inland waterway transport (1986)

Class	Vessel type	tonnage (dwt)	length (m)	width (m)	height (m)	draught (m)
I	Spits	300	39.0	5.10	5.00	2.40
II	Kempenaar	600	50.0	6.60	4.20	2.50
Ila	Hagenaar	800	67.0	7.20	6.30	2.55
III	Dortmunder	1,000	67.0	8.20	3.95	2.50
IV	Rhine-Hern	1,350	80.0	9.50	4.40	2.50

Source: Brolsma [5]

Table 7: Waterways classification in UK

Class	Specifications

A	9 .0m plus draught
B	4.5m - 8.9m draught
C	3.0m - 4.4m draught
D	Less than 3m draught, barges 551- 850 tonnes
E	Less than 3m draught, barges 351 - 550 tonnes
F	Less than 3m draught, barges 151 - 350 tonnes
G	Less than 3m draught, barges 51 - 150 tonnes

In summary, these overall objective of managing and creating prospect for capacity building through transfer of technology can be achieved with closely working together as regional partner in ensuring the full potential of IWTS benefits, economically, environmentally as well as social and politics can be a catalyst for growth of prosperity on countries and population of this region. Mutual and cooperative in nature, the following can be considered for the undertakings;

- i. Defining and refining the program for development and modernization of IWTS in this region.
- ii. Assessment of the adequacy of the capacity and services provided by the existing facilities and equipments in the IWTS sector.
- iii. Estimation of the future traffic, in complementary with other mode of transport sectors.
- iv. A review of existing organisational structure to formulate on recommendations on means for improvement in management and operational procedures.
- v. Analysis on the possible alternatives for newly proposed IWTS development, upgradation and improvement schemes in relation to other mode of transport.
- vi. Taking seriously on the environmental impact of the IWT development on short and long term.

## 9.0 Conclusion

In conclusion, the following can be considered as significantly important;

- i. Managing IWTS for transportation is overwhelmingly complicated when involves different authorities and countries.
- ii. Managing IWTS successfully at present must be based on past experience in identification of problems and solution.
- iii. Specific and dedicated riverine authorities must be identified and be responsible for the well being of the IWTS in terms of planning, implementing, managing and maintaining.
- iv. Coordination between member countries in operating IWTS must be given due consideration and an integral part of the overall IWTS system in ASEAN.
- v. The existing of IWTS still needed and economic, hence more development must be in the development agenda of all member countries.
- vi. European and USA experience in terms of classification and management, can be used as a model for IWTS in ASEAN.
- vii. Future prospect of IWTS in ASEAN and particularly in Malaysia is enormous, however, R&D activity in this sector should be made available and be given preferential consideration.
- viii. The existing of IWTS is needed more in future as it is now due to many reasons especially environment.

## 9.0 References

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