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Non-conventional ferry safety and the potentiality of inland waterways for multimodal transportation : a comparative analysis for the betterment of Bangladesh's situation

Quazi Mohammed Habibus Sakalayen
World Maritime University

WORLD MARITIME UNIVERSITY

Malmö, Sweden

NON-CONVENTION FERRY SAFETY AND THE POTENTIALITY OF INLAND WATERWAYS FOR MULTIMODAL TRANSPORTATION: A COMPARATIVE ANALYSIS FOR THE BETTERMENT OF BANGLADESH'S SITUATION

By

QUAZI MOHAMMED HABIBUS SAKALAYEN

Bangladesh

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Quazi Mohammed Habibus Sakalayen)

Date: …….

Supervised by:
Mr. Jan-Åke-Jönsson
Professor, Maritime Safety and Environment Protection
World Maritime University

Internal Assessor:
Mr. Patrick Donner
Associate Professor, Port and Shipping Management
World Maritime University

External Assessor:
Mr. Åke Sjöblom
Chief Surveyor
Swedish Maritime Administration

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Abstract

Title of dissertation: Non-convention ferry safety and the potentiality of inland waterways for multimodal transportation: a comparative analysis for the betterment of Bangladesh's situation.

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This dissertation is a study of the non-convention ferry safety issue and the inland waterways of Bangladesh to identify the needs of technical support for improving the ferry safety through translating the potentiality of the inland waterways as a multimodal element. Ensuring non-convention ferry safety is an important issue for Bangladesh as it is for developing countries like Somalia, Indonesia, Congo and Senegal. Each year hundreds of people die in these nations because of non-convention ferry accidents. In Bangladesh non-convention ferry accident is a regular phenomenon where poor rural people suffer most as it is the only effective transportation system for them. No effectual and sustainable measures have been detected so far in Bangladesh to prevent the non-convention ferry accidents which indicate the lack of expertise, resources and support. This research studies the causes of the ferry accidents in Bangladesh concentrating on the examination of the geographical, regulatory and operating environments of the non-convention vessels in the backdrop of the entire transportation system. It also examines the level of technology and business environment within the non-convention ferry sector and the inland waterways to apprehend the potentiality of the sector.

The research reviews the inland waterways of Europe and their efforts preparing IWT sector as a multimodal element, hence weighing up the potentiality of the inland waterways of Bangladesh. For Bangladesh the inland waterways transport is the sustainable development element as it requires less energy, less space and in near future continuous flow of costly energy is going to be a crucial factor for the country. Finally, the concluding chapters identify the loopholes, propose for the technical assistances and present recommendations to enhance the non-convention ferry safety and materialize the potentiality of the inland waterways of Bangladesh.

Keywords: Non-convention, Ferry safety, Multimodal, Transportation, Inland- waterways, Bangladesh.

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List of Abbreviations

ADP	Annual Development Program
ARC	Accident Research Centre
BIWTA	Bangladesh Inland Water Transport Authority
BIWTC	Bangladesh Inland Water Transport Corporation
BUET	Bangladesh University of Engineering and Technology
DOS	Department of Shipping
NGO	Non-governmental Organization
IMO	International Maritime Organization
SOLAS	International Convention for Safety of Life at Sea, 1974 and its Protocol of 1978
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocol of 1978
GOB	The Government of the People's Republic of Bangladesh
ILLC	International Convention on Load Lines, 1966
COLREG	International Regulations for Preventing Collisions at Sea 1972
EPIRB	Electronic Position-Indicating radio Beacon
GMDSS	Global Maritime Distress and Safety System
STCW	International Conventions on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended in 1995 and 1997
CAAB	Civil Aviation Authority of Bangladesh
CCSS	Code of Safety for Caribbean Cargo Ships
USL	Uniform Shipping Laws Code of Australia
DNV	Det Norske Veritas
MoU	Memorandum of Understanding
HSLC	High Speed Light Craft
PACSCAT	Partial Air Cushion Supported Catamaran
DMP	Decision Making Procedure
DPTC	Deck Personnel Training Centre
STC	Seamen's Training Centre
NMI	National Maritime Institute

Non-convention vessels in the inland waterways of Bangladesh

Chapter 1

Non-Convention Ferry Safety and the Concept of Multimodal Transportation

1.1 Introduction

Safety is always a live issue in the sense that it needs continuous monitoring and improvement. In other words, safety on the whole means the process to care for human lives from accidents or incidents of misfortune and is certainly related with the steps to prevent or reduce mistakes. However, to increase safety is always to be realistic and far-sighted. In Bangladesh non-convention ferries plying the inland waterways have serious safety problems. Each year hundreds of people die because of non-convention ferry accidents. The main objectives of this research are to identify the causes of the non-convention ferry accidents in Bangladesh for finding the loopholes and obstacles and pointing out the areas where technical assistances are required and to evaluate the potentiality of inland waterways as a complementary tool for multimodal transportation in an intention to enhance the overall ferry safety in the inland waterways of Bangladesh.

1.2 Non-convention ferry safety

The non-convention ferry safety problem exists not only in Bangladesh but is hovering over all developing countries. If we look into recent ferry accidents, we will be able to realize the magnitude of the problem. During the first five months of 2006, at least 1400 lives were lost due to ferry accidents. The 'Al Salam Boccaccio 98' (Egyptian Ro-Pax) catastrophe in Feb 2006 cost about 1000 lives. A wooden passenger boat sank off the cost of Cameroon in March 2006 costing 127 lives. In the month of April 2006, the 'Al Dana' incident near Bahrain cost 58 lives, the 'Al Baraka no. 2' sank near Djibouti costing 73 lives, the 'Born Again 604' capsized in

Ghana costing 120 lives and the 'Alexandros T' incident near South Africa in May 2006 cost 26 crew members. Out of these six accidents five disasters took place very near to the coast or in internal waters and four of them concerned non-convention vessels (Mitropoulos, 2006 May 6). In recent years, hundreds of people have died in developing nations like Bangladesh, Somalia, Indonesia, Congo and Senegal; it being regular phenomenon in these countries. This is depicted in Table 1 and the statistics are based only on the recovered bodies let alone the missing bodies. A lack of specific documentation is a hindrance in knowing the exact number of fatalities (Lawson *et al*, 2005, pp.18-19).

With this picture in mind, the safety of non-convention vessels is not an ignorable issue in this modern world even for IMO, which is not directly involved with this type of vessels. Non-convention vessels usually ply in the inland waterways of different countries where the inland waterway is an important mode of transportation. As the world is becoming more and more globalized, the demand for a safer and better infrastructure of every mode of transportation is inevitable, which the inland waterways can offer very easily. In other words, the necessity of the multimodal transportation system is unavoidable for a country to exist in the global economy where inland waterways can play a vital role.

1.3 Concept of multimodal transport

Transportation by more than one mode of carrier during a single journey where all parts of transportation including the exchange of information are efficiently connected and coordinated is known as multimodal transportation. Multimodalism, the synonymous use of Intermodalism in Europe is, according to Long (2003), "a shipment that uses different and coordinated modes of transportation" (p.125). It is a process involving smooth, seamless, continuous, reliable, flexible and logical linkages for systematic approach to business which eventually integrates the supply chain. Customer satisfaction is at the core of multimodal transportation (Muller, 1999, p.1). It is the dependency of one mode of transportation on another facilitated by the smooth transitional processes for a logical and timely transportation of freight.

Multimodal transportation has eventually made the door-to-door service easy and smooth. The invention of the container has revolutionized the idea of multimodal transportation. Nowadays, a great number of multimodal activities are the common picture at a port i.e. at the land-water boundary. Multimodal activities such as truck-to-rail, truck-to-air are also popular in the transportation sector. In some geographical areas such as in Germany, Netherlands, USA, Canada and China, coastal and inland waterways are widely used for transportation. Inland waterways can contribute firmly towards the further development of multimodal transportation.

The lack of flexibility and relatively low speed are the only limitations of inland waterways which have to be overcome. Investments in inland waterways not only flourish multimodality, but will develop an environment-friendly transportation system, reduce congestion on the land-based transport system and eventually help establish safety in the inland waterways, which is usually a neglected sector. An emphasis on inland waterways would be a positive step for a populous and space scarce country like Bangladesh, for the development of multimodal transportation and ensuring the safety of the vessels.

1.4 Problems

In Bangladesh, non-convention ferry accidents cause hundreds of fatalities each year. But ferry transport is significant because rural people use it effectively and the ferry system is more environmentally friendly and sustainable, needs less capital investment for expansion and improvement and has numerous values for economic growth (Lawson *et al*, 2005, pp.19-20). So, when accidents take place rural poor people become the first victims. Beside this, the same types of accidents take place again and again causing the deaths of hundreds of valuable lives, but no preventive measure has been detected so far. Rather, it seems that the non-convention ferry sector has fallen into a vicious circle.

Mostly sub-standard vessels are engaged in the private sector providing ferry/launch services. These private operators run syndicated businesses. They are so influential that they limit new operators joining this business and intimidate the service offered by BIWTC (Bangladesh Inland Waterways Transport Corporation),

which operates very limited safe passenger and cargo transport services. The improvement of the entire business environment of the non-convention ferry sector of Bangladesh, including the technical level of design scrutiny, construction supervision, methodology of survey, judgements of the technical fitness of the vessel are the big challenges to overcome**.**

Road construction in Bangladesh is such a popular agenda item for politicians that this has reached nearly to a saturated level. Sometimes roads are constructed by filling up waterways when they become dry during winter. Rural roads are constructed without proper planning resulting in water logging during the monsoon. Considering Bangladesh as a growing economy, her transport system, particularly the multimodal transportation probability, has not been focused upon where inland waterways and railways can play a vital role. The potentiality of the inland waterways of Bangladesh as a multimodal element has not been researched extensively. Since Bangladesh is a country where rivers are spread like a fishing net, the multimodal opportunity cannot be materialised without involving inland waterways. How the supply chain, including the transportation system, can be made consistent is still an unanswered low priority question.

In general, the problems of ferry safety can be better understood when the questions to be asked regard bodies that organize, make the policies, formulate and enforce regulations. Questions to be answered are on the level of use of technology, how are the standards and procedures of inspection, training, certification, search and rescue system, reporting and analysis system and the involvement of public and private sectors for a continuous improvement of the efforts (Lawson *et al*, 2005, p.21). The bottlenecks adjacent to the potentiality of inland waterways in Bangladesh as a multimodal element are not known. What steps should be taken, and what are the responsibilities of various quarters for promoting multimodal transport towards the integration and consolidation of supply chain, are not clear. Searching for the answers to these questions could be a positive step forward in addressing the problem.

1.5 Objectives

Transportation is at the core of economic development for a country. For Bangladesh the ferry system is the major constituent of the transportation systems. For this reason, a lack of safety in the ferry system of Bangladesh will be economically devastating. A safe and reliable ferry system is also crucial and evident to the nation's sustainable future. Despite the fact that ferries also produce emissions, they have a lower environmental impact than other forms of transportation (Lawson *et al*, 2005, p.20). So, understanding the ferry safety issues of Bangladesh is obviously significant for the country. The majority of the rural people of Bangladesh will benefit from the growth and improvement of a safe ferry sector, which in turn will have a direct and positive impact on the economy. One of the objectives of this study is to put the existing scenario of the non-convention ferry safety and the potentiality of inland waterways of Bangladesh on the table, so that the preliminary task of finding a model for the development of the entire sector can be established.

The nature and causes of ferry accidents in Bangladesh are multifarious and complex. Statistics regarding accidents are not authenticated and well preserved. It is essential to find the loopholes and obstacles against the documentation process. Good statistics will eventually help find the root causes and will create a basic platform for further meaningful study of the sector. This study undertakes to examine the loopholes in the documentation system and to identify the causes of ferry accidents in Bangladesh.

Each system has its own rules, regulations and policy direction that may be either good or bad but these usually generate over a long period of time. It is always worthwhile to know the prevailing regulatory and strategic standpoint of a system before devising a new or way out dimension. One of the objectives of this study is to examine the existing rules and regulations and government policy for the ferry sector in Bangladesh.

It is always beneficial to look for others' experience with an open mind for absorbing better ideas and eliminating the wrong one with an intention to recommend a

suitable process. This study takes the opportunity to compare ferry safety and the multimodal potentiality of the inland waterways of Bangladesh with those of other countries in the world and analyze the needs of technical assistance for the sector. The creation of investment opportunities for inland waterways could be a positive step to increase safety. The potentiality of inland waterways for multimodal transportation can be utilized for this purpose.

Finally, this study intends to make proposals and recommendations to improve the ferry safety of Bangladesh and to utilize the inland waterways optimally for the development of multimodal transportation.

1.6 Methodology

In order to achieve the above-mentioned objectives, a literature review, the collection and examination of data, interviews with the relevant persons, and analyses of the issues have been conducted.

Non-convention ferries in Bangladesh are used mainly for passenger transportation and for some cargo transportation. Locally this type of ferry is known as a 'launch'. For this reason, sometimes the term 'launch' has been used to mean 'non-convention ferry' in this study.

When the safety of a system or process is in question, at that time statistics always help reveal the truth and find the loopholes so that corrective measures can be taken for a sustainable system or process. In the same way, the deteriorated scenario of the non-convention ferry safety in Bangladesh is well understood through statistics. Statistics of non-convention ferry accidents in the inland waterways of Bangladesh have been collected from two different sources. Statistics from the Department of Shipping (DOS), Bangladesh and Accident Research Centre of the Bangladesh University of Engineering and Technology (BUET) have been used in this study.

Besides these, other main sources of information such as the conference proceedings, seminar papers, the staff appraisal report of the World Bank, safety

regulations for non-convention vessels for various parts of the world developed by IMO, shipping policy and inland shipping ordinance of Bangladesh, the media, especially newspapers, research reports of professionals, web-based documents and library-based books, magazines, journals, articles and previous dissertations have all served as vital sources of information. Various transport documents of the European Union and casualty investigation reports and procedures have provided an opportunity to depict a comparative picture.

It is worthwhile mentioning here that recently IMO, in co-operation with Interferry, finalized a program to reduce the ferry casualties in the developing world with a special focus on Bangladesh. Important information from IMO and Interferry helped to enrich this study. It is remarkable to note here that a consultation with the head of the technical division, Asia and Pacific section of IMO's Technical Co-operation Division, a key person to the IMO-Interferry program, was very stimulating and informative.

Documents of some European countries and their ongoing efforts are helpful to understand the strengths, weaknesses, opportunities and threats of the inland waterways of Bangladesh as a multimodal tool, and to present a comparative picture.

1.7 Structure of the dissertation

Depending on the strategies and tools mentioned above, the entire dissertation has been pursued in the following chapters:

As already illustrated, Chapter I presents the issue of non-convention ferry safety in Bangladesh. The basic concept of multimodal transportation, the problems, objectives and methodology of the study are also described in this chapter.

Chapter II describes the geography, the economy, the river system, and the transportation system of Bangladesh emphasising on the inland waterways. It also depicts the accident scenario of other modes of transportation and the trend of the resource allocation in the transportation sector.

Chapter III, one of the core chapters, deals with the nature and causes of ferry accidents in Bangladesh. It analyses the issue statistically and theoretically and describes the role of different quarters in this issue.

Chapter IV looks into the ferry accidents in other countries and evaluates the safety codes for non-convention vessels for various parts of the world developed by IMO. It also highlights the legislative framework, existing facilities, policies and strategies of the Bangladesh government on the relevant issues and identifies the need for reform and the necessity of technical support.

Chapter V pictures the inland waterways of Europe and their ongoing efforts on the inland waterways. It evaluates the significance of the inland waterways of Bangladesh in the backdrop of the European scenario.

Chapter VI appraises the inland waterways of Bangladesh as a complementary tool for the development of Multimodal transportation in Bangladesh and relates the non-convention ferry safety with the potentiality of inland waterways as a multimodal element.

Chapter VII, the concluding chapter, presents the recommendations for improvement of the non-convention ferry safety and the inland waterways of Bangladesh.

Chapter 2

Bangladesh and Its Transport System

2.1 Bangladesh and Its Geography

Bangladesh is a low-lying, riverine, South-Asian country where rivers criss-cross each other like cobwebs. It is a broad deltaic plain subject to frequent flooding and there is a small hilly region crossed by swiftly flowing rivers. The geographic coordinates of Bangladesh are 24° North and 90° east. It has a land boundary of 193 km with Myanmar in the south-east, 4053 km with India all around except in the south (U.S-C.I.A., 2006 June). The Bay of Bengal is in the south. Bangladesh has a coastline of 710 kilometers (440 miles) along the northern littoral of the Bay of Bengal. A large portion of the coastline is marshy jungle. The area of the country is 144,000 square kilometers formed by a deltaic plain at the confluence of the Ganges (Padma), Brahmaputra (Jamuna), and Meghna Rivers and their tributaries. Out of this 144,000 square kilometers of area about 10,000 square kilometers is covered with water. Bangladesh extends about 820 km from north to south and about 600 km from east to west (US Library of Congress, 2003-2005).

The tropical monsoon with wide seasonal variations in rainfall is the main characteristic of the climate of Bangladesh. Mild winters exist from October to March, hot and humid summer stay from March to June and the humid, rainy monsoon prevails from June to October. A large area is flooded regularly during the monsoon. Every year natural calamities cause lot of damage in Bangladesh where floods, tropical cyclones, tornadoes are regular phenomena. The destructive tidal bores caused by flood tides hit the country in the coastal belt and destroy people and their property (US Library of Congress, 2003-2005). Beside normal monsoon rainfall, devastating cyclones originate over the Bay of Bengal in the period April to May and September to November (Geocities, 1997 January).

The interweaving existence of land and rivers is the remarkable feature of the landscape in Bangladesh. The same river has different names in different places during its course of flow (Geocities, 1997 January). Mostly Bangladesh has plain land and the deposit of rich silt during flooding recharges the fertility of the land. Excess monsoon rainfall is carried to the Bay of Bengal by the rivers. So, rivers are the source of communication and resources but also cause hazards.

2.2 River System of Bangladesh

The rivers of Bangladesh can be divided into five major networks. The first network is Jamuna-Brahmaputra, which is 292 kilometers long and extends from northern Bangladesh to its confluence with the Padma. The Brahmaputra originates in China (Tibet), flows through Arunachal state of India and enters into Bangladesh from the north. In Bangladesh it meets with the river Tista and takes a new name Jamuna and flows up to the Manikgang district where it meets with the river Padma. The second network is the Padma-Ganges which is about 354 km long and extends from the western border with India to its confluence with the Jamuna at Manikgang, having the same name Padma further flowing up to Chandpur where it joins with the river Meghna and takes the name Meghna (US Library of Congress, 2003-2005).

The Surma-Meghna system is the third network, which is about 669 km long and is formed by the union of six small rivers. This system extends from the north-eastern border with India to Chandpur where it meets with Padma. Here it forms another network, the fourth one, namely the Padma-Meghna which flows about 145 km and enters into the Bay of Bengal having the same name Meghna. The fifth river network which is not connected to other networks is known as the Karnaphuli. The Karnaphuli flows through Chittagong district and Chittagong hill district and enters into the Bay of Bengal (US Library of Congress, 2003-2005). These river networks and their tributaries are spread over Bangladesh like a fishing net (Appendix-C).

2.3 Economy of Bangladesh

The economy of Bangladesh is mostly agricultural oriented. Nearly two-thirds of the workforces are employed in the agriculture sector where rice is the single-most-important product, with a weak but potential industrial base. Cheap unskilled labour is plentiful in this overpopulated country. Recently the garments industry of Bangladesh has achieved tremendous growth. The infrastructure of transportation, communication and power supply are improving very slowly. Bangladesh has moderate reserves of natural gas and limited reserves of coal. A big trade imbalance is the weak point of the economy of Bangladesh (Table 2). As export is not possible without import (Kleist, 1986, p.185) in this globalized world, Bangladesh is heavily dependent on import of machinery, technology and in some cases raw materials.

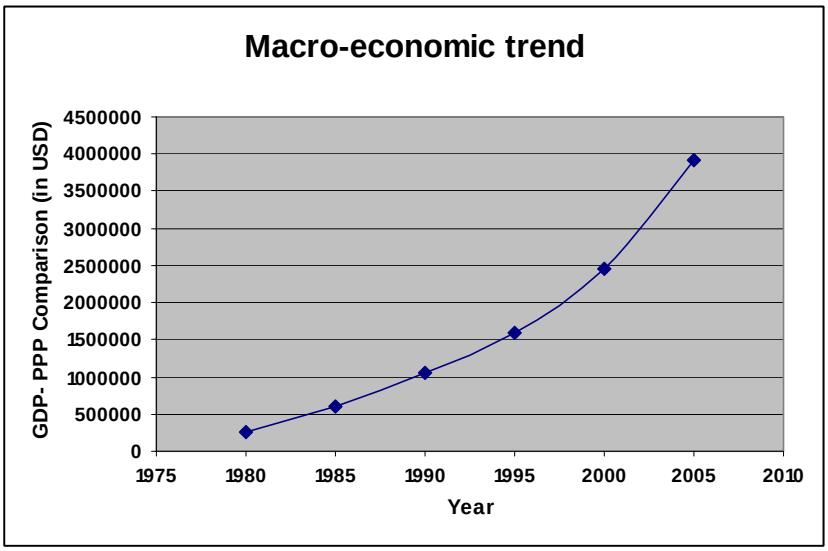

Figure 1: Macro-economic trend of Bangladesh
(*Data Source*: Adapted from Wikipedia, 2006 July)

In recent past, the service sector generated nearly half of the GDP. That is why employment generation is not getting that much momentum. Besides corruption and political unrest, major hurdles to development include incompetent state-owned enterprises, inadequate port facilities, a rapidly growing labor force which cannot be absorbed by agriculture, delays in exploiting energy resources (natural gas), deficiency in power supply, slow achievement in economic reforms, frequent natural

calamities such as cyclones and floods and hesitancy in taking important decisions such as approval of foreign investment projects.

2.4 Transportation System

The main transportation system of the country consists of networks of about 8300 km of waterways, 239226 km of roads, and 2706 km of railways (Appendix D). The rivers of Bangladesh create the skeleton of the country and influence other modes of transport. Most of the rivers, about 700 in number, of the country flow from north to south. Each year during monsoon, the rivers flow at an average speed of about 140,000 cubic meters per second, but during the dry period the rate diminishes to about 7,000 cubic meters per second (US Library of Congress, 2003-2005). Each mode of transportation is discussed below:

2.4.1 Seaports

Bangladesh has two seaports– 'Chittagong port', the main port or gateway to the country, is situated on the bank of the river Karnaphuli, nine nautical miles upstream from the shore lines of the Bay of Bengal and the 'Mongla port', which is situated at the confluence of the river Pussur and Mongla Nala in the south-western part of Bangladesh. Inland river ports and ghats (wharfs) also serve as the feeder ports to the two seaports of the country (Dewan, M.Z.I., 1995, pp.31-32).

Chittagong, the major sea port and essential node of the transport and logistic chain of Bangladesh, handles 80% of trade and connects Bangladesh with most of the business world. Although container handling business in Chittagong port is growing at an average rate of 15% annually (Domus, 2005, pp.28-29); it also handles a large volume bulk cargo (Table 3).

Mongla port has a good opportunity to serve south-western part of the country and north-eastern part of India. It handles about 12% of the seaborne trade of the country. Despite good road communication, the lack of maintenance dredging at channel (Domus, 2005, pp.30), slow industrialization rate in southern region and the lack of a bridge over Rupsa river hinders the proper utilization of Mongla port.

2.4.2 Air Transport

Out of 16 operational airports in Bangladesh 3 of them are international airports situated in Dhaka, Chittagong, and Sylhet districts. All airports of the country are looked after by the government entity the Civil Aviation Authority of Bangladesh (CAAB), except some minor ground facility is in the private sector. Biman, the state owned Bangladesh Airlines, has the monopoly to operate the freighter service, but its service is not standard and customer focused. For example, Biman charges $ 5600 for ground handling of a cargo aircraft but the charge for the same job in Dubai, Bangkok, and Kolkata are $1000, $1200 and $ 4000 respectively. The CAAB also charges higher for the landing, parking and navigational support compared to other regional airports. For example, the landing charge set by CAAB for a 55-tonne capacity cargo plane is $ 2332, but in Dubai, Bangkok, Karachi, and Kolkata the charges are $ 295, $ 312, $ 1450 and $ 1220 respectively. Public and private sector airlines both operate in domestic routes (Domus, 2005, p.31).

2.4.3 Inland Transport

2.4.3.1 Roads and Highways

Road transport is the dominant mode of inland transport carrying 65% of freight and 70% of passengers. About 15% of the total 239226 km road is a national highway and 8% is regional highways and the remaining is the feeder roads. Besides these, about 16000 km of rural road is maintained by local government out of which 8546 km is paved road (Domas, 2005, p.33). The overall strength of roads in Bangladesh is not up to the standard. This is a big obstacle to join in Asian highway project. On the other hand, only 49% of sub district roads are all weather standard. Rural roads are still insufficient to provide support to the rural economy and demands more investment.

2.4.3.2 Railways

A populated country like Bangladesh needs a Mass Rapid Transit (MRT) system and Bangladesh railway has the potentiality to meet that need. But the modal share

of railway is decreasing day by day because of its poor service, inadequate infrastructure and inefficient management.

The rail system is principally divided into broad gauge in western part and meter gauge in the eastern part; this division is another major drawback of the state owned Bangladesh railway. Out of 2706 km of railways about 900 km is broad gauge and rest is the meter gauge; in some places dual gauge is in use. Parbatipur, the place through which both gauges system pass, is the major railway station situated in the northern district of Dinajpur. The ferry operated by railway is the connector between eastern and western parts of the railway. The railway service covers only 32% area of Bangladesh (Fida, 2003 July) and can easily be expandable.

The congestion of two major catchments areas- Dhaka and Chittagong could also be solved for long term by constructing elevated mass rail transit system (EMRTS) (Khan, 2003 August). At present, a day-to-day service with India and occasionally service with Nepal via India are being provided by Bangladesh railway.

2.4.3.3 Inland Waterways and river ports

Bangladesh, the world's largest delta, is situated at the peak of the Bay of Bengal. Nearly 7% of its surface is covered by a total of about 24000 km long inland waterways. The navigable waterways vary from 8300 km during the monsoon to 5200 km (Alam, 2005, pp.1-3) during the dry season. Inland waterway transport is a popular and common mode of transport providing low-cost service and access to areas where land transport would be costly and in some cases time consuming. The Government has classified about 5968 km of waterways as navigable inland waterway routes (Table 5).

The central problems of Inland Waterway Transport (IWT) are continuous siltation or navigability crisis, management of IWT sector and safety issues; to address these problems both public and private investments are essential, but in the public sector only 1-4% of the transport sector budget is provided to IWT sector (Domus, 2005, pp.34-35).

The country boats can easily ply through the rest of the unclassified inland waterways. According to Alam (2005), about 0.2 million passengers and 0.55 million tons cargo are carried through the inland waterways network. The number of registered passenger vessels and cargo vessels are 1868 and 2160 respectively (p.4). Unregistered country boat is regarded as the informal sector. A significant number of country boats are mechanized, mostly with the low-cost shallow pump engines[1]. The number of country boats is about 745000 and 65% of them cater for the passenger service. Country boats carry nearly one million tons of cargo, which is approximately double the present carrying capacity of the formal sector (Alam, 2005, p.4).

From the commercial point of view, navigable rivers are one of the most important elements of the economy as it directly provides dynamism to the rural economy. Rivers have also influenced the location of the cities, as is the case for many cities of the world. Most of the major cities / towns and commercial centers in Bangladesh are located on the banks of rivers. The other transportation systems have been developed maintaining a relatively consistent connection with the inland waterways.

Country's 19 main inland river ports play a vital role particularly connecting some remote areas of Bangladesh. A significant percentage of passengers, domestic and foreign cargo traffic are transported by waterways (European Commission, 2001 August). Table 6 shows the modal shares of the passenger and freight transport in Bangladesh. Modal share of both passenger and freight transportation is dominated by road transport.

Water transport is the only means available to the poor people living in the coastal area of Bangladesh. Road infrastructure is not sustainable in the coastal areas as erosion and accretion are common phenomena there. As a result people depend on the water transport no matter whether it is safe or not. Beside this, water transport becomes the only solution during the annual floods, cyclones and natural calamities to distribute relief materials and to continue rescue programs (Alam, 2005, p.6). The

[1] Shallow pump engines are usually used for irrigation , but sometimes they are installed with the country boats to ply in the inland waterways

services in the coastal areas are mainly Government provided socially justifiable passenger services for the poor people. A small number of old vessels are used for providing this service. Very little cargo is carried by the mechanized vessels because of the lack of shore facilities in the islands; smaller country boats are used to provide cargo services instead of mechanized vessels (The World Bank, 1991, pp.50-51).

2.5 Accidents in different modes of transportation

Transport accidents are always shocking and sudden and take away lots of lives. In Bangladesh among all modes of transportation road accidents are more frequent than inland water transport (IWT) accidents. As the number of road accident each year remains highest, it causes more death also. Table 7 shows the number of road accidents and fatalities in the year 1993 to 2000.

Although the number of accidents in the inland waterways remains less, each year hundreds of lives are lost in these accidents. In other words, usually one accident in inland waterways causes more death than a road accident and mostly poor people suffer in the inland waterways accidents. Figure 2 shows increasing IWT accident trends in Bangladesh.

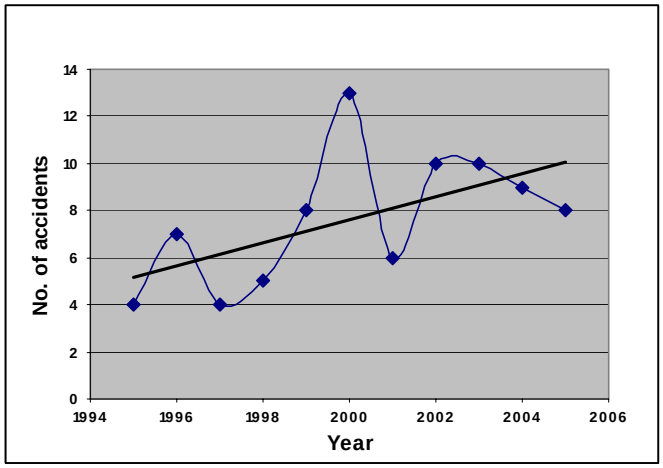

Figure 2: IWT accident trend in Bangladesh
(*Data source*: Ali, 2006)

In case of rail transportation, although the number of accidents is great, the number of casualties is less. For example, in 2011 train accidents about 59 people were killed in between 2002 and 2005 ("1670 acres rail land…", 2005 August). Accident in air transportation in Bangladesh is very rare.

2.6 Resource allocation for IWT

The IWT sub-sector is a small receptor of the total Annual Development Program (ADP). Figure 3 / Table 8 shows the trend of resource allocation for IWT sub-sector.

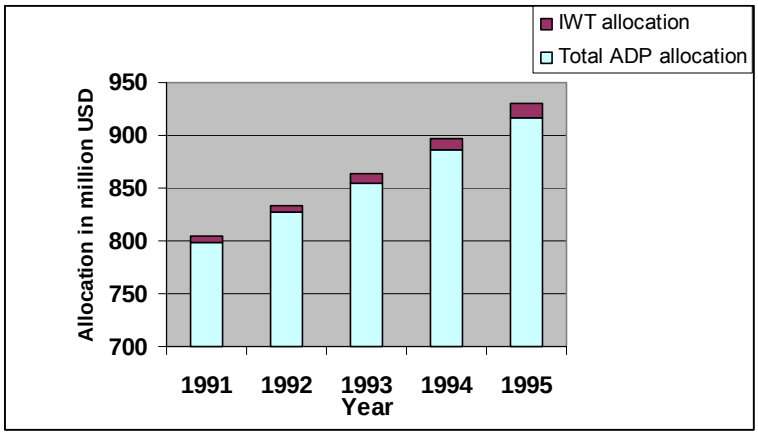

Figure 3: The trend of IWT allocation in Annual Development Program
(*Data source*: The World Bank, 1991)

The allocation in the ADP for IWT remains fairly steady between 0.7 to 1.4% of the total ADP (The World Bank, 1991, pp.8-9). The IWT sub-sector does not have the capability of properly utilizing more allocation of the ADP.

Chapter 3

Non-convention Ferry Accidents in Bangladesh

3.1 Nature of ferry accidents

The primary reasons or the first hand causes of the non-convention ferry accidents in Bangladesh are: bad weather, faulty construction of the vessels, faulty loading and inefficient crews. The loss of lives in every accident can be enormous. When an accident happens usually a single reason is focused upon, however, in most cases the situation is more complex. Several reasons together contribute to the accidents. According to the Accident Research Centre of the Bangladesh University of Engineering & Technology, Dhaka, five main factors, as shown in Table 9, are behind these accidents.

The rescue procedures and equipment are also obsolete. When ferries capsize the government tries to remove the wrecks with the help of BIWTA and Bangladesh Navy rescue vessels. In some cases they succeed, but most of the time the efforts fall in vain either because of the lack of technology and undercapacity of the rescue vessels or, because of the high siltation rate and current, the rescue team can not trace the wreck. The number of missing persons also remains high in most cases. Statistics of the missing and dead always remain unclear. A large gap in the number is always noticed among the statistics of government agencies and media for the same accident.

3.2 Statistical analysis of the accidents occurring

Although there is a discrepancy in ferry accident statistics, this can be overcome by analyzing statistics from different sources. The checking and crosschecking of statistics from different relevant sources always provides a realistic and analytical approach to the problems. One main source of data for this research is from the Department of Shipping (DOS), Bangladesh. This is the organization that looks

after most of the technical and administrative sides of the IWT sub-sector such as surveys, training, registration, certification and investigation. A recent investigation report into 84 ferry accidents of the Department of Shipping (DOS), Bangladesh provides the primary source of statistics. The Accident Research Centre (ARC) of the Bangladesh University of Engineering and Technology (BUET) is an authentic institute devoted to the relevant field. Their research papers provide a secondary source of valuable information. Tables 10-11 depict the analysis of DOS statistics and Tables 12-13 illustrate the consolidation of ferry accident statistics of the Accident Research Centre.

An analysis of DOS statistics (collected from investigation reports) reveals that collisions and the human element are the main causes of accidents. Most of the accidents occur in between 06:00-17:59 hours. It is worthwhile to mention here that the daylight in Bangladesh starts to shrink at about 19:00 hrs in summer and at about 17:00 hrs in winter time. Rough weather and overloading as a cause of an accident comes next. Most of the accidents occur between January and May which partially includes winter (Jan-March, foggy weather conditions) and summer (April-May, stormy weather conditions). This reveals that lack of navigational equipment, stability problems with the vessel and unskilled shipboard manpower were general problems. The south, southeast, and middle areas of Bangladesh are the most accident-prone.

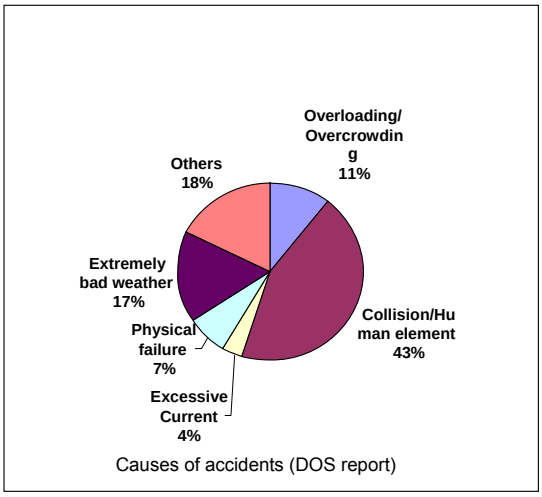

Figure 4: Causes of accident (DOS report) (*Data source*: Adapted fromAli, 2006)

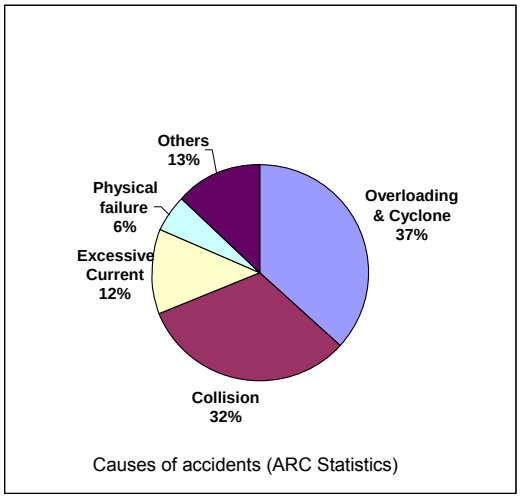

Figure 5: Causes of accident(ARC Statistics) (*Data source*: Adapted from Awal, 2006)

However, the statistics of ARC present overloading and cyclone as the main cause of accidents. Most of the accidents occur in stormy weather between 12:00- 23:59 hours, which is consistent with the main cause of accidents coming out of these statistics but different from the DOS statistics. This difference tells us that there are several reasons which together create a complex situation resulting in the accidents. Most of the accidents, according to ARC, occur between March-July, which mainly includes stormy weather conditions.

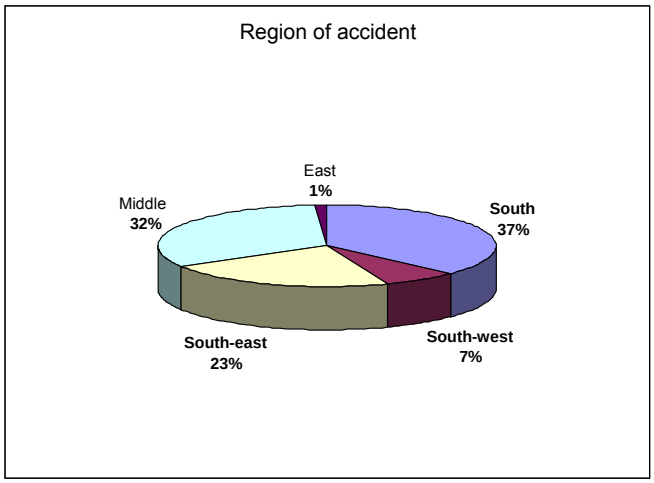

Figure 6: Regions of accident (DOS report)
(*Data source*: Adapted from Ali, 2006)

In both analyses the frequency of accidents because of physical failure is comparatively low. This indicates that the designs of non-convention vessels seem apparently correct for calm weather but they become explicitly dangerous for slightly rough weather, i.e. an unacceptable design. It is also true that there is no opportunity in the country to examine the stability of the design. Besides this, because of malpractice (change of super structure after survey) these vessels lose stability.

3.3 Causes of accidents: a theoretical perspective

The poor maritime administration and monitoring system, faulty design in the construction of vessels, inadequate regulations and enforcement, poor manpower and training systems, absence of proper funding and insurance, business policies, less political commitment, and poor waterways and infrastructure are the root

causes of these accidents. They are so deep that this sector needs urgent technical support to address the issues. These root causes are discussed below.

3.3.1 Poor maritime administration and monitoring system

Safety and order in a sector is obviously dependent on good administration and a monitoring system. In Bangladesh the Ministry of Shipping governs maritime administration. Under the control of the Ministry of Shipping there are mainly eight agencies among which the DOS (Department of Shipping) and BIWTA (Bangladesh Inland Water Transport Authority) look after the issues regarding inland waterways and the safety aspects. Another agency BIWTC (Bangladesh Inland Water Transport Corporation) is engaged in catering for passengers and cargo transportation services with a very small number of fleets.

However, BIWTA approves the design of construction of a vessel in the beginning. But it does not have adequate equipment and technology to cater for this service; only a small unit of naval architects looking after this job. BIWTA is also responsible for maintaining the navigability of the inland waterways through maintenance and development dredging and providing the landing facilities throughout the inland waterways and maintaining some river ports (The World Bank, 1991, pp.18-19).

BIWTA looks after about 19 river ports, 5 ferry ghats (wharf) where convention and non-convention ferries can access services and about 292 launch ghats where non-convention ferries or launches provide landing facilities. Non-convention launches or ferry ghats are constructed by using pontoons; these pontoons are connected to the shore by the wooden jetties and gangways. They are used for berthing the vessels, loading and unloading of cargo and the embarkation and disembarkation of passengers. BIWTA operates some of the launch ghats while others are operated by private operators (Alam, 2005, p.3).

The Government cannot provide enough funds for dredging. Whatever the fund, BIWTA cannot utilize it properly because of a lack of dredgers and a large amount of dishonesty in the dredging process. In fact, there is no transparent process for monitoring dredging. Besides these the nature of the river, floods and erosion

process compels the authorities to shift pontoons and ghats frequently. This entire situation makes the inland waterways vulnerable for ferries or launches to ply through these channels.

The Department of Shipping (DOS), on the other hand, does the survey and registration. The shortage of manpower, surveyors and technical hands, and inadequate infrastructure are the principal problems of this agency. The number of surveyors is so small that the survey of more than 5000 registered vessels is quite impossible for them. A lack of logistical support is one of the hindrances in performing the work of the surveyor. For example, a thickness gauge to measure hull plate thickness is a rare instrument (Rahim *et al*, 2002, pp.9-10).

In between the approval of the design and plan of construction by BIWTA and the survey and registration by DOS, there is an important stage of supervision of new construction. There is no authority to perform this duty. Sometimes surveyors are employed to do the job, but it is clear that they are heavily assigned with their original task of annual surveying. At the same time this employment brings up the question of conflict of interest because the same surveyor may survey the vessel after construction for its registration. The Ministry of Shipping has taken a step to create the ground for forming a local classification society, but this step still faces many hurdles from some particular evil quarters of professionals, ferry owners, and politicians. The department does not have sufficient skill and efficiency to investigate an accident scientifically. Nothing is learnt or changed after an accident or after submitting an investigation report, whatever the quality of the report.

Another problem that is eminent in DOS is the dominance of marine engineers and master mariners in the survey process instead of naval architects. The root of this issue has been planted in the recruiting process of the surveyors and prevails in every function of the department. There is a small marine court within the structure of the department, but the function of this court is also very slow because of the lack of magistrates and inadequate logistics. Sometimes the function of this court is influenced by political power or by corrupted quarters.

3.3.2 Faulty design and construction of vessels

Design and construction are at the root of ensuring safety. In almost every ferry accident faulty construction is the main or secondary cause. The form of the hull, structure, propulsion systems and different kinds of stability are the vital points when one considers design.

Some professionals put forward the idea that little modifications in the criteria developed by IMO for SOLAS ship would be suitable for ferries in the inland waterways of Bangladesh (Rahim *et al*, 2002, pp.6-8). The idea of professionals modifying certain criteria of IMO seems to be intended to reduce the construction cost which, in fact, leads to sub-standard vessels. Another impression is that the construction of SOLAS ship will increase the fares a lot, which the poor passengers will not be able to bear if owners build vessels considering sea-going criteria. However, this is also not true when we compare the situation with other modes of transportation. The fact is that the economic conditions of the people of the southern part of Bangladesh are better than in other regions of Bangladesh. Another fact is that the lack of industry in the villages and opportunity for work, people from the villages come to the cities to work and they use buses, trucks or trains to travel to and from. For these modes of transportation they pay more than in the inland waterways**.**

Also the standard of vessel construction industry or dockyards has never been checked. The standardization of construction facilities is an essential factor which can be done by introducing the certification provision for shipbuilders and shipbuilding manpower.

However, the idea of modifications of criteria developed by IMO is not that suitable and appropriate for Bangladesh because the nature of the rivers where most of the accidents occur are very violent. In the south, south-west and south-east areas the river currents are heavy and easily comparable to a sea environment. One of the main causes of accidents is rough weather. A vessel in such rough weather is effectively at sea. Bangladesh needs special type of vessels for its inland waterways which will be discussed in chapter 5.

Most of the ferries carry passengers and cargo in the holds. It has been observed that when an accident occurs the vessel sinks within a minute or two. Lots of passengers on the upper deck or overcrowding reduce the meta-centric height which puts the vessel in a risky situation (Rahim *et al*, 2002, p.7). It has been observed that cargo is not stowed in a professional manner, thus creating an instable situation. Even dropping cargo in the hold sometimes may cause serious leakage or rupture of the hull. When the vessel falls in bad weather this situation increases the risk.

The gearbox design is another vital issue. Almost all ferries use the obsolete manually-powered steering gear box and single plate rudder. These are inefficient and ineffective in bad weather. The hatch covers of the holds are sometimes found not to be watertight. There is no instrument for the surveyor to test the hull quality or even the hull plate thickness. A degraded hull plate during construction shortens the life-span of the vessel and makes the whole structure weak.

The attitude of ship owners to get a better design and construct a standard ship has to be injected through stringent policy implementation and by establishing a corruption-free administration. Establishing an accountable classification society should institutionalize supervisory tasks during construction.

3.3.3 Inadequate regulations and enforcement

Investigation reveals that most of the time overloading, faulty loading and overcrowding are the primary reasons for accidents or launch disasters occurring. This indicates a serious lapse in the implementation of the existing regulations. Although the Government has deregulated the fixation of freight rates in 1991 for fair competition (Alam, 2005, p.5), the ship-owners are misusing this opportunity by doing business forming types of syndicates and offering very low passenger fares (in some case 70% less). This low fare is sufficient enough to attract people who are willing to risk their lives. Adequate regulations and their proper enforceability will uproot this vicious syndicated business. It is better in the existing situation if the government fixes the fare for different routes and analyses the operating cost of the ferry service (Rahim *et al*, 2002, pp.5-6).

The launch owners go on strikes frequently when the authorities try to enforce regulations stringently. Since there is a very small public sector operated ferry service (operated by BIWTC) on very limited routes, the launch owners use this situation and take hostage the whole ferry sector and the passengers to press their illegal demands. This type of syndicated action of launch owners should be restricted through adequate regulation and strict enforcement.

Sometimes vessels are forced to leave the port when they are filled with a sufficient number of passengers and sufficient cargo, but the ship-operators, or in other words the ship-owners, take passengers and cargo in the middle of the channel. Some country boats assists in this case. These country boats carry passengers and cargo and place the boats beside the vessels in the middle of the channel. After shifting the passengers and cargo to the vessel for a long journey, the country boats leave the place. This points out that there is no river police to monitor these issues.

Throughout the year the demand of ferry services remains the same except during some festivals. Weekends also have some increased passenger intensity. Considering all these situations, and analysing the demand route, permits can be issued accordingly.

The enforcement mechanism of the existing regulations is not adequate and proper. Normally the police department helps BIWTA and DOS to enforce the regulations and monitor the discipline of the ports, ghats and channels with a very limited manpower. However, the police do not have logistical support such as in the form of petrol boats. Since the police are directed by the police department, they sometimes do not understand the necessity for or simply ignore the request of BIWTA. It is high time to form a river policing system with sufficient logistics. The river police could be a separate unit within the police department but linkage should be maintained empowering BIWTA to maintain the discipline of ports, ghats, channels, and river routes and will provide an extra tool to eliminate illegal occupiers on the banks of river ports and ghats.

Most of the vessel owners do not maintain their vessels regularly. Only when the need becomes essential do they dock their vessels, otherwise they do not pay any heed to any complaints by the crew. Small damages are fixed in a very simple way such as applying cement to a small hull leakage. This type of activity for fixing damages in a ridiculous manner weakens the vessel's structure. On the other hand, measures to prevent damages beforehand are completely absent in the sector. Annual docking for a survey to be done should be made mandatory through the regulations. Corrective and preventive measures prescribed during annual docking should be implemented rigorously (Rahim *et al*, 2002, pp.8-9).

3.3.4 Poor manpower and training system

The man behind a machine is always significant and this is also true for a vessel. However, most of the crews working in the operation of vessels in the inland waterways of Bangladesh are not up to the mark. Most of them are illiterate or have very little formal education. A great number of crew members are aged and they do not have the physical fitness to perform the job. What the aged crew members have learnt many years back have now evaporated from their memory. Formal training facilities for the crews are too little, let alone the review facilities of training. Some crew members with fraudulent certificates are also found (Rahim *et al*, 2002, p.10).

The profession as a crew member of a vessel is not a respectable one and it is also not an appropriately paid job. To attract young educated people into this profession, the government and vessel owners should establish training institutes. Training for ferry operations can be popularized among the vocational training centres' and Madrasa (religious school) students in the coastal regions of Bangladesh. The government can declare the minimum wage level and force vessel-owners to pay that amount. Payment through the banking mechanism will be helpful to monitor the minimum wage level.

3.3.5 Absence of proper funding and insurance policy

Vessel owners keep saying that they earn very little by providing ferry services and they do not get funds from the financial institutes to build new vessels. If financial

help for shipbuilding can be provided institutionally then some discipline could be established automatically in this business through those institutions, as they will provide loan depending on their own appraisal. This will also help the growth of this industry. The same is true for insurance policies. The lack of a proper insurance policy for this sector is a big problem.

3.3.6 Poor waterways and infrastructure

Political commitment is the main driver to translate a plan into reality. The inland shipping sector is a neglected sector in Bangladesh where It always has received a low development budget. Every year the same types of ferry accidents take place but no preventive measures are taken to improve the scenario. The lack of navigational aids makes the ferry routes risky in some places. Although some of the politicians or their relatives are vessel-owners, they use their influence for doing business but not to improve the sector. They influence the administration with illegal demands or dictate to the administration in their convenient way. This is a major hurdle to overcome because when the administration wants to take necessary action against a faulty vessel, and if the vessel belongs to an influential person, the administration overlooks it.

The use of information technology in the sector is very scarce. The establishment of a central database could bring transparency, accountability and swiftness to the registration, surveying and certification procedures.

3.4 Responsibilities of different quarters

The statistical analysis shows very clearly that the south, southeast, southwest and the middle part of Bangladesh are areas where most of the ferry accidents occur and one of the main reasons for accidents is overloading and overcrowding. The local administration and the elected members of parliament from those areas and the areas where the ferries take stop have the responsibility to make the people aware of the conditions and consequences of ferry accident.

Programs can be undertaken through the educational institutes to make people aware. The print and electronic media can also be used for the same purpose. Unlike many other areas, Non-governmental Organizations (NGO) are not seen in these types of awareness building activities. They can also step in to make people aware.

When ferry accidents take place, the news media mainly covers the matter very rapidly giving lots of emphasis, but they do not follow up the accidents and there is very limited discussion of the issues. The media, for example, never focus on the issue of identifying the responsible quarters properly and the ferry owners do not face any substantial civil liabilities or criminal sanctions for such mishaps or accidents (Henry, 2004 January 31). The ferry operators cannot count only on the revenues at the cost of poor people's lives. It is also sad that still in this 21st century, there are authorities or administration that allow this type of overcrowding or overloading and eventually assist in helping accidents to happen (Mitropoulos, 2006 May 6). It is essential to bring all these responsible persons to justice. This is only possible by establishing a transparent system and ensuring accountability.

Chapter 4

Safety Regulations and Codes for Non-Convention Vessels

4.1 Ferry accidents in other countries

Besides the ferry accidents of Bangladesh, they also frequently occur in the Philippines, Indonesia, China, Tanzania, Somalia, Zambia, Senegal, Congo and Burundi (Henry, 2004 January 31).

In the industrial world such services as the Staten Island ferry service in the USA are very popular. It carries nearly 70000 people everyday in a shuttle service to and from Manhattan. But one day a ferry of 3335 tons struck the dock on Staten Island at a speed of 17 knots and killed 11 people. The investigation revealed the fact that there were systematic contributing factors such as the failure to distribute and enforce safety rules, absence of proper navigational equipment and warning systems that caused the accident. Nepotism and corruption in the management of the Staten Island ferry system were also imminent. Further, the statistics also revealed the fact that similar type of accidents, but less destructive, had occurred in 1998, 1992, and 1978. These depict that accidents are recurrent in a nearly similar way and regulatory failures are at the core. The recurring nature of ferry accidents, both in the first and third world, reveal that it is a predictable consequence and proper systematic measures and the enforcement of regulations could reduce the fatalities (Henry, 2004 January 31).

Mv Bukoba, a Tanzanian flag ship, capsized in the bay of Victoria in 1996 with at least 700 hundred people perishing. It was a combined passenger/cargo vessel, like the non-convention vessels in Bangladesh, with a carrying capacity of 400 passengers. The cause of the accident was not only overloading but a number of factors which included poor design, a long standing stability problem, and poor

maintenance. The investigation report stated that the ship was procured on supplier's credit without following the normal procurement procedures and with the builder taking advantage since there was a lack of expertise on the Tanzanian side. Even the technical specifications were not discussed for the building contract (Tanzania Government, 1996, pp.1-3,12-14,59-62).

An Indonesian ferry sank near Rote Island in February 2006 where nearly 40 people died. In this case, the causes of the disaster were bad weather, engine failure, and the poor safety standard of the vessel ("Indonesia hunts for…", 2006, February 02). In the last 50 years, out of 122 transport accidents in Indonesia 43% were at sea related with ferry accidents followed by road 23%, air plane 20%, and rail 14% ("A call for Risk Management…", 2006, May 10).

A Senegalese ferry 'Joola' capsized because of overloading (carrying four times more passengers) and negligence off the coast of Gambia. In this tragic accident more than 1800 people died ("Senegal remembers ferry...", 2003, September 26).

A ferry, the Dashun, capsized in the Bohai Sea in China killing 280 people. The reasons identified for the accident were human error, fire, bad weather, and the improper loading of cargo. Human error was the main reason among these since the crew members used excessive water to fight the fire which made the vessel unstable ("Human error caused…", 2000, March 27). In south-western China, an overloaded ferry turned over killing 21 people in 2004 ("Overloading likely…", 2004, September 28).

In the Philippines a cargo vessel, the 71-ton ML Annahada, sank in which more than 74 people died in 2000; the vessel had the provision to carry only 11 passengers. The worst ferry accident in the world was also in the Philippines in 1987 when the MV Dona Paz was hit by an oil tanker killing more than 4000 people. This ferry was also overloaded ("Death toll in Philippine…", 2000, April 17).

A series of ferry accidents took place in Arab waters claiming a lot of lives. In 1996, near Eritrea 72 people died when an overloaded fishing trawler carrying refugees

caught fire. In 2002, in the Gulf of Aden near Somalia, a ship capsized and caused the loss of 90 lives. The ship was not fit to sail as there was a leak in the hull and the ship capsized in heavy seas. Again in the Gulf of Aden in 2003 near the Yemei coast, a boat caught fire killing 80 people and in 2005 a boat sank off the Somali coast claiming about 100 lives; both vessels were carrying refugees. In February 2006, the Al Salaam Boccaccio ferry accident in the Red sea claimed more than 1000 lives and in March 2006 a tourist boat capsized off the coast of Bahrain killing at least 57 people ("Worst ferry accidents…", 2006, April 01). This list can be easily lengthened.

4.2 Causes of the accidents and lessons learnt

It is a small list mentioned above which reveals the nature of ferry accidents in other countries. Although not all of the vessels are non-convention vessels, the truth which comes out is that some non-convention vessels are really big in size, involving losses which are sometimes more than those of convention vessels. The main causes are overloading, bad weather, improper cargo stowage, fire, poor design of the vessel, poor maintenance, lack of training and expertise, poor economic condition of some countries which create social problems and obviously the lack of resources. If we look back at the ferry accidents in Bangladesh (chapter3), we can easily realize the similarities of the causes.

Again overloading is the number one cause of ferry accidents. This is related with the excessive profit making mentality of businessmen or vessel operator. They are playing with the lives of people. It also reveals that the provision of punitive measures for these vessel operators or businessmen is not stiffer and the implementation mechanism is simply inadequate or has great loopholes.

Bad weather is another high ranking cause. The nature of bad weather may differ from region to region but the impact of bad weather on ferries is similar. It is necessary to check for the appropriate design of a vessel from region to region considering the respective weather conditions. The communication system within the vessel and to the shore is also important; getting accurate weather forecasts on the vessel should be assured. It is also necessary to mark some safer places, like

places of refuge, throughout the route of a vessel to accommodate sudden changes in the weather condition.

The poor maintenance process of the vessel also points a finger at the regulatory mechanism and at the vessel operators. Although a vessel can have a good design and condition, lapses in the maintenance process can make it a dangerous and unfit vessel to sail in. The lack of due diligence in maintaining and operating vessels should be focused on in future regulations.

Above all, the human element cannot be ignored. The proper training of the crews and their certification process should be scrutinized as we have seen in the Dashun ferry accident case in China mentioned above. The Bukoba ferry accident in Tanzania reminds us that the expertise in the ferry sector on country basis should be improved.

4.3 Safety codes for non-convention vessels developed by IMO

All these factors are related with the improvement of regulations and investment of resources. Although the ultimate impact is the same, that is the loss of lives and properties, there are also some inherent differences. The climate, route of trade, economic conditions, nature of people and existing regulations are different from region to region. With this background, IMO has sponsored the effort to make safety regulations for non-convention vessels.

Since IMO does not have a direct mandate for formulating regulations for non-convention vessels, it extends its hand from a technical support position where it has a strong mandate (Williams, 2000a, p.14-15). IMO has taken on some projects through which it has provided technical support. The outputs of some of these projects are:

a) Safety regulations for non-convention sized ships in the Asian region
b) Safety regulations for non-convention vessels operating in the Pacific region
c) Safety regulations for inland waterways vessels and non-convention size craft, including fishing vessels, operating in Africa etc.

IMO has also helped developing the Caribbean Cargo Ship Safety (CCSS) Code for ships of 24 m in length and over up to 500 GT (Williams *et al*, 2000b, pp.3-4).

4.3.1 Safety regulations for non-convention ships in the Asian region

Provisions, relevant to smaller ships, mentioned in international conventions such as SOLAS 1974, ILLC 1966, STCW 1978 and COLREG 1972 were taken into consideration when designing these regulations and some resolutions were referenced to guide the application of these technical regulations. Three regional seminars were held and lots of enthusiasm was expressed but only the Philippines took the initiative to adopt national regulations in accordance with the Asian harmonized regulations; Bangladesh and India expressed their will to set up new standards according to the harmonized regulations. Countries like Korea, Singapore, China, and Japan stated that their existing regulations were sufficient enough (Williams, 2000a, p.15-16). The main features of the Asian regulations are:

a) Applicable for new cargo ships of less than 500 gross tonnages but above 15 m of length (IMO, 2006, p.6).

b) Including one major survey every five years and an annual inspection; all survey and certification based on SOLAS principles

c) Requirements of machinery, electrical equipment, fire protection and safety arrangements, life-saving appliances and arrangements and navigation safety requirements are based on SOLAS

d) Manning provisions are related to relevant IMO standards

e) Simple bilge pumping provisions, MARPOL 73/78 for environment protection and Load Line Convention (LL) for provisions related to load line matters.

f) Equation for freeboard calculation provided as- 50+ (150x L) / 24 (mm), with necessary corrections according to LL (Williams *et al*, 2000b, pp.3-4).

4.3.2 Code of safety for Caribbean cargo ships (CCSS Code)

The initial regulations developed for Asia are the basis of the CCSS Code (Williams *et al*, 2000b, p.7). This Code is more comprehensive and has adopted a conservative approach. The main features of the CCSS Code are as follows:

a) Applicable for cargo ships of length 15m and above.

b) Distinctive organization for construction related chapters.

c) Freeboat requirements are more precise and conservative and should not be less than as follows:

Length of Ship	20m> L ≥ 15m	24m> L ≥ 20m	L= 24m
Freeboard	340 mm	375mm	400mm

(*Source*: Caribbean Port State Control Committee, 1997, p.34)

These values are nearly two times or more than the values stipulated in the Asian harmonized regulations through equation.

d) A noteworthy role has been given to the administration regarding the fitting of GMDSS equipment and provision has been made for EPIRB with a radar transponder.

e) Most important is a provision to keep a comprehensive record of equipment and ship information (Williams *et al*, 200b, p.7).

4.3.3 Safety regulations for non-convention vessels in the Pacific region

Regulations for the Pacific region non-convention vessels are based on the Asian harmonized regulations, CCSS Code, related IMO resolutions and Australian Uniform Shipping Laws (USL) Code. The main features of these regulations are as follows:

a) The scopes of the regulations are also extended to non-convention passenger vessels unlike the Asian regulations and CCSS Code. That is, the definition of non-convention vessels has been elaborated considering the specific purpose of the region (IMO, 2000a, p.8).
b) A new category of cargo-passenger ship requirements has been formulated with higher intact stability standard, life–saving appliances arrangement and communication equipment.
c) Subdivision and damage stability requirements have been developed in accordance with the International Code of Safety for High-speed craft.
d) Provision has been created to make it a stand alone document with regulations and the necessary supporting standard documents.

e) Emphasize has been given to the communication equipment depending on the size and the period of build (Williams, 2000a, p.16-18).

4.3.4 Model safety regulations for inland waterways vessels and non-convention craft in Africa

The necessity for new regulations for inland waterway vessels in Africa was felt after the Mv Bukoba ferry accident in 1996. The basic principles for ferry safety regulations were laid down when Kenya, Uganda, and Tanzania entered into a Tripartite Agreement on Inland Waterways Transport (IWT) in 1998. Later, IMO drafted model safety regulations for IWT in 2001 which is a subject of consultation among the countries of the region.

The basis of this model regulation is EC regulations for inland waterways vessels, considering African conditions and existing regulations (Williams *et al*, 2000b, p.7). The main features of these regulations are as follows:

a) The basic standards are derived from the existing regulations. Vessels operating in inland waterways have been given emphasis.
b) Emphasis has also been given to effective casualty reporting.
c) A company and the master are made responsible for the safety management and environment protection, but the details have not been formulated.
d) Scope has been made to apply sanctions for non-compliance.
e) Provision for a basic level of safety has been made for vessels less than 12.5 m in length. Life-saving and fire fighting equipment for fishing vessels of 12.5 m and above are required (IMO, 2002a January).

4.3.5 Safety regulations for cargo ships not covered by the provisions of IMO Conventions in the Mediterranean region

IMO has developed these safety regulations at the request of the Member states of the Mediterranean region. It is an effort to form a basis for a harmonized regulatory regime for the Mediterranean region. The main features of these regulations are as follows:

a) Application to cargo ships and barges 12 m in length and above.

b) After the survey of a ship no change in the structure or equipment or other part is allowed without administrative approval.

c) Accidents have been focused upon, separately in the regulations. For accident investigation a 'Code for the investigation of marine casualties and incidents' [IMO resolution A.849 (20)] has been referred to.

d) Wooden hatchway covers are not allowed and the provision of at least 450 mm for the height of hatch coamings is given (IMO, 2005, pp.1-15,20-27).

Beside these, Interferry, a shipping association representing the world-wide ferry industry, recently has taken two initiatives. Interferry has signed a Memorandum of Understanding (MoU) with IMO in January 2006 where the first initiative is to form a working group through which ferry safety issues will be addressed. Obstacles of this sector will be highlighted and a solution will be suggested. This 10-year long project has already been commenced in Bangladesh and the experience will be utilized in other countries. In the second initiative, an effort is underway with Det Norske Veritas (DNV), the Norwegian classification society, to standardize the rules for domestic ferry operations (Roueche, 2006, pp.18-19). High Speed Light Craft (HSLC) and the ferry committee of DNV are working to develop a domestic standard which is expected to be finished in October 2006. This domestic standard will focus on stability and loadlines, navigational safety, personnel safety and fire safety (DNV, 2005 June 06).

4.4 The National Shipping Policy and the Inland Shipping Ordinance of Bangladesh

Bangladesh has a well-defined National Shipping Policy which focuses on the related issues such as infrastructure development, navigation, bank protection, dredging, environment, safety, training and insurance. There is no indication in the shipping policy of establishing a river policing system; use of information technology has not been highlighted. It emphases for a contingency plan for port to ensure continuous service during accidents or natural calamities but there is no specific plan for inland waterways safety during emergency situation (Bangladesh Government, 2000).

The inland shipping ordinance (ISO) of Bangladesh came into force in 1976 and amended in 2005. This is the national legislation applicable to non-convention vessels plying the inland waterways of Bangladesh. It consists of seven chapters; the main features (Bangladesh Government, 2005) and loopholes are given below:

a) It covers registration and survey, certification, and the manning of the vessels. It also focuses on marine casualties, penalties and procedures, but as a whole it is not a comprehensive document as nothing is clearly mentioned about which standards should be followed in several situations such as construction, stability, and safety.
b) It applies to inland ships which mean any vessel plying the inland waterways and driven entirely or partly by steam, liquid fuel, electricity or any mechanical power. Vessels which are not propelled in any of the above mentioned ways but are towed or pushed by a vessel which itself is propelled in one of those ways, are also within the jurisdiction of this ordinance. The latter has been included to apply the ordinance to dumb barges[2].
c) On the other hand, it exempts the application to mechanised wooden country boats driven by any engine of a capacity of 16 HP or less.
d) It is not a stand alone document as it seems dependent or based on some IMO Conventions and resolutions but it does not declare so, making it complex and raising questions.
e) Nothing is given on construction, stability and load lines for the vessels. There is no indication of freeboard calculations.
f) There is nothing in detail about life-saving appliances or the fire protection arrangements.
g) There is a section on penalties and procedures but the provisions of sanctions are not strong enough and the ship owner's responsibility to avoid casualties is not clearly spelled out. This is why no ship owner has been punished for any accident, although they are responsible in the first place in many cases.

[2] Dumb barge- A barge which is towed by the tug and has no self propelled system.

h) In Bangladesh many ferry accidents occur where the rescue of the passengers and the removal of wrecks were obstructed by fishing nets set along the navigable routes. Considering this situation, obstructing navigable water routes by setting fishing nets or by any other means is prohibited in section 57A of the Ordinance.

i) The provision of penalties has been introduced for failing to delivery expired or cancelled certificates or change of ownership or failing to report the loss or damage of a certificate in section 63. It is worthwhile stating that the same Administration is engaged with both registration and certification and the survey process. The application of information technology, creating a central data base with an up-to-date information feeding system within the Administration, prompting the reporting of surveyors, display of regular news bulletin regarding cancellation and expiration would make the overall system more transparent and easy to use.

j) In the inland shipping ordinance there are provisions for penalties for passenger overloading (section 67), violation of storm signals (section 55 & 61A), and violation of collision preventing rules (section 56A & 61A). The penalties or sanctions should be more stringent. Nothing is clearly mentioned specifically about the overloading of cargo (except in section 58 where provision has been made not to carry cargo on the upper deck of a passenger ship) or wrong stowage of cargo.

k) Throughout the ordinance a phrase 'the owner or master of the vessel' has been used frequently. It provides a very good opportunity for the owner to escape the legal responsibility and make the master (who has little education) the scapegoat for any casualty or accident. The definition of an owner should be replaced by the definition of 'company' as in the ISM code (IMO, 2002b, pp.1,8-9) and the phrase should be 'company and the master' so that the owner or operator of the vessel cannot delegate responsibility and can become bound to apply due diligence in making the vessel fit in all respects.

l) Provision has been made to delegate the function of approval of design and plan of an inland ship to a classification society (sections 5A & 5C),

which will be responsible to the Government. Rules for classification societies have not been framed and consequently this is not in function yet.

m) The training of inland vessel crews is an important element in the process of ensuring safety. Provision has been made to arrange training, but if a person does not attend the training for which he has been selected without any reasonable cause, then the provision has been created to suspend his competency certificate or identity card (section 37B). Instead of the word 'or', the word 'and' should be used between 'competency certificate' and 'Identity card'. This provision should be more stringent so that no crew or company can ignore training.

n) Provision has been made for any voyage of an inland passenger-carrying vessel to have an insurance policy from an insurance company engaged in Bangladesh or the owner should be a member of the Marine Casualty Trust Fund established by the Government. At present, inland vessel owners do not take out any insurance policy because (in their opinion, which is not entirely true) of the high premium. Rather they deposit an amount of 20 taka (equivalent to US$ 0.30) per passenger in the Trust Fund annually. The fund is intended to be distributed amongst the relatives of dead / injured passengers after an accident occurs and is managed by a trust board headed by BIWTA. It would be better to eliminate the provision for the Marine Casualty Trust Fund because it is not a proper insurance system. Rather the government should force owners to take out insurance otherwise those reluctant owners should quit the business.

4.5 Analysis of the regional efforts and the situation of Bangladesh

According to the necessity, different types of definitions have been used for non-convention vessels in different regional model regulations. Asian and Caribbean regulations consider cargo ships as non-convention vessels. The Pacific region has extended the scope of regulations to passenger ships and the African model regulations have emphasized inland waterways vessels. In Bangladesh, non-convention vessels are mainly passenger ships or ferries but they also carry some

cargo in their hatches. Some of the non-convention vessels are cargo ships or dumb barges. Since different types of vessels are plying the inland waterways in Bangladesh, it would be logical, like in the African model regulations, to put a spotlight on inland waterways vessels emphasizing their length, gross tonnage and engine horse power.

Most of the model regulations refer heavily to the IMO conventions for standards. If it is the case, then what is the difference between vessels complying with IMO Conventions and vessels not covered by IMO Conventions? This is one of the main causes for which regional model regulations are very late in getting attention in individual countries in the respective regions. Emphasis should be given to IMO Convention mentioned standards where necessary, but more importance should be given to indigenous solutions or existing standard upgrading. Shipping, whether it is inland or international is always conservative. Confidence of all the stakeholders should be gained before setting a standard. This is also true for Bangladesh.

The CCSS Code introduced a conservative freeboard standard and that example would be good for Bangladesh because overloading and bad weather are the main reasons of non-convention ferry accidents. It is also the fact that now-a-days the design of ferries in Bangladesh is flat bottom instead of deeper draft ferries due to the siltation problem in the inland waterways. The probability of these flat bottom ferries capsizing during bad weather is greater. At the same time, some of the ferry routes require low draft vessels. As Roueche, CEO of Interferry, says the shallow draft stable catamaran could be the best vessel in inland waterways to avoid ferry accidents (O´Mahony, 2005 July 26). From this point of view the conservative freeboard calculation is consistent with the shallow draft catamaran.

Like the CCSS Code, a format of the comprehensive recording of equipment and ship information should be attached to Bangladeshi documents so that the history of a vessel can be preserved intact and companies do not get the chance to manipulate ship particulars. A soft and hard copy of the record of equipment and ship information should be held in the Administration. Following the Mediterranean model regulations, no change of the structure or equipment or parts of a vessel will

be allowed without administrative approval. Like the Pacific regulations all references, resolutions, guidance and examples of standard practices and formats should be kept with the Bangladeshi regulations to make it a stand alone document so that it can be a user friendly and transparent document.

As in the African model regulations, an effective casualty reporting and investigation reporting system is important for Bangladesh. It has been found that ferry accidents of similar types and sometimes in the same places occur, but no lesson is learnt from these accidents to prevent them in the future. An effective casualty reporting and investigation reporting system would help to improve the regulations and make them a live document. A provision can be made to revise the regulations once in every five years, so that the research and development efforts of the Administration do not become stagnant. Provision can be made to implement a time bound service providing system in the Administration which will reduce corruption. The use of information technology simultaneously with the documental procedure can be an effective approach in this regard.

Navigability is an essential element to ensure the safety of inland vessels which includes the maintenance of draughts, navigational aids, interference free waterways, and passenger and ship safety and security. It needs continuous resource investment. The formulation of a Navigational Act, which is currently absent in Bangladesh, is inevitable for the safety of inland waterway transport i.e. non-convention ferries (Zaman, 2003 July 24).

Strict provision should be made to eradicate the effort of syndicate businesses in this sector in Bangladesh, as the current situation is where vessel owners are employing only one company's vessels for a particular day and making the rest of the vessels idle. Since there is enough traffic, in this way ship owners are putting pressure on the government, but the ultimate result is overloading which is one of the main causes of the ferry accidents.

The people and organizations concerned with the design, construction, certification, maintenance and regulatory Authorities should be brought under a mandatory code

of conduct and strict liability regime. This step and the mandatory insurance policy taking provision will automatically reduce the safety concern, bringing discipline to the industry and allowing the entire industry to start running by itself (Zaman, 2003 July 24).

Chapter 5

Inland Waterways in Europe and the Comparative Scenario of Bangladesh

5.1 Introduction

Potentiality of inland waterways is being realised by the developed countries. It is the inland waterways which can provide a comparatively more sustainable transport service. It would be better to look into the inland waterways of developed world such as Europe and try to understand the scenario of the inland waterways of Bangladesh in the backdrop of European inland waterways to reach an attainable standard of safety and economic growth point of view.

5.2 Inland waterways of Europe

The length of European waterways is more than 35000 km which connects hundreds of cities, ports, terminals, and logistic centres spread in different regions of Europe having varying river characteristics. The modal share of river transport is about 10-12% of the total transport (Semenov, 2006 March). The modal shares of various modes of transport (Table 14) hints that the inland waterways of EU countries are underutilized.

European inland waterways can be categorised into four axes- the Rhine axis, the North-South axis, the East-West axis, and the South-East axis. Firstly, the Rhine axis which is spread over the Netherlands, Belgium, eastern France, northern Switzerland (non EU country), western and southern Germany. This axis joins the key ports of the Netherlands and Belgium with the business centres of the rest.

Secondly, the axis that connects the Netherlands, Belgium and northern France apart from the Rhine axis is known as the North-South axis. The part from Seine to Schelde in Belgium in this axis is an important one as it provides an alternative for congested motorways of north/south via Paris. Thirdly, the East-West axis includes the German inland waterway network and joins Netherlands and Belgium. This network crosses northern Germany, Hamburg and Bremen. In the east, this axis connects Berlin network to the Poland and Prague via the Oder and the Elbe respectively. Finally, the fourth axis known as the South-East axis is spread from the Danube to the Black sea connecting Rhine also through the Mainz-Danube canal. In this axis the part from Black Sea to Belgrade of the Danube, although it is in upgrading stage, has the largest capacity (Thew, 2006 March).

Among the European countries, extensive canals were developed in the inland waterways of UK and France. The clearance under bridges is important for further development of inland waterways. From this point of view, Netherlands is farsighted as most of their bridges have large clearance and section of the main bridges have opening provision which allows passage of exceptional loads such as floating cranes and hence provide advantage over other modes of transportation. Except Netherlands, in all countries road transport is predominant. Usually long distance cargoes and cargoes which can not be transported cost effectively are transported by inland waterways of EU countries. Among EU countries Belgium, Germany, and the Netherlands use inland waterways most (Thew, 2006 March).

The potentiality of inland waterways of EU has not been utilized properly. At present, Europe sees inland waterways as the powerful tool for the further development of intermodality. Several projects are being implemented finding ways to make inland waterways competitive. Some research based innovative ideas are on the table such as suitable inland vessel design, cost effective intermodal chains, modernization of inland nodes such as terminals, ports, and logistical centres, innovative means of servicing and interoperability with inland waterborne transport. Interoperability for the inland waterways relates to smooth freight and passenger transport having effective interactions of two or more modes i.e the useful functional compatibility with road and railway transport (Semenov, 2006 March).

Although the Danube is the second largest river in Europe, container transportation down to lower Danube is very limited. This is because, besides some economic and political reasons, there is no suitable or specifically designed container carrying vessels addressing the varying draught limitations of the river where maximum draughts are about 2.5 meters. The vessel which will ply on the river Danube should require higher speed to be competitive with the road transportation. The Danube also has problems of sewage and industrial waste which is currently being addressed (Hofman, 2006 March). At present only 10% capacity of the Danube river is utilized (CEC, 2006, p.3).

To reach at an optimal vessel characteristic for a specified waterway is one of the current innovative efforts getting exclusive attention in the maritime sector of EU countries. A new type of high speed vessel, PACSCAT (Partial Air Cushion Supported Catamaran), is being developed for operations on the Danube and the Rhine rivers. It is designed in such a way that it has low wash (disturbance caused by the height of the generated waves) and variable draught and can be utilized with the existing berthing / loading facilities. The draught of the vessel can be changed according to the need from 2.5 m to 1.5 m (Clements *et al*, 2005 June). The side-hulls, bow and stern seals are designed in such a way that in between them air cushion can be kept, which will allow reduce operating draught of the vessel, avoid squat phenomenon in shallow water and permit fully laden vessel operating at higher speed such as around 20 kt (Lewthwaite *et al,* 2005 June).

White paper on European transport policy identifies the lack of close connection between sea, inland waterways and rail and focuses on the regulated competition between modes and link-up modes for successful intermodality as two priority objectives to attain by 2010. Among many, the success of PACT (Pilot Action for Combined Transport) programme of EU, introduced in 1992 and finished in 2001, includes rail-sea link between Sweden and Italy, via Germany and Australia, removal of some 50 lorries from the busy road corridor through a daily barge service between Lille and Rotterdam, relief from approximately 6500 lorry journeys per year from roads by the rail-sea service between Spain and Germany etc. The PACT

promoted combined transportation. After PACT a large scale programme known as ‘Marco Polo ‘ programme has been adopted by the European Commission, [Marco polo I (2003-2006) and Marco Polo II (2007-2013)], to support intermodality emphasising on short sea shipping, logistics market, emergence of freight integrators, improvement of inland waterways, and sustainable transport. In EU the inland waterway transport is regarded as the potential complements of sea transport. Designing of vessels suitable for both river and sea is a great technical effort to integrate the inland waterways within intermodal chain (CEC, 2001, pp.20-22, 41-47).

The European Commission sets out an action programme call NAIADES (Navigation And Inland Waterway Action and Development in Europe) for a comprehensive inland waterways of Europe to be implemented between 2006-2013 covering five strategic areas such as market, fleet, jobs and skills, image, and infrastructure. The important thing of these strategic points is that they are interdependent areas and the recognition of IWT as a component of multi-modal service.

The creation of new market for IWT through cooperation and interaction with other modes, streamlining the administrative and regulatory framework, removal of barriers, improvement of logistics efficiency and environment through innovative technologies such as vessel design and energy-efficient engine have been recognized as the important areas. The enhancement of safety performance of IWT by introducing a River Information Service (RIS) and automation, and the improvement of infrastructure through introducing modern transhipment facilities and maintenance of IWT infrastructure have also been emphasised in the action plan. To attract workforce and image building for the IWT industry a functional education and training system by including inland navigation in the logistics education programme and introducing modern technologies have also been focused in the plan (CEC, 2006, pp.2-12).

5.3 Benefits of inland waterways for EU countries

There are many indirect benefits if the 20 ft. TEU container lorries can be replaced by inland waterways transport. This includes reduction of traffic congestion on trunk roads, less maintenance cost for trunk roads, less air pollution and green house gases, less fuel consumption, and reliability in delivery. Ideally road, rail, and inland waterways should have to be operated as a single coordinated transport infrastructure (Thew, 2006 March).

The external cost of the inland waterways is the least among all modes of transport (Figure 7). The inland navigation reduces the transport cost significantly and emerges as an important factor in deciding industrial location and hence contributes in preserving industrial employment in Europe. For example, in Germany about 400 000 jobs are somehow related with the inland waterways and related companies. In EU countries the IWT has entered into the hinterland container transport business. It is reliable and safer than other mode, which is proved from nearly zero fatality record in the Netherlands, a country with the highest inland waterway traffic density in Europe (CEC, 2006, p.3-4).

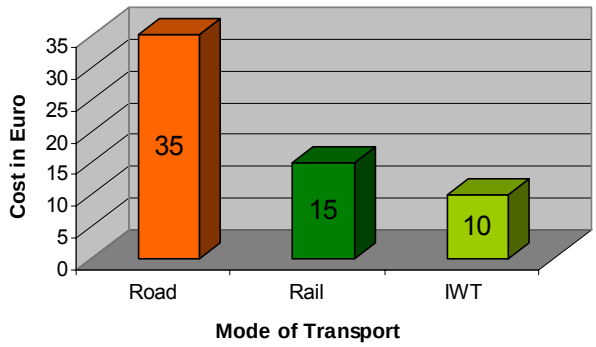

Figure 7: External cost of different modes of transport in EU countries per 1000 ton-kms [*Data source*: CEC, 2006, p.4)]

In comparison to other transport the working conditions on board and career perspectives for the IWT is not attractive. In EU countries the scarcity of skilled labour is imminent. Institutional framework is fragmented, restricting smooth running

of the Administration. This in combination with the lack of political commitment are the main problems of IWT sector (CEC, 2006, p.3-4).

5.4 Bangladesh: A comparative picture

In Bangladesh the mouth of most rivers ports are not wide, and siltation always creates problems for navigation, management, and operation of inland waterways transport. The lack of good approach roads and infrastructure for the river ports made IWT an unattractive mode of transportation (Bangladesh Government, 2000, p.21).

Some of the characteristics of the river Danube such as the varying draught limitations, air clearance, lack of container carrying vessels, width of the channel in some places etc. are very similar to the inland waterways of Bangladesh. Besides these, some places of the inland waterways of Bangladesh have excessive current. The weather rapidly becomes very bad which causes ferry accidents. The inland waterways of Bangladesh also have the potentiality for export-import transitional cargoes to and from sea ports, but it requires sufficient infrastructures and investment. Novel design of inland vessels is one of the essentials in this respect.

The government has to create environment and to invest initially for building up infrastructures. The inland river ports should be well equipped with berthing and container handling facilities, smooth passenger movement arrangements, good interactions with other modes, and above all adequate safety arrangements. In the effort of creating environment, government can launch concession loan packages for the vessel owners and port operators within stringent but lucrative principles. It is the economic competitiveness through which inland waterways could be made a strong transport mode.

The design of inland vessels could be a crucial factor in making inland waterways an element of intermodality (Hofman, 2006 March) in Bangladesh. Since safety is in the top of the priority list, it would be better to go for more stable vessel design.

The constraints or limitations of a particular inland waterway are very important in designing vessels for that waterway. Even a hidden or an implicit restriction can have great influence on vessel designing (Hofman, 2006 March). So, intensive care should have to be taken for vessel designing for the inland waterways of Bangladesh. Considering the restrictions of the inland waterways of Bangladesh some version of PACSCAT, designed for EU inland waterways, will be consistent to step up non-convention ferry safety. A bank of basic vessel models can be created for the use of shipbuilders and ship-owners. The cost of building such type of vessels will be more than the cost of building existing type of vessels. For this reason, incentives and concession loan package should also be offered for the shipbuilding industry. Initiatives should be taken to increase port facilities and to build industrial units in places from where inland waterways could be used easily.

Chapter 6

Potentiality of Inland Waterways as a Multimodal Element

6.1 Inland waterways as a tool of multimodal transport

The requirement of enhanced multimodal transport in Bangladesh can be viewed as having at least two perspectives i.e. to improve the competitiveness of Bangladeshi goods in global market and to accelerate the industrialization process for a better export basket. It can also be a medium of national integration. In this integration process cost-effective inland waterway transportation has an essential role to play.

The concept of free market economy has made international business highly competitive where transport sector plays an important role to achieve competitive advantage. In the international trade in recent past, tariff was regarded the only barrier, but now the transportation cost has become an important issue to be considered (Islam, 2004 November). Transport and logistics or holistically the supply chain management is the backbone in accelerating the trade growth where multimodal transport perception is the driving force. The Airbus A380 project of Europe is a vibrant example which shows the logistical chain of the multimodal transport where inland waterways play a significant role. Four different countries (UK, Spain, Germany, and France) are involved in making various complex and valuable parts of the aircraft Airbus which are transported both by sea and inland waterways for final assembly in France providing a safe and cost-effective transportation (Nieuwenhuijs *et al*, 2006 March). For Bangladesh the inland waterways transport can be a powerful tool for further development of intermodality or multi-modalism and hence the development of the economy. The extent of the inland waterways of Bangladesh itself announces the inherent capacity or the potentiality of the IWT.

Goods, services, operations, vehicles and infrastructure are the key elements in providing a transport service, whereas information and legal set up lay down the bonding among these elements (Orthlieb, 2006, p.1). The potentiality of the inland waterways transport in Bangladesh, in comparison with other mode, should be evaluated depending on these basic elements.

6.2 Indirect use of inland waterways

In Bangladesh it is better to increase the indirect use of rivers such as flood control, water purification projects etc. In this long riverine system of Bangladesh, the upstream communities can use treated water from river and can discharge the used water back into the river after treatment again and before it flows finally into the sea the water can be used several times by the downstream communities in this way. The only constraint here is the cost of recycling of water but this cost is going down rapidly with the invention of new superior filters, membranes and other technologies (Singapore PUB, 2006).

River erosion is another big problem of Bangladesh because of which ghats (wharfs), terminals, sometimes even river ports need shifting from one place to another. Annual flooding causes a lot of damage including river erosion. Beside costly river training process, Bangladesh can think about building several reservoirs linked with the inland waterways having capability of flood control and contribute to reduction of river erosion. These types of water management measures will help establishing a stable and sustainable inland waterways transport system. Moreover, feasibility study and analyses of the entire inland waterways of Bangladesh is a must now, but there is a lack of expertise and resource in the country to complete the task.

6.3 Economy of scale

Inland waterways transport ensures minimum use of land or space in comparison with other modes of transportation. A transport mode is regarded as the sustainable transport when it is designed for meeting the present needs without compromising the capability to meet needs for future generations. The inland waterway is the most efficient tool to construct a sustainable transport system. One study of EU shows

that inland waterways transport can move 127 tonnes of goods while road and rail can transport 50 and 97 tonnes respectively by one liter of fuel (CEC, 2001, p.43). From this point of view inland waterways transportation is more economical and environmentally friendly. To make a commercial inland waterway for Bangladesh this potentiality should be exploited fully. On the other hand, a high fuel price is an extra burden for the economy of Bangladesh. Hence, a sustainable energy-efficient inland waterway transport will be quite consistent with the economy of Bangladesh.

The external cost for inland waterway transportation, i.e. the costs of environment renewal, congestion consequences and refund of traffic accidents charges, is less in comparison with other modes. Considering these points, inland waterway transportation would be an effective choice for Bangladesh.

The movement of bulk and semi-bulk products from Chittagong and Mongla ports is already dependent on IWT, but inland waterways are not in use for the containerized cargo because of the missing links such as the lack of appropriate river terminals and the lack of suitable vessels for the inland waterways. One study (Table 15) of the Chittagong Port Authority (CPA) estimates that the probable cost for the use of IWT for transporting containerized cargo in between Chittagong and Dhaka is approximately half in comparison to the cost in other modes (ADB, 2004 November). This study reveals that the time required for the movement of containerized cargo through IWT is the main constraint. The designing of specific vessels for the inland waterways of Bangladesh and well-equipped river terminals will help to overcome this constraint.

6.4 Inland river ports as freight hub

Inland river ports should be located in such places where they become the accumulating point of freight and passenger. Building of industrial centers or units near inland river ports can ensure flow of inland freights and passengers. The functions of river ports should not only be limited to handle cargo and passenger but also expanded to storage, warehousing and logistics services. Among the existing 19 inland river ports of Bangladesh Dhaka, Narayanganj, Barisal, Khulna, Chandpur, and Patuakhali have these above mentioned characteristics. Although Dhaka river

port covers a large cross-section and a dynamic market, because of the narrow approach road and the lack of space further expansion and efficient interaction with road is not possible. But a second river port with good approach roads at Alibahar Char can solve the problem for smooth cargo transportation. Besides this, other river ports mentioned above have large catchment areas as reveal by the statistics from the yearbook of BIWTA (Table 16). They should be well-equipped with at least minimum transitional cargo handling facilities such as fork lifts, gantry crane, straddle carriers etc.

Private sector can be involved in the port business for competitive service and resources. Operation of river ports can also be coupled with building investment zones, export processing zones and inland container depot (ICD). So far six export processing zones (EPZ) in public sector have been created to promote foreign investment and increase export. Extensive warehouse facilities are provided in EPZs and ports (European Commission, 2001 August). Eleven inland container depots, one at Dhaka and others in Chittagong (private investment), are functioning to ease the congestion at Chittagong sea-port. These types of ICDs or investment zones will ease port operation and help accumulating freight from hinterlands.

6.5 Interoperability

The effective interaction with two or more modes is the essence of interoperability of a river port. In other words, it is the consistent feeder transport system with the road and / or railway transport ensuring functional compatibility to provide smooth freight / passenger flows eliminating bureaucratic tangles, technical and trade related barriers. Interoperability is connected with the satisfaction of passengers (through enhancement of the attractiveness of infrastructural nodes and ensuring safety), customers (through diversity and serviceability of the transport systems), consignors/consignees (through reduction of delivery times and haulage tariffs), investors (ensuring profitability through innovative transformation) and decision-makers (ensuring efficiency of the management techniques (Semenov, 2006 march).

All river ports mentioned in the above section have good links with roadways to the respective hinterlands. Beside this, the Chandpur river port is in Comilla district

where railway and airport connectivity is possible. On the other hand, Inland Container Terminals (ICT) at Adamjee near Dhaka (where road-rail-river interface is possible) and at Khanpur (where road-river interface is possible) would be a great step promoting multimodal transport. Both ICTs could have linkage with Chittagong port.

A consistent Decision Making Procedure (DMP) that corresponds to all possible transitions of transport by inland waterways is an essential tool to ensure smooth interoperability (Semenov, 2006 march). In the river ports of Bangladesh, the anomaly in issuing and obeying timetables is noticeable which can be streamlined through activating a DMP containing different priorities.

6.6 IT, regulation and policy

Information system plays a vital part integrating different modes and elements of the multimodal transportation (Long, 2003, pp.361-366). It becomes easier for manufacturers, logistic providers or operators to manage supply chain if information is shared among terminal operators, shippers, and customs (WTO, 2004, p.121). Use of Information Technology (IT) to prepare a backbone of the River Information System (RIS) will help integrate the inland waterway transport as a complementary element of intermodal transport in Bangladesh. Recently the country has been connected with the information super highway which will facilitate the IT backbone in the country. One way the RIS will provide an opportunity to cater an efficient and transparent service; on the other hand it will contribute in ensuring safety in the inland waterways.

In 2000, a technical assistance project namely the establishment of Inland Ship Safety Administration (ISSA) has been implemented in Bangladesh. The project had three components- i) Consultancy service ii) Procurement of office equipment and vehicles and iii) Appointment of manpower (Bangladesh, 2000 March). The outcome of the project is not comprehensible and noticeable; even the outcome related documentary evidences have not been preserved. It is worthwhile to mention here the comment of the World Bank's staff appraisal report that the sustainability of physical investments in Bangladesh is fairly good though delay in

implementation is always obvious and great, but the difficulties are in the implementation of technical assistance components, institutional development and in utilizing the results of these assistance (The World Bank, 1991, p.4).

Regulation and deregulation process in Bangladesh is working slowly. Government regulation has been decreased a lot to promote trade and investment (Barkat *et al*, 2004, pp.38-39). Bangladesh government has recently finalized integrated multimodal transport policy aiming at poverty alleviation, employment generation and reinforcing rural and urban economies ("Integrated multimodal transport…", 2005 August).

6.7 Trade Facilitation

Trade facilitation effort deals with the logistics efficiency for the movement, release and clearance of goods, including goods in transit for cross-border trade; in a broad sense this also takes account of customs procedures and other practices that may add to the cost or time requirements of trade (Mutahunga, 2005 September 21-23).

A study of WTO had estimated the trade gain from capacity building of some South-Asian countries in comparison with South-East Asian countries in 2004 which suggests that Bangladesh could significantly increase trade through trade facilitation (Table 17). Simplification and automation of customs procedure is essential to help facilitate multimodal transport concept. It will decrease corruption and optimize the resource utilization.

The idea of inland river ports or inland container terminals (ICT) coupled with inland container depots (ICD) for Bangladesh would shift the customs procedure from seaport to inland, would create environment for self declaration customs procedure, an idea that Swedish Customs is using (Swedish Customs, 2004, pp. 15-17), thereby reducing time for documental procedures and would help reduce traffic congestion on roads. Hence, the inland waterway transport in Bangladesh can contribute in trade facilitation.

6.8 Sea-port Connectivity

The skeleton of Inland waterway infrastructure is a naturally given network. It can be expanded by providing links through canalization where topography allows (Priemus, 2002). Besides this, the maintenance of the inland waterways through dredging, river training and damming is an essential task. A smooth connectivity of the inland waterways to the sea-ports, a fundamental criterion, signifies the inland waterways as a trunk line in the multimodal network. The strategy of providing the type of service in the inland waterway routes is another factor to consider (Priemus, 2002).

Siltation is a major problem of the inland waterways of Bangladesh which needs continuous attention, support and resource. The connectivity of the inland waterways to the sea-ports is not only beneficial for intermodality through inland waterways but also helpful for future growth of the ports, particularly Chittagong sea-port which has been experiencing a container handling growth of about 9% each year. Chittagong port is also facing a problem with a large quantity of empty containers (Table 3 & 4) where inland waterways can play a vital role. So, inland waterway is not only good from environmental point of view but also for less cost, reliability, and possibility of cost cut on storage as it is the present realization of the European Union (ECMT, 2005 September). However, the hinterlands of all inland river ports in Bangladesh are not capable to provide sufficient flow of freights to the port. So, the hub-and-spoke strategy can be adopted with capable and well connected other transport mode enriched hinterland as hub such as Chandpur.

The connectivity of the inland waterways to the sea-ports will be effective and worthy when both the inland waterways and ports are well maintained. But low operational efficiency and the lack of rapid modernization efforts have made Chittagong an expensive port in the world. Paper based clearing process is one of root causes of corruption and inefficiency of the port ("Chittagong 'most corrupt' port", 2006 Feb). It has been estimated that Bangladeshi product will gain competitive advantage and particularly garment's sector of Bangladesh could earn 30% more if port inefficiency can be removed (Domus, 2005, p.29). This earning and competitive advantage would be unbeatable if cost efficient inland waterway transport can be used to reach the port.

A large number of empty container handling at Chittagong port indirectly reveals the fact that export basket of Bangladesh needs to be diversified to materialize multimodal transport potential (Table 3). So, the connectivity of the inland waterways to the sea-ports is a multi-dimensional relation to maintain.

6.9 Supply Chain Integration

The movements of goods from the ultimate origin to the ultimate destination, involving a system of entities that provides and produces services and uses information to add value for customers and other stakeholders, is known as the supply chain (Long, 2003, pp. 3-6, 43-45). Logistics is the part of the supply chain that involves the management of acquisition, storage, transportation, and delivery of goods. Browning (2005) defines logistic management as "the science of balancing the storage (stocks) and movement (flows) of inputs and outputs to meet demand, and minimize total cost while delivering increased efficiencies" (p.10). Logistics is an optimization process (Shuo, 2005, p.2) which gains through competitive advantage and achieved through multimodal transport. Integration of supply chain means integration of all logistic functions (Islam *et al*, 2005, p.386).

Cooperation and coordination among channel members establish the backbone of supply chain integration and brings global synergy (Christopher *et al*, 2003, p.133). It is not possible for the inland waterways and inland ports alone to market their services competently without the help and cooperation of logistics integrators, transport operators, freight forwarders, and shipping agents (ECMT, 2005 September). According to Steininger (2001),"Competitive advantage in production is the reason for multinational activity in international vertical integration" (p.56).

Supply chain integration brings efficiency, dynamism and growth in the economy. In Bangladesh the inland waterways and inland ports can easily contribute to the supply chain integration. The main transport corridor Dhaka-Chittagong road will not be sufficient for container haulage in near future (Islam *et al*, 2005, p.390). Construction of inland container terminals, specific designed container vessels for the inland waterways of Bangladesh as mentioned earlier, employment of

management operators for container terminals and equipment handlers, diversified linking with other modes to ports and building a new deep sea port in south or south-west corner of Bangladesh, where mother vessels can berth, will create competition and bring ports productivity and eventually help integrate supply chain. Following the U.S experience, inland river ports can also be used to attract bulk cargo from the inner parts of Bangladesh to the sea-ports. Ocean barges could be the vehicle for multimodal competition as they need smaller crews and less operating costs and they will be able to access ports which have less depth (Waugh, 1981, pp.692-693, 698). Hence inland waterways as a multimodal tool could play the central role to further economic prosperity of Bangladesh.

6.10 Human element and safety

The customer value should be linked with the supply chain through efficient logistics performance (Gordon, 1998, p.245, 304-305). Dynamic and well coordinated information technology based customer service will be the source of competitive advantage (Lambert, 1998, p.43-47,556-557). The human element always plays a significant role for the information technology based customer service and safety of a system. The shortcomings in the non-convention ferry safety is a big issue in Bangladesh and the reason for this is the lack of investment, underutilization of existing resources (The World Bank, 1991, p.6) and the lack of political commitment. Turning this situation into the positive direction requires the existence of the inland waterways transport as a complementary tool for the multimodal transportation, where the necessity of standard human element is significant.

Institutes engaged in providing maritime education under the control of the Ministry of Shipping in Bangladesh are the Deck Personnel Training Centre (DPTC), the Seamen's Training Centre (STC) and the National Maritime Institute (NMI). The agency BIWTA looks after the activities of DPTC while the Department of Shipping (DOS) takes care of STC. The facilities in DPTC and STC are not adequate, so is the quality of training in these institutions. The training of DPTC is important for safe operation of the vessels in the inland waterways of Bangladesh. The National Maritime Institute is an apex body providing maritime education in the country. Each year about 120 marine engineers / master mariners pass out from this institute

which has great demand in the world. Beside these there are other two institutes; one is the institute of marine science, an institute of the Chittagong University, providing education on marine environment and fisheries and the other is the institute of marine technology under the control of the Ministry of Labour and Employment providing diploma on marine technology. Although Bangladesh has these institutes, the lack of experts within the marine sector is notable. Integration and modernization of these courses and institutes under a Maritime University is inevitable. Quality maritime education can make Bangladesh an important seafarer providing country in the world and can contribute in developing expertise in this sector. The standard of crews in the inland waterway transport, particularly for non-convention ferry and the pilotage service will also be raised.

Table 19 presents the strength, weakness, opportunity and threat (SWOT analysis) on the non-convention ferry safety and the potentiality of the inland waterways of Bangladesh as a complementary multimodal element.

Chapter 7

Conclusions and Recommendations

7.1 Introduction

The life of the people of Bangladesh, the world's largest delta where rivers and their tributaries are spread over the entire country like fishing net, is very much influenced by the inland waterways. Non-convention vessels plying in the inland waterways, carrying about 30% of cargo and about 15% of passenger, is a frequently and heavily used transport means particularly for the southern part of Bangladesh where it is the cheapest and only choice of transport for a large number of people. Being regular phenomena the non-convention ferry accidents cost hundreds of lives and property each year weighs a great loss for the economy. Although the number of non-convention ferry accidents is less in comparison with the road and rail accidents each year, the figure of casualties in one accident is large and in aggregate it is comparable to the number of casualties in road.

7.2 Conclusions

The main causes of the non-convention ferry accidents in Bangladesh are overloading, bad weather, collision, excessive current and fault of human element. The hidden factor behind this causes are faulty design, because the number of accidents in calm weather is less, and there is no opportunity in the country to examine the stability of the vessel design. Consequently, a limitation of the inland waterway such as excessive current during monsoon has great impact on the faulty designed vessels and cause accidents. The standard of vessel construction industry is also questionable. Besides this, the human factor, training and education factor and organizational inefficiency are the major factors needed to be addressed.

The statistics of the Accident Research Centre (ARC) of the Bangladesh University of Engineering and Technology (BUET) and the statistics collected from the accident investigation report of the Department of Shipping (DOS), Bangladesh reveals two different reasons as the most frequent causes of accidents. Overloading and cyclone came out as the main causes of the accident from the statistics of ARC. On the other hand, collision and human element came out as the main causes from the DOS statistics; the next ranking causes which came out from the DOS statistics are rough weather and overloading. These differences raise two things: first one is the problem of methodology of collecting statistics regarding non-convention ferry accidents in Bangladesh and second one is pre-occupied directional problems for the investigation and preparation of the reports of the DOS.

The organizations that are directly related with the inland waterways and non-convention ferry safety in Bangladesh are the Bangladesh Inland Water Transport Authority (BIWTA), and the DOS. However, there is a lack of coordination in some functions such as the BIWTA approves the design of the construction of a vessel, and on the otherhand the DOS does the survey and registration. Sometimes the DOS supervise the new construction that brings up the question of conflict of interest. Another example is that the BIWTA runs the Deck Personnel Training Centre (DPTC) and the DOS looks after the certification and examination process. These organizations also have serious limitations in catering their services. For example, a thickness gauge is a rare instrument for surveyors to measure hull plate thickness.

Another problem that is eminent in DOS is the dominance of marine engineers and master mariners in the survey process instead of naval architects. The root of this issue has been planted in the recruiting process of the surveyors and prevails in every function of the department. The number of surveyors in the DOS is not adequate. The government has made provision in the inland shipping ordinance to delegate the function of approving the design and plan of an inland ship to local classification society. But the rules for classification societies have not been framed and consequently this is not in function yet.

The police department helps BIWTA and DOS to enforce the regulations and monitor the discipline of the ports, ghats and channels with a very limited manpower and logistical support such as in the form of petrol boats and they have little knowledge about the intricacy of the non-convention ferry safety and the inland waterways.

There is no institutional funding mechanism for the entire sector such as construction of vessel, construction of river terminals, and equipment installation. The absence of insurance policy providers is also a big problem of this sector. Although there is a clear policy guideline in the National Shipping Policy, the Inland Shipping Ordinance has been amended with an alternative provision of creating a trust fund which is a wrong step for the industry and is one of the main causes of the sub-standard non-convention vessels.

The shipowners form syndicate and offer very low passenger fares to attract people to risk their lives. They also go for strikes frequently when the authorities try to enforce regulations stringently. Currently the vessel owners are employing only one company's vessels for a particular day and making the rest of the vessels idle, creating environment for overloading which is one of the main causes of ferry accidents. These are all the examples of loopholes of the existing system. Besides these, the inland shipping ordinance is not a well-defined stand alone instrument. For example, there is nothing in detail about the life-saving appliances, fire protection arrangements, construction, stability and load lines for the vessel.

Multimodal transportation is the coordinated shipment using two or more modes of transportation through an integrated supply chain where customer satisfaction is the ultimate goal. The developed world such as the European Union has recognized the inland waterways as a powerful tool for the further development of multimodal transport and has taken programmes to accelerate and promote the multimodal transportation which includes suitable vessel designing for the particular inland waterways, modernization of inland nodes such as terminals, ports, and logistical centres and interoperability with inland water transport. Interoperability is the

functional compatibility and effective interaction of inland river ports with two or more modes of transportation. Large catchment area, storage, warehousing, and logistic services are involved with the port interoperability where port can contribute with the help of logistic integrators, transport operators, freight forwarders, and shipping agents. Among the inland river ports of Bangladesh, Dhaka (Alibahar char), Narayanganj, Barisal, Khulna, Chandpur and Patuakhali are potential river ports for making interoperable ports; Adamjee and Khanpur are also potential places for construction of interoperable inland river terminals.

In comparison with the river Danube, the inland waterways of Bangladesh have similarities and differences. The similarities are varying draught limitations, air clearance, and the lack of container carrying vessels. On the other hand, the differences are excessive current, cyclone or bad weather, narrow channel width at the mouth of the river, and high siltation rate in the inland waterways of Bangladesh. In Europe and in the USA several efforts of innovative designs of vessels such as PACSCAT (Partial Air Cushion Supported Catamaran), domestic standard of High Speed Light Craft (HSLC) are made, and ocean barges are being developed for the optimum use of the inland waterways for further intermodality. This type of effort that is helpful to ensure safety is absent for the inland waterways of Bangladesh. It will also enhance port connectivity, fill the existing missing link for starting container carriage through IWW, inspire construction of inland container terminals through private initiatives, increase intermodality, and will be consistent for future short-sea shipping after constructing a deep sea port in the south of Bangladesh.

Finally, the inland waterways and IWT are sustainable development elements as they provide cheapest and energy-efficient service. Besides these, the external cost is less in comparison with that of other modes. For Bangladesh, the rapid growth in containerized cargo in Chittagong port, about 9% each year, necessitate the better and reliable alternative as the main transport corridor Dhaka-Chittagong road is going to be insufficient for container haulage in future. In near future, only the cheap labour cost will not bring competitive advantage for Bangladeshi goods; rather transportation cost will be an important issue where inland waterways has the

potential. There is ample scope for further researching on non-convention ferry safety and inland waterways of Bangladesh.

7.3 Recommendations

In the inland waterways of Bangladesh non-convention ferry safety issue needs technical assistance (Tentative Policy Matrix / Table 20) and investment both from public and private sector. On the other hand, for a sustainable transport system in Bangladesh the potentiality of the inland waterways as a multimodal element is immense which will attract investment in this sub-sector and hereby ensure the ferry safety in the inland waterways of Bangladesh. As a result of the conclusions drawn in this paper the following are the recommendations:

7.3.1 Modernizing organizational setup

The approval of the vessel design, survey and certification should be with the Department of Shipping (DOS). The number of surveyors and related manpower in the DOS should be increased and the naval architects, marine engineers and master mariners should be in the equal footing by changing the recruitment rules. Sufficient logistics should be provided to inland river port, terminal and the DOS officials to cater their duty. Marine court should be equipped with sufficient manpower, and logistics. Training should be given to the manpower of marine court so they can provide service effectively in this very technical sector. The classification society should be established for monitoring design and construction of the vessel. The pilotage service for the non-convention vessels should be made compulsory.

7.3.2 Upgrading of regulations

The Rules and the organizational structures for the local classification society should be framed immediately. The provision of trust fund membership should be eliminated from the Inland Shipping Ordinance (ISO). The mandatory insurance policy taking provision should be introduced to reduce the safety concern, bringing discipline to the industry and allowing the entire industry to start running by itself. The people and organizations concerned with the design, construction, certification, maintenance and regulatory authorities should be brought under a code of conduct.

The ISO should be upgraded introducing strict regulations for resisting syndicated business of the vessel owners and operators. The ISO itself should be amended in an intention to make it well-defined, consistent and stand alone instrument for the Inland waterways (IWW). A comprehensive format of recording of equipment and ship information like the CCSS Code, inspection, casualty and investigation reporting procedure as in the African model regulations, the fire protection arrangements and detail about the life-saving appliances, construction, stability and load lines for the vessel should be attached with the ISO. Technical assistance should be sought to draft a stand alone, and self-content regulatory instrument for the inland waterways of Bangladesh.

7.3.3 Standardization of shipbuilding industry

The construction of sub-standard vessel will be uprooted when standardization in the shipbuilding industry will be ensured. So, the standardization of vessel construction industry or dockyards should be done by introducing the certification provision for shipbuilders. Technical assistance will be required to design the entire certification process and the criteria for the shipbuilding industry.

7.3.4 Construction of suitable inland vessels

High siltation rate, varying draughts, bad weather, excessive current, narrow width at the mouth of the river ports are the limitations in the inland waterways of Bangladesh. With an objective of ensuring ferry safety and considering the limitations and the potentiality of the inland waterways as a complementary element of intermodality, the designing of inland High Speed Light Craft (HSLC) or Partial Air Cushion Supported Catamaran (PACSCAT) is an essential task. The high speed craft will be helpful for better manoeuvrability during the bad weather situation, but may raise collision incidents and increase river erosion. On the other hand, PACSCAT will ensure stability and will be consistent with variable draft situations. So, a design compromising between the two considering the inland waterways limitations will be suitable for Bangladesh. Technical assistance in desiging inland vessel for Bangladesh is essential.

7.3.5 Establishment of a bank of basic vessel models for IWW

A bank of basic vessel models should be created where models of small passenger vessel, large passenger vessel, container carrying inland vessel, barge, sea truck, small tanker vessel, water taxi and tourist vessel should be included. Technical assistance should be needed to create a basic model bank. It should be compulsory for shipbuilders and ship-owners to use these basic models. Initially the public-private joint venture projects should be run for constructing suitable vessels for the inland waterways of Bangladesh.

7.3.6 Interoperability of inland river ports and container terminals

Construction of container terminals at Adamjee, Pangaon and Khanpur should be started without delay and the existing Dhaka, Narayanganj, Barisal, Khulna, Chandpur, and Patuakhali river ports should be made interoperable strengthening the linkages with other modes of transportation and the hinterlands. Technical support should be sought for designing models for the interoperable river ports and container terminals.

7.3.7 Arrangement of institutional funding and insurance

The arrangement should be done to form institutional funding mechanism for the inland shipping sector in support of construction of vessel, construction of river terminals, and equipment installation. The concession package should be offered initially to the shipowners for upgrading the existing non-convention vessels. Besides regulatory provision, arrangement should be done for mandatory insurance policy for the inland waterway transport.

7.3.8 Upgrading maritime education

The educational facilities and curriculum of the Deck Personnel Training Centre (DPTC), and the Seamen's Training Centre (STC) should be upgraded and should be more practical. A maritime university should be established and all maritime related education should be coordinated through that maritime university. Technical assistance should be sought to improve the course curriculum and facilities for maritime education.

7.3.9 Establishment of river police

The inland river police should be formed to enforce the regulations and monitor the discipline of the ports, ghats (wharfs) and channels with sufficient manpower and logistical support. Effective linkage should be ensured among the Police department, the Department of Shipping, the Bangladesh Inland Water Transport Authority, the Local Administration and the Bangladesh Coast Guard to command and ensure efficiency of the river police force.

7.3.10 Establishment of River Information System (RIS)

A River Information System (RIS) and a central data base should be established for the inland waterways of Bangladesh. The RIS should contain the up-to-date hydro-graphic information of the inland river routes and the use of RIS should be part of the course in the DPTC. As RIS is a new concept technical assistance should be sought in its development.

7.3.11 Awareness building

Most of the non-convention ferry accidents take place in the southern and central part of Bangladesh. Awareness building activities should be taken in these areas through the local administration, the members of parliament, electronic media and newspaper and through educational institutes. The Non-governmental Organizations (NGO) should also be involved with the awareness building programmes.

7.3.12 Marking safer places

The safer places should be marked throughout the accident prone routes of the inland waterways of Bangladesh to have room for abrupt changes in the weather condition.

7.3.13 Dredging of inland waterways (IWW)

Siltation is the main problem of the navigability of the inland waterways of Bangladesh. On the other hand, there is lack of transparency in the dredging

process which encourages corruption. The dredging capability of the BIWTA should be enhanced by procuring dredgers and allocating resources.

Finally, a master plan should be prepared for the inland waterways of Bangladesh for a sustainable transportation system considering objectives such as flood control, reduction of river erosion and siltation, river training, and other uses of rivers. In near future continuous flow of costly energy is going to be a crucial factor for a densely populated country like Bangladesh, so the inland waterways transport is the sustainable development element as it requires less energy and less space.

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Appendix A

Table 1: Ferry Fatalities in the recent past

Date	Nation	Number of Fatalities	Cause
May 25, 2004	Bangladesh	>150	Weather
March 20, 2004	Somalia	100	Collision
March 20, 2004	Indonesia	>200	Rough seas
March 19, 2004	Maldives	17	Overcrowding
March 10, 2004	Madagascar	100	Cyclone
Feb 22, 2004	Pakistan	6-12	Capsize
Nov 2003	Congo	163	Collision
Nov 2003	Zambia	40	Storm
Oct 2003	United States(NYC)	11	Illness
July 2003	Bangladesh	400	Whirlpool
April 2003	Bangladesh	>280	(4 incidents)
January 2003	Tanzania	40	Capsize
January 2003	Somalia	80	Rickety boat
Nov 2002	Somalia	30	Lost power
Oct 2002	Senegal	1800	Storm
May 2002	Bangladesh	370	Storm
-	Indonesia	60	-
Dec 29, 2000	Bangladesh	200	Collision

(*Data source*: Lawson *et al*, 2005)

Table 2: Fundamental statistics on Bangladesh

<table>
<tr><td>Area [1]</td><td>Land Boundaries [1]</td><td colspan="2">Coast line [1]</td></tr>
<tr><td>Total: 144 000 sq km
land: 133 910 sq km
water: 10 090 sq km</td><td>Total: 4246 km
Mynmar: 193 km
India: 4053 km</td><td colspan="2">580 km</td></tr>
<tr><td>Population [1&2]</td><td>GDP-per capita (PPP) [1]</td><td colspan="2">Density [2&3]</td></tr>
<tr><td>Total: 147 365 352 (July 2006 est)
23.4% in urban areas
76.6% in rural areas</td><td>$ 2100 (2005 est)</td><td colspan="2">Population density: 955.3 persons per sq km
Tele density: 9 %</td></tr>
<tr><td>Exports[1&2]</td><td>Main export Commodities[1&2]</td><td colspan="2">Main export Partners [1&2]</td></tr>
<tr><td>2004---$7.5 billion
2005---$9.37 billion</td><td>Garments (75%),Jute& Jute goods, Leather, Frozen fish, Sea food</td><td colspan="2">US, Germany, UK, France, Italy</td></tr>
<tr><td>Imports [1&2]</td><td>Main import Commodities[1&2]</td><td colspan="2">Main import Partners [1&2]</td></tr>
<tr><td>2004---$10 billion
2005---$12.97 billion</td><td>Machinery & equipment
Chemicals
Iron & Steel
Textiles
Foodstuffs
Petroleum products
Cement</td><td colspan="2">India, China, Singapore, Kuwait, Japan, Hongkong</td></tr>
<tr><td>Infrastructures [2,4&5]</td><td>Transportation system [1,2&6]</td><td colspan="2">Modal shares [2]</td></tr>
<tr><td rowspan="2">Sea ports: Chittagong & Mongla

Inland river ports: 19

Inland Container Depots (ICD): 11

Airport 16 (3 international)

Export Processing Zone (EPZ)/ Special Economic Zone (SEZ) : 6</td><td rowspan="2">Highways:
Total: 239 226 km
Paved: 22 726 km
Unpaved: 216 500 km
Waterways:
Total: 8372 km
Main cargo routes:5636 km
(network reduces to 5200 km in dry season)
Railways:
Total: 2733 km
broad gauge: 884 km 1.676-m gauge
narrow gauge: 1,822 km 1.000-m gauge
Pipelines:
Gas 2012 km
(internal use)</td><td>Passengers</td><td>Freight</td></tr>
<tr><td>Road: 72%
Inland waterways: 17%
Railways: 11%</td><td>Road: 65%
Inland waterways: 28%
Railways: 7%</td></tr>
</table>

[*Data sources*(details in reference):1(U.S. CIA,2006), 2(Domus, 2005), 3(Bangladesh to have 12 million….,2006), 4(Alam,2005) & 5(Ali, 2006) 6(European Commission, 2001]

Table 3: Freight handling statistics in Chittagong Port Authority (CPA)

Period	Cargo handled (in m/tons)		Container handled (in TEUs)			Vessel handled		
	Export	Import	Export	Import	Total TEUs	Container vessel	Bulk vessel	Lighter vessel
2001	2009492	15609048	242537	245762	488299	571	1060	29
2002	2020776	17139413	263628	262725	526353	620	982	3
2003	2457554	18984335	310135	314425	624560	659	1061	14
2004	2458972	19413460	336899	351872	688771	691	1073	0
2005	2895769	22989122	383725	399628	783353	744	1148	0

[*Data source*: Chittagong Port Authority (CPA). 2006]

Table 4: Performance related statistics of CPA

Period	Empty Container handled (in TEUs)			Turn around time (in days)		Container handled at ICD* (in TEUs)		
	Export	Import	Total TEUs	Only container vessel	Average of all vessel	Export	Import	Total
2001	75179	9115	84294	6.64	5.91	26693	26727	53420
2002	83240	8072	91312	4.56	4.76	30171	29562	59733
2003	96107	7938	104045	4.31	4.56	33214	33437	66651
2004	98203	11785	109988	3.99	4.22	34195	34372	68567
2005	117433	11298	128731	4.08	4.55	39078	39582	78660

***** ICD → Inland Clearance Depot in Dhaka, Bangladesh (maintained by CPA)

[*Data source*: Chittagong Port Authority (CPA). 2006]

Table 5: Classified navigable inland waterways of Bangladesh

Class	Type/ No	Depth	Length
Class-I	4 Trunk routes	3.66m – 3.96m	About 683 km
Class-II	8 Link routes	1.83m – 3.65m	About 1000 km
Class-III	12 Secondary routes	0.91m – 1.82m	About 1905 km
Class-IV	Seasonal routes	Less than 0.91m	About 2380 km

(*Source*: Alam, 2005)

Table 6: Passenger/Freight flows and modal shares

Passenger Transport		**Modal shares (in %)**		
Year	Total Pass–km (billion) Passenger	Road	Rail	Inland Waterways Transport (IWT)
1975	14.6	54	30	16
1985	29.6	64	20	16
1989	26.4	68	17	15
1993	32.5	75	12	13
2000	32.1	73	13	14
2005*****	34.0	74	12	14
Freight Transport		**(Modal shares (in %)**		
Year	Total Ton–km (billion) Freight	Road	Rail	IWT
1975	2.6	35	28	37
1985	4.8	48	17	35
1989	6.3	59	11	30
1993	9.0	61	7	32
2000	14.5	74	6	20
2005*****	20.3	74	7	19

***** Forecast of Bangladesh Planning Commission

(*Source*: Adapted from ADB, 2004).

Table 7: Reported road accident trend in Bangladesh (1993-2000)

Year	Number of		
	Accidents	Fatalities	Injuries
1993	3140	1495	2409
1994	3013	1597	2686
1995	3346	1653	2864
1996	3727	2041	3301
1997	5453	3162	5076
1998	4769	3085	3997
1999	3942	3314	2620
2000	3970	4046	2270

(*Source*: Hoque *et al*, 2003)

Table 8: The trend of resource allocation for IWT sector in ADP

(All figures in million and US $1=Taka 71)

Year	**IWT Development Budget [Currency(Taka)] (Equivalent figure in US$)**	**Total ADP [Currency(Taka)] (Equivalent figure in US$)**
1991	400 (5.63)	56700 (798.59)
1992	500 (7.04)	58700 (826.76)
1993	600 (8.45)	60700 (854.93)
1994	750 (10.56)	62900 (885.92)
1995	900 (12.68)	65100 (916.90)

(*Source*: Adapted from The World Bank, 1991, p.9)

Table 9: Factors behind water transport accidents

Factors	Causes of accidents
Vessel design factor	• Faulty design and construction • Mechanical failure of the vessels • Insufficient and flawed navigational instruments
Operating environment factor	• Foggy weather condition • Excessive current and whirlpool • Cyclone and stormy weather
Human factor	• Overcrowding and overloading • Rush of passengers during embarking and disembarking • Incompetence of the Captain, Master and other professionals
Enforcement and educational factor	• Negligible amount of application and practice of vessel safety regulations • Deficiency in public awareness building programs • Deficiency in weather warning and counter measure system

(*Data source*: Awal, 2006 March)

Table 10: Types, frequency, weather condition, and time of ferry accidents (DOS report based)

Type of Accident	1995 - 1999	2000-2005	Sub Total	Frequency of occurrence considering weather condition				Frequency of occurrence considering time of accident (in hrs)				
				Fair	Cloudy / Foggy	Rough / Stormy	Sub Total	00:00-05:59	06:00-11:59	12:00-17:59	18:00-23:59	Sub Total
Overloading / Overcrowding	4	5	9	9	0	0	9	1	5	2	1	9
Collision / Human element	12	25	37	32	5	0	37	8	10	8	11	37
Excessive current	2	1	3	2	1	0	3	0	2	0	1	3
Physical failure	1	5	6	5	0	1	6	1	2	2	1	6
Extremely bad weather	5	9	14	1	1	12	14	1	2	8	3	14
Others	5	10	15	13	1	1	15	2	3	7	3	15
Total (84 Investigation Report Analysis)	29	55		62	8	14		13	24	27	20	

(*Data source*: Ali, 2006)

Table 11: Months and region of ferry accident during 1995 – 2005 (DOS report based)

Type of Accident	Frequency of occurrence considering months													Frequency of occurrence considering regions					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sub Total	South	South-West	South-East	Middle	West	East
Overloading / Overcrowding	1	2	0	1	1	1	1	0	0	0	2	0	9	4	0	3	2	0	0
Collision / Human element	4	5	4	3	0	1	3	4	5	5	1	2	37	14	2	8	13	0	0
Excessive current	0	0	0	0	1	0	1	1	0	0	0	0	3	1	0	1	1	0	0
Physical failure	0	0	0	0	1	0	1	1	1	1	0	1	6	2	2	1	1	0	0
Extremely bad weather	1	1	4	3	5	0	0	0	0	0	0	0	14	4	2	4	3	0	1
Others	1	1	0	1	3	0	1	5	3	0	0	0	15	6	0	2	7	0	0
Total (84 Investigation Report Analysis)	7	9	8	8	11	2	7	11	9	6	3	3		31	6	19	27	0	1

(*Data source*: Ali, 2006)

Table 12: Types frequency, weather condition, and time of ferry accidents (ARC statistics)

Type of Accident	1995 - 1999	2000 - 2005	Sub Total	Frequency of occurrence considering weather condition					Frequency of occurrence considering time of accident (in hrs)					
				Fair	Foggy	Stormy	Unreported	Sub Total	00:00-05:59	06:00-11:59	12:00-17:59	18:00-23:59	Unreported	Sub Total
Overloading & Cyclone	20	45	65	0	0	65	0	65	6	9	21	24	5	65
Collision	19	38	57	45	5	0	7	57	8	9	10	22	8	57
Excessive current	7	15	22	3	0	0	19	22	2	5	5	2	8	22
Physical failure	3	7	10	7	0	1	2	10	2	2	3	0	3	10
Others	3	20	23	5	0	1	17	23	3	2	6	8	4	23
Total (177)	52	125		60	5	67	45		21	27	45	56	28	

(*Data source*: Awal, 2006)

Table 13: Months of ferry accident during 1995 – 2005 (ARC statistics)

Type of Accident	Frequency of occurrence considering months												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Overloading & Cyclone	0	0	14	12	19	7	10	4	4	10	3	1	65
Collision	6	3	7	6	4	3	3	5	4	11	2	3	57
Excessive current	1	0	0	0	2	7	7	2	2	1	0	0	22
Others including physical failure	4	3	0	2	1	9	1	2	0	3	5	3	33
Total	11	6	21	20	26	26	21	13	10	25	10	8	177

(*Data source*: Awal, 2006, March)

Table 14: Modal shares (in percentage for the year 2002) of 8 EU riparian countries for all surface freight

Country / Mode	Rail	Road	Inland waterways	Pipelines
Austria	29.7	51.3	5.0	14.0
Belgium	12.9	70.0	14.3	2.8
France	14.0	77.8	2.3	5.8
Germany	14.5	69.7	12.8	3.0
Hungary	27.2	59.8	5.8	7.1
Luxembourg	15.2	77.3	7.5	0
Netherlands	4.4	44.9	44.2	6.5
UK	10.0	84.1	0.1	5.8
EU 25	16.4	72.0	6.0	5.6

(*Data source*: Thew, 2006, March).

Table 15: Cost comparison of the three modes of transport in Bangladesh

(in US$)

Item	Containerized cargo via rail	Containerized cargo via road	Containerized cargo via IWT (Estimated)
Terminal Handling Charge	43.40	43.40	88.0
River Dues	9.60	9.60	9.60
Inland Haulage (Haulage time – Distance)	141.18 (rail) (9 hrs.-347 km)	188.11 (Road) (8 hrs.- 280 km)	55.00 (IWT) (20 hrs.- 305 km)
Unstaffing Charge (11 tons)	32.47 (at ICD)	32.47	-
Container Demurrage (10 days)	4.21	4.21	-
Container Storage (10 days)	9.00	9.00	-
Landing Charges	44.91	44.91	12.00
Road transport- final delivery	35.30	-	12.00
Total	**320.07**	**331.33**	**176.60**

(*Data Source*: Adapted from ADB, 2004 November)

Table 16: Passenger and freight transportation statistics of important river ports

River port	Passenger and freight transportation statistics					
	2002-2003		2003-2004		2004-2005	
	Passenger	Freight (mt)	Passenger	Freight (mt)	Passenger	Freight (mt)
Dhaka	10549086	481629	11256372	656033	11599408	826500
Narayanganj	1569836	614899	1458352	1275833	1390452	922300
Chandpur	1602232	221668	1418203	2897433	1412374	255233
Barisal	2510218	115712	2488882	21803	2440038	223700
Patuakhali	825166	90520	830626	91020	820181	105000
Khulna	253639	514717	243252	709233	237672	1233933

(*Data source*: Adapted from BIWTA, 2006)

Table 17: Trade gains (in $ million) from capacity building by some South Asian countries.

Country/Region	Port efficiency (Air and Maritime)	Customs	Regulation	Service-sector infrastructure	Total
Bangladesh	228	144	71	339	782
India	314	193	123	519	1149
Pakistan	74	29	42	191	336
Sri Lanka	97	63	41	175	377
South Asia	712	429	278	1224	2644

(*Data source*: Wilson *et al*, 2004, p.20)

Table 18: Comparison between Bangladesh IWT and the Netherlands IWT

Bangladesh IWT	The Netherland IWT
Waterways: (a) Natural but subject to continuous capital and maintenance dredging (b) 55896 km navigable waterways (c) Length of navigable waterways are shrinking and the river beds are coming up because of high sedimentation	**Waterways:** (a) Natural as well as artificial and subject to dredging (b) 2500 km of navigable waterways (c) Length of the navigable waterways are subject to sedimentation, but because of continuous dredging and canalization the effect is not so visible
Infrastructure: (d) The river ports are developed, maintained and operated by the government agency (e) Aids to navigation, safety matters are looked after by the government agency	**Infrastructure:** (d) The inland terminals (river ports) are developed on 'fifty-fifty' basis between government and inland shipping industry and maintained and operated by the private or local authority (e) Aids to navigation, safety matters are looked after by the government agency
Competition: (f) Share with other transport modes is 29% (of domestic cargo) (g) International inland shipping share is only about 21% (India to Bangladesh) (h) Intra mode competition- Private vs. public operator, registered vs. non-registered, and free market competition for dry and liquid cargo, though liquid cargo is carried mostly by the company's own vessel (i) There are single vessel owned and operated firms. The families do not live on board vessel.	**Competition:** (f) Share with other transport modes is 55% (of domestic cargo) (g) International inland shipping share is 60% (1990) (h) Intra mode competition- No commercial public inland shipping organization. Non-licensed vessel can not take part in competition. Competition is only in liquid cargo market (i) Most firms (86.9%) are single vessel owned. The families of owner-cum-operators live on board vessel.

(*Source*: Dewan, 1995, pp.78-79)

Appendix B

Table 19: SWOT analysis of the IWT of Bangladesh

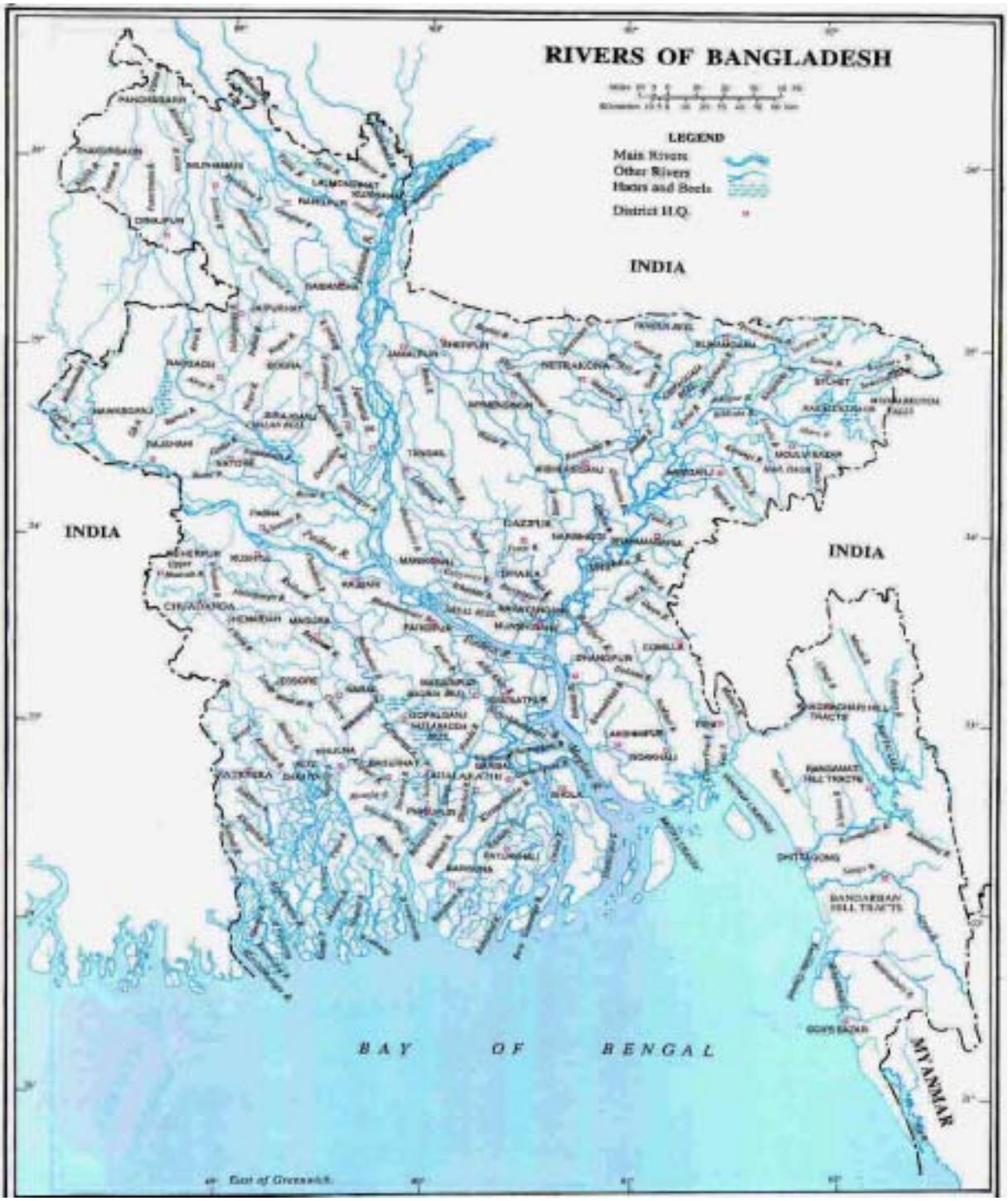
Strength	**Weakness**
1) Inland Waterways Transport (IWT) is an environment friendly transportation system 2) IWT requires less land space which is pertinent to a space scarce country like Bangladesh 3) It is less effected by other modes of transport and complexities 4) Reliable transportation particularly for sensitive goods 6) It is a cost-effective transportation system for medium and low value goods 7) Already 15% of passengers and 30% of cargo are carried by IWT 8) IWT provides an energy-efficient transportation	Poor maritime administration and monitoring system The speed of IWT is relatively low The authenticity of the IWT related statistics is poor The lack of navigational aids 5) The lack of flexibility since the skeleton of IWT is naturally given 6) Inadequate regulations and enforceability 7) Absence of the Navigational Act 8) Absence of river policing 9) The slow rate of industrialization and a small export basket of Bangladesh 10) The lack of IWT experts and workforce
Opportunity	**Threat**
1) Potentiality of IWT as sustainable transportation 2) Requires less capital investment 3) Prospect for private investment in IWT 4) Good hinterland prospects for most major river ports 5) Easy to monitor with relatively less establishment cost 6) Smooth and congestion free port connectivity 7) Most cities and towns are situated on the bank of rivers which can easily contribute to the supply chain integration 8) Educated unemployed workforce which can be converted into maritime workforce through maritime courses 9) Unexplored IWT related business 10) Already existing interacted backbone with other modes of transportation in places such as Khanpur, Adamjee, Chandpur, Khulna etc.	Maintenance cost of the inland waterways Siltation and problem of navigability Less political commitment Climate change and natural calamities- sea-level rise, frequent flooding, cyclone etc. Absence of institutional funding and insurance mechanism Excessive profit making mentality of the vessel owner Substandard designing of non-convention vessels

Table 20: Tentative Policy Matrix

Component	Strategic Goals	Key Targets	Technical Assistance	Future priorities
1) Non-Convention ferry safety in the inland waterways of Bangladesh	1) Assurance of smooth IWT navigation 2) Up gradation of the ship building industry 3) Up gradation of the standard existing non-convention vessels 4) Consistent maritime education and use IT 5) Awareness and environment	1) Certification for non-convention shipbuilding industry 2) Formation of river policing 3) Establishment of River Information System (RIS) 4) Mandatory insurance policy for the non-convention vessel owners and operators 5) Establishment of local classification society 6) Awareness building for IWT and its environment 7) Enhancement of dredging capability of BIWTA 8) Priority of the IWT in the Annual Development Program 9) Concession program for upgrading existing non-convention vessels 10) Injecting fresh workforce in IWT through enhanced training	Technical assistances are required to formulate the process and criteria of certification for the shipbuilding industry, preparation of stand alone regulatory instrument, upgrading existing non-convention vessels, improvement of maritime education, and establishment of river information system.	Enhancement of enforceability of regulatory matters and environment awareness issues
2) Promotion of IWT as a complementary multimodal transport element	1) Designing of appropriate IWT vessels including container carriers 2) Construction of interoperable river ports and terminals 3) Integration of other modes of transportation with inland waterways 4) Development of port and terminal hinterlands	1) Construction of khanpur, Pangaon, and Adamjee container terminals with interoperable facilities 2) Construction of suitable passenger vessels and container carriers for inland waterways of Bangladesh 3) Commencement of institutional funding mechanism for investment in IWT sub-sector and promotion for private investment 4) Modernization of the existing major river ports 5) Establishment of industrial units in the hinterland of river ports 6) Feasibility study for the IWT and preparation of master plan	Technical assistances are required for designing of suitable vessels for the inland waterways of Bangladesh and models for interoperable river terminals and ports. Assistances are also required for feasibility study of the inland waterways and preparation of master plan for IWT.	Emphasis should be given on intermodal operation, coastal and short-sea shipping

Appendix C

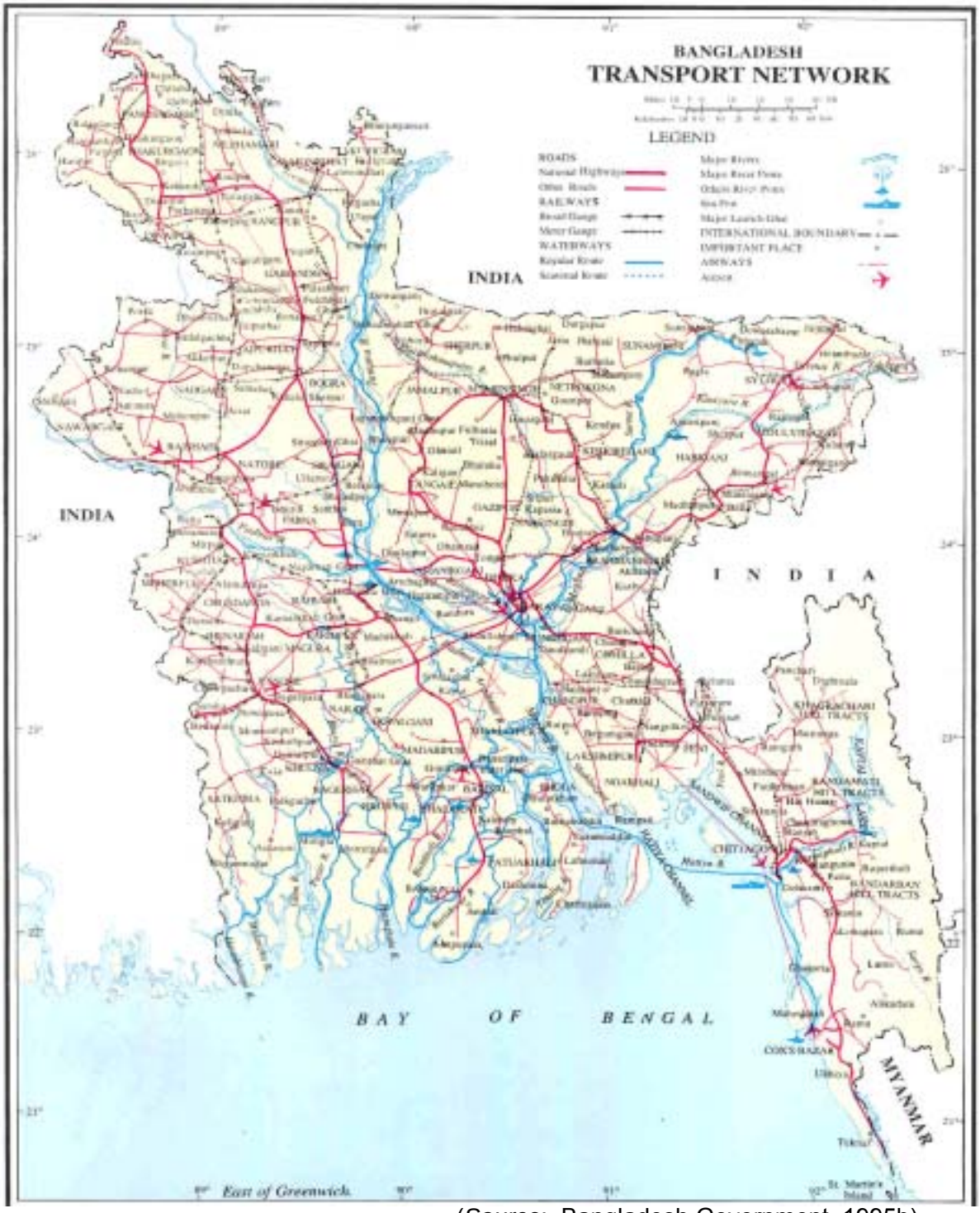
The map of the rivers of Bangladesh



(*Source*: Bangladesh Government, 1995a)

Appendix D

Transport network of Bangladesh



(*Source*: Bangladesh Government, 1995b)