

Safe Operation of Inland Water Passengers' Vessels in Bangladesh: Challenges and Policy Options

A S M Abdul Baten^{1*}

Abstract

The safety aspect of the Inland Water Transport (IWT) sector in Bangladesh lacks appropriate attention since long. This is often reflected through disastrous incidents at rivers with loss of valuable life and property. This study aims to identify the challenges faced by operators during the operation of passengers' vessels in the rivers of Bangladesh and to confirm the appropriateness of the existing governance processes in the IWT sector. The study involves a diagnostic approach using the conceptual framework, where independent variables: Governance, Human elements and Technical aspects of vessels' operation have been examined by the data collected from both primary and secondary sources. This study finds a number of active and hidden challenges. Some of these challenges are caused by weak regulatory frameworks, absence of Classification Society, poor design/construction of vessels, improper training etc. As a result, accidents of different magnitudes take place, which needs to be addressed by policy-level decisions to make the IWT sector a more acceptable and safer branch of transportation in Bangladesh. The significance of the study lies in the fact that these findings shall be useful guidelines for updating the current strategies for the safe operation of IWT vessels and support different national and international commitments (8th 5YP, SDGs etc.).

Keywords: Safe operation, passenger vessels, stability, classification, governance, survey.

1. Introduction

Bangladesh has a fairly large fleet of inland water vessels. These vessels are of different types and categories used to transport people, goods and support other maritime activities. All inland passenger vessels are built indigenously, where the majority of these are owned by the private sector (98%). Private sector participation in shipbuilding has increased by almost 10-12 % in the last 15 years. The total number of registered vessels (according to ISO 1976) by the Department of Shipping (DoS) is

¹ Research Fellow at Bangladesh University of Professionals.

*Corresponding Author
asmabaten@gmail.com

13486 up to 31 December 2020. Out of all the vessels registered by the DoS, only about 10 % are passenger vessels (DoS report, 2020). Public and private sectors are involved in managing and operating IWT passenger vessels, which are exposed to various challenges resulting in different magnitude accidents. So far, very limited research has been done in Bangladesh on this subject. As such, the core issues have not been indeed identified. This study is devoted to examining the major three selected variables: governance, technical and human elements of operation with available instruments and mechanisms to identify the problem areas during operation at the inland river routes of Bangladesh. The area is quite vast though, the scope of this work has been limited to the study of registered passengers' vessels (by DoS) at major river routes/ areas of the country prone to accidents.

2. Statement of the Problem

Despite having the inherent experience of untapped capacity, the IWT sector has not yet reached its potential in Bangladesh. Due to problems prevailing in the governance process and other related items, the IWT system is not considered safe enough as it should have been. The trend of riverine accidents of different magnitude with casualties and loss of life over the last 45 years have been shown on a graph (Figure-2), from the study of about 719 recorded accident cases in the office of the Department of Shipping (DoS) of the Government of Bangladesh (GoB) by the researcher. It is seen that there is two downward drift during 1996-2002 and again 2011-2016. The first drift could be tighter control on the movement of personnel by the authorities concerned and the introduction of some larger passenger vessels in the fleet. The second drift may be due to the stopping of vessel movement with weather warning signals and limited movement control. However, by studying some accident cases even during these periods (say, ML Pinak -6, 2014; MV Morning Bird, 2020), it appeared that governance at IWT has not been appropriate. Hence, operators' efficiency, vessels' design and construction, adoption of the owners'/operators' safety culture, and legal framework need to be assessed. Preliminary investigations and reports show some causes, which are also shown in Figure-2. It is revealed that many of the cases were not fully investigated by independent bodies, and reports were never published and analyzed using any standard approach with models or accident investigation tools available. As a result, the credibility of the investigation remained under question, and for some major accidents, root causes were hardly identified.

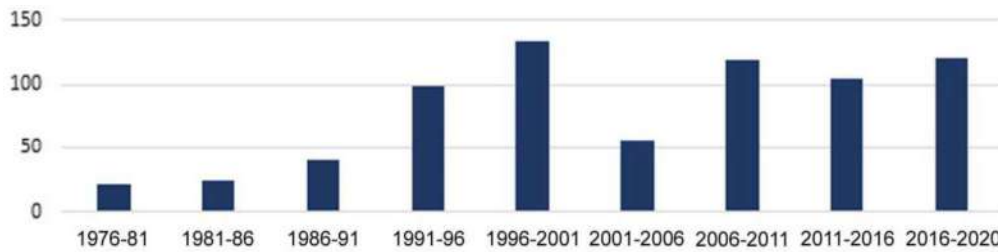


Figure 1: Number of IWT Accidents over the years
 (Source: Department of Shipping (DoS), GOB)

Several case studies of accidents reveal that the investigation procedure is a kind of blame game. Once blame is established, the investigation finishes. Unfortunately, there are not many research works available on operational challenges faced by the operators and the consequent suffering.

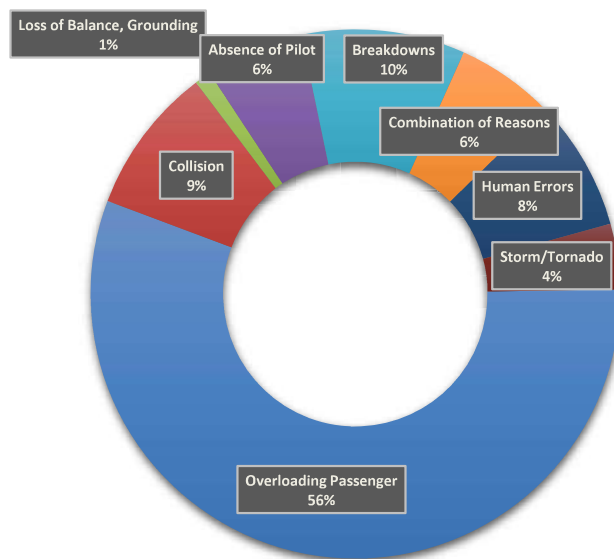


Figure 2: Causes of Riverine Accidents
 (Source: Department of Shipping (DoS), GOB)

A survey on several senior officials and staff of BIWTA and DoS revealed that the majority of the personnel (almost 70%) feel there is a constant challenge to maintain the safety of passengers and vessels. The majority of them agreed that BIWTA and DoS face regular challenges for the safe operation of passenger vessels (Figure-3). The challenges are prominent during the festival periods each year.

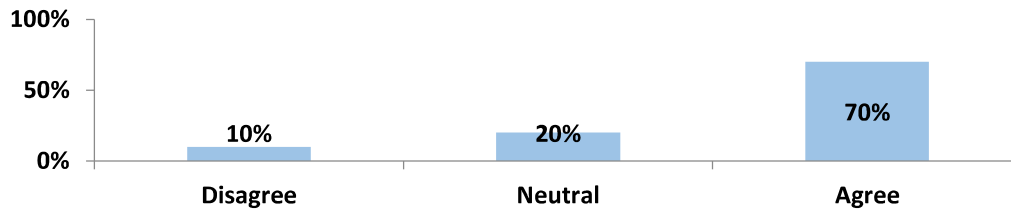


Figure 3: BIWTA and DoS Face Regular Challenges for Safe Operation of Passengers' Vessels
(Source: One to one Interview; n=35)

Thus, a broad inference can be drawn as follows: Inland passenger vessels at IWT sector are operated without giving due attention to safety, resulting in frequent accidents caused by inappropriate governance processes, including human and technical issues.

3. Rationale of the Study

It has been strongly felt that IWT is not given due attention in regards to safety. There are scores of governance, human and technical issues that often put operation under tremendous challenge. Since very limited research on this particular area has been conducted, the findings of this study would give guidelines to improve the safety standard of the IWT vessels. Once safety standards would reach a higher level, the chances of accidents with loss of life and property would be minimum, and people would be encouraged to invest more, and it will impact the national development positively as per policy level targets for both national and international.

4. Research Objectives

The general objective of this study is to examine the challenges encountered by the passenger vessel operators at the inland river routes of Bangladesh and identify the ways of improving existing safety standards and minimize riverine disasters. The study's specific objectives are: Explore the gaps in available policy guidelines and recommend measures to improve the existing performance of IWT vessels so that future national commitments (5YPs, and SDG targets) can be met.

5. Research Questions

In view of the broader objectives of the study, the following research questions have been raised:

- (a) Are the operators prepared to face the challenges they meet during the operation of inland passengers' vessels?
- (b) Are the Governance processes adequate and/ or appropriate for the safe operation of vessels at inland waterways of Bangladesh?

6. Literature Review

Review of literature has been done at national and international levels, some of which are as follows:

Uddin et al. (2017) studied riverine accident cases over a period of 10 years and recorded 229 accident cases where more than 300 vessels were found either damaged or lost. The researcher mentioned with Geographical Information System (GIS) study that the most vulnerable areas of accidents were near Barisal, Chandpur etc. The main reason was a collision (60.3%), but root causes and issues with governance have not been identified.

Su, X et al. (2017) carried out a study on the capsizing of Chinese Ferry Eastern Star near the town of Jianli with 456 people aboard. Bad weather was a cause, and the Master of the vessel did not comply with the safety standards as reported. The team used 24Model, as an accident causation model based on system thinking, which holds that all causations of the accident are hazards and all hazards in the system need to be identified and comprehensively controlled in accident prevention. Lesson learnt has relevance to the present study.

Kalyani, et al. (2015) carried out a formal safety assessment and had listed a number of factors responsible for accidents which are also common in the IWT of Bangladesh. Shortage of data was a limitation, though the Fault Tree analysis using Odisha Boat Capsize has been a good example for hazard analysis, which has relevance in IWT in Bangladesh. The study, however, did not mention anything about governance issues that affect safe operation.

Chukwuma (2014) has a comprehensive study on inland water transportation in Nigeria, which recommends that to lay the foundation for accelerated progress in the future, government and the private sector need to review their policies and introduce new strategies which can make water transport compete favourably with road transport in Nigeria. Findings are useful references and guides to building confidence in the IWT sector of Bangladesh.

Anyanwu, J. O., (2014) conducted research on causes and minimization of maritime disasters on passenger vessels covering a wider time from 1852 to 2011. The findings show the causes and effects of maritime disasters were poor education and training, inadequate policies and procedures etc. and has a useful indication to check similar areas in the Bangladesh context.

Awal, Z I (2006) studied riverine accidents (total 197) that took place over a period of ten years (1995-2005) and concluded that the main causes of such accidents were overloading, cyclone and collision. However, the researcher has not addressed core issues, including governance aspects and the human element, which is deemed to be the initiator of such untoward incidents. (Awal et al., 2006) showed accident cases at rivers of Bangladesh over a period of 26 years (1981-2007) where 75% of those cases resulted due to collision of passenger's vessels with cargo vessels where smaller vessels were affected more (44% of the vessels have had a length between 40 to 60 metres). Other areas of governance and human elements were not addressed.

Baten (2004) indicated discrepancies in the implementation level where noncompliance to Classification Society for the survey and design checks was one of the major issues, which is still missing in the process.

Hossain et al. (2003) attempted to trace out the causes of launch disasters and the geographical distribution in Bangladesh over 23 years (1977-2000). The team studied 140 cases, and found that the most frequent types of launch accidents were caused by collision (42%), followed by foundering, i.e., lack of maintenance and poor construction (30%) and overloading (20%) and weather-related issues etc.(8%). Out of 140 accidents, zone-wise, Barisal, Bhola, Patuakhali, Chandpur and Dhaka areas had 69.55% of accidents altogether.

7. Conceptual Framework

Keeping the research questions in mind and from the study conducted so far, an analytical framework for the research work has been delineated (Figure- 4). Two accident models, namely: Swiss Cheese Model, Reason (1990) and Accident Model based on system theory on safety, Leveson (2004), have been supportive to the conceptual framework. Here the indicators would identify the different barriers or constraints before any sort of challenge. Theoretic Indicators which has been considered important are also listed and put with each concerned variable. Following variables have been identified for study to judge their overall impact on the safe transportation of passenger's vessels and weigh operators' challenges.

7.1 Dependent Variable: Safe operation of Inland Water Transport (i.e., Accident or injury-free operation). The term '**safe operation of passengers**' vessel would mean any vessel at inland waterways, which meets all prerequisite criteria for safe operation as per the existing standards/ regulations that the Government of Bangladesh authorizes.

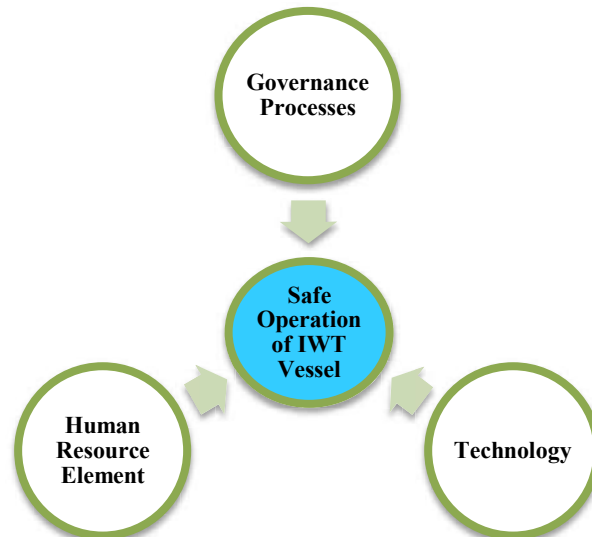


Figure-4: Conceptual Framework for Safe Operation of Passenger's vessel
(Source: Author's Illustration)

7.2 Independent Variables

Three independent variables have been identified, which are: **Governance Processes, Technology and Human Element**. If an efficient human operator backs the right technology under a process of good governance, it is expected the operators' challenge would be minimum, and passengers on board would be safe during operation.

7.2.1 Governance Processes

Independent variable 'governance processes' would be examined in the safe operation of Inland Water Passenger vessels by three main indicators, which are the following:

- **Rule of Law.** It is the **first indicator** identified for smooth governance of the IWT system in the operation of passenger's vessels. By the rule of law, it signifies the requirement of a fair legal framework.
- **Role of Participating Bodies.** The **second indicator** of good governance is the effective role of the participating bodies (respective organizations). Here, efforts have been made to examine mainly the safety administration.
- **Effectiveness of Infrastructure and Channels.** The **third indicator** for good governance is well maintained effective port and supporting infrastructure, including channels.

7.2.2 Technology

The second independent variable for the safe operation of passenger's vessel is to judge whether the vessels which are studied are technically sound to maintain the safety of passengers. Vessels built with proven design and fitted with standardized equipment accepted by a classified authority is the main consideration.

7.2.3 Human Resource Eleme

The third independent variable is the operator. The majority of the theories, tools, and models on accident and risk so far discussed has one ubiquitous item: the human element. To avoid risk and stay safe, people need to be aware of the requirement of safety. The indicators which would be studied here are human awareness, training and education.

8. Methodology

8.1 Study Area and Population

The research's main study area is the southern part of Bangladesh, starting from Dhaka through the confluence of major rivers: the Padma, the Meghna towards south to, Barisal, Patuakhali, and Hatiya **Bhola** and **Mawa**. It is estimated that these routes generate more than 70 per cent of the total IWT output. Most of the major inland ports are located along the routes under the present study.

8.2 Choice of Methods in Data Collection

8.2.1 Data Collection by Survey

The research involves a collection of huge amounts of data. The survey has been done on different groups of people. The major population was passengers. After that, there were other groups of professionals who were surveyed/ interviewed with a preset questionnaire. In addition, focused group discussion was essential to get opinions from different groups of professionals and experts.

Simple Random Sampling (SRS) was applied in selecting the respondents. The questionnaires include both closed and open-ended questions. The majority of the questions were related to governance processes, legal framework, infrastructure, river routes, management of ports, vessel design/ construction, training, etc. The author conducted the survey at all relevant offices, 11 river ports, more than an equal number

of landing stations and vessels of different sizes operating at different routes/zones. It is to be noted that the aim of the conducted survey was not to explain the full characteristics of the population but rather to get a deeper understanding of the issue under study. The output of the survey has been examined mainly using frequency analysis. However, the qualitative part of the survey was also investigated based on secondary data available. In conducting the frequency analysis, statistical software 'SPSS' has been used.

Ten vessels have been identified, of which five vessels had sizes from small to medium, having passengers' capacity ranging from **90 to 200**. The second group of vessels have passengers' capacity of **200 and above**. Eight passengers from each of 5 small to medium-sized vessels and 12 passengers from each of 5 larger vessels have been chosen for an interview. In each vessel, passengers have been categorized into two groups: one on the decks and the other in cabins.

8.2.2 Data Collection from Key Informants Interviews (KIIs) and Focused Group Discussion (FGD)

For KIIs and FGD, different professional groups were selected, including government officials, private owners, lawyers, naval architects, educationists, engineers, and mariners. A set of questions on policy, regulation, practice, experience and other technical/ legal matters are framed for the KIIs and FGDs.

8.2.3 Data Collection from Secondary Sources

Records have been used from different sources containing other researchers' research, reports of consultants hired by government offices, various administrative orders, policy papers, statistical data books, journals, and safety-related books and papers. Majority of relevant data have been collected from DoS, BIWTA, BIWTC, Survey offices of the government, building yards, office of the association of the owners and different national and international websites.

8.2.4 Sources of Information for Variables

Table 1: Variables and their sources

Independent Variables	Indicators	Responsible Organizations/Authorities	Principal Areas of Key Questions
Governance Processes	<ul style="list-style-type: none"> • Rule of Law • Role of participating bodies • Effectiveness of Infrastructure including routes 	<ul style="list-style-type: none"> • Department of Shipping (DOS). (including bureaucrats) • Director-General and his officials/staff • Bangladesh Inland Water Transport Authority (BIWTA), • Chairman BIWTA and his officials/staff. • President Passenger vessel owners' association, • Owners of Design houses, • In-charge training institutes 	<ul style="list-style-type: none"> • Legal framework • Judicial Process • Organization for safety • Ports and Structures • Rivers' effectiveness
Technology	<ul style="list-style-type: none"> • Design, Construction, survey /maintenance. 		<ul style="list-style-type: none"> • Standard of design/construction • Survey and classification • Technical snags
Human Resource Element	<ul style="list-style-type: none"> • Awareness and Safety Culture • Training of Operator • Socio-Economic Condition 		<ul style="list-style-type: none"> • Safety culture • Education and training • Motivation and socioeconomic impact on safety
<p>Sources: Interview KIIs, desk reviews, surveys/study of the organization: DoS, BIWTA, BIWTC, Training Institutes, FGD, websites of organization, journals national/internationals. 21 areas were put under question with average 43 persons in each, plus 274 passengers were surveyed.</p>			

9. Analysis and Findings

9.1 Introduction

Three major independent variables, namely: governance processes, technical and human elements that influence challenges for the safe operation of passenger's vessels have been examined for major weaknesses.

9.1.1 Governance: Rule of Law

a. Need for Strengthening Regulatory Framework

About 70% of the stakeholders' representative have opined that the regulatory framework is not strong. Some of the areas which need immediate attention are the inappropriate scale of punishment for violation of rules. Rules for vessels design are not comprehensive as these do not cover the local weather condition, including port and river routes' physical characteristics and these need review and amendment in line with

acceptable international (say, International Maritime Organizations). Division of stakeholders' responsibilities is not clearly demarcated, which result ambiguity in sharing of responsibilities and duplication. Discretionary approach of DG's authority regarding manning of vessels is not transparent, which allow unqualified crews at the helm of vessels and face challenges at critical hours of operation. There is no law in existence for shipbuilders. Existing law/regulation do not make designers, inspectors responsible for flaws/ irregularities. Provision to have no communication set for vessels carrying less than 100 passengers needs amendment.

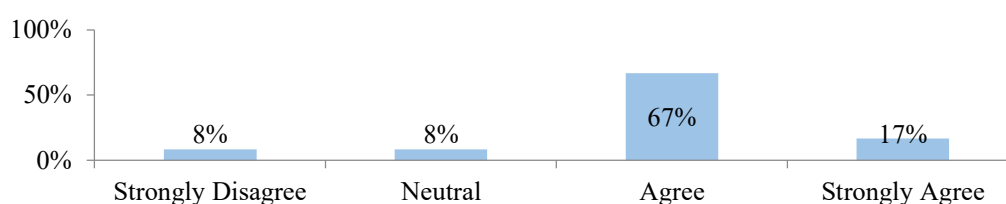


Figure 5: The Legal Framework for Inland River Transportation is Weak
(Source: One to one interview; n=35)

b. Slow Judicial Process

Only marine court with inadequate capacity fails to handle the total load of the cases filed yearly and thus slows down the judicial process. Although this is a general picture in the country, which is also supported by the 8FYP of the government (GED, 2020), which say, “Bangladesh presently has one of the lowest judge-to-people ratios in the world, which has contributed to the huge backlog of cases and the low rates of their disposal. In fact, latest estimates indicate that Bangladesh has approximately 1.1 judges for every 100,000 people, which is far below the South-East and South Asian average of between 2 and 2.5 judges per 100,000 people”. Slow judicial process demotivates some of the operators who often become a victim due to no fault of theirs, and it affects accountability in governance, and perpetrators remain carefree. Existing law has no guidelines on how to make the judicial process prompt and effective.

c. Inappropriate Safety Administration

Safety Administration as recorded at National Shipping Policy (2001) has not been formed. Whatever is held on paper does not function as the person responsible for safety survey and design approval is also the in-charge of Inland Ship Safety Administration (ISSA). Methods of accident investigation so far conducted are not appropriate as the modus operandi is not set by any rules and laws, where the neutral board could perform the task using appropriate tools and models. No national-level Institute or board is available to conduct an investigation on maritime accidents. This generates issues leading to poor safety culture, weak and inappropriate governance.

9.1.2 Infrastructure: Port and Related Facilities

a. Inappropriate Governance at the Port and Landing Station make the situation appalling

This results in a challenging situation both for management and operators in the safe operation of vessels. Ports lack discipline, which has been agreed by 78% of respondents at BIWTA and DoS. Apparently, no/or inadequate control on passengers' movement at the port and landing station make the overall situation chaotic and unsafe. Almost 100% of ports and landing stations have no arrangement for embarkation/disembarkation of sick people with wheel-chair. Whereas SDG Target 11.2 say: "by 2030, there is need to give access to safe, affordable, accessible, and sustainable transport systems for all, with special attention to the needs of those in vulnerable situations, women, children, **persons with disabilities, and older person**". Thus, operators find it difficult the safe handling of vessels at inappropriately maintained landing stations/ports. Allocation of the fund compared to other means of transportation is very less. An example is shown in Table 2 and 3, where it shows at 8th 5YP that the ADP allocation for IWT is the minimum, although IWT carries more passengers/goods than rails.

Table 2: Ministry-Wise 8FYP Annual Development Programme Allocation
(Taka Billion)

Fiscal Year	FY21	FY22	FY23	FY24	FY25
Road Transport &Highways Division	177.9	185.0	203.0	217.6	252.8
Ministry of Railways	65.6	73.4	94.1	99.5	115.0
Ministry of Shipping	40.6	47.5.1	53.1	56.41	61.2

Source: GED Projections.

Note: (ADP Taka Billion in FY2021 Prices)

Table-3: 8FYP Transport Sector Targets

Indicator:		FY 2019 Base Year	FY 2025
Passenger Traffic (billion passenger- kilometers)	Roads	169	246
	Inland Waters	16	23
	Railways	10	15
Indicator: Freight (Billion Tonnes-Kilometers)	Roads	24	31
	Inland Waters	5	7
	Railways	2	3

Source, GED Projections,85YP

Despite Bangladesh’s notable economic growth, performance and impressive record of social progress, the country lags many other Asian developing economies on Transportation infrastructure-related indicators. In 2019 the Global Competitiveness Index (GCI) Ranking Bangladesh infrastructure stood 114 out of 141 countries (Fig-6), (8 FYP, Pp 225).

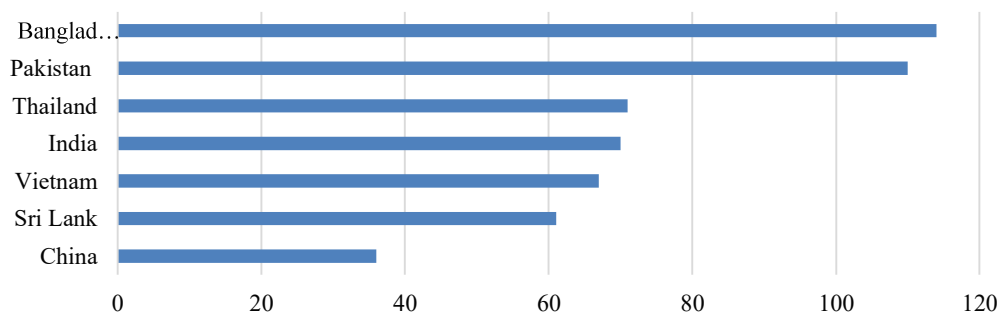


Figure 6: Global Competitiveness Index: Ranking In Transport Infrastructure, 2019 (Source: World Economic Forum 2019)

b. Unplanned Dredging of Rivers Result Shallow Water Effect

The dredging process at rivers has never been comprehensive. Whatever is done on a piecemeal basis for the short term can hardly maintain all the navigational channels over the years. Operators keep on facing regular challenges during the dry season due to the shallow water effect and occasionally even during the monsoon period.

9.1.3 Human Resource Element

Human error, wrong perception and decision at every level may cause any operation unsafe in the IWT system. Indicators selected here are awareness/safety culture, socio-economy, and levels of training and education to assess the operators’ confidence in the safe operation of Passenger’s vessels at IWT.

a. People’s Awareness of Safety

A survey on the southern part of Bangladesh at the selected port shows that 65% of passengers do not have knowledge about the quality of the vessels they use at river routes. 85% of passengers have no idea about the consequences of travelling in an unfit vessel without adequate lifesaving appliances. 60% of operators feel that vessels have adequate lifesaving appliances even when they do not carry the minimum number of

tested life jackets and lifebuoys. 30% of passengers did not know what to do in case the vessel capsizes and 47 % feel that all depends on God and had nothing to do.

b. Education, Training and Manning

DoS has a shortage of personnel to conduct primary items of survey, design approval, certification and additional responsibility of training. The DoS has no institute to conduct training which is all under the BIWTA. Thus, the quality of training is compromised. The trainees have no service record book similar to those of seafarers at sea and their career structure is also not planned. Majority of stakeholders' representatives had opined that crews of passenger's vessels are not well trained (Figure7).

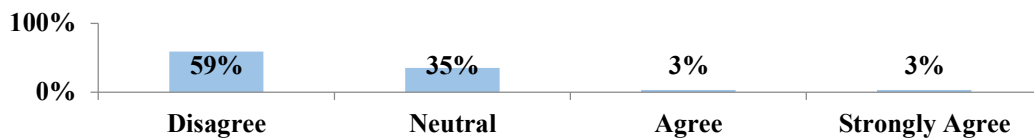


Figure 7: Crews of Passenger vessels are Well Trained
(Source: One to one interview; n=37)

The practical survey reveals that more than 90 % of passenger vessels, in particular, are not formally trained at any Institute for a duration of one year. Thus, this is a point of concern to put the operators under challenge during emergent requirements from the safety point of view.

c. Dearth of Motivation and Incentive

Inland Shipping Ordinance (ISO) 1976 has no provision to look into the motivational aspect, including the welfare of the operators similar to that of Merchant Shipping Ordinance (MSO) 1983. This results in frustration among the operators, and competent operators are reluctant to join the passenger's vessels. Those who serve the vessels are exposed to challenges as they are not eligible to operate in the true sense. There is no career development programme for the crews.

d. Limited Use of Modern Technology

Majority of the IWT vessels are still dependent on a manual process, and the use of sophisticated high-tech electronics is minimum. As vessels are operated by ill-trained less educated personnel, modern means of operation and communication are also not

used and welcomed within operators, which hinders using a computer-based mechanism to monitor traffic and control.

e. Deficiency in Ships Quality

Almost 50% of vessels are not surveyed annually, and the rest though surveyed, are done mostly on papers. Absence of Classification Society (CS) as per law over four decades is not only noncompliance of an important section of the legislation, but an act for slackening safety of the vessels and putting the operators under extra challenge. Almost cent per cent passengers' vessels are constructed without the assistance of any CS group. There is a lack of standardization in the whole sector. Both very large and too small vessels operate at the same areas, which is not safe for either group. The recent practice of introducing vessels bigger than 70 metres has caused new challenges for smaller vessels' operators in narrow channels. Construction of vessels above 70 metres length are also beyond the rules at 2001, (ISO 1976). This results in additional problems at berthing and during operation at the restricted harbour and narrow channel regarding safety. Unregistered vessels (not under ISO 1976) operate at random and create additional hazards for registered vessels at authorized routes and bring challenges against passenger vessels' safe operation.

f. Technical Aspects of Operational Challenges

Out of all respondents from the stakeholder's department (BIWTA and DoS), 90% agreed that the standard procedure is not followed to approve the designs and the rest 10 % remained neutral. Physical inspection at yards along the river the Buriganga, the Shitalakhya also found that construction is being done at several places without any approved design at hand. In this respect, the legal framework allows unscrupulous activity among the stakeholders. The law is also not very clear on the issue and no penalty for the designers.

g. Observation on Practical Design

Twenty-four designs available with the DoS have been studied, documentation accident cases (national) and almost a dozen vessels' structures have been surveyed, and design houses consultants have been interviewed. Study shows that 80% of those designs are not comprehensive, and none had any details of structural drawings. Almost 98% of vessels that sank had design faults. Design of passenger's vessels is erroneous and unsafe. Almost 95% of the passengers' vessels have no reserve buoyancy. Stability criteria are doubtful (no model test); almost 85 % of vessels are made of reused steel with extra size of scantlings, which also make the superstructure for multi-deck vessels with higher Centre of Gravity and make the vessels risky.

10. Conclusions

The study reveals answers to the two basic questions which are: whether the operators are prepared to face the challenges they meet during operation of passengers' vessels in rivers and whether the governance processes are adequate for safe operation of passengers' vessels of Bangladesh. The answer to the first question is operators are not arguably prepared to face any kind of challenge which usually they come across during operation of inland water passengers' vessels because of the following:

- The operators (crews) of passengers' vessels are not properly trained to operate vessels. This circumstance is supported by 60% of the officials of the stakeholders' groups during interviews. Again, physical survey showed that more than 90% of the crews do not have any formal training at school (say, of duration one year or so).
- The design of Inland water passengers' vessels is found to be inappropriate to keep the vessels stable during any adverse weather condition.
- Existing method of inappropriate survey procedure and supervision of new construction and absence of any classification society as per rules, the production of inland vessels stand nowhere in comparison to any international level.
- Unknown number of unregistered vessels operate at random both day and nights through authorized routes and make it very onerous for the masters of vessels. Main reasons for inadequate governance processes are as follows:
- 70% stakeholders opined that regulatory framework for operation of passengers' vessels is weak in nature. Four decades old ISO 1976 needs review due to several reasons. Scales of punishment is disproportionate and change in currency valuation effect the penalties. There is no provision in laws for designers, builders and guidelines on sharing of responsibilities between stakeholder's departments. Discretionary power of DGS has made the safety administration weaker in respect of manning vessels without appropriate training. Inappropriate management of ports and maintenance of routes pose additional challenge for operators during operation.
- Authority and responsibilities are not equitably divided at the organogram of DoS and professionalism has not been prioritized. This effect transparency and accountability at different levels. Particularly trainer, designer, builder, inspector and operators' responsibilities need further clarification by rules without any overlapping between authorities concerned. Investigation procedures are not being done to find the root causes neutrally, as a result the core issues are never addressed well.

11. Way Forward

This study has opened new opportunities for further study for a different group of specialties. Some of these are:

- Designers to find for an optimum solution to recommend standardized vessel based on tested model to suit local water at all weathers. Study may be conducted on how to improve the safety culture of people at marine environment.
- An appropriate safety administration needs to be formed and there should be independent board to investigate accident cases to find root causes.
- There are almost a million people attached to the operation of vessels which are both registered and unregistered. A study may be conducted to form a cadre of people who may be trained to enhance the quality of operation and maintenance as well as form a career structure for these huge number of workforces in the sector.
- A study needs to be conducted on how to improve the riverine traffic management using digital technology.
- A study needs to be conducted to reorganize the whole IWT sector keeping some full-time experts at policy level to guide the operations, formulate/amend rules and improve governance in the sector so that the SDG goals are met satisfactorily in due time.

References

- Anyanwu, J. (2014). The Causes and Minimization of Maritime Disasters on Passenger Vessels, *Global Journal of Researches in Engineering: G Industrial Engineering* Volume 14 Issue 2 Version 1.0, 2014. Online ISSN:2249-4596 & Print ISSN:0975-5861.
- Awal, Z.I., A Study on Inland Water Transport Accidents in Bangladesh: Experience of a Decade (1995-2005), *Proceedings of the International Conference on Coastal Ships and Inland Waterways*, Royal Institution of Naval Architects (RINA), 2006, London, pp. 67-72.
- Awal, Z.I., (2007) A Study on inland water transport accidents in Bangladesh experience of decade (1995-2005), *Bangladesh University of Engineering Technology*, Bangladesh (BUET).
- BBS (2020), *Bangladesh Bureau of Statistics, Statistics and Information Division*, Ministry of Planning, 39th Edition, Dhaka, 01 May, 2020, ISBN-978-984-475-020-3, Pp-13.
- Baten, A. (2005). *Internal Water Transportation System: Safety of Inland Passenger Vessels*, National Defense College Journal, Dhaka, Bangladesh, 2005.
- DoS Report (2020). *Information of the Department of Shipping and General Shipping Statistics of 2020*, Office of the Chief Inspector, Department of Shipping, Ministry of Shipping, Government of Bangladesh.

Islam, M.R., Rahaman, M, and Deiguli, N (2015) Investigation of the Causes of Maritime Accidents in the Inland Waterways of Bangladesh, Brodogradnja/Shipbuilding, Volume 66, Number 1, 2015, V66-N1-P2-C1029. *Journal of hazardous materials*, Vol. 111, No. 1, pp. 29-37.

Chukwuma, O. M., The Characteristics of Inland Water Transport in Nigeria, IOSR Journal of Humanities And Social Science (IOSR-JHSS), Volume 19, Issue 3, Ver. IV (Mar. 2014), PP 119-126.

Huq, N A. and Dewan, A M. (2003), Launch Disasters in Bangladesh: A Geographical Study, *Geografia* Vol. 1 Issue 2 (14-25), © 2003, ISSN 0126-7000.

Islam, M.R., Rahaman, M, and Deiguli, N., 2015, Investigation of the Causes of Maritime Accidents in the Inland Waterways of Bangladesh, Brodogradnja/Shipbuilding, Volume 66, Number 1, 2015, V66-N1-P2-C1029. *Journal of hazardous materials*, Vol. 111, No. 1, pp. 29-37.

Kalyani, T., Vidyasagar, D., Srinivas, V. (2015). Accident Analysis of River Boats Capsize in Indian Inland Waters and Safety Aspects Related to Passenger Transportation, [Online]. Vol 4 Issue 7 (Special Issue) Pp 8-17. Available at International Journal of Innovative Research and Development. www.ijird.com July, 2015. [Accessed 26 July 2016].

Uddin, M. I., M. R. Islam, Z. I. Awal, and K. M. S. Newaz. (2017). "A Study of Inland Water Transport Accidents of Bangladesh: Lessons from A Decade (2005–2015)." *Procedia Engineering* 194: 291–297. doi:10.1016/j.proeng.2017.08.148.

Uddin, M. I., and Z. I. Awal. (2017). "An Insight into the Maritime Accident Characteristics in Bangladesh", 1st International Conference on Mechanical Engineering and Applied Science, Military Institute of Science and Technology, Dhaka, Bangladesh, Vol 1919, paper no. 02001.

Leveson, N. (2004). *Safety Science*, Vol. 42, No. 4, April 2004, pp. 237-270. The research was partially supported by NSF ITR Grant CCR-0085829 and by grants from the NASA Intelligent Systems (Human-Centered Computing) Program NCC2-1223 and the NASA Engineering for Complex Systems Program NAG2-1543.

Reason, J. (1990). The contribution of latent human failures to the breakdown of complex systems. *Philosophical Transactions of the Royal Society London B*, Vol. 327, pp. 475-484.

World Bank, (2006), 38009. People's Republic of Bangladesh Revival of Inland Water Transport: Options and Strategies, 28 November, 2006, Document of World Bank, Sustainable Development, South Asia Region, Pp-III-V.

8FYP, General Economic Division, Ministry of Planning, Government of Bangladesh, Pp- 175, First Published December 2020.