

# A STUDY ON THE ASSESSMENT OF THE REQUIREMENT OF MARINE SERVICE VESSELS FOR MONGLA PORT WITH RESPECT TO FUTURE DEMAND AND IMO GUIDELINES

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## ABSTRACT

*The objective of the study is to assess the future requirement of marine service vessels for Mongla Port Authority (MPA) to meet the increasing demand and to improve the performance of the port for carrying out the mandated responsibilities of different marine services to incoming and outgoing ships as an international maritime port under IMO guidelines. The growing international trade in Bangladesh impacted largely in the maritime activity of the country. It is seen that the growth rate of the cargo and container volume of imports and exports at Mongla port is increasing day by day. However, there are only 32 (thirty two) marine service vessels, out of which 19 (nineteen) vessels are more than 30 years old, 12 (twelve) vessels are less than 15 years of age and one vessel is between 15 to 30 years. Therefore, MPA lacks far behind to provide different marine services due to inadequate and very old marine service vessels. In view of the same, a study has been carried out which comprises the assessment of the requirements of different necessary marine service vessels with respect to increasing traffic demand as well as IMO guidelines to provide essential marine services to various incoming and outgoing ships. Consequently, a procurement plan has been suggested which depicts the number and type of marine service vessels to be procured by 2020 and by 2030 to enable MPA to be developed as a modern maritime port and fulfill the responsibility as the south-western gateway of the country as well as a regional hub supporting transit facilities to India, Nepal and Bhutan.*

## 1.0 BACKGROUND

Bangladesh is showing an average 6% growth in the gross domestic product (GDP) for last decade with a total GDP of 302.57 billion USD in 2019 [1]. The share of international trade is 35% of total GDP in 2017 [2]. The export share is dominated by the readymade garment sector which is 84% of the total export of 40.53 billion USD in 2018-19 [3]. With a population of 167 million, the country's import is also getting larger and larger day by day. The total import for the year 2018-19 is 68.10 billion USD [4]. The country has a higher maritime dependency for international trade. The share of maritime trade is 94.44% for import and 98.99% for export of the total import and export of the country in 2018-19 [4]. And for the maritime trade the country completely depends on the Chittagong Port, which handles more than 90% of the total trade of the country [5] and [6]. Even though Mongla is the second largest seaport of the country, it is hugely suffering to penetrate more market share. Taken into consideration of the trade prospects of the country as well as development of the south-western part of the country, the Government emphasizes on the development of the Mongla Port recently.

In 1950s Mongla Port became operational as an Anchorage Port at the confluence of Passur River and Mongla Nulla about 45 km south of Khulna Metropolitan city. Anchorage was started over Joymonirgoal to Digraj, which has been shifted to Herbaria. A feasibility study for construction of shore based port facilities on the bank of Passur River was done by an American firm, Fedric R. Harris and Pak Techno Consultant, in the 1967-68 and Hedco, the Netherlands, studied approach to Passur River from Bay of Bengal. On the basis of their recommendation of

the 1st phase of Master plan, about 2068.80 acres of land were acquired at the east bank of Passur River. About 5 km long riverbank along the waterfront from Mongla River confluence to Digraj was used to build up land based port operation facilities. Different port oriented government and private enterprises were allotted about 3 km of waterfront. Out of 2068.80 acres of land, Mongla Port Authority in its own jurisdiction utilized 1046.88 acres of land for construction of different port based facilities. In view of expansion of the business of Mongla Port, about 255.41 acres of lands were allocated to BEPZA (Bangladesh Export Processing Zone Authority), 315.15 acres to BEZA (Bangladesh Economic Zone Authority) and 346.34 acres to different govt. and non-govt. organizations. A number of different port facilities have been developed based on the Master plan and since 1950, Chalna Port started to function as Government Directorate and in May 1977, the directorate was concerted to an autonomous organization called Chalna Port Authority. The Chalna Port Authority was again renamed as "Mongla Port Authority" on 8th March 1987 [7].

To accelerate and develop Mongla Port, government has taken different initiatives recently such as construction of Padma Bridge at Mawa point, establishment of Khulna-Mongla railway link, supply of gas through pipe line, construction of Khan Jahan Ali airport, establishment of 1320 MW coal based power plant at Rampal and Special Economic Zone at Mongla Port area, etc. The above projects are expected to be completed by 2018-20. After completion of the Padma Bridge, an opportunity will be generated up for Dhaka based export and import cargos especially for ready-made garments. Moreover, after establishment of coal based power plant at Rampal, minimum 45.00 lac ton coal would

likely to be imported through Mongla Port annually as raw materials of the plant. On the other hand, Special Economic Zone will create a new horizon for imports and exports. Consequently, the uses of Mongla port will be increased enormously.

To meet up these additional demands efficiently and effectively, Mongla port has to commence different types of strategic plans which will play a vibrant role in the national economy facilitating sea borne import and export trade of the country and the region as well [8]. Port provides amenities and services to the international shipping lines and other concerned agencies providing port facilities with capacity of handling about 70,00,000 tons general cargo/break bulk and 4,00,000 TEUs container. It has 5(five) jetty berths, sheds, open space, cargo handling equipment and safe navigable channel for day and night shipping. Total 34 (thirty four) nos. ships can take berth in jetty and anchorage i.e., in the port at a time. With the completion of Rupsa and Paksey bridges, transport network with northern area has been elevated and uninterrupted. Resultantly port bound cargo of western part of Jamuna River and transit cargo from Nepal and Bhutan as well as India can find a good demand of handling through Mongla Port. After completion of Padma bridge, it is anticipated that Mongla Port will get a new turn in handling of Dhaka bound export-import cargo in promoting international trade and business of the country and the region as well. In the study report entitled “Bangladesh: Port and Logistics Efficiency Improvement” conducted by ADB [9], a projection of the utilization of port facilities have been conducted where it is shown that even though in case of the maritime trade the share of Chittagong port is 90% and Mongla is 10% at present. However, it is estimated in the same report that there will be 50% share of Chittagong port and 40% that of Mongla port in 2040.

It is, therefore, seen that to cope up with the growing demand of cargo handling at Mongla Port, further development is an inevitable necessity. In view of the same in order to improve the performance of the port and to meet the increasing demand, different proposals for development of the port as well as procurement of different types of marine service vessels for carrying out the mandated responsibilities of Mongla port (Figure-2) as an international maritime port under IMO guidelines as well as providing required marine services to incoming and outgoing vessels in the port are being studied.

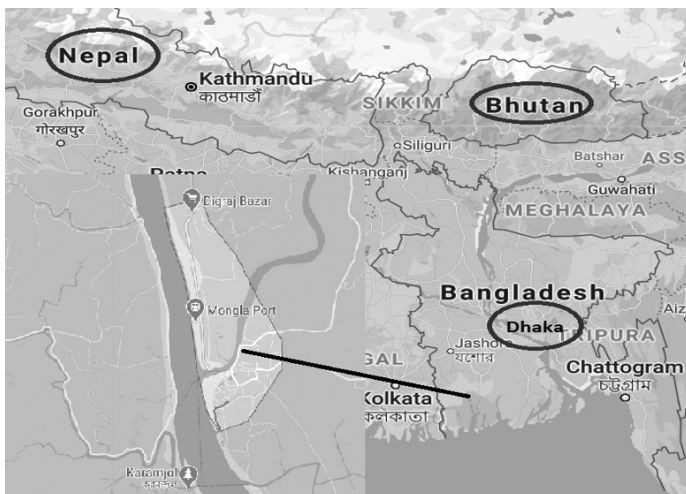


Figure 1: The Location of Mongla Port and its Possible Hinterlands

## 2.0 METHODOLOGY

The main objective of the research is to identify the numbers and types of marine service vessels for enhancing the operational performance and reach the optimum utilization of the Mongla port. That is also to reduce the incredible pressure on the Chittagong Port and reduce the risk for the country of depending high on a single port. In order to achieve the object of the research the trade and traffic prospects of the country and Mongla port have been analysed. The findings of the previous studies along with the port performance statistics have been investigated. The present status of the marine service vessel fleet is examined technically and classified according to their suitability to provide the required marine services. Comparing the trade and traffic prospects of the country and the port with the marine service fleet requirement a conclusion on the required number of vessels have been drawn. A procurement plan has also been suggested to procure the marine service vessels in different phases considering the trade and traffic pattern. In order to decide the types of marine service vessels mainly different international regulations, policy and guidelines are taken into consideration which are mostly IMO regulations and guidelines which is highlighted in Section 3 and World Bank Port Reform Toolkit 2007 [10].

## 3.0 IMO GUIDELINES FOR MARITIME PORT RELATED TO MARINE SERVICES

IMO is the United Nations' specialized agency responsible for safety and security of shipping and the prevention of marine pollution by ships. The national maritime administration of different countries of the world has many tasks according to the IMO conventions, also has many responsibilities toward the ships rising its flag or entering its ports which are; flag state control, port state control, search and rescue, pollution prevention and navigational services, etc.

IMO Convention does give the organization a mandate to regulate in ports and some current IMO regulations do indeed extend to port operations, such as surrounding security, waste reception facilities, etc. However, there are many opportunities to further explore and enhance the cooperation between shipping, ports and the logistics industries. A port sector that can streamline procedures and remove barriers to trade, embrace new technologies and treat safety, security and reputation as both desirable and marketable, will be a major driver towards stability and sustainable development and support the achievement of the U.N. sustainable development goals.

It is evident that more dialogue with ports and more involvement from port-related stakeholders at IMO were necessary, particularly with advancements in automation and digitalization. Ports are becoming increasingly relevant in actions to combat climate change and reduce shipping emissions, including supply of low-emission fuels for ships, port call optimization and just-in-time operations and moves towards sustainable onshore power supply, requiring port infrastructure and information exchange.

IMO has also developed and adopted international collision regulations and global standards for seafarers, as well as international conventions and codes relating to search and rescue, the facilitation of international maritime traffic, load lines, the

carriage of dangerous goods and tonnage measurement. The Maritime Safety Committee (MSC) is IMO's senior technical body on safety-related matters. It is aided in its work by a number of Sub-Committees. The following safety related issues, which are on the other hand guidelines for port activities are important to mention;

- Code for Safe Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code);
- Recommendations on the Safe Transport of Dangerous Cargoes and related Activities in Port Areas;
- The adequate protection of any sea port from fire, explosion or other similar incidents is essential to the continued wellbeing of the country. To assure such protection, adequate marine disaster response capability should be available and utilized under well-conceived disaster contingency plans of the port. The harbor master must develop this Marine Firefighting plan in consultation with the local fire and emergency response agencies and organizations to encourage coordinated planning and exercising.
- IMO has always paid great attention to the improvement of navigational safety whether the ship is in movement or anchored in port and harbor. SOLAS covers various aspects of ship safety, including construction, fire protection, life-saving appliances, radio-communications, safety of navigation, the carriage of cargoes and safety measures for high speed craft.
- Implementation of maritime search and rescue to be implemented by flag state, port state or coastal state.
- Pilots with local knowledge have been employed on board ships for centuries to guide vessels into or out of port safely. Qualified pilots are usually employed by the local port or maritime administration and provide their services to ships for a fee, calculated in relation to the ship's tonnage, draught or other criteria.
- Within SOLAS's [11] chapter XI-2 on Special Measures to enhance maritime security is the International Ship and Port Facility Security (ISPS) Code, which is a mandatory instrument for all countries, party to the Convention.
- Currently, the agenda of IMO's Facilitation and Maritime Safety Committees is the issue of adequate anti-cyber security practices, which may be used to protect and enhance the resilience of cyber systems supporting the operations of ports, vessels, marine facilities and other elements of the maritime transportation system.
- IMO is continuously pursuing a pro-active approach to enhance implementation and enforcement, both by flag and port states, including a pro-active action plan to ensure that shore-based reception facilities for ship generated waste keep up with international regulatory requirements.
- IMO has recognized that provision of reception facilities is crucial for effective MARPOL [12] implementation and the IMO Marine Environment Protection Committee (MEPC) has strongly encouraged member states, particularly those Parties to MARPOL as port states, to fulfill their treaty obligations on providing adequate reception facilities.

From the above review, it is well understood that IMO has formulated different regulations and codes through different sub-committees in order to ensure safety and security of the ships during their movement through waterways and during

their berthing in the port harbors. The rules and regulations for protection of environment and mitigation of pollutions both in waterways and in port areas have also been formulated by the concerned sub-committees and well defined in SOLAS [11], which has been first accepted in 1973 and amended and extended in different years. Therefore, the maritime port authorities have huge responsibilities to follow the relevant rules, regulations and code of conduct and develop necessary facilities to provide different designated marine services including tugboat service, water supply, fuel supply, emergency medical service, mooring service, navigational aids, hydrographic survey, waterway maintenance and dredging, etc. in order to ensure safe navigation and operation, safety and security of the vessels and environmental protection of the nature under their jurisdictions.

#### 4.0 MARINE SERVICES OF MONGLA PORT

As mentioned earlier, there are a number of responsibilities to be fulfilled by a sea port in order to ensure safety, security and environmental protection to the ships, water and other areas of the port according to IMO and UNCLOS regulations and guidelines [13]. Other than these, a seaport should also render some marine services like pilotage, mooring, ship handling, harbor towing, salvage and rescue, escorts towing, anchor handling and survey and research, etc. These can be found under different components of Port User's Information Network as shown in Figure 2.

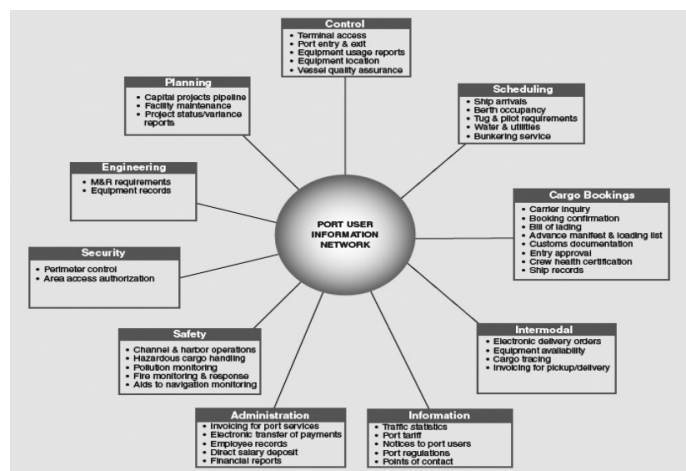


Figure 2: Marine Services under Different Group in Port User Information Network, Source: Port Reform Toolkit 2007

Marine services are port-bound activities accomplished to confirm the safe and prompt flow of vessel traffic in port approaches and harbors and a safe and secured stay at berth when moored or at anchor. Safe means port conditions ensure that ships using the port, the port environment and the marine environment are sheltered from danger. Prompt means ships are not unduly delayed and that the ships' port transit times, as a part of the total turn-around time in the port, are kept to a minimum.

Although ports may define marine services differently and may have different methods of providing them, the term is used to refer generally to services having a navigational attitude, be it maritime safety, vessel traffic efficiency, or marine environment protections, which are the prime requirement of IMO [14].

Other services (for example, immigration and customs services, security and port state control), as mentioned below, may also affect port proficiency and safety. A variety of other aspects may be regulated by a port authority [15] under a port's law, such as:

- Inquiries with respect to any case where damage has been caused by or to a ship in port.
- Keeping and placing buoys, beacons and other navigational aids as well as provision and maintenance of lighthouses.
- The landing of personnel belonging to an armed service.
- Cleaning of basins, works and premises.
- The use and manning of harbor craft (sometimes requires fire-fighting capabilities).
- Provision and maintenance of pontoons.
- Manning and use of tugs and other vessels.
- Special police powers for patrol boat personnel (may also be included in the harbormasters function).
- Disaster control and emergency communication procedures.
- Fire-fighting procedures and operations.
- Prohibiting the embarkation and disembarkation of persons except at such places as may be authorized by the port authority.

While important to the overall operation of a port, the above other services are not dealt with in this section, since these are merely related with the procurement of marine service vessels.

The specific marine services rendered by a modern sea port depend largely on the scopes of the port's marine responsibilities and jurisdiction. The scope of the port's marine jurisdictions does not follow a general rule and there exists no international legislation or standard practice that defines the responsibilities of port authorities. However, there are some obligatory requirements as guided by IMO in order to protect the safety of the port and the environment. Usually, marine services provided by a port authority are geographically delimited by the area directly under control of the authority, which may encompass only the waterfront of riparian berths (the port's domain). However, there are countries where the port authority is also responsible for managing lighthouse services outside its immediate area of control. This extended area may cover harbor waters and approaches as far as the open sea.

#### 4.1 Harbormaster's Function

The harbormaster (or port captain) manages port activities relating to maritime safety and the protection of the marine environment. The legal basis of the harbormaster's function is embedded in the port by law or, in the case of this state-owned port, in a specific law or ministerial decree. The harbormaster has specific legal powers to act in emergency situations. In some countries, the harbormaster may work for an independent public entity such as the coast guard. However, the MPA harbormaster is part of the port authority organization and heads the marine department.

The harbormaster is responsible for ensuring the efficient flow of traffic through port and coastal waters (including allocation of vessels to public berths) and on behalf of the government or port authority for coordinating all marine services. The harbormaster operates out of a port coordination center (or Captain's Room), which is often part of an elaborate vessel traffic management system.

#### 4.2 Chief Engineer (Marine)

- i) Responsible for focusing attention of the major decision / task of each / level in the decision making structure and ensuring

constant applications of overall policies of the board in the field of marine related activity like procurement, repair and maintenance of marine service vessels.

- ii) Assesses port development requirements in the field of marine engineering and services. Prepare development schemes; determine technical and economic feasibility of projects and monitoring of ongoing maritime projects.
- iii) Responsible for preparing design, specification and contract documents for new building, repair and maintenance of different type of marine service vessels and marine structures for the port.
- iv) Ensure optimum use of marine service vessels and different machinery and equipment installed/operated at marine workshop.

#### 4.3 Pilotage Services

Pilots usually constitute a closed group of professionals (often master mariners), who are keenly aware of their unique position in the port environment. Successful vessel management relies heavily on the efficient functioning of the pilot organization, a fact that pilots may use to maximum advantage during port reform. In MPA, the pilotage services are a part of the port authority and the harbormaster also serves as head of the pilotage services.

#### 4.4 Tugboat Operations

Tugboat services are considered as those destined to help maneuver ships on the instructions of its captain, using one or more tugs that use their engine power or accompany the ship within the waters of the service zone of the port. Tugboat operations are typically carried out by private firms in different modern ports of the world. However, most of the port, worldwide like MPA, is still providing the tugboat services, since private sector did not come up for the same. Generally, if the volume of ship traffic is not sufficient to support a tugboat service on a commercial basis, a port authority may be obliged to provide such services itself. Sometimes neighboring ports can share tugboat services to reach volumes sufficient to sustain a commercial operator which is not possible practically here in Bangladesh, since other ports are not so close to any of the sea port.

#### 4.5 Mooring Services

A mooring refers to any permanent structure to which a vessel may be secured. Examples include quays, wharfs, jetties, piers, anchor buoys and mooring buoys. A ship is secured to a mooring to forestall free movement of the ship on the water. An anchor mooring fixes a vessel's position relative to a point on the bottom of a waterway without connecting the ship to shore. Mooring, therefore, refers to the act of attaching a ship to a mooring structure. In MPA, the mooring services are a part of the port authority and under the control of harbormaster also serves as head of the pilotage services.

#### 4.6 Vessel Traffic Services

A vessel traffic system (VTS) is a marine traffic monitoring system established by harbor or port authorities, similar to air traffic control for aircraft. Typical VTS systems use radar, closed-circuit television (CCTV), VHF radio-telephony and automatic identification system to keep track of vessel movements and provide navigational safety in a limited geographical area.

#### 4.7 Aids to Navigation

An aid to navigation (AtoN) is a device or system external to a vessel that is designed to enhance the safe and efficient navigation of the vessel such as lighthouses, buoys, beacons, lights, leading marks and radio position fixing systems.

Like other national maritime authority, the responsibility for aids to navigation is in the hand of Mongla Port Authority within port approaches and in port areas. The provision and maintenance of buoys and beacons are contracted out with close supervision by MPA officers. Because aids to navigation are generally part of an integrated maritime infrastructure, the costs of providing these services are included in the general port dues. Mongla port has only one very old buoy laying vessel to provide aids to navigation services necessary of safe passages of different incoming and outgoing ships.

#### 4.8 Other Marine Services

Generally, emergency response services are carried out by a variety of public organizations such as the port authority (harbormaster), fire brigade, health services and police. Some ports have sophisticated tools available to aid in crisis management, such as prediction models for gas clouds. Such tools are often integrated in a traffic center of the local vessel traffic management system (VTMS). Other than above emergency services, vessels resting in outer anchorage or in the harbor area needs emergency medical services and needs supply of drinking water for the crew or might be under fire. For the purpose, all sea ports must have ambulance ship and also water carrying barge to provide the respective services to the incoming and outgoing ships as well as tugboat or patrol boats with firefighting options. However, MPA has fire-fighting tug and water barge but no ambulance ship till now. MPA does not have any waste collection vessels or any reception facilities too.

#### 4.9 Dredging of the Harbor and Waterway

Dredging operations to keep the port channel navigable by a port authority is of utmost importance. Often, the port authority or the competent maritime administration does not have enough expertise to exercise sufficient control over both maintenance and capital dredging. Port authorities with large water areas under their control should employ sufficient competent personnel to prepare dredging contracts and oversee dredging operations. Sounding is an activity that should preferably be carried out (or contracted out) by the port authority itself. Dredging is usually carried out by private dredging companies. It might be cost effective for some ports to use their own dredges, especially when continuous and important maintenance dredging is required. For the large quantity of dredging, MPA employs competent contractors though they have their own cutter suction dredgers to carry out maintenance dredging in the Passur channel.

#### 5.0 MARINE SERVICE VESSELS NEEDED BY A SEAPORT

Port operations are a necessary tool to enable maritime trade between business partners. To ensure smooth port operations and to avoid congestion in the harbor it is inevitable to permanently improve the port's physical infrastructure, invest in human capital, fostering connectivity of the port and upgrade the port

operations to prevailing standards. Hence, port operations are regulated by a number of policies, reforms and regulations that influence the infrastructure and operations of port facilities including different marine services.

There is a variety of marine services which are being provided by a maritime port as well as there are some compulsory marine related responsibilities of a sea port according to IMO and UNCLOS guidelines as mentioned before. A sea port needs a number of different types of marine service vessels with different capacities as per the handling capacities of the port. The list of various types of marine service vessels providing different marine services as well as other services to ensure safe, secured and environment friendly services to port users, ships and other stake holders by a sea port according to IMO and UNCLOS requirement have been presented in Table 1.

*Table 1: List of Marine Service Vessels needed by a Sea Port according to IMO and UNCLOS requirement*

Sl No.	Type of Vessels	Sl No.	Type of Vessels
1	Escort, towing and ship handling tug	12	Mooring boat
2	Fire-fighting tug	13	Pilot boat
3	Buoy Laying Vessel	14	Dispatch Vessel
4	Search and Rescue vessel	15	Self-propelled Water supply barge
5	Security Patrol boat	16	Ambulance Vessel
6	Navigation and Hydrographic Survey & Research Vessel	17	Inspection vessel
7	Oil Spill Management vessel	18	Cutter Suction Dredger
8	MARPOL Waste/ Garbage Collection Fleet & Reception Facility	19	Work Boat
9	Wreck Removal/ Floating Crane ship	20	Crane boat
10	Trailing Suction Hopper Dredger	21	House Boat
11	Salvage Ship	22	Training Vessel

#### 6.0 REVIEW OF THE STATUS OF EXISTING MARINE SERVICE VESSELS OF MPA

It has been already mentioned that a maritime port has to provide a number of marine services as per requirements of IMO guidelines which on the other hands requires a number of different types of marine service vessels. The performance as well the efficiency of providing these marine services to incoming and outgoing ships to the port depends mostly on the availability and performance of the marine services vessels. It has been learnt that from the beginning of its activities, 32 (thirty two) numbers of different types of marine service vessels were acquired by MPA at different time from which 6 (six) vessels are obsolete now. The types of vessels are; tugboat, mooring boat, pilot boat, dispatch launch, survey vessel, self-propelled water barge, dredger, workboat, crane boat, house boat, inspection launch, buoy laying vessel, oil spill management vessel and fire-fighting tug. Table 2 shows the list, age and present status of different marine service vessels of Mongla Port Authority.

We can see that Mongla port, itself, is providing the tugboat services to different incoming and outgoing ships, since there is

no involvement of private sector in any of the maritime port of the country for the same. Generally, if the size of vessel traffic is not sufficient to support a tugboat service on a commercial basis, private sector does not come up and as a result, a port authority may be obligated to provide such services itself. Sometimes neighboring ports can share tugboat services to reach volumes sufficient to sustain a commercial operator which is not possible practically here in Bangladesh, since other ports are not so close to Mongla port. There are 6(six) tugboats of MPA including one firefighting tug. However, M.T Mehgdoot is 73 years old and is not providing any services now.

It is also seen that Mongla port has its own pilotage and mooring services and has few pilot boats and mooring boats to provide pilotage and mooring services to different incoming and outgoing ships. However, these are not being considered adequate in view of the necessity of fast movement and the increased port area. Like other national maritime authority, the responsibility for aids to navigation is in the hand of Mongla

Port Authority within port approaches and in port areas. The provision and maintenance of buoys and beacons are not contracted out and are carried out by MPA Marine Department. Because aids to navigation are generally part of an integrated maritime infrastructure, the costs of providing these services are included in the general port dues. However, it is seen from Table 2 that there is only one buoy laying vessel of MPA which is 33 years old.

It is also seen from the Table 2 that there are two dispatch launches and one inspection launch which are very old and lifetime has already expired. The dispatch launch are used to carry pilot form the port to the pilot station in the Akram Point and also carry out delivery of different necessary items in case of emergency. The inspection launch is used for inspection of any marine establishment as well as channel condition by the officials of the port. There is one survey boat and two self-propelled water barges (one is non-working) in the fleet too. The only old survey boat serves the necessities of surveying in the

*Table 2: Information on Existing Marine Service Vessels of MPA*

Sl No.	Name of the Vessel	Type of the Vessel	Country of Manufacture	Year of Build	Life Span (Year)	Present Condition
1	M T Meghdut	Tug Boat	USA	1942	73	Active
2	M V Sarathi-2	Tug Boat	KSY, BD	1973	44	Active
3	M V Sarathi-1	Tug Boat	JAPAN	1973	44	Non-working
4	M T Shibsha	Tug Boat	GERMANY	1983	34	Inactive
5	M T Chandana	Tug Boat	INDIA	2015	2	Active
6	F FT Agniprohori	Fire Fighter Tug	BELGIUM	1979	38	Active
7	M L Usha	Pilot Boat	USA	1967	50	Active
8	M L Urmee	Pilot Boat	USA	1967	50	Active
9	M L Gangchil	Pilot Boat	NWML, BD	2013	5	Active
10	M L Mayurpankhi	Pilot Boat	NWML	2013	5	Active
11	Chalna Pilot-1	Pilot Boat	HOLLAND	1980	37	Non-working
12	M L Hira	Mooring Boat	USA	1967	50	Active
13	M L Moti	Mooring Boat	USA	1967	50	Active
14	M L Mukta	Mooring Boat	USA	1967	50	Active
15	M L Panna	Mooring Boat	KSY, BD	2003	14	Active
16	M L Kanti	Work Boat	-	1979	38	Scrapped
17	M L Mohua	Work Boat	-	1977	40	Scrapped
18	S P Ruhi	Self-Propelled Water Craft	DEW, BD	1980	37	Inactive
19	M V Trishna	Self-Propelled Water Barge	KSY, BD	2004	13	Active
20	M L Rajhongsha	Dispatch Launch	USA	1968	49	Active
21	M L Balaka	Dispatch Launch	USA	1968	49	Active
22	M L Jhnuk	Inspection Launch	KSY, BD	1983	34	Active
23	B L V Malancha	Buoy Laying Vessel	GERMANY	1984	33	Active
24	M L Anushandhani	Survey Vessel	DEW, BD	1997	20	Active
25	C D ImmamBukhari	Dredger	NWML	2013	4	Active
26	C D ImmanShafi	Dredger	INDIA	2015	2	Active
27	C D Ballian	Crane Boat	NWML	2013	4	Active
28	House Boat	House Boat	NWML	2013	4	Active
29	M L Annesha	Work Boat	DEW, BD	1979	38	Active
30	Dolphin-1	Work Boat	INDIA	2015	2	Active
31	Dolphin-2	Work Boat	INDIA	2015	2	Active
32	Oil Spill Management Vessel	Oil Spill Management Vessel	Finland	2018	0	Active

Note: There are in total 32 nos. of marine service vessels in MPA at present, out of which 6 nos. are obsolete, the rest 26 nos. as shown above are operating at the moment.

port channel as and when required and the only workable water barge fulfills the requirement of drinking and fresh water of the incoming ships to the port.



MV Sarathi-1

Chalna Pilot-1

Figure 3: Photograph of two Non-working Vessels of Mongla Port

We know that vessels of 9.0 m, 8.0 m and 7.0 m loaded draught can take berth in the anchorage, mooring buoys and jetties respectively. In the Passur channel the draught varies between 4.9 m to 6.1 m. There is continuous requirement of dredging of the channel and the berths. In view of the same, MPA has procured two numbers of cutter suction dredgers to carry out maintenance dredging of the channel and jetty areas including necessary crane boats, house boats and other accessories. However, MPA did not have any Trailing Suction Hopper Dredger which is the most suitable means for channel and outer anchorage dredging of Mongla Port. MPA has also few work boats which are used for different support services, though two of the same are non-working now.

The control of dangerous goods for maritime cargoes is usually performed by a specialized branch of any maritime port authority. The same goes for the handling of dangerous goods in port terminals. Oversight and regulation of land transport of dangerous goods is normally a responsibility of the government. The highly sensitive and technical nature of this work makes it close monitoring by customs department and coastguard as well as port authority. But MPA does not have any specialized security patrol boat at present, though port patrol services are part of the harbormaster's resources and therefore, are managed by MPA. As mentioned before, MPA has two dispatch launches, one inspection launch and one survey vessel in its fleet.

Waste management services in modern ports are under strict control of the port authority. Proper waste management can be expensive for shipping lines. With high costs, ship captains might be tempted to dump waste into the sea or into port waters. Control of such dumping practices is extremely difficult, especially for chemical cargoes. However, there are no vessels for waste management services and port reception facilities at Mongla port at the moment though according to IMO requirement, waste management and oil spill management vessels are very much necessary for a port. Indeed, an oil spill management vessel has been procured recently, which is not adequate for the purpose.

Table 3 gives a summary of different types of marine service vessels of Mongla Port Authority categorized based on their ages. It is seen from the same Table 3 that the age of the oldest vessel is 74 (seventy four) years and there are 8 (eight) number of vessels from 49 to 50 years old and few others are more than 30 years old.

It is also seen from Table 3 that out of 32 (thirty two) vessels, 19 (nineteen) vessels are more than 30 years old, 12 (twelve) vessels are less than 15 years of age and one vessel is between 15 to 30 years. Therefore, it is very much necessary to replace 20

(twenty) numbers of old vessels since it seems that using these vessels might cause danger any time.

Table 3: Summary of Different Types of Marine Service Vessels of Mongla Port Authority

Sl No.	Type of Marine Service Vessels of MPA	Existing Marine Service Vessels	Existing Non-operating Vessels	Vessels with more than 30 years old	Existing Vessels to be replaced	Existing Vessels to be used
		(Nos.)	(Nos.)	(Nos.)	(Nos.)	(Nos.)
1	Escort, Towing and Ship Handling Tug	5	2	4	4	1
2	Fire-fighting Tug	1	-	1	1	-
3	Buoy Laying Vessel	1	-	1	1	-
4	Survey & Research Vessel	1	-	-	1 (20 years old)	-
5	Oil Spill Management Vessel	1	-	-	-	1
6	Mooring Boat	4	-	3	3	1
7	Pilot Boat	5	1	3	3	2
8	Self-propelled Water Supply Vessel	2	1	1	1	1
9	Inspection Vessel/Launch	1	-	1	1	-
10	Dispatch Launch	2	-	2	2	-
11	Cutter Suction Dredger	2	-	-	-	2

## 7.0 ASSESSMENT OF THE MARINE SERVICE VESSELS REQUIREMENT FOR MPA

Ports not only play as a link in transportation for interchange, but they function as self-sustaining industry that is linked with domestic and international trade. At some places, they also act as foreign exchange earner not only in the form of transshipment or hub port but as part of supply chain management by providing logistics services to the industry. That is why a port needs to be treated as an industry when it is being planned. The planning of a port should not only be concerned by simply demand and supply of throughput but more than that of institutional framework, application of technology, marketing strategy, handling capacity and ultimately economic impact analysis for the development and implementation of a huge project. It may be through expansion of an existing port or may be a green field project. It is very difficult to develop a single typology for all types of port; rather it can be tried to cover generic features of ports that apply to all classes of ports. According to the Port Reform Tool Kit of World Bank [10], the total port assets have been classified into four parts such as Basic Port infrastructure, Operational Port Infrastructure, Port Superstructure and Port Equipment. Among them, *port equipment* as listed, are to support the operation and maintenance of the port operations. Due consideration should be given to plan for those equipment, since those equipment assist

in the successful and efficient operation of a port. For instance, the cargo handling equipment at a fully automatic terminal of Rotterdam port greatly improves the productivity of the port. But again there needs to be a tradeoff between the capital cost of that equipment and manpower cost and the revenue collection by the port. Anyway, through technological improvements and advances like ship/shore and cargo handling equipment, the efficiency of a port throughput improves. The relevant port equipment as listed in Port Reform Tool Kit-16 is as follows:

- Tugs
  - Line handling vessels
  - Dredging equipment
  - Ship/ shore handling equipment
  - Cargo handling equipment (apron and terminal)
- On the other hand among others a Port Plan includes:

- Search and Rescue operation
- Oil Spill Contingency
- Media
- Civil Unrest
- Grounding of vessel
- Sinking of vessel
- Fire protection and prevention
- Pollution mitigation and control
- Air pollution (Toxic cloud)
- Chemical spillage mitigation
- Bomb threat / terrorism
- Medical emergency
- Hazardous substances washed ashore
- ISPS

From the above discussion, it is seen that in order to implement a proper port planning procedure, different types of marine service vessels are necessary, which are the parts of port operational infrastructures as well as port equipment [16]. In view of the same, Table 4 has furnished a list of different marine service vessels needed by a modern maritime port to provide safe and efficient marine services as per IMO requirement as well as the existing vessels of MPA.

**Table 4: Required Different Types of Marine Service Vessels for a Seaport and the Existing Different Service Vessels of MPA, which can be used further**

SI No.	Type of Marine Service Vessels	Useable Service Vessels (Nos.)	SI No.	Type of Marine Service Vessels	Useable Service Vessels (Nos.)
1	Escort, Towing and Ship Handling Tug	1	13	Pilot Boat	2
2	Fire-fighting Tug	-	14	Pilot Mother/ Dispatch Vessel	-
3	Buoy Laying Vessel	-	15	Self-propelled Water Supply Vessel	1
4	Search and Rescue Vessel	-	16	Ambulance Vessel	-
5	Security Patrol Boat	-	17	Inspection Vessel/ Launch	-
6	Survey & Research Vessel	-	18	Dispatch Launch	-
7	Oil Spill Management Vessel	1	19	Training Vessel	-
8	Waste Collection Fleet & Reception facilities	-	20	Cutter Suction Dredger	2

9	Wreck Removal/ Floating Crane ship	-	21	Work Boat	2
10	Trailing Suction Hopper Dredger	-	22	Crane boat	1
11	Sand Carrier	-	23	House Boat	1
12	Mooring Boat	1	24	<b>Total</b>	<b>12</b>

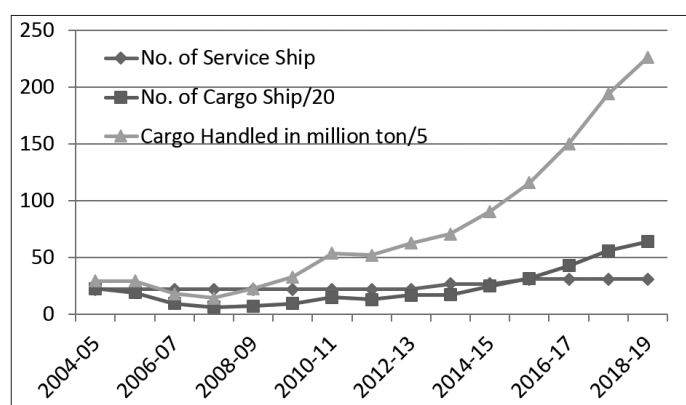
Note: Marine Service Vessels of more than 15 (fifteen) years of age have not been considered, since these needs immediate and gradual replacement.

From Table 4, it is seen that MPA is far behind the required different types of marine service vessels to become a modern port and to provide necessary marine services to incoming and outgoing ships in the port. MPA needs adequate numbers of tugboat including fire-fighting tug, buoy laying vessel, search and rescue vessel, security patrol vessel, survey and research vessel, waste collection vessel, wreck removal or salvage ship, trailing suction hopper dredger, pilot mother vessel/dispatch vessel and ambulance ship.

### 8.0 ASSESSMENT OF THE REQUIRED NUMBER OF MARINE SERVICE VESSELS

It is found that cargo throughput, container throughput and the ships call at Mongla port is increasing gradually [17]. Therefore, in order to provide necessary marine services the number of marine service vessels should also be increased simultaneously with the number of ships call as well as cargo and container throughput. Figures 4 to 7 shows the number of marine service vessels of MPA with the ship call, cargo throughput and container throughput in recent years.

It is seen from Figure 4 that number of cargo ships call is increasing gradually from 2007 as well as cargo throughput increases sharply though the number of marine service vessels did not increase at all.

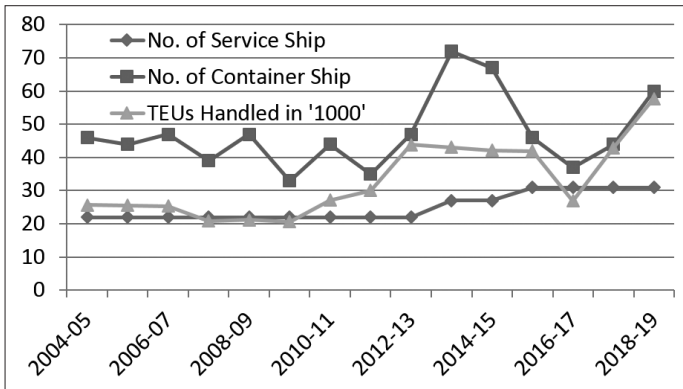


**Figure 4: Variation of Marine Service Vessel, Cargo Ship and Cargo throughput**

It is seen from Figure 5 that number of container ships call is increasing gradually from 2011-12 as well as container throughput also increases enormously though the number of marine service vessels are increasing in a very slower rate. However, from 2013-14 container ships-call drops sharply as well as container throughput drops gradually.

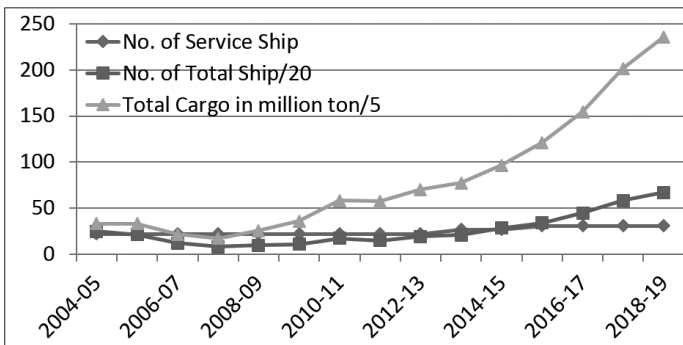


**A STUDY ON THE ASSESSMENT OF THE REQUIREMENT OF MARINE SERVICE VESSELS FOR MONGLA PORT WITH RESPECT TO FUTURE DEMAND AND IMO GUIDELINES**



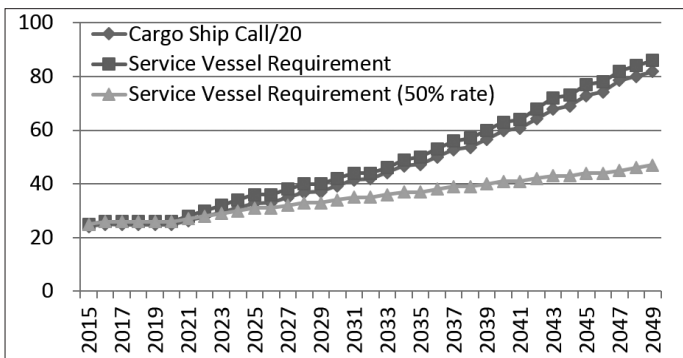
**Figure 5: Variation of Marine Service Vessel, Container Ship and Container throughput**

It is seen from Figure 6 that number of total ships call is increasing gradually from 2007-08 as well as total cargo throughput also increases sharply and the number of marine service vessels also increases slightly.



**Figure 6: Variation of Marine Service Vessel, Total Ship and Total throughput**

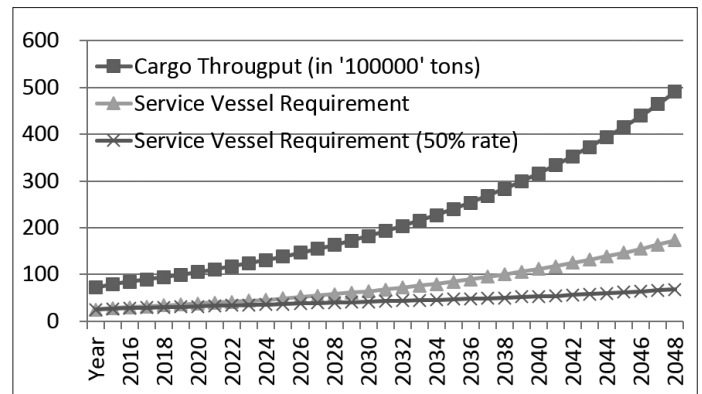
Figure 7 shows the future prediction of cargo ship call at MPA and also the prediction of marine service vessel requirement at same rate of increase of cargo ship call. It is assumed that the number of service vessels at 2015 is 25, which are providing services at present though 12 vessels are more than 30 years old and need replacement. It is seen that the number of marine service vessel requirements in 2020 are 26 with assumption of same rate of increase of marine service vessels with the increase of cargo ship and 26 with the rate of increase of service vessel as 50% rate of increase of cargo ship. Therefore, if we assume the rate of increase of service vessel as the 50% rate of increase



**Figure 7: Requirement of Marine Service Vessels with Cargo Ship forecast**

of container ship, MPA needs 1 more new service vessel and 12 vessels need to be replaced within 2020. The numbers of service vessel requirements in 2030 are 42 and 34 respectively with assumption of same rate of increase of marine service vessels as the increase of cargo ship and the rate of increase of marine service vessels as 50% rate of increase of cargo ship. Therefore, if we assume the rate of increase of marine service vessels as the 50% rate of increase of cargo ship, MPA needs 1 more marine service vessel within 2020 and MPA needs 9 more marine service vessels within 2030. However, 13 numbers old vessels need to be replaced gradually.

Figure 8 shows the future prediction of cargo throughput at MPA and also the prediction of marine service vessel requirement at the same rate of increase of cargo throughput. As mentioned before, it is assumed that the number of marine service vessels at 2015 is 25. It is seen that the number of marine service vessel requirements in 2020 are 36 and 31 respectively with assumption of same rate of increase of marine service vessel as the increase of cargo throughput and the rate of increase of marine service vessel as 50% rate of increase of cargo throughput. The numbers of service vessel requirements in 2030 are 61 and 41 respectively with assumption of same rate of increase of marine service vessels as the increase of cargo throughput and the rate of increase of marine service vessel as 50% rate of increase of cargo throughput. Therefore, if we assume the rate of increase of marine service vessels as the 50% rate of increase of container throughput, MPA needs 6 more marine service vessels within 2020 and MPA needs 15 more marine service vessels within 2030. However, thirteen (13) numbers of old vessels have to be replaced as mentioned before gradually.



**Figure 8: Requirement of Marine Service Vessels with Cargo Throughput forecast**

Figure 9 shows the future prediction of container ship call at MPA and also the prediction of marine service vessel requirements at the same rate of increase of container ship call. It is assumed that the number of marine service vessel at 2015 is 25, which are providing services at present though 12 vessels are more than 30 years old and need replacement. It is seen that the number of marine service vessel requirements in 2020 are 133 and 65 respectively with assumption of same rate of increase of marine service vessels with the increase of container ship and the rate of increase of marine service vessel as 50% rate of increase of container ship. Therefore, if we assume the rate of increase of marine service vessel as 50% rate of increase of container ship, MPA needs 40 more marine service vessels within 2020. The

numbers of marine service vessel requirements in 2030 are 314 and 100 respectively with assumption of same rate of increase of marine service vessels as the increase of container ship call and the rate of increase of marine service vessel as 50% rate of increase of container ship call. Therefore, if we assume the rate of increase of marine service vessels as the 50% rate of increase of container ship call, MPA needs 40 more marine service vessels within 2020 and 75 more marine service vessels within 2030.

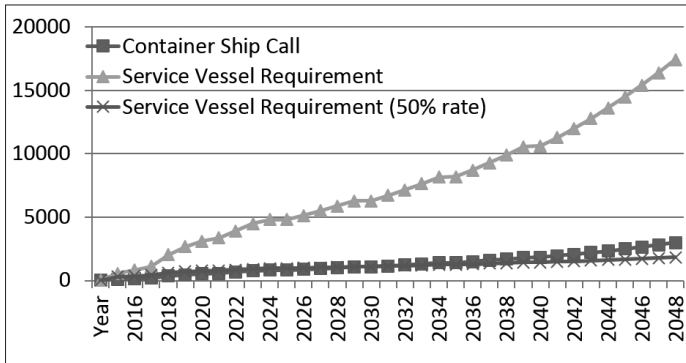


Figure 9: Requirement of Marine Service Vessels with Container Ship forecast

Figure 10 shows the future prediction of container throughput at MPA and also the prediction of marine service vessel requirement at same rate of increase of container throughput. As mentioned before, it is assumed that the number of marine service vessel at 2015 is 25 as mentioned before. It is seen that the number of marine service vessel requirements in 2020 are 134 and 65 respectively with assumption of same rate of increase of marine service vessel as the increase of container throughput and the rate of increase of marine service vessel as 50% rate of increase of container throughput. The numbers of marine service vessel requirements in 2030 are 393 and 113 respectively with assumption of same rate of increase of marine service vessel as the increase of container throughput and the rate of increase of marine service vessel as 50% rate of increase of container throughput. Therefore, if we assume the rate of increase of marine service vessel as the 50% rate of increase of container throughput, MPA needs 10 more marine service vessels within 2020 and 88 more marine service vessels within 2030.

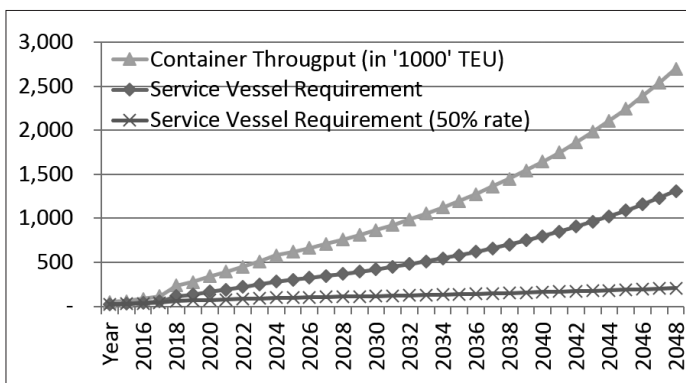


Figure 10: Requirement of Marine Service Vessels with Container Throughput forecast

Figure 11 shows the future prediction of total ship call at MPA and also the prediction of marine service vessel requirement at same rate of increase of total ship call. It is

assumed that the number of marine service vessel at 2015 is 25, which are providing services at present though 12 vessels are more than 30 years old and need replacement. It is seen that the number of marine service vessel requirements in 2020 are 42 and 33 respectively with assumption of same rate of increase of marine service vessels the increase of total ship call and the rate of increase of marine service vessel as 50% rate of increase of total ship call. Therefore, if we assume the rate of increase of marine service vessel as the 50% rate of increase of total ship call, MPA needs 8 more new vessels and 13 replacements within 2020. The numbers of marine service vessel requirements in 2030 are 81 and 45 respectively with the assumption of same rate of increase of marine service vessel as the increase of total ship call and the rate of increase of marine service vessel as 50% rate of increase of total ship call. Hence, if we assume the rate of increase of marine service vessels as the 50% rate of increase of total ship call, MPA needs 10 more marine service vessels within 2020 and MPA needs 12 more marine service vessels within 2030. Moreover, 13 numbers of old vessels have to be replaced as before gradually. **Therefore, total number of new marine service vessels requirement is 23 by 2020 and 12 more by 2030.**

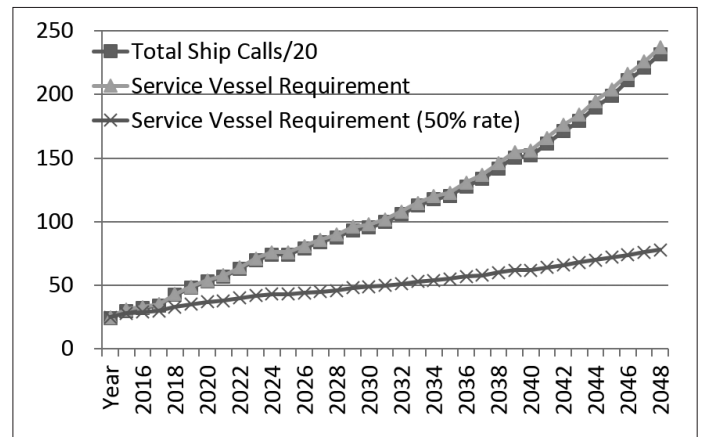


Figure 11: Requirement of Marine Service Vessel with Total Ship forecast

It is to be mentioned that since the marine service vessels will provide services to the incoming and outgoing ships not the containers, therefore, it is wise to assess the future requirement based on the total ship call, not the total cargo or container throughput. In view of the same, the necessary marine service vessels to be procured by MPA within 2020 and 2030 have been presented in Table 5.

Table 5: List of the Existing Usable Marine Service Vessels of MPA and Required Number of different Type of Similar Vessels according to IMO Guidelines

Sl No.	Type of Marine Service Vessels	Usable Service Vessels (Nos.)	New Vessel Requirement By (Nos.)	
			2020	2030
1	Escort, Towing and Ship Handling Tug	1	2	1
2	Ship Handling Small tug	-	1	1
3	Buoy Laying Vessel	-	1	1
4	Search and Rescue Vessel	-	1	-
5	Security Patrol Boat	-	2	-

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6	Survey & Research Vessel	-	1	1
7	Oil Spill Management Vessel	1	2	-
8	Waste Collection Fleet & Reception facilities including ancillary vessels and accessories	-	1	1
9	Wreck Removal/ Floating Crane ship	-	1	-
10	Trailing Suction Hopper Dredger	-	1	1
11	Sand Carrier		2	1
12	Mooring Boat	1	1	1
13	Pilot Boat	2	1	2
14	Pilot Mother/ Dispatch Vessel	-	1	1
15	Self-propelled Water Supply Vessel	1	2	-
16	Ambulance Vessel	-	1	-
17	Training Vessel	-	1	-
18	Dispatch Launch	-	-	-
19	Inspection Vessel	-	1	-
20	Cutter Suction Dredger	2	-	-
21	Work Boat	2	-	1
22	Crane boat	1		-
23	House Boat	1		-
	<b>Total</b>	<b>12</b>	<b>23</b>	<b>12</b>

Note: Vessels of more than 15 (fifteen) years old has not been considered, since these needs replacement.

### 9.0 PROCUREMENT PLAN

Procurement Planning is one of the most important steps in the public procurement cycle. The procurement plan is expected to list all the requirements that are under the responsibility of a particular procurement entity and that are expected to be procured over a period of time. There are instances where some items that are below a certain monetary threshold are not listed on the procurement plan. However, effort should be made to have everything that a particular procurement entity is responsible for procuring listed on the procurement plan of that procurement entity. The procurement plan should also be updated regularly (if required), but constant updating should be avoided. The fact that the procurement plan needs updating is an indication that it is not expected to be a static document. This, however, should not lessen the importance of procurement planning as the primary tool used for triggering procurement actions. This means that all procurement actions taken by a particular procurement entity should be guided by an approved procurement plan.

The procurement plan isn't only useful for determining what needs to be procured and by when, but it's also for determining the need for additional manpower to support the preparation of specifications and bid documents, requesting, receiving and evaluating offers, contract negotiation, award and administration and the number of procurement requirements within a certain period of time. Once the procurement plan is prepared and approved after allocation of funds and consolidation (bundling) of similar requirements to attract a broader pool of supplies and for economies of scale, it should only be allowed to change through approved amendments and all requirements procured by the responsible procurement entity should be found on the approved procurement plan. Only for exceptional reasons should a particular procurement shall be allowed to commence without

being listed on the approved procurement plan or on an approved amendment of the procurement plan.

In order to fulfill its statutory aims and tasks in providing navigation safety in Mongla seaport and the approaches and to provide services to incoming ships as well as to ship owners in seaport waters, MPA should plan to procure the following marine service vessels by 2020 as shown in Table 6 for necessary purposes.

**Table 6: Procurement Plan for Marine Service Vessels for MPA**

First Phase under DPP-1: (3) <ul style="list-style-type: none"> <li>• Waste Collection Fleet &amp; PRF-1</li> <li>• Oil Spill Management Vessel-2</li> </ul>	First Phase under DPP-4: (4) <ul style="list-style-type: none"> <li>• Ambulance Vessel</li> <li>• Training Vessel</li> <li>• Security Patrol Boat</li> <li>• Self-propelled Water Supply Vessel</li> </ul>
First Phase under DPP-2: (7) <ul style="list-style-type: none"> <li>• Escort, Towing and Ship handling/ Fire-fighting Tug</li> <li>• Pilot Mother/ Dispatch Vessel</li> <li>• Search and Rescue Vessel</li> <li>• Survey &amp; Research Vessel</li> <li>• Buoy Laying Vessel</li> </ul>	First Phase under DPP-5: (5) <ul style="list-style-type: none"> <li>• Inspection Vessel</li> <li>• Security Patrol Boat</li> <li>• Mooring Boat</li> <li>• Self-propelled Water Supply Vessel</li> <li>• Pilot Boat</li> </ul>
First Phase under DPP-3 (1) <ul style="list-style-type: none"> <li>• Wreck Removal/ Floating Crane ship</li> </ul>	First Phase under DPP-6: (3) <ul style="list-style-type: none"> <li>• Trailing Suction Hopper Dredger</li> <li>• Sand Carrier (2)</li> </ul>

For the procurement of rest 12 (twelve) Marine Service Vessels by 2030, DPP can be prepared considering the immediate requirement and suitable combination at that time.

### 10.0 CONCLUSIONS AND RECOMMENDATIONS

Mongla Port is one of the principal maritime ports of Bangladesh. Even if, in theory, there should be a ratio of 60% – 40% handling of maritime trade between Chittagong and Mongla, the reality is far from that with Chittagong currently totalizing 90% of the country's international trade. Mongla Port has the capacity to handle 6.5 million M. tons of cargo and 50,000 TEUS of container per year. In the year 2009-10, 1.65 million M. tons of cargo and 20,500 TEUS of container were handled. That means, the present capacity of this port is not fully utilized.

In Bangladesh, the industries are located in and around Dhaka-Chittagong. The business community of Dhaka and its surrounding areas is less interested to import and export their cargo through Mongla Port because of lack of fair road and bridge connections. The present government has given emphasis for the development of Mongla Port and pushes the construction of the Padma Bridge at Mawa point. When Padma Bridge will be operational, the distance from Dhaka to Mongla will be 170 km. So, the business community of Dhaka and its surrounding areas will be more interested to use Mongla Port for importing & exporting cargos as the transportation distance from Dhaka to Mongla will be shorter than Dhaka to Chittagong.

At present, jute and jute goods, frozen cargo and other general cargo are exported from Mongla port. Moreover, import of heavy machinery and equipment, fertilizer, food grain, sugar,

motor vehicles, raw materials of industry, etc. through Mongla Port will increase. As a matter of consequence, the act of establishing different types of new industries in the south-western part of the country, scope of huge employment, expansion of trade and business and overall activities of Mongla Port will increase and develop rapidly. Nevertheless, in connection with the sub-regional discussions ongoing with the Indian, Nepalese and Bhutanese governments aiming at developing regional operational corridors, it seems that the current government has decided to start again the development of the Mongla port. A 2-phased development plan has been drafted and is about to be funded by the national authorities and senior management was appointed in this regard.

In view of the fulfillment of mandated responsibilities of Mongla port with specific emphasis to faster and adequate marine services to the incoming and outgoing ships and also to enhance surveillance, security patrol, emergency transportation and search and rescue operation, the study has been carried out. The marine services provided by MPA have been studied with special emphasis to the services to be provided according to IMO and UNCLOS requirement and a procurement plan has been proposed which will facilitate the requirement of procurement of necessary marine service vessels to render mandated marine services of MPA to different incoming and outgoing ships to the port.

It is recommended that in order to improve the quality of marine services to be provided as per requirement of IMO and UNCLOS, MPA should procure different types of 35 (thirty five) numbers of marine service vessels as proposed in the procurement plan in the previous section. For the procurement of rest 12 (twelve) marine service vessels by 2030, procurement plan can be prepared considering the immediate requirement and suitable combination at that time.

It is pertinent to mention that the research has potential limitation. The number of marine service vessels is identified based on the trade and traffic prospects, which is mainly considered from some previous studies and the recent performance statistics of the port. Even though infrastructure is one of the main reasons for using the Chittagong Port instead of Mongla but the users of the port that is the trading communities have their reason. An investigation of users' choice through primary data collection will provide a better understanding of the port sector development of the country. ■

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