

Procurement System for Maintenance Dredging Projects in Malaysian Seaports

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Abstract: In the seaport industry, the port operators need to undertake maintenance dredging to maintain depths of its harbour basin and navigational channels for the safety of the vessels against the accumulation of marine sediments. For a successful maintenance dredging project, appropriate types of procurement systems must be employed by the port operators. This study provides an overview of the procurement systems used for maintenance dredging projects at two Malaysian seaports, i.e., Johor Port and Port of Tanjung Pelepas. Structured interview with respondents from the procurement department and technical department of both ports were employed to elicit relevant information and data. Two types of procurement system that is competitive bid and direct award are implemented in both ports. The selection of procurement system depends on factors such as condition of channel, complexity, size, price and time urgency of the maintenance dredging project. For recurring maintenance dredging, competitive bid is employed, whereas for emergency maintenance dredging, direct award is typically used by both port operators.

Key words: Dredging process, dredger, competitive bid, direct award, two-envelope system, depends

INTRODUCTION

Dredging can be described as the process of taking away deposits and debris from the bottom of waterways such as rivers, channels and harbours. As sedimentation gradually fills the channels and harbours, dredging is necessary to maintain the depth of existing waterways, ports and water channels around the world. Besides that dredging process is also used in flood control measures to maintain or improve the river or channels flow capacities. In the event of contamination of water bodies, dredging is also carried out in order to contain the contaminants from spreading to other areas (NOAA., 2014).

In accommodating growing vessels size, existing harbours and approach channel have to be deepened. Port authority need to determine the angle of the side slopes and investigate parameters like current condition, wave climate, sediment transport and soil conditions. These parameters are important for the port authority to estimate

The life expectancy of the port that can provide an insight into the probability of failure or the maintenance costs. There are three types of dredging which are capital dredging, maintenance dredging and remedial dredging. Capital dredging is the dredging carried out in a new location and materials that has never been dredged out.

Maintenance dredging is conducted where channels or constructions works has to be at their desired dimensions with a time frame. Remedial dredging is done to improve the quality, human health and environmental protection purposes.

Maintenance dredging can be defined as a process of excavating and removing unwanted deposited soil such as mud, sand and gravel from the bottom of harbours and waterways for purpose of deepening or maintaining the water depths in areas where sedimentation occur. It is regularly undertaken by many port operators to maintain navigable channel, allow ship access and transfer their loading to the port (Vivian, 2005). Emergency dredging, a form of maintenance dredging, need to be undertaken immediately when violent storm or wind or flood mobilised and piled up huge amounts of sediments in ports and harbours.

All major ports in Malaysia require periodic maintenance dredging. The maintenance dredging cycle and dredging volume varies for different ports. Maintenance dredging cycle interval ranges between 1-4 years and the volume of sediments to be dredged ranges between 0.5-6.0 mm³/year for the ports. In a year alone, 4 mm³ of sediments for maintenance dredging of ports and jetties were dislodged (Chan, 2014).

Managing procurement system is part of the knowledge areas in project management. To date there

has been no or very little exploration on the procurement system in Malaysian dredging industry. Hence, this study aims to highlight procurement system used for maintenance dredging project in (2) Malaysian seaports. Interview approach was employed to elicit the relevant information from the two seaports. Beforehand, this study presents the dredging process and technology that in some extent related to the selection of the procurement system.

MATERIALS AND METHODS

Dredging process: The dredging process consists of the following four elements: excavation, transportation of excavated materials, storage and reuse or disposal of dredged materials (Eisma, 2005; PIANC., 2002).

Excavation: This process involves the removal of sediments which consist of soils and rocks from the water body. A dredger is normally used to excavate the material either mechanically, hydraulically or by combination of both.

Transportation of excavated materials: This process is about transporting the dredged materials to a storage area or disposal site. There are 2 types of transportation which are via water and land. It is generally achieved by using self-contained hopper dredger, barges, pipelines, trucks or conveyor belt.

Storage: Storage comes before the treatment process. Dredged materials can be stored for disposal or reuse but depends on quantity and the place of storage.

Reuse or disposal of dredged materials: Dredged Marine Sediments (DMS) are generated in large quantities from dredging activities. Although, most of the DMS normally being disposed back into the sea due to economic, logistic and environmental constraints, it can be a great resource for construction material. Dredged materials should go through treatments process such as solidification before being reused or disposed according to law and regulations. A preliminary management framework for beneficial reuse of DMS in artificial land creation proposes three major stages which are transportation, storage and treatment (Kaliannan *et al.*, 2015).

RESULTS AND DISCUSSION

Dredging technology: Each of the four elements of the foregoing dredging process requires certain technologies

Table 1: Types of dredger

Types	Dredger(s)
Mechanical	Grab/clamshell dredger, backhoe dredger, dipper dredger and bucket-ladder dredger
Hydraulic	Plain suction dredger and dustpan dredger
Hydraulic and mechanical	Cutter suction dredger, bucket wheel dredger, trailing suction hopper dredger
Hydrodynamic	Water injection dredger

to be carried out. However, the dredging technology that will be focused here is dredger. There are four categories of dredgers: mechanical dredgers; hydraulic dredgers; mechanical/hydraulic dredgers (utilising both basic elements in some combination) and hydrodynamic dredgers as shown in Table 1.

In selecting dredger, the volume of soil is the main determinant. It is recommended that smaller size, more economical and environmental friendly are set as preference in the dredger selection. Production rates for dredgers vary widely depending on the circumstances the material to be dredged and the transport and disposal methods applied. Other factors such as weather and sea state, ship traffic, depth and thickness of material being removed, also affect dredging production rates. The cost of dredging varies according to the technology and equipment used, estimated volume, type of dredged material, distance from excavation to disposal site, time and distance of mobilization and demobilization and disposal method. The high cost has always been the main problem for port operators, who are responsible for dredging and maintaining deep channels but also need to spend funds to expand or build new terminals in order to cater for growing trade activities.

Based on port circulars issued by the Marine Department of Malaysia in 1997-2016, it is found that trailing suction hopper dredger, cutter suction dredger, and grab/clamshell dredger are among the common types of dredgers being used in many dredging projects of both JPB and PTP as well as other seaports throughout Malaysia. Dipper dredger and water injection dredger are occasionally used so far.

Procurement systems and dredging projects:

Procurement in the context of dredging and maritime construction project, comprises a number of phases as shown in Fig. 1.

In identifying potential contractors, pre-qualification is an effective strategy. It is a process to evaluate the ability of potential contractors in executing the project within specified cost, time and quality. Through this process, only qualified contractors can be ensured to proceed to the tender phase. Similar to bidding for civil

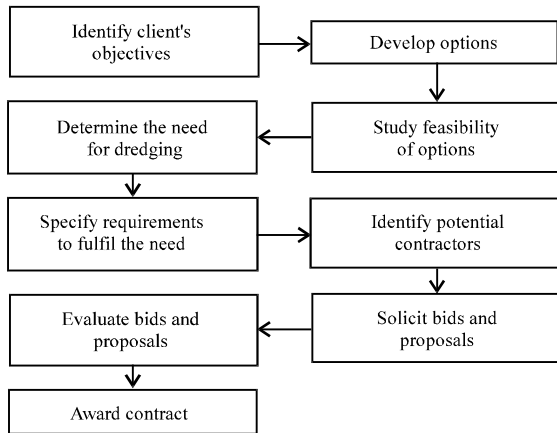


Fig. 1: Phases in procurement of dredging and maritime construction project

engineering construction contracts, bidding for dredging contracts is generally in the form of competitive tendering on the basis of tender documents prepared by the employer or by consulting engineers appointed by the employer.

Two-envelope system is an approach that can be adopted for dredging projects. This approach is suitable when price is not the top priority or main constraint for the project. The method of contractor selection is quality-based where the best technical proposals will be selected before contract negotiations are made. Short-listed contractors are required to submit two separate proposals in sealed envelopes: technical qualifications, methodology and schedule in the first envelope and proposed fee in the second envelope. All contractor's proposals in the first envelopes will be evaluated. Then, only second envelopes of top contractors will be opened. The proposed price is added to the scores of the technical proposal in the first envelopes. The contract will be awarded to the best scoring bidder.

Procurement system for maintenance dredging projects in Malaysian seaports: There are two seaport was selected for this study that are Johor Port and Port of Tanjung Pelepas (Fig. 2). Johor Port is the first port in Johor and located on a shoreline of the East Johor straits 32 km from Johor Bahru city center as part of Pasir Gudang industrial area. It was designed as a multi-purpose port that capable to cater all types of cargo. It has operated 5 terminals with 24 berths totaling 4.75 km, with maximum depth of 13.5-13.8 m and covers containers, bulk and breakbulk activities. It is currently run by Johor Port Berhad.



Fig. 2: The location of JP and PTP at the Southern part of Malaysia (source:mmc.com.my)

Port of Tanjung Pelepas (PTP) is Malaysia's most advanced and largest container terminal located on the Eastern side of the mouth of the Pulai River in Gelang Patah in South-Western Johor. The port construction was started in 1998 and officially operated in year 2000. Currently, it has 14 linear berths totaling 5.04, 12.6 km of access channel for two-way traffic and turning basin of 600 m. The PTP is operated under the PTP Sdn. Berhad.

During the interview sessions both port operators, Johor Port Berhad (JPB) and Port of Tanjung Pelepas Sdn. Bhd (PTP) were represented by a General Manager of Procurement Department and a General Manager/Chief Technician of Technical Department (aka Engineering Service Department at JPB and Marine Service Department at PTP). All the four respondents have minimum 15 years working experiences in handling procurement and marine work related to dredging projects.

At PTP and JPB, usually recurring maintenance dredging work will be carried out after 5-7 years depending on the amount of sediment at the channel. In the case of certain amount of sediment is critically need to be dredged immediately, emergency maintenance dredging will be carried out. Normally the area to be dredged for emergency maintenance dredging will be smaller than for recurring maintenance dredging.

At both ports, competitive bid and direct award are the two types of procurement system employed for maintenance dredging works. Both port operators only invite short-listed contractors to submit their bid proposal for maintenance dredging projects. In both ports, competitive bid is normally employed for complex and large project. For recurring maintenance dredging project, the size of dredging work area can be more than 10 km², which may involve whole area of the navigation channel, and the project cost is normally above RM 500,000.00. If early time completion is not a critical priority, a

maintenance dredging project can be procured through the competitive bid. Trailing suction hopper dredger is commonly used in the project.

Unlike the competitive bid, direct award system is normally employed in both ports for maintenance dredging that requires urgent completion. As the size of dredging work area is small (e.g., <5000 m² for emergency maintenance dredging project), typically at certain location(s) in the navigation channel, the cost of project is normally less than the minimum cost of project procured through competitive bid. It is a common practice for the project to be directly awarded to a contractor that has a good past projects track record with them. DOP dredger, a hydraulic dredger which normally used for small scale dredging operations in restricted areas is typically used in the project procured through this system at both ports. In JPB, contractor selection for emergency maintenance dredging is carried out using this direct award system to allow the work start immediately. The process of both competitive bid and direct award system that has been implemented at both ports is as the following:

Competitive bid process: The technical department of both ports operator will conduct surveys (such as hydrography and bathymetric), especially to check the depth of the navigation channel of the ports. At PTP, the marine service department normally do the survey for every 6 and 7 months and if the depth of the channel is at minimum 5 cm less than the required depth, the maintenance dredging is necessary to be carried out. Based on the survey, a technical report that contains all information such as the volume of sediment that need to be dredged, the width and the depth of the navigation channel need to be maintained and cost estimation for the proposed maintenance dredging work will be prepared and submitted to the port biz owner for getting “approval to spend” to carry out the work.

After getting the approval from the biz owner, a more detailed technical report (which includes specifications and bill of quantities) for tender purposes will be prepared by the technical department. Once the technical report is ready, the procurement department will prepare necessary documents for tender calling process. Beforehand, the procurement department identifies a list of potential contractors as the invitation to tender is restricted to a number of selected contractors. Normally four contractors will be invited. Each contractor is required to prepare technical proposal and commercial proposals, normally within 2-4 weeks. In the technical proposal, the contractors are expected to propose the best method and to highlight their ability (including expertise, man power,

plant and machineries) to carry out the maintenance dredging work. Meanwhile, for the commercial proposal, the contractors are required to explain their company background and financial standing supported with evidences and to propose reasonable price for the work through bill of quantities.

The technical proposal and commercial will be evaluated in separate sequence. The technical proposals that are submitted by the contractors will be evaluated first by the technical department. Two contractors that are most technically capable will be proposed in the technical evaluation report for deliberation of the procurement department. Then, the two shortlisted contractors will be evaluated by the procurement department based on their commercial proposals. Negotiation process will be take place during this stage.

At PTP, both contractors will be invited to procurement department office to discuss the commercial proposal and especially to negotiate the price of the work. The best contractor will be awarded the maintenance dredging work. At JPB, procurement department will form a commercial negotiation team and will arrange for commercial clarification and negotiation process with the two shortlisted contractors. After the negotiation, a techno-commercial proposal evaluation report will be produced and the best contractor to perform the maintenance dredging work will be determined.

At PTP, the negotiation also can be carried out through an online auction. Both contractors are required to submit their revised bidding online. Both contractors will be given a separated password to log in to the online bidding system and to bid for a best price that they can give to the PTP in 30 min. During the bidding period both contractors can only see their ranking (based on their price offered) either in first place or second place. After the 30 min over the auction will be closed and the contractor who offering lower bidding price will be awarded the maintenance dredging work.

Figure 3 illustrates the process of competitive bid implemented at both ports. It is clear from the foregoing explanation that both ports have similar process except for online auction bid which is unique for the PTP.

Direct award process: Technical department will conduct a survey on the condition of the channel and they will produce a technical report that contains all the information about the works that need to be done, including the amount of sediment that needs to be dredged. Procurement department will list out potential contractors that have an experience doing a similar past

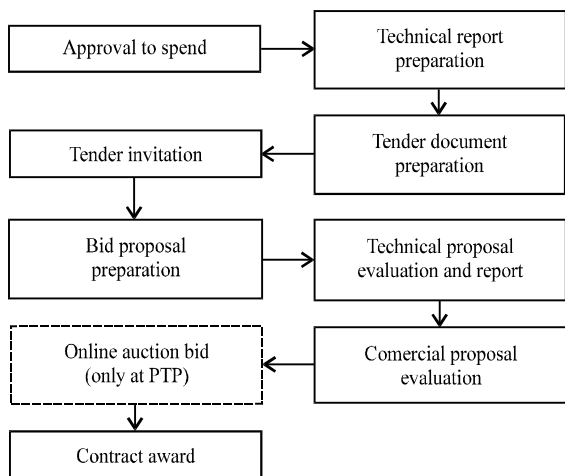


Fig. 3: Competitive bid process for maintenance dredging project at Johor Port and Port of Tanjung Pelepas

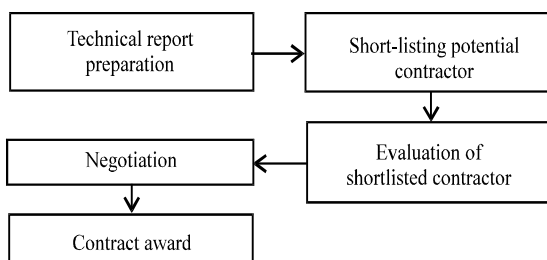


Fig. 4: Direct award process for maintenance dredging project at Johor Port and Port of Tanjung Pelepas

projects with the PTP/JBP. The contractors will be evaluated based on their past project performance, current project in hand, amount of dredge vessels that they have and their financial stability. An evaluation report will be produced and one contractor that has the best performance score will be selected. The selected contractor will be called for a discussion and negotiation with the procurement department to reach agreement on the project contract and price. The overall process of direct award system implemented at both ports which is identical to each other is summarised in Fig. 4.

CONCLUSION

This study has clearly elaborates the concept and process of two types of procurement system, i.e., competitive bid and direct award that are employed for maintenance dredging projects at Johor Port and Port of Tanjung Pelepas. Two types of maintenance dredging, i.e., recurring and emergency undertake by both port

operators has also described. Sediment quantities, size of dredging operation area, project complexity, time and cost are among main factors for consideration in determining the appropriate procurement system. The technology (dredger with different capacity and application) used could also indicate some pattern with the types of procurement systems employed in satisfying the scope and nature of the maintenance dredging projects. It is obvious that pre-qualification, a process to ensure that only qualified contractors participating in the tender process, and two-envelope system which emphasise objective technical and commercial evaluations to avoid bias towards lowest project price are the cores for the procurement systems implemented at both ports. It also can be concluded that competitive bid system used by both port operators is similar with traditional procurement system in building or civil constructions where the three phases, i.e., design bid and build are the essential features.

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