

# ASSESSMENT OF THE APPLICATION OF BUSINESS PROCESS MODELLING APPROACH IN MARITIME OPERATIONS

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**Abstract:** Maritime industry is characterized by highly globalized structure and operations. Shipping companies apply various approaches for inter-industry cooperation and information exchange. Operational efficiency is strongly enhanced by improved communication and cooperation by all stakeholders and partners. The present article outlines the benefits of business process modelling approach to maritime operations. A conceptual model is proposed, identifying the main processes and benefits for efficient information exchange and cooperation between shipping companies.

**Keywords:** MARITIME INDUSTRY, MARITIME OPERATIONS, BUSINESS PROCESS MODELLING

## 1. Introduction

The principle of total quality management is vital for efficient shipping company operations. The present article analyses quality matters in maritime operations as the basis for effective design of business process models in maritime operations.

Business Process Modeling (BPM) permits strategies to be efficiently put into practice [3]. Business Process Modelling allows for concentration of business activities on customers' requirements. The structure of every Business Process Model consists of a sequence of activities linking both the internal processes of the organization and extending beyond the company for efficient customer relationship management. On the other hand, the Business Process Model is to be considered as the off-set for further restructuring of the company, additional personnel training, application of innovative strategies and increased level of services quality control.

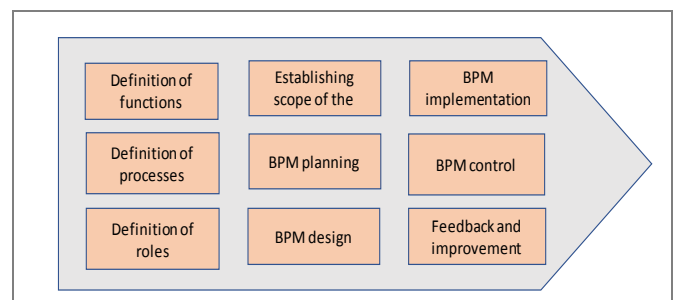
As maritime companies operate within a very unstable market environment, on-going control and follow up of activities is vital for preserving the company's market power. From a strategic point of view, the organization of the working processes must be considered in interrelation with communication processes (exchange of communication) and the applicable information technologies. The processes of maritime operations of a medium-sized shipping company are studied and identified. The theoretical concepts proposed serve as a background for optimization of maritime operations in terms of cost efficiency. For the purposes of the present analysis the transportation of bulk cargoes is used as a theoretical basis. The detailed processes description allows for identifying the main groups of operations whereas management activities and control are considered as tools for restructuring of the business processes. The analysis of the conceptual model allow for conclusions and recommendations for improved maritime operations.

## 2. Theoretical background and structure of the Business Process Model

In general, modelling of business processes can be defined as identification, analysis and implementation of work activities schemes within a certain company as well as between the company and external market players. Traditional BPM mainly attempts to automate business processes from a computer-oriented perspective, i.e., the approaches emphasize on the data, structural and other technical aspects of business processes [2]. The procedure for designing of the Business Process Models is presented in Figure 1. The processes are to be identified and be discernible at strategic and operational level. Being part of company's quality management system, the described procedures (processes) are to be documented and revised continuously in terms of operational efficiency.

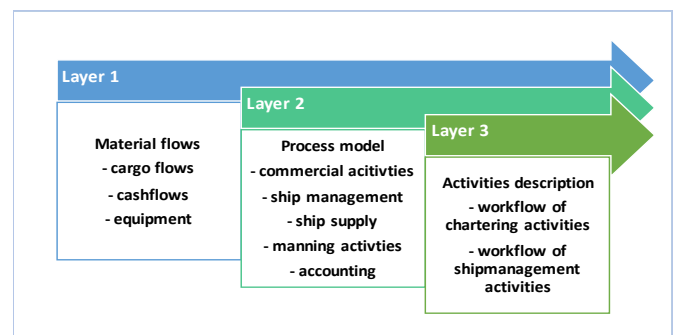
The initial process of the BPM design involves establishment of the processes scale, i.e. setting forth limits and outlining the main roles of the participants. BPM are usually structured at several layers whereas each level has certain information flows and documentation pertaining to it. In this way the detailisation of the processes is performed via implementation of sublevel processes and activities.

**Figure 1.** Phases of Business Process Modelling approach



Another vital issue is to ensure for the representativeness of the BPM and its easiness of perception by all participants. The processes scheme itself is a useful tool for implementation of two-way communication between management and operations departments. There are usually several types of BPM in each organization depending on the level of management whereas BPM of strategic processes are less detailed than those of operational activities. Figure 2 shows an example of how a process can be described using both processes and workflow descriptions.

**Figure 2.** Structuring the Business Process Model in a shipping company



The design of the BPM entails several stages. The conceptual model is created basis specific data related to the material flows which help identifying the scale of the model. The first layer consists of processes describing the functional structure of the organization whereas each function corresponds to a certain segment of the material flows. The subsequent layer is structured in

more detail and describes the specific activities. There is a limit to the degree of detailization to avoid difficulties of perception and realization. The activities are presented by functions, actors, communication tools in the actual process succession. Usually there is additional information, outside the main framework of the model, providing details re actors, activities, documentation exchange, etc.

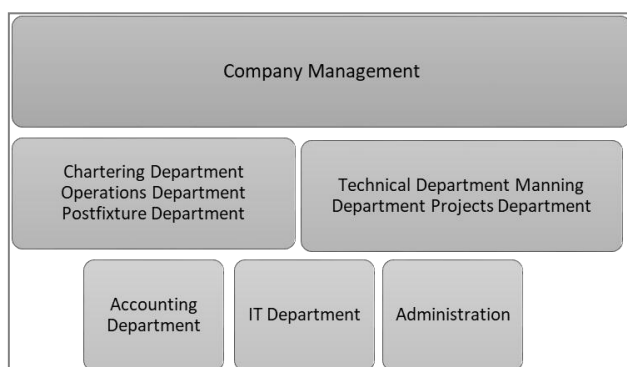
### 3. Business Process Modelling approach in shipping company operations

The concept of BPM approach in maritime operations is implemented in an Europe based medium-sized shipping company specializing in ship management. The company operates a fleet of 5 coaster type general cargo vessels, employed mainly in carriage of break-bulk and bulk cargoes in the Black Sea and the Mediterranean region.

There are several departments in the company, each is characterized by specific functions and roles. The functions, activities and operations of each department are outlined. Further, the interrelations with external parties for each department are identified. In addition, each process is analyzed basis "as is" and improvement in terms of time savings is assessed on the basis of BPM application.

The Management department is involved with strategic decision-making that refers to all departments of the company, i.e. management decision affects the operations of each specific department (Figure 3). Chartering and Operations department, as well as Postfixture department present the core of the company operations as being responsible for income generation and direct contacts with clients. Technical department is responsible for the maintenance of the operated ships, repairs, supply and certification. The latter four departments are considered as resources for profit output and costs optimization. The products of company activities are the transportation of cargoes by sea, which represents the material flows. The supporting activities are implemented by the functions in Accounting, Manning, Administration and IT departments. All departments should function in interrelation in accordance with company strategy.

Figure 3. Functional structure of a shipping company



The business processes in Chartering department are described as follows: identification of open positions of ships, identification of suitable cargoes for operated vessels, preliminary voyage estimation, comparison of results for available cargo options, decision for initiation of negotiations on a firm basis, fixing of the vessel, transfer of contract details and all relevant data to Operations department. The final voyage estimation is performed after voyage completion and comparison of actual voyage results versus planned is made. All above described processes are in line with company strategy, freight markets structure and status, internal schedule of the vessels.

The processes of Operations department are described as follows: sending voyage instructions to master, appointment of ship agents at load and discharge ports, provision of special documentation regarding cargoes to be carried, voyage monitoring, provision of charter party details, payment of disbursement accounts, approval of draft cargo documents, instructions to master regarding delivery of cargo, arrangement of supplies in accordance with technical department requirements, arranging of crew repatriation in accordance with manning department requirements.

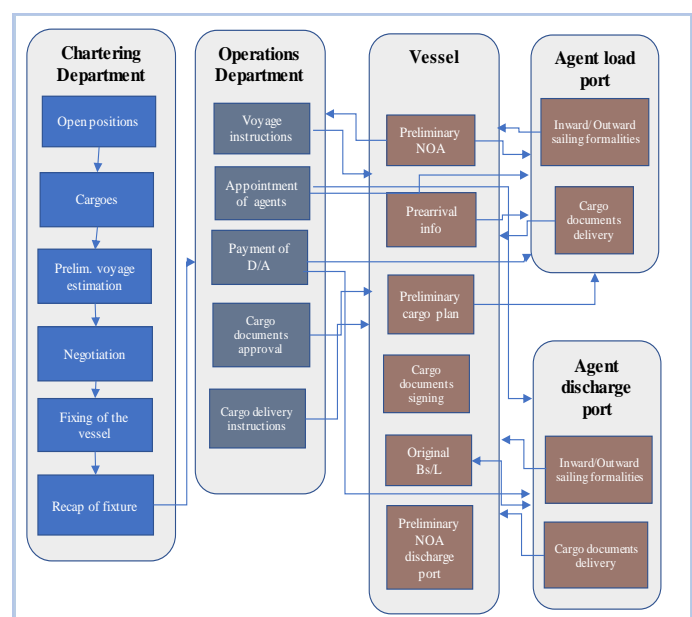
The above processes performed by Operations department are concurrent with actual movements of the ships, i.e. the product element of the BPM:

- sailing to the port of loading (receipt of voyage instructions, sending preliminary notices of arrival to load port agents, sending prearrival information to port authorities at load port);
- loading operations (preparation of preliminary cargo plan, berthing, supervision of loading ops, issuing and signing of cargo docs, unberthing, outward sailing formalities);
- sailing to the port of discharge (sending preliminary notices of arrival to agents at discharge port, receipt of cargo delivery instructions from Operations department).
- discharging operations (implementing cargo delivery instructions, obtaining endorsed original Bill of Lading, signing of discharge port cargo documents).

The processes described in Figure 4 present the core processes during the entire voyage. Each sub-level, for example the processes at load port, can be further presented in detail, including additional actors and processes. The input data for above described model are the charter party details whereas the output is the right delivery of cargo to the authorized cargo receiver.

As presented in Figure 4, both development of processes and documentation exchange is included. It should be noted that at lower levels of processes' mapping documentation exchange can be presented as separate sub-models showing the interactions between the vessel, the shipping company and the external actors in more detail. The approach for subdivision of business processes into several layers allows for better understanding of the company operations and their relation to the company strategy.

Figure 4. Voyage implementation BPM



The port of loading activities include roles such as: load port agents, stevedores, load port authorities, custom authorities and the vessel. Same refers to the port of discharge. The material flow, i.e. the transportation of cargo is presented via the following processes:

- vessel's proceeding to load port after receipt of voyage instructions;
- vessel's loading operations;
- sailing to discharge port;
- discharging operations and delivery of cargo to the receivers.

Mapping the intrinsic business processes in shipping company operations allows for clearer perception of all activities in interrelation. In this way it is easier for the company management to identify the weak nodes and perform follow-up and control.

#### 4. Evaluation of Business Process Modelling approach in maritime operations

When evaluating any possible improvement to the BPM of shipping company operations in terms of time and costs the following considerations are to be taken into account:

- vessel's sailing time is forecasted basis average speed and sailing via usual trade routes;
- the time in port depends on the speed of loading/discharging operations;
- auxiliary operations at ports depend on the current navigational conditions and port infrastructure;
- cargo is usually stored in port on vessel's arrival unless part of the cargo is still not delivered in port;
- the cargo quantity determined as per the preliminary cargo plan is not final thus the time of loading may vary according to the actual quantity of cargo loaded on board;
- the duration of discharging operations is determined by the port rate of discharge and the cargo handling option (direct or indirect);
- preparation of cargo documents may take between 2 and 12 hours, depending on commercial matters.

Sailing time of the vessel can be forecasted but there is little potential for improvement of this variable as it depends on the vessel's characteristics (service speed), distances between ports and navigational conditions. The considerations regarding sailing time should be focused on increasing the number of voyages during the operational period to ensure for higher volumes of cashflow.

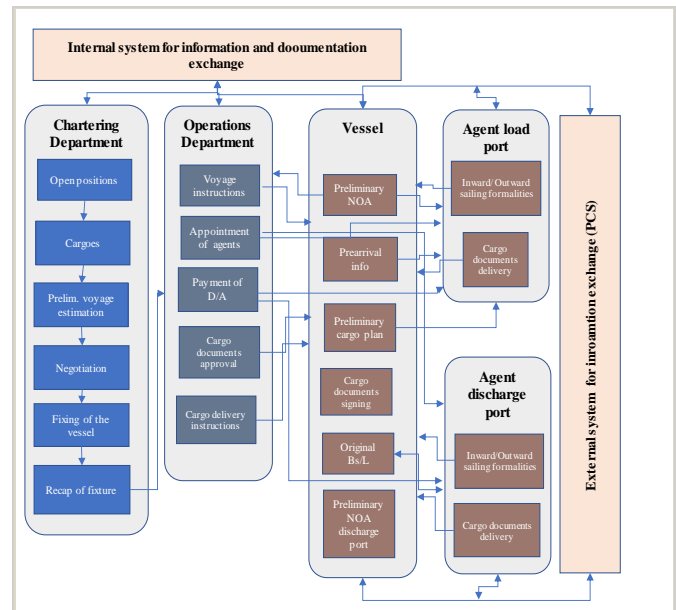
The detailed analysis of the BPM, as presented in Figure 4, shows that improvements can be achieved regarding the optimization of information flows. The latter can be implemented via:

- internal communication system of the shipping company, allowing for information and documents exchange between the departments and to/from the vessels;
- external systems of information exchange of the ports of loading and discharging for exchange of information about vessel's arrival and departure, documents regarding inward and outward formalities for creating efficient exchange of information and documentation without delays.

The internal information system of the shipping company is usually custom-designed to correspond to the BPM at all levels and to allow for real-time streamlining and control of processes and cashflows. The port information systems are either national-based or are part of Port Community Systems, allowing for seamless exchange of documents and information within a secure

environment. In this way all procedures at ports can be optimized in terms of time reduction which will lead to cost savings for the company (decreased port stay time) and higher turnover for the ports as more ships will be handled. It should be noted, however, that documentation in hard copy is still to be in circulation due to the requirements of the banks and the commercial interests (Figure 5).

Figure 5. Optimized shipping company operations via improved BPM



Further, as concerns traffic control in ports, such systems are already in place in accordance to EU policy for implementation of systems for traffic control. In general, the automation of information exchange will increase the accuracy of the preliminary voyage estimation by the Chartering department. For the ports, such systems will have the effect of increasing of the port handling equipment efficiency. Another issue concerning ports operations is the time vessels spent waiting for berth. This issue is of vital importance for smaller and so competitive ports as same can disrupt the normal port operations. Applying integrated information exchange systems can reduce vessel's waiting time by 50% thus reducing the voyage time considerably [1].

Implementing internal and external information exchange systems allows for direct access to necessary information. The latter ensures for timely distribution of information and lack of delays due to unavailability of documentation.

#### 5. Conclusion

The present article has analyzed the operations of a medium-sized shipping company operating several cargo vessels. The processes have been studied in detail, outlining the interrelations between departments that ensure company revenues. A theoretical framework of a BPM of the maritime operations is presented, describing the implementation of a ship's voyage. The performance of each role and the pertaining processes are presented in detail, showing the communication and documentation flows. The detailization of processes into several layers allows for better control of company operations and effective feedback from all actors. The analysis of the BPM of the maritime operations is based on the theoretical framework and actual interrelations among company departments, vessel and external parties. The proposed theoretical model for improved maritime operations aims at more efficient functioning of the entire company. Similarly, mapping of the business processes ensures for identification of the need for new

services provision, implementation of internal and external IT systems for information exchange.

The presented BPM of the shipping company is structured at several layers, corresponding to the hierarchy of the company functions. As the business scope of the company is to provide transportation, the proposed BPM concentrates on the product, i.e. the implementation of the ship's voyage for carriage of cargoes by sea. It has been proved on a theoretical basis that the sensitive elements of the BPM are the costs of maritime operations and the duration of each operation. The introduction of IT systems for internal and external information exchange will lead to considerable time savings, especially during vessel's port stay and for the duration of port procedures. Extending the research further might involve more complex options of voyage rotation (including more ports) to assess the benefits of application of BPM approach for improved maritime operations. The outlined benefits are important to all stakeholders of the maritime supply chain in terms of increased voyage turnaround for the operational period.

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