Chapter 6 Logistics Facility Management I

Introduction

This is the sixth chapter in the module Logistics Management and Practice. This chapter deals with logistics facility management, with a focus on container terminals.

The aim of this lecture is to

- Define logistic facility management
- Describe the operations of logistic facilities such as ports, terminals, cross-docking stations, warehouses, transshipment platforms
- Identify main cargo handling processes in terminals, outline the measurement of handling performance and their advantages/disadvantages,
- Outline the role of logistics facilities in supply chains.

The structure of this chapter is as follows.

First some elements of port operations will be discussed. This is followed by a more detailed look at terminal operations. The chapter closes with a discussion on warehouse operations.

Port Operations

A Logistics facility management is:

The management of logistics facilities, such as ports, terminals, and warehouses in such a way that they contribute as best as possible to the efficient flow of goods, services and related information.

Ports can be defined in many different ways:

- As a place to shelter for ships.
- As a cluster of maritime related activities.
- As a modality interchange port.
- As a catalytic converter for economic growth.
- As a gateway to the hinterland

What is important to realize is that maritime transport and ports go hand in hand and that developments in one segment have an impact on the other one. See in the context the ever ongoing increase in ship’s sizes and the way ports cope with this.
The Port of Rotterdam (PoR) wants to offer the port’s customers an optimal business climate. The PoR focuses fully on the smooth and safe handling of shipping traffic. In a highly competitive environment this requires continual investments in space, infrastructure and to her facilities.

The following figure contains the basis elements that are required for cargo handling: a quay, a crane, and an area to temporarily store the cargo.

### A port does not facilitate only deep sea

*Figure 1: the role of the port in the supply chain (data in 1000 tons)*

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### Ports do not facilitate only deep sea

*Figure 2: main cargo handling g elements in a port*

Ports are usually governed by Port Authorities. These can be public or public/private bodies. Three main operation areas of a Port Authority:

- To maintain security in cargo handling and traffic
To facilitate the port’s customers an optimal business climate

To execute custom formalities

Some examples of facilitating projects in the port of Rotterdam:

- Multicore pipeline system
- FAMAS (First All Modes All Sizes): new designs for container terminals
- Maasvlakte 2: quality requires space

Read more about this projects on the following website:

http://www.portofrotterdam.com/organizations/UK/PortofRotterdam/ProjectsPoR/Index.asp

Figure 3: port traffic coordination centre

Ports play and important role in supply chains, but in a rather indirect way, because they facilitate the international transportation of the flows that make up the international supply chains. The way this works out for ports is that they have a strong focus on efficiency, cost levels and volume.

A major strategic question for many ports is how they can increase their role in the supply chain. In Europe, ports have tried to do this by developing areas of more high
level logistics activities, such as warehousing and value adding activities close to the areas where the cargo is loaded and unloaded.

If and how such a strategy can be a succes is a matter of debate. In some countries, businesses and policymakers aim for the development of logistics activities because these do not require much education and training, and these activities seem very suitable to create large numbers of fairly low wage jobs. In other countries this development is seen as a disadvantage because low wage jobs create little economic added value.

**Terminal Operations**

A terminal can be defined as a location where at least two different modes of transport meet each other.

Terminals can be different by the type of product being handled i.e. passengers, cargo or information. A transshipment center is a unimodal terminal. See below for an overview.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Product</th>
<th>Connection modalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport</td>
<td>Passengers/cargo</td>
<td>Airplanes/public transport/cars</td>
</tr>
<tr>
<td>Bulk</td>
<td>Cargo</td>
<td>Barges / trains</td>
</tr>
<tr>
<td>Container</td>
<td>Cargo</td>
<td>Feeders / trucks / barges / rail</td>
</tr>
<tr>
<td>Tanker</td>
<td>Cargo</td>
<td>Pipelines / product</td>
</tr>
<tr>
<td>Cruise</td>
<td>Passengers</td>
<td>Cars / public transport</td>
</tr>
</tbody>
</table>

**Terminal types**

This section will discuss a number of terminal types.
Characteristics of deep water bulk handling facilities:

- Vast storage areas required (in view of ground pressure)
- Processing facilities e.g. blending / weighing
- High crane productivity (50 to 85 tons per lift)
- Hinterland connections required by rail / inland waterways
- Remote location (noise / dust)
Characteristics of tank terminals:

- Deepwater facilities.
- Bridging time between delivery and processing: storage.
- Transport to refineries takes place either via pipeline or barge.
- Given characteristic of product different set of handling equipment required: pumps
- Quayside construction is simple, only a jetty is required.
- When a wide variety of chemical products are handled, the complexity of the terminal increases in view of separation and contamination of products

Main objectives of a container terminal:

1. To turn around vessels as quickly as possible by achieving high throughput figures.
2. To bridge time by storing containers.
3. To act as an interchange point between different transport modalities e.g. rail, road and barge or feeder.

In general there are two types of container terminals:
1. Gateway terminals: Serving a captive area by means of primarily non-feeder modalities.

2. Transhipment terminals: Mainly serving deep-sea and feeder vessels (trans)shipping cargo to either out-ports or overseas destinations. Hub-and-spoke operations.

Main developments affecting container terminals:

- Increase in production due to bigger vessels and call size.
- More container movements (transshipment)
- Every loaded TEU is nowadays handled 3.5 times on average
- Peak and queuing management.
- Automation of stacking and horizontal transport.
- Increase in storage density.
- More emphasis on non-truck modalities.

The development of container terminals is still ongoing, because of the continued pressure on fast turn around times and performance (see also below). This picture is a sketch of one of the concepts that was developed for the port extension in Rotterdam. It shows the various possibilities of making intermodal connections. These conceptual terminal designs were not realized in practice, at not at this location.

*Figure 7: container terminal concepts*
Below is a generic container terminal design. One can clearly recognize the quays with the berths, the cranes, the stacks, and the equipment to transport containers between the stacks and the cranes. Notice also that the terminal lay out has an entry and exit gate building, and (in light blue) slots for trucks to pick up and off load containers. These elements appear in all container terminals designs, although the specific geographical circumstances may require adaptations.

In addition to the physical flow of containers on a terminal, the terminal is also a node of information flows. These information flows accompany the containers and inform the handlers what is in the container, where it should go, who is picking it up and when, and so on. Further information flows involve port authorities, customs and other inspection agencies and their respective activities.

As a result of all these information requirements, terminals require complex information and container control systems to make sure that all the required information is available at the right time for the right organizations.

*Figure 8: generic container terminal lay out*
The next figure gives a structured overview of system components that are part of the terminal management system.

This next figure puts these processes in relation to each other. Notice that one of the main activities of terminals is planning the various activities, and integrating these planings into an operational schedule.
Terminal equipment

The pictures below give some examples of terminal equipment. Notice that some of this equipment is automated.

Automatic Stacking Crane A.G.V. horizontal transport

Automated Guided Vehicle

Transfer point with straddle carrier

Figure 11: terminal planning activities

Figure 12: examples of terminal equipment
The figure below shows some of the main terminal elements: barge terminal, rail terminal, gate area and deep water quays.

![Dedicate barge terminal][1]

![Rail terminal][2]

![Gate-area for trucks][3]

![Deep-sea Berth][4]

*Figure 13: main terminal components*

The main trends in terminal equipment development are:

- Handling capacity of quay cranes will continue to increase
- Terminal transport system between quay and stack will be automated although conventional systems are predominant
- Automated stack equipment will become standard
- The truck gate will use electronic identification by means of pin-code cargo card or bar coding, pre-information and pre-booking allows priority truck handling, leading to 30 min. turn around times. Gates are unmanned and equipped with video-data (Vision Technology)
- Software suppliers standardize terminal management systems

**Terminal performance**

The capital intensity and fixed nature of the capacity of a terminal creates a strong need for careful monitoring and optimisation of capacity and asset utilisation. The possibilities
for optimal performance are largely based on the possibilities of the assets, but also on the quality of planning and operations. The figure below gives some analysis of the performance of a gantry crane. The outreach and clearance determine the size of the ship that can be handled with the crane. The cycle time determines the number of containers per hour that the crane can process.

![Gantry Crane Characteristics](image)

**Figure 14: gantry crane characteristics**

To evaluate performance, many terminals use benchmarks. These are usually internal benchmarks, because the differences in geographical lay out of terminals make comparison between terminals difficult.

Types of performance benchmarks:

- Container handling performance
- Quay line performance
- Ship-to-shore gantry crane performance
- Yard area performance

Some of the questions that arise in evaluating terminal performance are:

- Why do we benchmark?
- How do you measure performance?
- Why are there regional variances between terminal performance?
- What forces play a role?
- New concepts in terminal management.
What will the future bring in view of terminal performance?

The objectives of terminal performance are clear:

- Learn to evaluate the performance ratios of a terminal.
- Be able to read “in between the figures”.
- Evaluate criteria when selecting a terminal.

Benchmarking from a terminal perspective alone is not enough. Terminals should always be aware that the users of the terminal (the shipping lines) have their own ideas of the performance of the terminal. Performance is …

**According to the shipping line**

Measurement of the performance of a terminal against its closest neighbor, looking at service levels e.g. berth and labor availability, feeder connections and vessel turnaround times against the handling charges.

**According to terminals**

Measurement of the level of output (TEU handled) compared to level of input e.g. meters of quay or number of cranes.

Approximately 60 to 70% of the variation in terminal performance is caused by factors outside the control of the terminal operators, examples are size and type of vessels, the size of exchanges and the arrival patterns.

**A number of trends in performance benchmarking for terminals is already becoming visible:**

- Shortage of terminal capacity pushes more and more carriers in to the direction of terminal ownership.
- There is more and more pressure to increase the number of moves per hour and dedicate all resources to speed up the turn around time of the vessel.
- More and more concentration will take place in the terminal industry and carriers may join forces with them.
- Terminals must make choices on the allocation of resources in order to meet the requirements of different terminal users.

However … there are differences between the productivity levels between similar types of vessels caused by the way these vessels are planned. The factors that may also disturb comparisons are:

1. Re-stows
2. Un-containerisable cargo e.g. yachts / construction material
3. Late cut-off’s

The planning of a vessel is nowadays a balancing act between different alliance partners and different cargo mixes (equipment size and types), governed by time and the quality of information.

**Warehouse operations**

The warehouse is a place where the supply chain holds or stores goods. Main warehousing functions are:

- Receiving goods from a source
- Storing goods until they are needed by customer
- Retrieving the goods when requested

There are various types of storage required in the supply chain. These types of storing material are:

- WIP (Work In Process) : storing for internal customer
- Finished product storage : storing for external customer

The objectives for Warehousing (Tompkins, 1988) are

- Maximize the use of space
- Maximize the use of equipment
- Maximize the use of labor
- Maximize accessibility to all items
- Maximize protection of all items

Warehouses are generally used for storing goods over a period of time. Sometimes, a warehouse functions only as a temporary location to pack and unpack trucks or containers. This is called cross docking. Cross docking is: transporting goods directly from the receiving area to the shipping area within as little time as possible, and avoiding to place goods into storage. It obviously depends on the logistics concept if storage or cross docking is required.

Advantages of cross docking:

- Elimination/ reduction of inventories and associated costs
- It becomes possible to take real-time decisions
• Short lead times and service improvement for customers

• Improvements in relations with suppliers

(Source: Dr. Iris F.A. Vis, University of Amsterdam 2004)

Cross-docking requires suppliers to provide effective addressing (bar codes) and packaging that enables rapid transshipment.

Figure 15: cross docking schematic

(Source: Dr. Iris F.A. Vis, University of Amsterdam 2004)

While storage and warehousing seem different activities, the boundaries between warehouse and cross docking centre are vague.

Warehouse

Arriving products are first stored and are retrieved from storage on request of customers at a later time point

Cross-docking centre

Dynamic environments in which products, already ordered, arrive and are transshipped from one truck to another truck. Distribution of various products over customers and short-term storage still might be necessary.

Not all products are suitable for cross-docking. Those that are are characterized by:
- Short delivery times
- Large demands
- Predictable demand

Products suitable for warehouses:
- Almost anything
- Insecure supply
- Pallets have to be split
- Fast deliveries are required
- Deliveries have to be guaranteed 100%