

MODERN PORT MANAGEMENT

MODULE FIVE

METHODS AND TOOLS OF MANAGEMENT

PARTICIPANT'S MANUAL

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Plan

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SUB-MODULE 5a: METHOD - STRATEGIC PLANNING FOR MANAGEMENT

Introduction

A commercial port cannot be run in the way a small family business operates, on a day-to-day basis, according to the arrival of customers. As we have already seen in the first part, the bodies responsible for ports (Ministries, Municipalities, Board of Directors) devise a mission and objectives for the port although, many of the concepts are hazy and unofficial. Strategic planning is a process that requires a port to define its mission, study and understand itself and the environment in which it exists, define and prioritize goals, set objectives and implement the strategic plan. It is a process that allows a port to formulate guidelines for resource allocation.

Strategic planning has been purposely put at the start of this first module where the methods and tools of port management are discussed. Strategic planning is a modern management technique, which can be applied to the port as a whole as far as there is a structured port organization with a governing body, staff and resources. Strategic planning is mostly carried out at the level of the port authority or port companies.

Concretely, few ports apply strategic planning in the way it will be described in the following pages. Ports still have to set objectives, at least in some respects, for traffic, activity, income...; and have opted for « ways and means », or a policy, to achieve those objectives. Such rule-of-thumb strategy is short-sighted, as it appeals to the managers' « intuition ». Conversely, strategic planning implies an overall structured and coherent process, with well-defined stages and thorough study of all key parameters internally, for example within the port authority, and externally. The study of strategic planning will start with the examination of the phases or stages the process. A case study will be given at the end of the theoretical analysis of this topic.

For further information on this subject, read the documents that are listed below:

- Strategic Planning for Port Authorities; UNCTAD/SHIP/646; July 1993.
- Strategic Planning: A guide for the port industry; American Association of Port Authorities; 1010 Duke Street, Alexandria, Virginia 22314, USA; September 1988.
- Strategic management: A panorama of concepts, models and tools; Dominique Jolly; Review: Economic Problems N° 2286; 29 July 1992.
- Considering Strategic Planning for your Port?; Thomas J. Dowd; Washington Sea Grant; Maritime Advisory Services; Seattle WA 98105; January 1992.

SECTION I: THE BASIS OF THE PROCESS OF STRATEGIC PLANNING

A - Definition

The concept of strategic planning came into being in the mid-sixties in the United States (Harvard) and was applied in industries in the seventies as business became more competitive and the environment more dynamic. In the late 70's, the Port Authority of New York and New Jersey was the first port authority to implement the concept.

Strategic planning or management can be defined as the planning and management method that allow, continuously and systematically, to define the activities for using available resources in order to achieve the objectives and fulfill the mission of the port authority, taking account of the external environment and internal strengths and weaknesses of the authority.

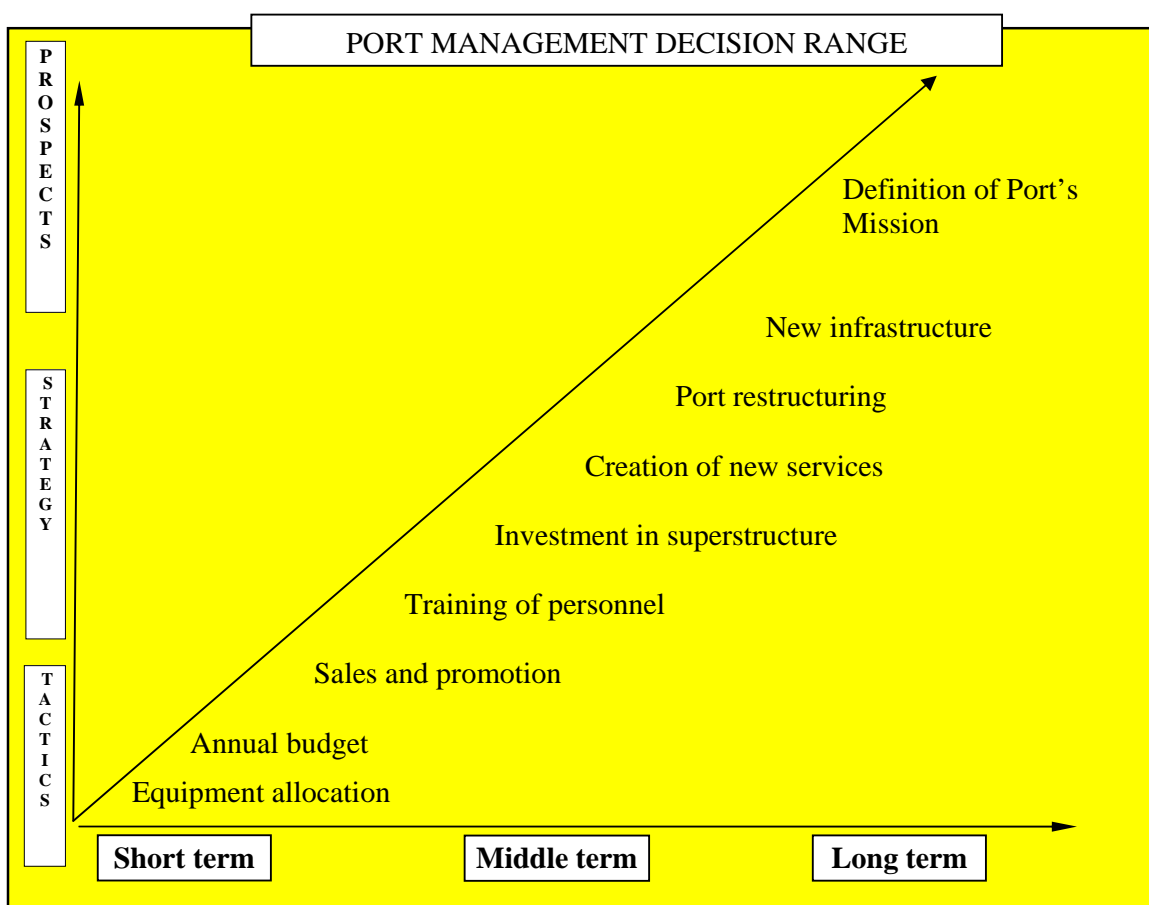
The process of strategic planning leads to a document (a plan) describing the specific activities and the procedures to pursue in order to achieve the objectives. It has been recognized that strategic planning belongs to the middle term (2 -3 years). It is then between the long term, related to the mission of the port and the short term, several months or even a year, which is the time frame for budgetary and operational forecasts. The master plan of a port, which includes the main facilities and expansion areas on land and sea, embodies the long term plan but both the master plan and the strategic plan are driven by the mission of the port.

Daily or monthly assignments of the personnel and machines or drawing up the annual budget are examples of the short term framework as there is no major modification of the internal environment. However, if there are changes in the environment due to competition, the port's resources (personnel, machinery...) could be redeployed to meet demand for port services and this means coming into the domain of strategic decisions. Strategic planning is the stepping stone between the long term and the short term as short term decisions are driven by long term goals. There are strategic decisions, when a port decides to restructure its warehouses or to upgrade its marketing services in order to expand or provide added value activities.

Strategic planning helps management to plan ahead so that all port activities achieve the given mission. The process provides information about itself, customers, its community and a firm understanding of what business it is in. Strategic planning allows ports to take on projects that are valid and profitable. Management carried out on a daily basis will produce opposite results as we react only to bad results (drop in traffic, etc.). It is often either too late or too costly to remedy the mistakes.

B – General Plan

The plan below illustrates some decisions ranging from the short to the long term affecting port activities:



Strategic planning can be divided into four separate phases:

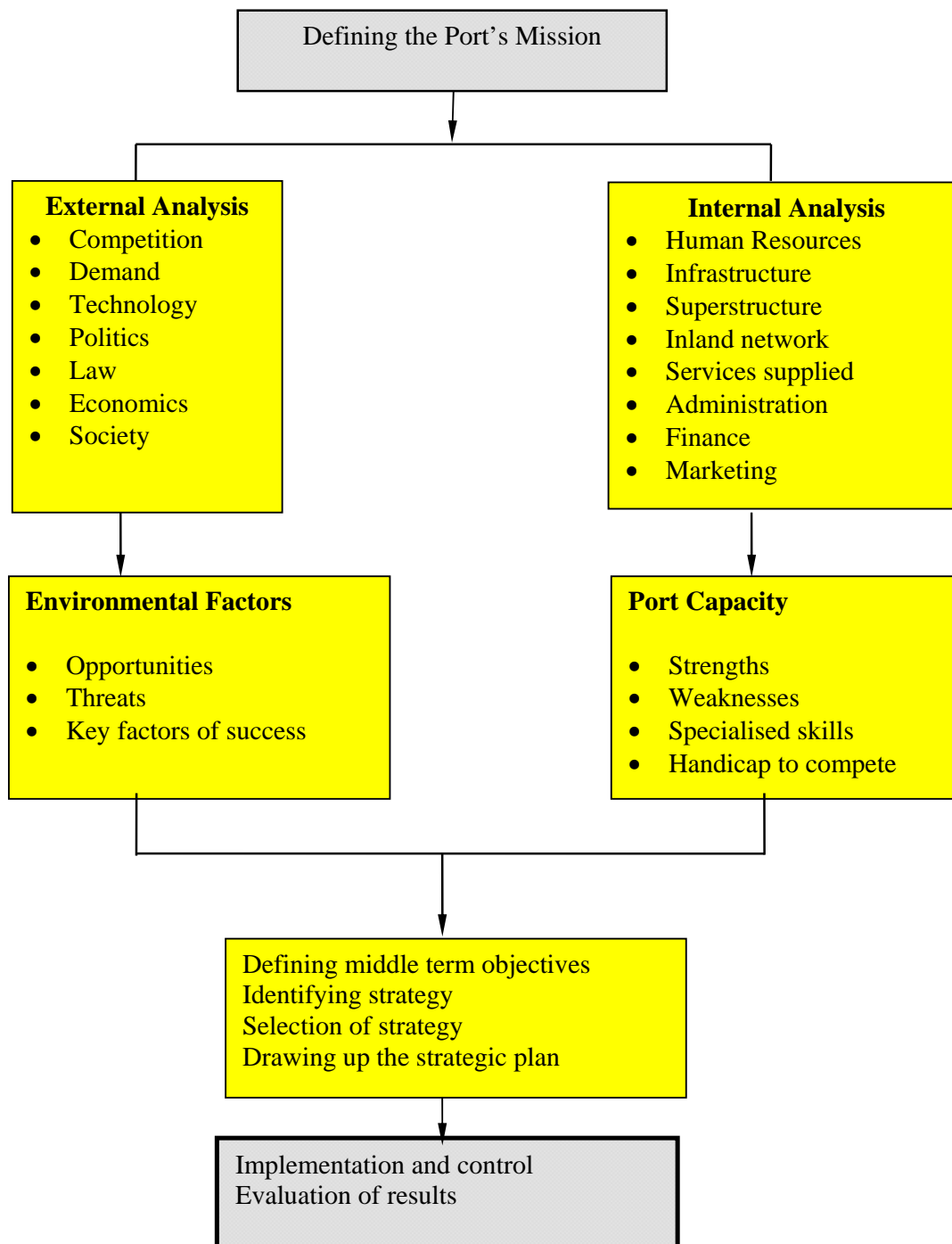
The first phase involves the CEO and Board of Directors and is definition of the mission of the port. This is a crucial phase and good communication is essential to achieve feedback from managers and staff and to keep them informed. During this phase an in-house coordinator needs to be appointed who has the respect of staff and direct access to the executive director.

The second phase will analyze and evaluate the situation existing within and outside the port authority (or the port company). This analysis will first be focused on the external environment: study of users' demand, competition, technological change, etc.. The threats, opportunities and key factors that can lead to success in some domains could thus be identified. A survey will then be carried out within the company (internal environment) to identify, for each of its main functions the ability and resources, know-how, strengths and also weaknesses when confronted with competitors.

In the third phase known as the formulation or strategic decision, the port managers will define the strategic orientations in order to match the port skills to the requirements of its environment. It is at this point that the objectives, the policies to be adopted and the means required to achieve them will be established.

The fourth and final phase will concern the implementation of the policies adopted and control of achieving the objectives.

The graph below shows this process. Note that the process is not concluded in a single cycle; depending on the results of analysis, it is possible to come back to modify data or previous options (retroaction or feedback).



Several questions could be raised at this point:

➤ Is this method too theoretical?

It may in fact seem theoretical and complex but it is endowed with logic. It helps to make timely decisions to react to the roots of port management problems instead of panicking after the symptom of trouble: declining traffic, drop in financial resources, etc... As the situation concerns all the personnel, everyone reacts strategically with a view towards the mid-term. It helps management to be proactive (taking steps before opportunities or problems arise) rather than reactive (taking steps after).

➤ Does this method only apply to big ports?

In fact, big ports were the first to use this method: New York, Los Angeles, Long Beach, Baltimore, Singapore... In the same way, big companies apply it: Apple, Benetton... But this method can be applied to any port whatever its size: the smaller the ports have less parameters to consider and thus the process is easier.

The following table presents the main features of strategic planning and a port strategic plan:

Strategic planning:

- is a systematic process
- is a formal document
- identifies the port mission
- formulates middle term objectives
- draws up action plans and deploys resources

Strategic port plan:

- is prepared every 3 to 5 years
- is reviewed every year
- concerns the personnel, equipment, and facilities
- depends on the marketing targets
- is implemented in a competitive environment

SECTION II: The Phases of Strategic Planning

A – Defining the port mission

A commercial port is normally a public entity: the State, the region or the city. We have already seen, in the first part, that its functioning might involve public and private management. It is, however, the duty of the owner, namely, the state, the region or the city, to define the mission or the raison d'être of the port with the Board and CEO. This is an essential long term perspective to guide its expansion and lay the milestones for its functioning.

The mission is contained in a broad qualitative statement of what the organization wants to be in 15 or 20 years. The mission of the port will have to be spelled out in specific terms, avoiding sweeping statements, which could sound ambiguous and lead to confusion. The mission of the port will have to be drafted to become an official document like the «Port Law ». The Mission Statement identifies the underlying design, aim or trust of an organization. Some examples are as follows:

- To develop marine commerce, engage in economic development, earn sufficient revenue to cover direct and indirect expenses, maintain facilities, provide for a prudent level of reserves and produce capital for future development.
- To be a proactive, customer-oriented, financially healthy service organization whose primary purpose is to maximize the flow of waterborne commerce by providing highly productive facilities, equipment and support services.
- To be a leader in providing services and facilities to accommodate the containerized transport of cargo and to foster economic vitality.
- To induce capital investment in an environmentally responsible manner to create jobs and enhance public recreational opportunities.

The formulation of the Mission statement is an appropriate opportunity to get public input and gain support. This could come in the form of an advisory committee representing a variety of interests. Once the Mission Statement has been prepared and accepted the Board takes on a new role as an overseer of the process.

B - Analysis of the external environment

This analysis is a key feature of strategic planning as it will help to identify the potential areas where the port has advantages over its competitors and also highlight their threats. To carry out this analysis, an environmental scan must be taken and data collected on: traffic, users' needs (goods, ships), technological changes, market, competition and regulations.

A complete list of topics for study is given below. This list can be simplified, specially, for small ports. A document could be drawn up describing the external environment on which the port has limited influence; but is essential for future planning.

The Association of American Port Authorities (AAPA) suggests that this type of analysis should be conducted by port task forces in collaboration with consultants and members of the port community.

Steps to be taken in an external environment evaluation

➤ Identify markets

- Determine the main sectors of activity, their market and customers.
- Identify emerging markets and other potential opportunities.
- Classify markets (« growing », « steady », or « declining »).
- Draw up a list of major customers for each of the existing and potential markets.
- Work out the market share of the port and that of its competitors for the different markets.

➤ Evaluation of services provided to port customers

- Classify the activities according to the users (Ships, cargo...)

- Note the resources supplied to these activities
 - Identify the port's contribution to these activities
 - Choose performance indicators to quantify the value added by port
 - Determine comparative performance indicators for the port and its competitors
- Technological evaluation (underscore the trends)
- Sizes and types of ships
 - Types of goods
 - Equipment for handling of goods
 - Labour productivity
 - Designing facilities
 - Berth occupancy and productivity
 - Land based activities (storage, distribution...)
- Legal and statutory evaluation (underline the changes)
- Government's role in port activities
 - Regulations as regards trade and transport
 - Specific regulations on ports and maritime transport (security)
 - Environmental laws concerning ports and maritime transport
 - Safety laws regarding ports and maritime transport
 - Workers' rights and labour standards
- Social evaluation (list the concerns of the port community)
- Port operations
 - Noise, pollution and safety within the port
 - Use of port public domain
 - Trade and transport
 - Economic growth

C - Evaluation of the strengths and weaknesses of the organization

The evaluation will focus on an internal analysis of the port authority assessing its competitiveness against its rivals. The evaluation will be based on different components of the port: its infrastructure, access channels, land facilities, skills of staff, the financial situation, administrative and legal constraints.

The evaluations do not only aim at identifying the strengths and weaknesses of the organization but also at taking advantage of the former while overcoming the latter. As regards the staff, the evaluation should bring out the prospects for their redeployment and retraining in line with the new strategies. The same could be applied to the facilities: could the draught of the access channel be deepened, berthing draught increased or the storage areas enlarged.

The strategic plan is developed through iterations: After the first internal and external evaluation which will help to devise new strategies, we will fine-tune the analysis of the external factors and the port capacity by examining every strategy in order to adopt the best suited.

Below is a list of the main topics to be studied.

Components likely to constitute a company's strengths or weaknesses

- **Location**
 - As regards trading routes
 - As regards cargo consignors/consignees
- **Facilities**
 - Access channels, depth of water, harbour facilities
 - Types of infrastructures
 - Specialized equipment (quantity and quality)
 - Specialized warehousing
 - Specialized berths
 - Capacity of available equipment
- **Skills in the following domains**
 - Different types and sizes of vessels
 - Different types of goods
 - Different types of freight
- **Labour**
 - Qualifications
 - Current jobs and required jobs
 - Social climate
 - Motivation
 - Professionalism
 - Contact with customers
- **Productivity**
 - Utilization, delays: berths, equipment
 - Cargo handling
 - Labour relations
- **Adaptability, resources**
 - Handling of exceptional goods
 - Capability to meet different needs of customers
 - Implementation of new services to meet requirements
 - Adaptable workforce
 - Flexibility in planning and using the facilities and equipment
 - Efficient procurement procedures
 - Simplification of the relevant documents
 - Simplification of tariff and invoicing procedures
- **Additional services**
 - For Goods: handling, warehousing, collecting, added value, customs clearance
 - For Shipping: supply of stores, bunkering, planning ships' movement, ship repair, crew hiring
 - For Logistics: warehousing, intermodal links
 - For Marketing department, free zones
 - For Finance: banking operations, trade financing
 - For Data processing: EDI, follow up of goods, invoicing
 - Communications
- **Financial situation**
 - Investing capacity
 - Accessibility to funding sources
 - Capital and reserves
 - Level of operating cost – labour costs
 - Debt

D – Policy Making

Studying the external factors and the evaluation of strengths and weaknesses of a port helps to raise some « key questions » that are and will be burning topics for the next two or three years to come ; which could either boost or hamper the port's mission or raison d'être. It is advisable during preliminary analysis to draw up a list of all problems encountered, strengths, weaknesses, in order to shortlist the « key questions » which will be used to define port strategies. Below is a list of suggested key questions:

- Are some types of traffic threatened?
- Are there new types of traffic or new activities that could be implemented?
- Are the facilities outdated and hamper the port's expansion?
- Are the port tariffs competitive?
- Do the services provided have a competitive edge?
- Are the operations efficient?
- Are the customers satisfied?
- Are the procedures and regulations more cumbersome than rival ports?
- Do users get full and handy information readily?
- Are the tariffs competitive?
- Is the organization, the infrastructure, the public sector adapted to the traffic needs?
- Is there a team spirit within the port?
- Are the port community members united and do they contribute to the development of the port?
- Is the relationship between the port and the Municipal Authorities a driving force or a brake for the port expansion?
- Is the transport network (road, rail, sea) adapted to traffic needs?

Each port will draw up a list of key questions depending on their respective missions. The answers to the questions will provide many alternatives, which will have to be dealt with cautiously. One single question could result in several strategies, which will either be combined or sorted out to find the best suited one. Thus, if it is deemed that a traffic can be further increased, a strategy will be devised for a combination of technical (upgrade facilities), economic (review of tariffs) and commercial (prospecting) measures.

There are four grand categories of strategies: growth, retrench, stabilize and combination. The growth strategy has the goal to expand capacity, to introduce new activities and to increase market share. A retrenchment strategy seeks to reduce the number of activities, to reduce costs and to sell some assets. The stability strategy seeks to provide the same services, maintain market share and focus on small improvements. Finally the combination strategy is a mixture of the previous three for example adding some services and reducing others. Find below a list of key measures that could be applied to these strategies.

Each strategy involves the setting of very accurate objectives and sub-objectives. Being a middle term strategy carried out over a span of three years, it is advisable to execute the decisions made in short term (year, semester...) to take up new challenges more effectively.

Examples of objectives:

- Get a 10 % increase in one year on traffic X.
- Modify the regulations (or the tariffs) concerning cruise ships before spring 2007.

Sub-objectives are far more accurate and specific:

- Increase to more than 95% the availability rate of the top loaders at terminal X.
- Send customer invoices less than three days after the end of the operations.

Once the strategic planning process is completed a document must be finalized that will provide a guideline for future investments of the ports resources, land, labour and capital. It will set out the ports goals and objectives, and strategies for attaining those goals and objectives. The Strategic Plan is a dynamic document that must be subject to constant review and adjustment in years to come. Strategic planning is a long-term process and not a quick fix for current problems.

Some examples of strategies are supplied below:

- Facilities and equipment
 - Investing in new facilities and equipment
 - Upgrade existing equipment
 - Improve their efficiency
 - Boost their productivity

- Labour
 - Develop services that rely on the skill and productivity of labor force
 - Use skilled workforce for priority operations and activities
 - Redeployment of key staff
 - Delegating supervisory staff
 - Introducing flexible management based on tasks
 - Subcontracting activities
 - Upgrade training programmes
 - Including more training time on the work schedules
 - Improve internal training courses
 - Devote more funds to both internal and external training programmes
 - Performance related pay and incentive pay
 - Upgrade human resources management:
 - Performance appraisal
 - Evaluation of professionalism
 - Match staff's skills to requirements
 - Adjust operating standards
 - Establish quality circles

- Financial situation:
 - Have recourse to new funding means
 - Authorize direct investments from the private sector
 - Go into joint ventures
 - Open subsidiaries

- Legal constraints
 - Analysis of legal modifications
 - Improve legal status
 - Further involvement in preparing legislation and regulations
 - React quickly to legal changes
 - Introduce relevant measures to become more environmentally-friendly
 - Adopt environmentally-friendly laws
 - Take advantage of the cumbersome regulation affecting competitors

The two charts below summarize the main features of standard port management (1st example) versus strategic planning management (2nd example).

1st Example

- Captive hinterland
- Stable traffic
- Weak competition

2nd Example

- Fluctuating hinterland
- Volatile traffic
- Competitive environment

PORT MANAGEMENT

- | | |
|--|--|
| <ul style="list-style-type: none"> • <u>Reacts</u> to changes • Routine management • Planning based on old patterns • Decide and inform users • Objectives and <i>ad hoc</i> or informal procedures | <ul style="list-style-type: none"> • <u>Strive</u> to steer changes • <u>Assesses</u> the strengths and weaknesses of the port • Collects and processes data on markets • Consults users • <u>Redeploys</u> resources and <u>formalize</u> strategies |
|--|--|

E. Implementation and follow up

Implementation and follow up will be made easier if the personnel have been involved in decision making. It is part of the corporate culture that has to be promoted. As strategic planning is a continuous process, its follow up should be on a routine basis. The Association of American Port Authorities (AAPA) underscores the importance of having a follow up structure, a team working under the supervision of one of the in house coordinator. The structure will need relevant resources. The adopted strategies will have to be regularly updated to meet the changing trends in the sector of activity. The AAPA, which is highly qualified in this domain, as many American ports have embraced strategic planning policies, has put forward the idea of publishing a review or newsletter to keep the personnel informed of port events. It also brings out the capital importance of having the support of port managers at the highest level. The evaluation is a means to check, sporadically, whether objectives and expected results have been achieved or to take measures to « redress the situation » if need be.

Strategic planning boosts port operations as it promotes an empowered team spirit among the personnel ready to adopt changes regarding the organization and facilities. Strategic planning concerns all aspects of port planning which explains why it was dealt with at the very outset of this course which main topic is port management.

SECTION III: Practical Case: Port of New York and New Jersey

The Port Authority of New York and New Jersey has perhaps been the first to have embraced the method of strategic planning. This organization, founded in the early twenties, to manage the port and tunnels was later gradually extended to manage harbor facilities, airports, suburban trains and the famous « World Trade Center » building. The port authority is therefore only a branch of the whole organization. It is organized in three directorates: trade, marketing and sales and development. Financially, port operations are fairly balanced but investments are often subsidized.

Strategic planning was introduced in the 70's. It was a centralized policy under the direct supervision of the port manager. Currently, its features are more decentralized and widespread. Its core objective is to set up a five-year plan. It is carried out by a task force made up of one or two representatives of each operating department. The task force examines the events that occurred the previous year with a view to carrying out a performance appraisal and set future objectives. Different scenarios are made for the five years to come. Topics for discussion are prepared and submitted to the managers' seminar, which is held every year in January. Decisions are made on that occasion enabling the setting up of the five-year marketing plan for each department which analyses the current trends (external environment) as well as the opportunities and threats for the five years to come. The investments, the objectives and the operating budget are defined. The management and budget departments study them and transform them into a corporate plan, which is submitted for approval to the Port Commissioners (committee where the representatives of both states, New York and New Jersey, that are the owners of the port.).

Every quarter reports are published comparing the planned and achieved figures for objectives set in all fields: project implementation, financial results and personnel. The reports are examined by the port manager during a meeting with the deputy managers.

Strategic planning is used to devise new policies. Its main aim is to study achieved objectives analyze, the internal and external environment and adopt policies, programmes or projects proposed in the past. It implies that each department evaluates its own competitive position and determines how to best distribute its resources for the year.

Annual budgets control strategic planning in spite of efforts made to extend its coverage beyond one year.

Redeployment of personnel according to the programmes and strategies adopted is carried out in an unofficial way rather than following the more official staffing plan. However, each department has to analyze each employee's workload. In 1993, such analyses led the management to redeploy staff in favour of priority programmes.

Of late, interactivity between the port authority departments and regional plans has been stimulated for better coordination and cooperation. To reach this goal, analysis of the regional situation has been reinforced.

The lessons from the port of New York experience

❶ Get management support at top hierarchical level

The Association of American Port Authorities is highly in favour of this recommendation. The mission statement has to be fixed by the Board of Directors in line with the mandate of the political authorities: boost the regional economy, profitability... Then, the management staff takes over to set the objectives, to determine the programmes and relevant human and financial resources in order to submit them for approval to the Board of Directors. The Port Authority of New York and New Jersey has applied flexible staffing structures, which eases redeployment when necessary. Once a « plan » is adopted for the years to come, it should not be put aside and forgotten. It is the Managing Director's duty to see to it that it is enforced and to assess the skills of the personnel in order to achieve the objectives of the plan.

❷ Have defined strategic plans

At the beginning, in the 70's, there were general plans without specific actions. Long and short term objectives and the measures to be adopted need to be defined: indicating the deadlines, modalities, financial and human resources. The content of the plan has to be considered in planning the budget and careful attention must be paid to avoid repeating the same figures of the previous year. Important, though difficult, staff duties have to be reassessed in order to redeploy them if necessary.

❸ Make sure there is a follow up

The results achieved by the whole company and those of the agents have to be evaluated. Quarterly reports have to be prepared by the managing director giving an account of progress made, economic and financial objectives achieved, profitability... The reports drafted by other managers may be more frequent and highlight: core positive or negative features. The periodical personnel evaluation includes their contribution to the implementation of the plan (performance indicator).

The Port Authority of New York and New Jersey has, over the past twenty years, considerably improved its techniques for marketing planning, personnel redeployment and performance appraisal. The Strategic Plan keeps changing: it is a living document, which moves with the goals and the environment of the port.

SUB-MODULE 5b – TOOLS: STATISTICS AND INDICATORS

Introduction

One of the principal tools for an efficient management of the port is a reliable system for collecting, processing and disseminating port statistics. The statistics provide an overview of the port situation at a given time or over a given period of time and are part of the diversity of the overall port activity. They will, later, be used to compare and contrast past, present and future performances. Obviously, all inaccurate compilation of data distorts facts. Hence, the compulsory need to check their accuracy at all times from the initial collecting of data to their dissemination to users as the authenticity of the results rarely questioned.

The statistics department, which performs this task, is part and parcel of the port organization. It is a focal point of port activities, having links with every decision-making section ranging from a day-to-day to the long-term basis. The department should be endowed with skilled personnel and with the relevant equipment, which enable the staff to carry out his work effectively. Disseminating current statistics quickly is capital in the efficient management of a modern port.

SECTION I: Uses of port statistics

What are the uses of statistics in a port? The answer to this simple but ever present question is that statistics are vital to the following six areas and which, will be described one by one.

- (a) External communication of the results of port activities;
- (b) Planning, management and control of port operations;
- (c) Verifying operational events in case of dispute;
- (d) Planning of port infrastructures;
- (e) Control of financial management;
- (f) Control and planning of human resources of the port.

A – Results of port activities for external communication

The prominent role of the port in the local and national economy explains the interest for port information from external bodies: public authorities, trade like shipping agents, Chambers of Commerce and Industry, banks, exporters and importers, the local or regional media including the specialized publications.

Qualitative and quantitative, annual figures regarding shipping movements, traffic flows for several categories of goods, number of passenger and sometimes the overall financial situation are supplied to the above-mentioned bodies. The statistics are usually published in the form of a special report or a directory for consultation by the public at large. Short-term – monthly, quarterly or half-yearly-- additional information could also be given. Publishing statistics contributes to promote the corporate image of the port. The overall, or sector-based, performance shown by the statistics will be compared with the results of previous years and those of other national and international ports. Consequently, many people – professionals of the maritime and trade sector or citizens – would conclude that the port “is thriving” and is quite dynamic, or, on the contrary, that the port “is down beat” and stagnating. Once the statistics are published, it is difficult for the port to conceal its situation

Besides, disseminating port statistics externally, the statistics are very useful in marketing and prospecting customers « to sell » the port to ship-owners or shippers (or to those specialized in goods or specific destinations). This topic would be fully covered in the following module.

B – Planning, managing and controlling port operations

A thorough knowledge of the physical activities regarding ships, goods or passengers, can ensure an efficient management of port operations. A subjective visual assessment that a berth or quay is heavily used, that handling operations are more or less fast or that goods stored in a given warehouse tend to take longer to dispatch, do not meet the rational requirements for managing port operations. Only the analysis of carefully selected, processed and presented data can achieve this goal. Such statistical information is for internal use. They are mostly charts and graphs with standard indicators showing information about specific organizational units. Their main purpose is to help in that analysis resulting in measures that minimize the ships' transit time in the port, speed up transit of goods through the port, reduce the cost and ensure an efficient use of facilities and labour. Thus, the port of Marseille publishes an internal document called "Provisional results for the month of..." where all major traffic categories are shown by port and terminal including monthly traffic, accumulated annual traffic and the traffic over the last 12 months. Charts showing the statistics with explanatory remarks are sent to all port managers.

C – Verifying operational events in case of dispute

Thanks to operational data collected for statistical purposes, the port authorities can supply proofs in case of disputes. These may arise, at any time, either from ship-owners or shippers. It is vital to analyze and answer queries concerning the quality of services during operations by providing quantified data, in case a ship-owner is displeased with the long stay of his ship in port or handling productivity when compared with that of rival ship-owners or that available in other ports. Failure to have a sound database system can expose the port to adverse publicity, which could prove highly damaging for its corporate image.

D – Planning port infrastructure

All ports should have a vision of the future over a span of 10 to 20 years, that is on a long term basis. If the analyzing of statistics for major traffic categories is unavoidable, data on the operational performances of the various berths, storage areas and equipments must be available too. We already know the importance of accurate data. Nevertheless, planners are interested in the traffic trends and long term operations, given that major projects may take several years to complete. They also need these data for simulations to assess extra facilities or upgrading existing facilities. Planning should complete long term projects by carrying out short term surveys to make investments in equipment for an efficient port operation. For this purpose, statistics on traffic flows and operational performance and costs are useful.

E – Financial management control

Financial statements such as the balance sheet usually indicating major headings of assets and liabilities as well as the investments are regularly published for consumption. Nevertheless, an internal follow up of the financial situation has to be carried out. Financial indicators have to be submitted to the Finance department so that managers can group the trends in traffic and services. The use of these data would define how it should be collected and processed. There is a wide range of data starting from the follow up of revenues from port dues to the main traffics or revenues from the rental of equipment to staff expenditures in the different sectors of activity. The analysis of the data collected usually lead to the enforcing of

measures to boost the performance of port activities. Refer to module six for full information on those topics.

F – Human Resources planning and control

Given that staff expenditures account for a major share of the expenses of a seaport, an efficient management would require the Human Resources department to have updated records regarding the staff roll in each sector of activity within the port, their skills, age, experience and background. For an efficient redeployment of staff, the absenteeism rate linked with sick leave, work accidents or others, has to be supervised. The analysis of data collected on human resources is of vital interest for recruitment planning and career management. We have discussed these elements in module eight.

SECTION II: What kinds of statistics to collect?

The port environment is fertile in providing profuse quantitative data to collect. Some of them will be a permanent focus of interest for port management and will, therefore, be routinely collected, processed and disseminated. Others will only be of internal and one-off interest and may not be disseminated regularly. The extent of users needs in each port, will determine the data to collect, process and disseminate. However, wisdom and common sense show that the cost of producing statistics should not exceed the benefits according from them. Obviously, it is not easy to define those benefits which include in addition to money some subjective factors like good relationships with the port users. In fact, the answers to the following two questions could determine the types of statistics to collect. What would happen if data failed to be collected, processed and disseminating? How can these data improve port activity? If no evidence can be produced, it is therefore a waste of time and energy to compile statistics. We must proceed cautiously in this field: it is better to compile statistics that will perhaps not be used fully, than to solve a management or planning problem without any statistics which take months, even years, to collect.

As a matter of convenience, we can divide the statistics to be compiled into four main parts:

- (a) Commercial statistics
- (b) Operational statistics
- (c) Financial statistics
- (d) Social statistics

Roughly speaking, these statistics address the four main basic questions on the traffic, the core of the port activity. How much (a measure of its volume)? How (the services to be offered)? For what profit (in monetary terms)? With what kind of staff?

The following remarks made on each type of statistics are far from being exhaustive and therefore will not concern the various kinds of statistical needs of a port. Those needs change according to the port structures, the ways the different ports operate and the structure and flow of traffic. We will, notwithstanding, try to present the basic principles that govern the way data has to be collected.

A – Commercial Statistics

Commercial statistics deal with the movements of vessels, goods and passengers in the port area, that is, the elements that make the major share of port income. The amount of these movements (unit and/or tonnage), their physical and commercial features, as well as their geographical directions, have to be defined.

① The ship

Drawing a list of all ship' calls is a common practice which becomes significant when information on the types and/or sizes of the ships is provided. The different types of ships have been dealt with in sub-module 1b of this course. The classification could be useful to work out the ship statistics there but will have to match the specific features of each port. For instance, segregation of ferries from RORO vessels or crude oil tankers from gas tanker would be needed if they constitute a major part of the traffic. In some developing countries' ports where specialized traffics play a key role, it could happen that a list concerns only ships that carry a specific category of goods like timber, sugar or bananas. The dimensions of the ships are recorded by tonnage measurements (g.r.t, n.r.t, d.w.t or all three under different categories), the length especially if the dimensions are taken into account to calculate the port dues, and the carrying capacity (T.E.U., for container vessels).

Besides providing information on the increasing or decreasing ship calls (compared to previous months or years), these statistics allow to see trends of average size of different types of ships which is a key element in the rational planning of port facilities in the mid-term (see tables below).

Example of a table showing total ship movements

Types of vessels ①	Number of ship call			Total tonnage (nrt or dwt)		
	Year 'X'	Year 'Y'	Variation %	Year 'X'	Year 'Y'	Variation %
Ferries and vessels						
Semi-containers						
Roll-on roll-off						
General cargo ships						
Sub-total of general cargo ships						
Bulk-ore carriers						
Oil tankers						
Liquid petroleum gas carriers						
Other liquid cargo bulkers						
Sub-total of bulk cargo ship						
Ships not doing commercial operations②						
TOTAL						

① Classification to change in accordance with types of ship calling at the port.

② Bunkering, repair, supply... without cargo movement.

Example of tables for the analysis of vessel dimensions ①

Month or Year	NUMBER OF SHIP CALL FOR GENERAL CARGO SHIPS (in millions of tonnes of d.w.t.)				
	< 5	5 - 10	10 - 15	15 - 20	> 20

Month or Year	NUMBER OF SHIP CALL FOR CONTAINERSHIPS AND SEMI CONTAINER SHIPS (in T.E.U.)				
	< 500	500 - 1000	1000 - 1500	1500 - 2000	> 2000

Month or Year	NUMBER OF SHIP CALL FOR GENERAL CARGO AND OTHER SHIPS (in length overall in meters)			
	< 100	100 - 150	150 - 200	> 200

① Classification is only indicative. Each port will devise its own classification based on its parameters.

Types of ships

Ship classification	Types of vessels	Available ship types – Criteria for classification
SHIPS MAINLY FOR PASSENGERS		
1 Ferries and cruise vessels	10 CRUISERS 11 .PASSENGER CRUISERS 12 FERRIES 13 RORO PASSENGER SHIPS	Passenger ships with tourist in transit Passenger ships in homeport (except ferries) Passenger ferries along regular rooter RoRo ship and cargo conventional > 200 passengers.
SHIPS MAINLY FOR CONTAINERS (conventional cargo > 80% and containers > 60 % of total tonne)		
2 CONTAINERSHIPS AND SEMI-CONTAINERSHIPS	50 CONTAINERS 51 ROLL-ON/ROLL-OFF CONTAINER 52 MULTIPURPOSE CONTAINER 53 CONTAINER RO-RO VESSEL	Vessel without ramp Tonnage > 90 % of total tonnage Vessel with Tonnage > 90 % of total tonnage Vessel with out ramp Tonnage > 60 % of total tonnage Vessel with ramp Tonnage > 60 % of total tonnage
MAINLY ROLL-ON/ROLL-OFF VESSELS (breakbulk cargo > 80% SAVE IF containers > 60 % of total tonne)		
3 ROLL-ON/ROLL-OFF VESSELS	61 COMBINED RORO SHIPS 62 RORO TRUCKS 63 CAR CARRIERS 64 RORO METAL CARRIERS 65 RORO SPECIFIC CARGO CARRIERS 66 ROROS BREAKBULK VESSELS	Passenger vessel with ramp (between 20 and 199 passengers) Vessel with ramp, rolling cargo> 80% of total (tare) weight Vessel with ramp, rolling conditions, NST 91...>80% Vessel with ramp NST 5 > 90% Vessel with ramp cargo NST (save 5) up to 2 positions > 500 t. Vessel with ramp not included in others
OTHER VESSELS (LIFT-ON/LIFT-OFF SHIPS) CARRYING MOSTLY BREAKBULK CARGO		
4 CONVENTIONAL VESSELS	71 CONVENT.METAL CARRIERS 72 CONVENT.SPECIALIZED CARGO CARRIER 73 CONVENTIONAL CARRIER 74 MULTIPURPOSE AND DRY BULK CARRIER 75 CONBULKER 80 AUTOMATED CARRIER	Vessel without door NST 5 > 90% of total tonnage Vessel without homogenous cargo (NST with 2 positions) > 500 t. Vessel without bulk cargo > 80 % Vessel without dry/liquid bulk < 80 % and breakbulk cargo < 80 % Vessel without 1 or containers on deck Vessel without door falling under none of the above classes
DRY BULK CARGO VESSELS (ships which dry bulk tonnage > 80 %)		
5 BULK AND ORE CARRIERS	31 DRY BULK CLEAN CARRIERS. 32 OTHER DRY BULK CARRIERS (DIRTY) 33 COMBINATION CARRIER	Dry bulk cargo, NST 0 et 1 > 80 % of total tonnage Dry bulk cargo, NST other than 0 et 1 > 80 % of total tonnage Dry and liquid bulk > 80 % of total tonnage
LIQUID BULK CARGO VESSELS (ships which liquid bulk tonnage> 80 %)		
6 LIQUID HYDROCARBON CARRIERS	20 CRUDE CARRIER 21 PRODUCTCARRIER	Tanker NST 31,32,34 > 80 % of total tonnage and NST 31 > NST 32 + 34 Tanker NST 31,32,34 > 80 % of total tonnage and NST 31 < NST 32 + 35
7 LPG / LNG	22 GAS CARRIER	Liquid gas carrier. NST 33 > 50 % of total tonnage
8 OTHER LIQUID BULK CARGO	23 LIQUEFIED CHEMICALS TANKER 24 CHEMICALS TANKER 25 WATER CARRIER TANKER 26 LIQUID BULK EDIBLE TANKER 27 OTHER TANKERS	Tanker NST 33 < 50 % of total tonnage Tanker NST 8 (excl. water) > 80 % of total tonnage Tanker NST water > 80 % of total tonnage Tanker NST 0 and 1 > 80 % of total tonnage (excl. water) Tanker liquid bulk > 80 % of tonnage falling under none of the above classes
NO CARGO HANDLING VESSELS		
9 NON COMMERCIAL SHIPPING	01 NON TRADING SHIPS 02 SEA-RIVER CARRIERS	All vessels without loading or discharging operations. Inland shipping. Ships without loading or discharging operations.

As regards general cargo and for marketing purposes, it is good to know the number of ship calls for the different geographical zones and to combine the data with inbound and outbound cargo traffic. These statistics enable a port to track down the strengths and weaknesses of its services for different geographical areas and grasp the imbalances that the marketing department might later on seek to redress.

Example of a table showing the number of ship calls by liners^① and their tonnage

Geographical zones	YEAR					
	Arrivals	Departures	TOTAL	Tonnage Inbound (in thousands)	Tonnage Outbound (in thousands)	Total Tonnage (in thousands)
ex. North America	56	65	121	84	61	145
Central America/ Caribbean ...	27	20	47	15	22	37

① The same vessel can call in two or three geographical areas. In this case, each area is a ship call. If a ship calls at several ports within the same zone, then, indicate whether the calls one for the total number of ports or the area as a whole. The 'tonnage' columns could be replaced by the number of arrivals/departures for another year.

Finally, collecting ship data leads to store the ship characteristics in a central file. The file is in fact a database system that must be regularly updated and which would be useful to identify ships by the Harbor Master, for example, to have the technical features of the ship when planning berthing. The file can include the following key data:

- Registration number (chronological number or Lloyds Registered number)
- Name of the ship
- Flag (code)
- Ship-owner (or charterer)
- Type of ship (code)
- Year of construction
- Maximum draught
- Deadweight tonnage (dwt)
- Gross tonnage (grt)
- Net registered tonnage (nrt)
- Length overall
- Moulded breadth

The above list can be completed with further information regarding loading capacity for container vessels (T.E.U.), different cargo load volumes, load lifting capacity and equipment, the number of holds according to the port's requirements and available data (Lloyds or the ship's agent).

2 The goods

Total tonnage handled in the port and its main components are part of key data on port activity. This data are usually published in the form of statistical tables for external use. A full analysis of the statistics is vital for the promotion of the port. For each tonne of goods, the following information has to be taken into account:

- The type of goods;
- Cargo packaging;
- Country of origin and/or of destination of goods.

● The type of goods

All goods transiting through the port should be identified and classified into different categories. Each port can define its own categories according to the features of its traffic. This, however, would make difficult comparisons with other ports, or departments like Customs. This may not be a major hurdle for port managers aiming to fulfill their own requirements. Yet, universally recognized goods codification systems, specially devised for international trade, should be considered because their use would ease data exchange, which are essential in the development of sea trade.

● Classification of goods

The CCP, or central classification of goods is the standard used in economic analysis of production and consumption. It was adopted by the UN in 1989, and has a quite similar European standard called CAP.

It is based on the positions of the HS (as it is less elaborate).

The HS, or harmonized system, is an international Customs classification system adopted and managed by the World Customs Organization. The HS is used in all international trade statistics and in all customs formalities (assessing customs duties, regulations...).

These two classifications are not always adapted to transport problems. The different levels of aggregation of the HS, 21 sections and 96 chapters, do not really meet the port and transport classification needs.

This explains why the bodies in charge of transport statistics had to devise their own specific classification.

It is known as the SCT, or statistical classification of transport, a European classification, adopted by other regions.

This classification allows to get several levels of significant groupings (transport wise but also from an economic standpoint) with only 176 positions (one position is being left open so the users can use it according to their needs), described in 10 chapters, 19 sections and 52 groups (24 sub-groups have been adapted by the EU).

Many countries apply SCT only at the level of chapters or sub-groups, especially when data is fed directly without having recourse to Customs or tariff codifications.

There are codification tables for exchanges between the SCT and the HS, which give the possibility of drawing up SCT statistics from HS customs documents.

The SCT classification, established in 1961 is outdated and no longer meets the Eurostat requirement which stipulates that all specific classification should be derived from the CPC. A revision is under way but may take some time to be completed.

Besides, there is another transport classification, **the ECET**, established by the economic commission for Europe of the UN, but is seldom used.

The chart below illustrates an example of the classification of goods used in a European port.

Product classification

Major product groups	Sub-groups	Codes S.C.T.	Details
Agricultural products	Fruit and vegetables Other agrifoodstuffs Raw materials Animal and vegetable Foodstuffs	0200 -- 0399 0010 - 0199 1110 - 1130 1340 - 1661 1710 - 1792 1810 - 1819 0410 - 0490 0510 - 0571 0911 - 0999 1211 - 1289 1310 - 1399 1411 - 1480 1611 - 1670 1820 - 1829	Fruit and vegetables, frozen and fresh Live animals Sugar, molasses Tobacco, tapioca Fodder, cattle-cake et flour Groundnut, corn and oilseeds Wools, cotton and fibers Wood, logs, cork Hides, leather, bones, rubber, seeds Wines, alcoholic drinks, mineral water Coffee, cocoa, tea, sweets, spices Meat, fish, (incl. cans), dairy produce Flours, semola, fruit and dry vegetables Vegetable oils
Energy products	Solid oil products Crude oil products Oil products refined and gas petroleum	2110 - 2330 3491 3100 - 3170 3211 - 3279 3300 - 3310 3410 - 3499	Coal, lignite, peat, coal coke Oil coke Crude and semi-refined oil, condensates Aircraft and automobile oil , white spirit, gas oil Butane, propane, methane (natural gas) Lubricants, asphalt, other oil by-products
Raw materials	Iron ores, scrap iron Iron ores, non ferrous iron Fertilizers	4100 4620 - 4670 4510 - 4599 6110 - 6150 6210 6220 - 6399 7110 - 7290	Iron ore Iron, scrap iron, scoria, burned pyrites Non ferrous iron (copper, aluminium, manganese) Sand, gravel, clay, milk Salt Sulphur, freestone, chalk, asbestos, asphalt Sodium nitrate, phosphates, potassium and nitrate fertilizers
Semi-finished products	Ferrous metallurgic products Non-ferrous metallurgic Products Basic chemical products Building materials	5120 - 5150 5220 - 5450 5510 - 5520 5610 - 5689 8110 - 8200 8200 - 8201 8310 - 8420 8600 8910 6410 - 6500 6910 - 6929	Raw smelting, ferro-alloys, raw steel Semi prod. Steel-making., profiles, laminated iron, rails, sheets Tubes, pipes, millings Copper, aluminium, lead, tin, nickel and others Acids, ammoniac, GTBA-MTBE, propylene, chloride vinyl, benzene methanol, caustic soda Calcinated and hydrated alumina Coal tars, cellulose, scrap paper Industrial water Raw plastic material Cement, clinkers, lime, plaster Chipboardss, bricks, tiling
Finished products	Other chemical products Transport goods Special investment goods Other consumer goods	8921 - 8969 9100 - 9200 9318 - 9399 9410 - 9499 9720 - 9721 9315 - 9940 9995 - 9999	Paintings, Pharmaceutical prod., soaps, explosives, Chemical products New vehicles, car spare parts, CKD Bulky electrical equipment, machines, engines Building accessories, tools, towrope Paper, cartons, paper rolls Household appliances, crockery, textile, furniture, wood, property Arms, munitions, parcel post, various goods
Special transactions	Special transactions Tare weight	9910 - 9911 9912 9913 - 9916 9918 - 9919	Container tare weight (full or empty) Packing weight Truck and tow tare weight (empty or loaded) Empty and used packing, barges (tares)
Passenger vehicles	Passenger vehicles	9991	

● Cargo packaging

In addition of identifying each commodity, the way it is packaged has also to be studied, either taking into account its handling by pieces or units (bags, bales, containers, trailers...) or in bulk (solid and liquid). While most goods can be easily identified as belonging to general or bulk (solid or liquid) cargo, according to their physical features, it should be noted that some goods are likely to be transported as general cargo in bulk. This is the case with sugar and rice, which are partly carried in bags or containers. As the port activity focuses in cargo handling and warehousing, it is important that port statistics should bring out the way cargo is packaged and stored. An illustration of this classification is made in the chart below under Level 2 item.

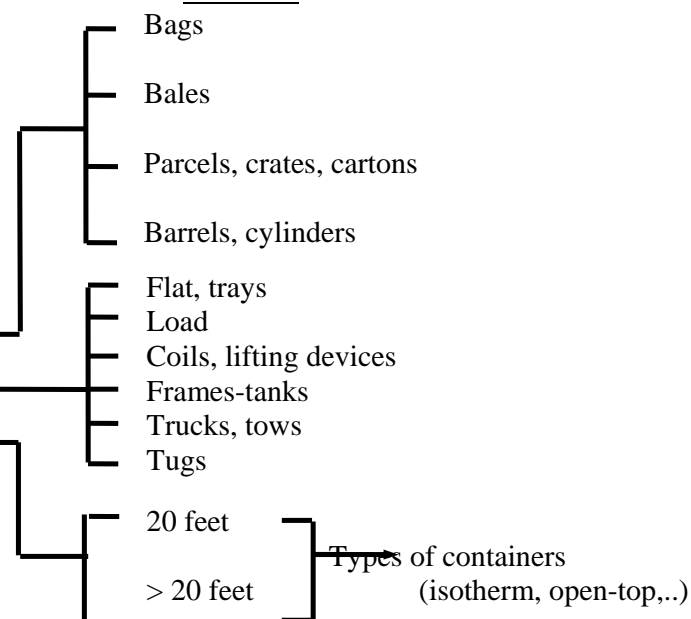
Due to the expansion of containerization, most ports draw up statistics for only this type of packaging indicating also the goods that are handled in this way. The same goes for Ro-Ro traffic when this horizontal handling accounts for a major part of the port activity. These statistics pose the problem of the tare weight of containers, tows, trucks or barges. It is common practice to separate the total tare weight and to publish it separately.

EXAMPLES OF CARGO TRAFFIC STATISTICS ACCORDING TO CARGO PRESENTATION MODE ①

A) Year or Month

Packaging	TOTAL TONNAGE (IN MILLIONS)		
	Inbound	Outbound	TOTAL
<u>Liquids in bulk</u>			
<u>Solids in bulk</u>			
<u>General Cargo</u>			
- Units < 15 tonnes			
- Units 15-50 tonnes			
- Units > 50 tonnes			
- Break bulk cargo			
- Unitized cargo			
- Containers			
- Other packaging modes			
TOTAL			

Level 2



① Item to be adapted to local uses



B) Year or Month

TOTAL TRAFFIC OR INBOUND OR OUTBOUND

in tonnes (or millions)

Types of cargo ^②	MODE DE CONDITIONNEMENT ^③									TOTAL
	Liquid bulk	Dry bulk	Units < 15t	15-50t	> 50t	General cargo	Unitized cargo	Containers	Other cargos	

② This column can be used for other segmentation such as geographical zone, type of shipping line...

③ These columns could be modified for further analysis as shown in Level 2 above.

Example of a table for the follow up of containers

Month/Year	NUMBER OF 20' CONTAINERS								OVERALL TOTAL
	INBOUND				OUTBOUND				
	FCL	LCL	EMP -TY	Total	FCL	LCL	EMP- TY	Total	
Total									
Month/Year	NUMBER OF CONTAINERS EXCEEDING 20'								
Total									
Overall Total									

- Country of origin or destination of goods

The data collected on the physical features of cargo traffic must be completed by information related to their country of origin or destination, which are key factors used to carry out an effective marketing policy. In principle, almost all ports separate inbound and outbound cargo traffic and combine them with different types of goods together with their packaging. If the port is endowed with an international transshipment traffic system, the corresponding movements should be indicated separately.

When collecting data, it is advisable to identify each country of origin or destination of cargo separately. The same applies to the different coasts of the same country when they are served by services as, for example, the east coast and the west coast of the United States or of Canada. Such accurate statistical data should be provided to the marketing department for the analysis of traffic flows. When it comes to presenting data for external communication, only the traffic flows of broad regional geographical areas including several countries such as western Africa, or the east coast of Latin America, should be provided. This segmentation would be of intent when associated to ship-owners liner services. Find below a possible classification of the geographical areas that can be used by ports.

Classification of geographical zones

North West of Europe	Great Britain - Ireland - Benelux - Germany - Denmark - Scandinavia – The Baltic Republics- Poland
South West of Europe	Portugal - Spain - Gibraltar - Italy
Maghreb	Morocco - Algeria - Tunisia - Libya - Malta
Eastern Mediterranean Sea – Black Sea	Yugoslavia - Albania - Greece - Cyprus - Turkey - Lebanon - Syria - Israel - Egypt – Black Sea - Azov Sea
Western Africa	From Mauritania to Liberia – from the Ivory Coast to Nigeria – from Cameroon to Angola – the Azores – the Canary Islands - Cape Verde Islands
East, Southern Africa and Indian Ocean	East Africa – Republic of South Africa - Madagascar - Reunion - Mauritius- Comoros
Middle East	Red Sea – the Persian Gulf: Saudi Arabia - Yemen - Oman – United Arab Emirates - Iraq - Iran
Asia	India - Sri Lanka - Pakistan - Bangladesh - Maldives
South East Asia	Singapore - Myanmar - Malaysia - Thailand - Indonesia - Philippines-Laos - Cambodia
Far East	Taiwan - Hong Kong - Macao - China - Japan – North Korea – South Korea
North America, East Coast	United States – North of Cape Hatteras - Canada
Central America - Caribbean	Mexico - Panama - Venezuela - Colombia - Guyana - Surinam - Cuba – Dutch West Indies- Bahamas
West Indies	Martinique - Guadeloupe – Guyana – Bahamas – Jamaica – Trinidad
South America, East Coast	Uruguay – Paraguay – Brazil – Argentina
Australia - Oceania	Australia - New Zealand - Tahiti - New Hebrides - New Caledonia

In ports where land transport services include two or more modes (road, rail, waterways, and pipelines) and where competition is fierce concerning traffic flows of the same hinterland, the port authority would like to know the different modes of transport used by the traffic. This data would be the first step of studies analyzing the power of attraction of the port to the hinterland's cargos.

B – Operational Statistics

Port managers need to know whether the services offered to their customers and the way the facilities are used, are improving or deteriorating; in which case they can act accordingly. In the same way, port planners need to know whether the infrastructure or equipment have to be modified in quantity or quality in line with the operations. Furthermore, operational weaknesses (for example, waiting liner, breakdown of machines, their causes...) have to be identified to redress them.

To meet these requirements, a reliable operational data collecting system must be implemented which will provide the performance reached in the different sectors of port

activity and this is why these statistics are called performance indicators. Because of complex port activities, the number of indicators might be very high. A list of primary indicators has to be established to allow an overview of the situation and identify the troubled sectors. The sectors under examination are analyzed by using secondary indicators. All indicators which could be collected continuously or for ad-hoc purposes, depending on the objectives, are for internal use.

In some ports, including those of developed countries; statistics (or indicators) are not produced on a permanent basis. This practice which implies a day to day management of the port was effective when competition was less fierce and traffics more « captive » than today. It no longer applies to modern and efficient ports. Yet, no gross exaggerations should be made by producing highly detailed operational statistics and indicators, as probably their costs do not match the expected benefits to be derived from their uses.

- The indicators

Operational statistics lead to indicators, which although unofficially defined, are comparable between ports. Overall, the indicators apply to the following section:

- the quality of the services provided to the ship-owner;
- the quality of the services provided to the cargo owner;
- the utilization rate of port facilities in order to plan their timely extension or adjustment;
- the use made of available facilities and equipment so that corrective action is taken if need be.

When analyzing the results is found that the last two indicators, by their very nature, are closely linked with the first two. In fact, the indicators are interconnected when the operational situations are studied.

To prove effective, operational statistics must be based on similar data, for example, ships or cargo of the same type or class, groups of similar berths or warehouses located in the same geographical zone of the port or allocated to the same use – roll on roll off berth, general cargo warehousing zones... An average calculated on the basis of dissimilar items will be of no interest for the analysis of the services offered by the port.

To simplify their presentation, the main performance indicators will be divided into four groups:

- ① Ship turnaround time indicators;
- ② Berth occupancy indicators;
- ③ Berth warehouses throughput indicators;
- ④ Ship berths and warehouses productivity indicators.

Example of a cargo statistics by main cargo types and geographical zones

YEAR or MONTH

in million of tons

Geographical Zones ①	INCOMING					OUTGOING					Overall Total
	Liquid Bulk cargo	Dry bulk cargo	General cargo	Of which containers	Total	Liquid Bulk cargo	Dry bulk cargo	General cargo	including containers	Total	
North America											
Central America / Caribbean											
Total											

① Adapt to local traffic

Fully detailed level

- Canada Great Lakes
- Canada Atlantic Coast
- Canada Pacific Coast
- United States Great Lakes
- United States North Hatteras
- United States South Hatteras
- United States Gulf of Mexico
- United States Pacific Coast

Example of cargo statistics by type of commodities and geographical zones

YEAR or MONTH TOTAL TRAFFIC or INBOUND or OUTBOUND in tonnes (or millions)

Types of goods ①	North America	Central America/ Caribbean	South America	—	—		TOTAL
Farm products							
...							

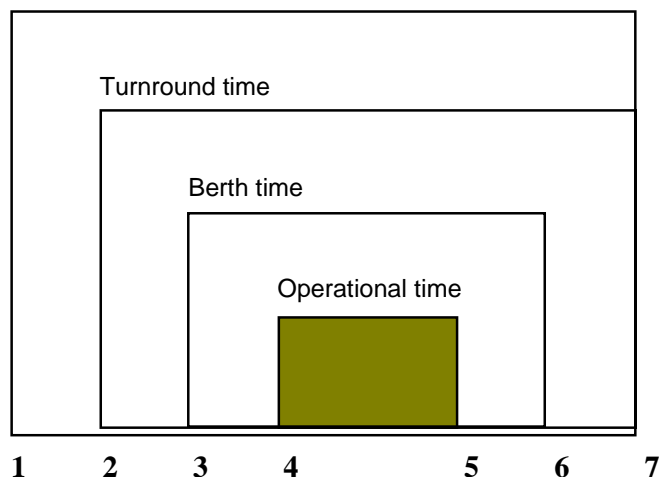
① Match with local traffic structure

① Ship turnaround time indicator

The high operating costs of ships demands quick turnarounds in a port which will otherwise see a ship-owner turn towards the more efficient ones. That explains why data relating to ship turnaround transit time are of capital importance.

Distribution of the time spent by a ship in the port

Turnaround time



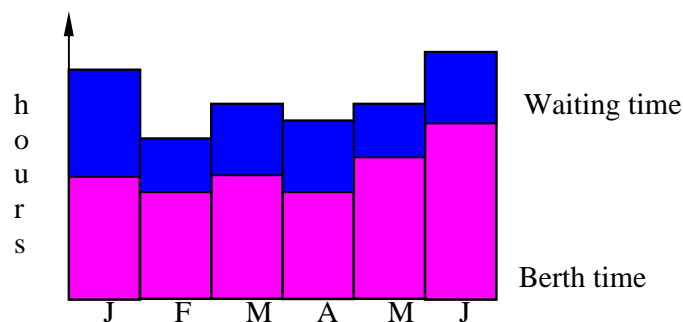
- | | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
- 1 Arrival at the port
 2 End of waiting time for a berth
 3 Berthing
 4 Beginning of cargo handling operations
 5 End of cargo handling operations
 6 Departure from berth
 7 Departure from port

The ship-owner is especially interested in the total turnaround time, but, a link has to be made between this and the loaded or discharged tonnage and the types of goods. For the same traffic, the lower the turnaround time, the better the quality of service provided to the ship. Dividing the turnaround time into waiting time (the differences between the arrival at the port and berth) and the berth time (total time spent at berth including idle time) matter much less to the ship-owner who would, nonetheless, be interested in operations that last longer than scheduled. On the contrary, the port managers must follow these data closely and analyze the reasons for waiting time and idle time during berth time.

A chart could be drawn showing the link between data concerning waiting time and berth time, if they refer for a given period of time, to a group of berths, or traffic (for example, containers). The figures could be expressed in percentages in proportion with the total time. It could be a useful indicator to calculate the average waiting time or berth time for a ship if it applied to the same types of ship or traffic.

Ship turnaround time

(average turnaround time for all ships of the same type during the month)

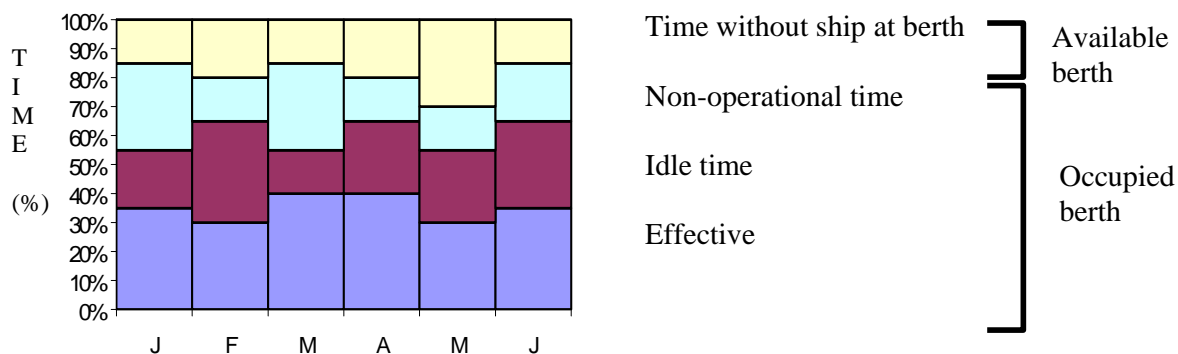


② Berth occupancy indicators

Port managers should keep a close eye on the occupancy rate of berths (or group of berths). This indicator is a percentage calculated with the total number of hours in which the berth was occupied divided by the total hours of berth availability time. A careful interpretation of this primary indicator has to be made as a high rate could be synonymous with traffic congestion, therefore, of higher ship waiting time, as a result of poor management (sluggishness, so longer ship's time at berth) or from an efficient management generating more traffic and activities, or simply a favourable (and short-lived) trade period unaffected operating conditions. When this primary indicator reveals that extra information will be needed, it will be wise to analyze the berth time. The secondary indicators listed below, which can be expressed in percentage of the total time at berth, will help to explain the changes that occurred in the primary indicator.

- ◆ Effective working time;
- ◆ Idle time during working hours that is time which could have been worked;
- ◆ Non operational time that is time not worked because it is outside working hours.

Components of berth time per month



The berth occupancy rates have a direct link with the ship turnaround time indicator as shown above in ❶. It is good to note that the calculations of a berth occupancy indicator should exclude the ships that berthed for repair, bunkering or other non commercial reasons.

❷ Berth warehouse and throughput indicators

The complement to the berth utilization is the tonnage flowing through it during a given period of time. This is a key data that enable managers to accurately grasp traffic allocation within the port area. Berth throughput includes total tonnage loaded and discharged at berths as well as those movements between berthed vessels and barges, or, in the case of specialized berths, the number of containers in TEU or roll on/roll off units. A single indicator is often given for specific traffics (ore berths or roll on/roll off berths...) or for a specific area of the port. Understanding these indicators implies to consider the types of goods that pass through the berths. Although the throughput can be divided by the number of ships to obtain an average in tons or in units per ship, for loading or discharging, its main use is to calculate the productivity indicator as shown below in (❸). It can happen that secondary indicators such as tonnage worked per meter at quay, are also calculated for more specific purposes.

What applies to berths can also be effective for warehouses or to main pieces equipment under the responsibility of the port. Thus, it may be necessary to estimate the average throughout of a warehouse or specific storage are which is of interest for planning and management of the port or the throughput of major piece of equipment like a gantry crane. Below is a synoptic table of operational data collected in a large European port.

PORT TIME											
2000	Number of ship call	Ship turnaround time	Harbour waiting by time waiting	Waiting time due to lack of berth	Berth time	Number of ship calls with waiting time due to lack of berth	Average waiting time	Operational time at berth	Stoppage of idle time	Utilization of gang cranes Gross – Net	
Total traffic	793	16 139.7	342.2	265.6	14 608.0	26	10.2	6803.0	3104.7	9806.0	6701.2
Seaborne	679	15050.0	342.2	265.6	13689.4	26	10.2	6630.3	3041.5	9633.2	6591.7
Waterway	114	1090	0	0	919	0		173	63	173	110
JANUARY	59	1061.6	0.0	0.0	973.1	0		505.5	217.6	718.2	500.6
Seaborne	51	1023.6	0.0	0.0	947.1	0		499.6	214.9	712.2	497.3
Waterway	8	38.0	0.0	0.0	26.0	0		6.0	2.7	6.0	3.3
FEBRUARY	59	1076.8	17.7	3.8	970.5	1	3.8	463.7	189.6	654.3	464.7
Seaborne	51	1026.6	17.7	3.8	932.4	1	3.8	455.0	186.7	645.6	458.9
Waterway	8	50.2	0.0	0.0	38.2	0		8.7	2.9	8.7	5.8
MARCH	73	1397.4	26.4	4.5	1261.5	2	2.3	615.8	265.3	862.9	597.6
Seaborne	63	1236.3	26.4	4.5	1115.3	2	2.3	600.0	261.7	847.1	585.4
Waterway	10	161.1	0.0	0.0	146.1	0		15.9	3.6	15.9	12.3
APRIL	61	1119.7	7.0	7.0	1021.2	2	3.5	476.1	224.9	715.6	490.7
Seaborne	52	1032.1	7.0	7.0	947.1	2	3.5	468.0	221.5	707.5	486.0
Waterway	9	87.6	0.0	0.0	74.1	0		8.1	3.4	8.1	4.8
MAY	67	1234.6	16.8	16.8	1117.3	2	8.4	528.1	215.1	779.7	564.6
Seaborne	56	1141.6	16.8	16.8	1040.8	2	8.4	510.6	206.4	762.1	555.8
Waterway	11	93.1	0.0	0.0	76.6	0		17.6	8.7	17.6	8.9
JUNE	68	1236.6	0.0	0.0	1134.6	0		508.7	207.7	742.4	534.7
Seaborne	57	1069.3	0.0	0.0	983.8	0		492.1	202.4	725.9	523.4
Waterway	11	167.4	0.0	0.0	150.9	0		16.6	5.3	16.6	11.3
JULY	73	1231.0	37.9	37.9	1083.6	2	19.0	574.8	262.1	854.6	592.5
Seaborne	58	1122.3	37.9	37.9	997.3	2	19.0	547.4	247.8	827.2	579.4
Waterway	15	108.7	0.0	0.0	86.2	0		27.4	14.3	27.4	13.1
AUGUST	65	1406.3	19.0	19.0	1289.8	3	6.3	582.8	251.7	838.6	586.9
Seaborne	60	1371.7	19.0	19.0	1262.6	3	6.3	574.8	247.4	830.6	583.1
Waterway	5	34.7	0.0	0.0	27.2	0		8.1	4.3	8.1	3.8
SEPTEMBER	64	1126.0	0.0	0.0	1030.0	0		563.7	239.9	819.3	579.4
Seaborne	55	1063.2	0.0	0.0	980.7	0		547.7	235.2	803.3	568.1
Waterway	9	62.8	0.0	0.0	49.3	0		16.0	4.7	16.0	11.3
OCTOBER	73	1432.5	57.5	57.5	1265.5	3	19.2	613.6	265.1	900.2	635.1
Seaborne	64	1382.2	57.5	57.5	1228.7	3	19.2	598.3	261.3	884.9	623.6
Waterway	9	50.3	0.0	0.0	36.8	0		15.3	3.8	15.3	11.5
NOVEMBER	68	1918.5	50.6	50.6	1765.9	6	8.4	744.1	442.9	1082.1	639.1
Seaborne	60	1778.7	50.6	50.6	1638.1	6	8.4	730.5	438.7	1068.4	629.7
Waterway	8	139.8	0.0	0.0	127.8	0		13.7	4.2	13.7	9.5
DECEMBER	63	1898.8	109.2	68.5	1695.1	5	13.7	626.0	322.8	838.2	515.4
Seaborne	52	1802.7	109.2	68.5	1615.5	5	13.7	606.5	317.5	818.6	501.1
Waterway	11	96.1	0	0	79.6	0		19.6	5.3	19.6	14.3
REF. 1996	71					4	12				
REF. 1998	65					8	14				

④ Indicators for ships, berths and warehouse productivity

The value taken by the indicators related to ships turnaround and berth occupancy depends on the speed at which operations are carried out. Some useful productivity indicators are directly related to the components of the total time spent by the ship in the port.

♦ Tonnage worked per vessel and per hour of work

This is the most significant productivity indicator which reflects the efficiency of handling operations. It can (and must as far as possible) be improved by taking into account the number of gangs and shifts per ship, which will allow to calculate the tonnage worked per gang and per hour for various types of cargo and ships. For container traffic, the number of T.E.U. units and the number of cranes used replace the tonnage and gangs respectively.

Here is a plain illustration of this indicator:

During an 8-hour shift, vessel A discharges 240 tonnes of breakbulk cargo and sacks. That means 30 tonnes per hour of work. But if no clue is given on the effort made to do the work, this figure is vain. Let's assume that three gangs were employed. With this only figure, we can calculate that each gang will have discharged an average of 10 tonnes per hour.

Along a nearby berth, vessel B, in turn, discharges a similar type of cargo but during the shift only reaches 160 tonnes, that is 20 tonnes per hour of work. Does that mean that the performance of vessel B was poorer than vessel A? In fact, when we realize that the latter ship worked with only one gang for 8 hours and another one for 4 hours, that is, 1.5 gang for the shift, we can deduce that the performance required 13.3 tonnes per hour and per gang, which is a much better outcome than vessel A. The reasons for these discrepancies could be numerous and need closer scrutiny. They may not all be under the control of the port authority or the stevedore company but when so, measures must be taken to upgrade the service.

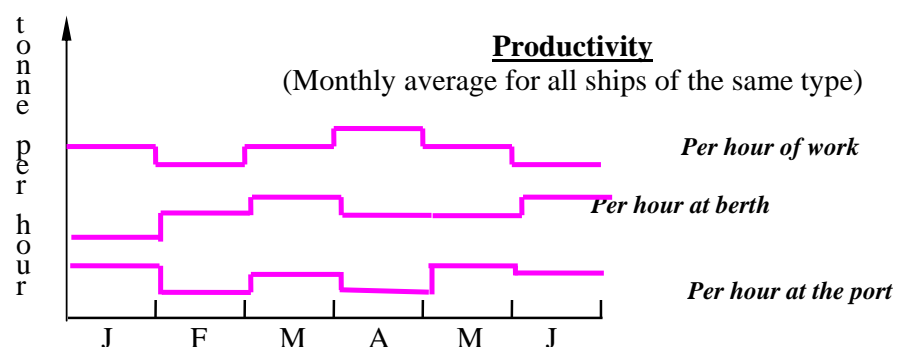
♦ Tonnage worked per hour at berth

This indicator is less significant than the previous one as it counts also the non-operational time that is all hours during the vessel was at berth but not worked. If the gap between these two indicators is too wide, the managers should seriously think of analyzing the reasons for high non-operational time. The averages for given periods of time should be estimated for the same types of berths.

♦ Tonnage worked per hour at port

This is the least important indicator in that it takes into account the waiting time between the ship's arrival time and berthing. This indicator, nevertheless, supplies the ship-owner with useful information on the overall port productivity.

All the above-mentioned indicators can be improved if they are calculated for each of the shipping companies and/or agents. The chart below shows the link between the different indicators:



These indicators are equally useful to those in charge of storage, areas and equipments. In the first case, the throughput figures can be related to the available space in square meters or by taking the average dwell time for cargo. Similarly, for a more efficient management of equipment, the indicators showing their use per unit of work time or by the total availability time could prove useful.

Further information on various possible operational statistics and their interpretation can be found in UNCTAD's publications:

- Manual on a Uniform System of Port Statistics and Performance Indicators, UNCTAD/SHIP/185/Rev.1, Geneva, 1985.
- Measuring and evaluating port performance and productivity, UNCTAD's Monographs on Port Management, N° 6, Geneva, 1987.

Note that in some regions, the harmonization of port statistics, namely operational statistics, has been underway as in West and Central Africa. Find below examples of tables showing the current indicators for a container terminal and operational statistics as applied in Europe; examples of ship codification system, of cargo handling and packaging of merchandise, together with primary indicators proposed for West and Central Africa.

Example of a table with performance indicators for a container terminal during a given time ①

Name of ship	Number of ship call	Number of movements	Berth time (hours)	Gross equipment operating time (hours)	Productivity per hour of ship at berth (movements)	Gross equipment productivity per hour (movements)
a	361	306	39,3	20,8	7,8	14,7
b	362	705	22,6	27,6	31,2	25,5
C	363	179	16,0	7,0	11,2	25,6
d	364	1019	25,3	38,6	40,4	26,4

O	375	...	...	...	...	...
P	376	...	...	...	...	...
Total / Average	16	4913	253,8	214,5	19,4	22,9

- ① The figures on this table reflect performance for a week in a European port.
 ② Weak performances require careful scrutiny and analysis.
 ③ The performance gap must be bridged by an analysis of idle time at berth.

Example of a table with annual performance indicators for a general cargo berth

Berth (number)	No. of ships	Berth time (hours)	Occupancy rate ①	Total effective working time (hours)	Occupancy rate ②	Cargo tonnage	Productivity per hour at berth (tons)	Productivity per operational time available when berth occupied (tons) ③	Productivity per effective hour (tons)
12	65	2863	33,1	1560	32,5	55250	19,3	28,9	35,4
Total									

- ① Berth time / Available time (e.g. 360 d x 24 = 8640 h)
 ② Effective working hours / operational time (e.g. 16h / d x 300 d = 4800 h)
 ③ Assuming 1912 operational hours.

Example of statistics and performance indicators used in a European port:

PORT TIME											
2000	Number of ship calls	Port time	Waiting time at harbour	Waiting time due to lack of available berth	Berth time	Number of ship calls with waiting time due to lack of available berth	Average waiting time	Handling operations time	Stoppage of work	Gross – Net utilization time	
Shipping	679	15050.0	342.2	265.6	13689.4	26	10.2	6630.3	3041.5	9633.2	6591.7
JANUARY											
shipping	51	1023.6	0.0	0.0	947.1	0		499.6	214.9	712.2	497.3

OPERATIONS DURING A SHIP CALL								
2000	No. of containers handled			Other cargo lifted	Unproductive movements			Total number of movements
	Excl. transhipment	Incl. transhipment	total		Batch covers	Shifting	total	
Shipping	175 841	18 252	194 093	46	8497	3999	12496	206635
JANUARY								
shipping	13362	1420	14782	2	752	282	1034	15818

SHIP CALL PRODUCTIVITY AND ITS DETERMINANTS											
2000	Productivity of ship call (in containers)		Crane productivity (in movements)		% stoppage of work	% of unproductive movements and other liftings	Average number of cranes used	Volume of work per ship call		Waiting time at the harbour	Waiting time due to lack of available berth
	port	berth	Gross	net				port	quay		
Shipping	12.9	14.2	21.5	31.3	31.6%	6.1%	1.5	44.1%	48.4%	2.3%	1.8%
JANUARY											
shipping	14.4	15.6	22.2	31.8	30.2%	6.5%	1.4	48.8%	52.7%	0.0%	0.0%

Port Operational Statistics - Codes**①** Code for types of ships

Code	Type of ship
GC	General cargo
CO	Cellular container ship
BU	Bulk carrier
OR	Ore carrier
TK	Tanker
BC	Barge carrier
RO	Roll-on/Roll-off ship (Ro-Ro)
LPG	LPG (lignified petroleum gas) carrier
LNG	Lignified nature carrier
O/O	Crude oil/ore carrier
OBO	Dry bulk / crude oil and ore carrier
CM	Container / multipurpose
CR	Container / roll-on/roll-off
CB	Container / barges
PA	Passengers (Cruise)
LT	Lighter / barge
CC	Car carrier
RC	Refrigerated cargo carriers
TC	Timber carriers
CE	Grain carrier
FV	Ferries, Fishing boats
VC	Wine carriers

② Codes for handling types (code in two combined figures)

First digit: Operation	Second digit: Mode
1 Discharging: LIFT-ON/LIFT-OFF	1 Indirect transit shed
2 Discharging:ROLL-ON/ROLL-OFF	2 Indirect warehouse
3 Loading: LIFT-ON/LIFT-OFF	3 Indirect open storage area
4 Loading: ROLL-ON/ROLL-OFF	4 Storage in operational areas
5 Shifting through Discharging / Loading (via Quay)	5 Road
6 Shifting on board	6 Rail
	7 Barge ^①
	8 Direct other ship
	9 Direct floating
	0 Unlabelled mode ^②

① Cargo with or without barge

② Use only for shifting

③ Packaging Code

Code	Designation
1	General cargo
2	Unitized (pallets, prepackaged, containers, RoRo, Barges excluded)
3	Unitized (containers, cargo units)
4	Unitized rolling trailers, flat cars
5	Wheeled vehicles
6	Barges
7	Dry bulk
8	Liquid bulk

C – Financial Statistics

As a provider of commercial services, the port must keep a close interest in the revenue generated by those services. This can be performed by a series of continuous statistics showing the amount of the income per source. Furthermore, it is vital to analyze the costs of providing these services to ships and cargoes.

To collect relevant data, all details have to be considered concerning traffic flows of all types of ships and cargoes (to calculate port dues), as well as the operational time of facilities, warehousing and cranes, if they belong to the port authorities (rental fees). If cargo handling is carried out by the port authority and not by the private sector, a separate account for revenues and expenditures should be kept.

The criteria on which revenue calculation is based vary from one port to another, save in the case of a country where all ports are managed by a central body. More will be said about these topics in Module 6. Statistical results take into account the revenues generated by each type of ship (often through a simple classification called a « fiscal » system which applies a net registered tonnage unit), by type of shipping (liner services often benefit from discounts on the number of ship call and/or the importance of the ship call as well as on some destinations), and by shipping lines (or consignee specially for bulk cargoes where most vessels are chartered). As the berth, tonnage and type of cargo loaded or discharged are known, it is easy to calculate the revenues generated by each berth or group of berths as well as the contribution made to this total by ships and cargoes.

Example of table for presenting major port revenues per source
(in currency units)

Source ①	MONTH / YEAR 'X'			
	Port dues	Renting of facilities	Others	TOTAL
General cargo	●	●	●	●
Container terminals	●	●	●	●
Other installations	●	●	●	●
- warehouses, yards		●		
- equipment		●		
- electricity, water, telephone		●		
- sundry		●		
Liquid bulk cargo	●	●	●	●
Oil terminals	●	●	●	●
Other installations	●	●	●	●
Dry bulk cargo	●	●	●	●
Bulk terminals	●	●	●	●
Other installations	●	●	●	●
Passengers	●	●		●
Naval repair		●	●	●
Industrial zones		●	●	●
Water, sundry		●		
Land leases			●	
Others		●	●	●
TOTAL	●	●	●	●

① Items to be adjusted following port features

● Data usually provided.

Example of table for presenting port dues per source
(in currency units)

Source ①	MONTH / YEAR 'X'			
	Ships	Merchandise	Passengers	TOTAL
General cargo	●	●		●
Container terminals	●	●		
Other installations	●	●		
Liquid bulk cargo	●	●		●
Oil terminals	●	●		
Other installations	●	●		
Dry bulk cargo	●	●		●
Bulk terminals	●	●		
Other installations	●	●		
Passengers	●		●	●
TOTAL	●	●	●	●

① Items to be adjusted following port features.

● Data usually provided.

Example of table analyzing port dues per fiscal type and net registered tonnage (or per berth)

Fiscal types and ship types ① A.R.N ①	Number ship call	SHIPS			GOODS			PASSENGER S	
		Total net tonnage	Tonnage revenues ②	%	Tonnage ③	Cargo revenues ②	%	Number	Revenues
Ferries<500									
500-1500									
1500-2500									
2500-5000									

① To be adjusted to the classification and the revenue collection of the port. Substitute berths (name, number) in this column for other table.

② In local currency. They refer to net revenues (after deductions)

③ Substitute units, if necessary.

N.B.: Similar tables can be drawn up for the analysis of revenues per shipping lines or liner shipping (or both together, combined with the fiscal type of ships, if necessary).

Example of table splitting port dues on ships in accordance to percentage of reductions

Type of reduction	% of reduction ①	MONTH / YEAR 'X'				
		Number of ships	Total tonnage NRT	Gross revenue	Amount of the reductions	Net revenue
Importance of ship call	10					
	20					
	30					
	40					
	50					
●						
Sub-total						
Frequency of ship call	15					
	30					
	45					
	●					
Sub-total						
Special destinations	●					
	●					
Sub-total						
Special ships						
TOTAL	—					
Ships without reductions	—				—	

① Percentages for information only. Adjust to port requirements.

N.B.: For specific surveys, computerized data could be combined from both tables – for example, to know the reduction resulting from the different percentages applicable to ship calls for each level of NRT for ferries.

The same principle applies to the renting of equipment to cargo handling firms as the operating time will have been recorded in the operational statistics. It could happen that the port authority needs the statistics showing the revenues from dues paid by the different types of cargo. It has to be underlined that following these data is vital for the marketing policy of the port as it is a key factor in promoting the competitiveness of the port. Ship-owners and charterers alike will find in these data the tangible quality of the port services when comparing what they paid to the port with the revenues. The port should be ready to respond to those who consider the port services to be too expensive.

Example of monthly management table for port dues per cargo type

Type of cargo ①	MONTH 'X' of YEAR 'Y'							
	Accumulated tonnage ②			Unit revenue		Accumulated revenue		
	Previous year	Current year	Gap	Previous year	Current year	Previous year	Current year	Gap
<u>Inbound</u>								
<u>Farm produces</u> - fruits & vegetables - other food products								
<u>Outbound</u>								
<u>Farm produces</u> - Fruit & vegetables - other food products _____ _____								
TOTAL								

① Items to be adjusted to local traffic flows

② Units in some cases (ex. live animals, vehicles not used for business purposes, containers)

The preparation of the statistics for the costs of services is made difficult by the fact that accounting methods and financial policies concerning indirect costs such as depreciating assets vary from one port to another. On the other hand, collecting data on direct operational costs per sector, such as labour expenses and consumables, should take place regularly.

Modern port management increasingly needs handy and reliable financial data. It is common practice to prepare weekly management tables (even daily in key sectors) to be analyzed by the financial and marketing departments. These two

departments that deal with the users and the statistics department must work hand in hand. All these topics will be covered in Module six.

D - "Social" statistics

In daily port management "social" statistics are regarded as less important than the other three types as they do not directly affect the money-spinning sectors or their follow up. They are however important for a modern port cannot be an efficient link in the transport chain without the rational management of its workforce.

Internally, these statistics should allow the analysis of the port employment situation starting with the comparison between the total available labour per sector (according to the organization chart) and the actual attendance of workforce for given periods (week, month...) on the basis of common standards such as worker/hours or days of work. The analysis of all discrepancies must show up on the statistics (in the same way as the analyzing of waiting times for operations). Special attention must be paid to safety statistics notably work accidents especially if the port carries out handling operations and employs the dockers.

As labour costs are important in total expenditures, statistics showing the labour expenses per sector of activity would be useful to calculate the costs of port services and the optimum deployment of human resources. In this way these statistics contribute to reduce the costs of port services, and consequently, to boost port competitiveness.

An efficient management of human resources requires the updating of general statistics relating to the profile of the workforce: age groups, length of service, skills are some examples, which can be further studied by relating them with the functions of the organization and services. These aspects would be covered in Module eight.

SECTION III: Collecting, processing and presenting

Over the last two decades, deep changes have gradually modified the way of collecting and processing data thanks to information technology and their interconnection. Thus, filling forms with basic data, transferring them towards a central processing unit and presenting printed reports, are disappearing from most modern ports. Yet, those documents will not be totally phased out in spite of fast moving computerized systems.

There are two major principles in the way data is collected:

❶ Whether data collection is computerized or done by hand, it will always have recourse to human intervention that ensures the reliability of the final data. Human error can occur when transcribing data, therefore constant checking, which has been eased today with highly accurate computerized systems, has always to take place. It is vital that strict controls are always applied to the collection of data at the source.

❷ The process of collecting and transferring data has to be reviewed regularly to reduce, as far as possible, the hassle of collecting and transferring the same data more than once. The statistics department must work in collaboration with the different users in order to determine the best way to meet their requirements, as regards relevant data and their presentation format. This collaboration must be underlined, as the statistics department must in no way decide on its own which

statistics to present and in which format. Its role is, above all, to track down data relating to each sector of activity and to define the best way to collect and process the relevant information, in line with the available computerized systems and structures. However, it has to be kept in mind, that each port has its own structures for collecting and processing data which have been established over the years. The aim, therefore, is not to change everything but rather to make necessary and timely adjustments and to upgrade the information channels when:

① users express the need for new requirements or show dissatisfaction with the quality of information provided (or the speed at which they are delivered);

② technological improvements are implemented, such as the computerization of new departments and/or their interconnection, because in this case the collection and processing of data can be modified;

③ new administrative procedures are put in place, including procedures in other organizations whose activities are linked with the port such as the Customs and Excise.

A – Data collecting and processing

The origin of raw data will differ from one port to another according to the importance given to the local organization. The statistics must reflect this fact. This is why there is no universal collecting and processing system that could apply to all ports. It is however, a fact that, besides the departments that fall under the port authority, the statistics department must, absolutely, liaise with four external data sources:

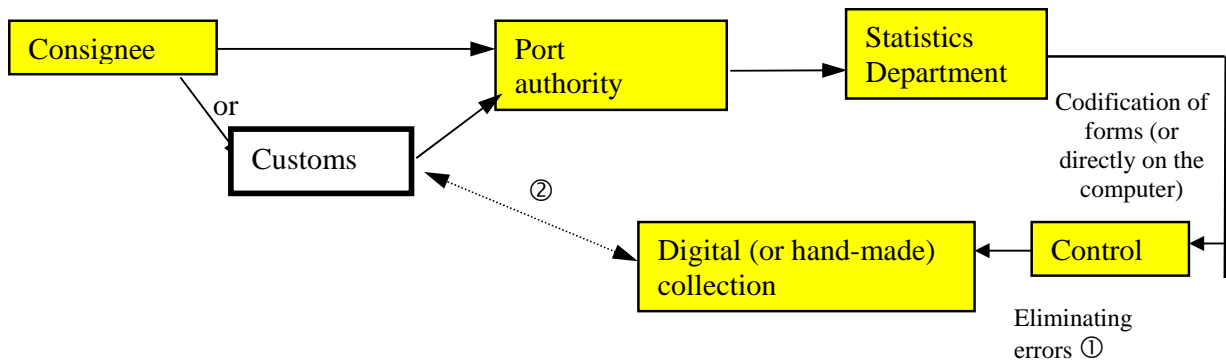
- harbour master office for ship movements;
- the shipping agent for the declarations of the ship as he is in charge of settling port dues and of the manifest, which is the key document used when loading and discharging cargo;
- Customs and Excise department which should check the accuracy of trade transactions for fiscal reasons, and draw up its own statistical figures for foreign trade by sea;
- Specialized publications providing information on vessels and cargo. Here are three examples :
 - The Lloyd Register of Shipping. Provides features of vessels operating worldwide.
 - Ports of the World. Describes the main features of ports.
 - International Container Yearbook. Annual publication on container traffic (shipping lines, ports...)

The cargo handling department could also be added on the list; if private, it could be asked to supply information on operational statistics notably, when it works on public quays using public equipment. However, this is not possible if the quay is leased for long periods and that the operator works with its own equipment.

Given the large volume of statistics that has to be prepared for the users and to avoid misinterpretations in collecting, processing and distributing the results, the statistics department should publish an internal manual for reference. This document could include:

- ↓ A flow chart showing the flow of forms filled with raw data until they reach their processing point; or in case where data is digitally collected the way it is transmitted;
- ↓ Deadlines to be respected for sending filled forms;
- ↓ The reason for collecting data;
- ↓ A list of data that must be compulsory recorded;
- ↓ A copy of the forms or, in case data is directly collected into the computer, a printed copy of the display on the screen;
- ↓ Check points for controlling the accuracy of data including the codes to apply to the relevant items (or where to find these codes);
- ↓ Samples of statistical outputs (charts, graphs) including paper copies of the displays that should be read directly on the computer screen (a practice that is spreading).

The following example shows a typical flow chart of a manifest:



① This control can take place after feeding data in the computer

② If cargo classifications are compatible, the task of data collection could be divided or entrusted to one or the other party (same for printing of the results)

Let us examine the case of data collection concerning a ship call. As the time of arrival, berthing and sailing are known to the harbour master office, this is the primary source of nautical information. It will also collect some other data like the flag of the ship and the berth number. Still other technical information for the central file of the ships is pending. Perhaps the harbour master office can perform this task (consult Lloyds Register or ask the agent) or left this tasks to the statistics department. In any case, the responsibility of the collecting data should be clearly defined. If the ship shifts to another berth during her stay in the port, the harbour master will also record the data. Yet, for operational statistics, it is advisable to dissociate time for berth of the ship from time of operations and explain the reasons for the waiting time. The manual must specify who (often a port officer) will this data, the form on which the information will be recorded, the transmission means and the possible control system. Data on the cargo operations carried out by the berthed ship (tonnage loaded, discharged, type of cargo, packaging, and revenues from the ship call) will be collected on other forms that will have to be specified too. To know the full history of a ship call, a close collaboration has to be established between the port players and the statistics department. For that purpose, the trend towards collecting data directly in the computer at the source (for example, at the agent) and its electronic transmission gradually reduces the workload of the statistics department, but not the need for a strict control of the accuracy of data and the careful presentation for final statistics destined to the user. Increasingly, equipment is endowed with automatic data recording systems which enable the collection and processing of specific information electronically.

B – Presenting statistics

Presenting statistics is a demanding task that requires reflection and care. The aim must be to simplify the interpretation of the statistics by the user who will use the data in his decision-making. A complex, confused and inadequate presentation should, therefore, be avoided. The two basic methods used to publish statistics are charts and graphs and it is fitting to analyze some of their principles which are applied to their presentations. We will start by underlining the importance of defining the variables, units and sources clearly. It is better for readers to understand the features of charts and graphs from the very beginning.

❶ Tables that are badly labeled with abundant columns and figures are difficult to read and understand by the user. Tables must be designed clearly so that data is easily related to the objective. The user must not waste time trying to decipher the objective of the table and the data. If the goal is to highlight the evolution of ship traffic in number of ship call and dwt for two years, it is not enough to give the difference between the two absolute figures which are difficult to understand, but rather to present the variation in relative terms (growth/decline in percentage). It has to be decided whether those relative terms have to be calculated or presented for each type of ship or for the total (or possibly both ways). The following chart inspired from real figures illustrates this problem:

Evolution of port traffic per type of ship: YEAR X versus Y

Type of ship	Number of ship calls			Deadweight tonnage (million)		
	Year 'X'	Year 'Y'	Variation %	Year 'X'	Year 'Y'	Variation %
Ferries and boats	46	46	-	122	122	-
Semi container ships	130	131	0,7	1994	2124	6,5
Roll-on/Roll-off ships	163	139	- 14,7	1129	950	- 15,8
Conventional carriers	51	61	19,6	363	568	56,5
Bulk-ore carriers	52	36	- 30,7	1421	1045	- 26,5
Oil tankers	88	74	- 15,9	5855	4993	- 14,7
LNG carriers	27	41	48,1	476	705	48,1
Other liquid bulk carriers	71	62	- 12,7	483	435	- 9,9
Non commercial shipping	34	40	17,6	473	277	- 41,4
TOTAL	662	630	- 4,8	12316	11219	- 8,9

This table which uses two variables, the number of ship calls and the DWT for each type of ship, highlights the performance for each type of vessel. It shows the types of ships that are apparently active in port traffic from one year to another, those that change slightly and those that are in decline. As the rates are calculated on the basis of different values, they have to be read very carefully. Note that almost the same variation rate occurs for roll-on/roll-off ships and tankers. Yet, the number of ship calls 24 and 14 respectively while in DWT the variation is 179 000 tonnes and 862 000 tonnes respectively, due to the difference in size for these two types of ships. While the percentages presuppose an equal evolution, the absolute figures, which will affect the revenues generated by those types of vessels, are quite different, although in decline in both cases.

This table could have shown the share of each type of ship in total traffic, the percentages being easier to compare than absolute figures. Thus, regarding the number of ship calls, roll-on/roll-off ships account for 163/662 % of total ship calls for year X. If these statistics were to be added to the table, it would make 10 columns (two more for each year), hampering its understanding. You will have to choose either presentation **A** or presentation **B**.

When designing tables, the major problem is to find a balance between too many simplified tables and a few complex ones. This explains why the statistics department should work closely with the users in order to focus on key factors. Widely speaking, trade statistical tables for external communication must be presented with a simplified number of variables to make them more accessible to the reader. Those for internal communication destined to a knowledgeable staff can be more complex.

② Graphics or charts are used to present figures in a more visual and pleasant way than tables and for time series (in absolute or relative values), distribution of frequencies and by sector. They do not always suit the needs of a more hair-splitting analysis. The main types of graphs are the bar charts, which are adapted for time series for a single variable or to show the importance of different variables in absolute value; histograms are used to show frequencies of one variable; pie or sector charts are the best ways to visualize proportions or shares; line graphs are often used to show the relationship between two variables. Below are illustrations of charts with, in most cases, the relevant table for comparison.

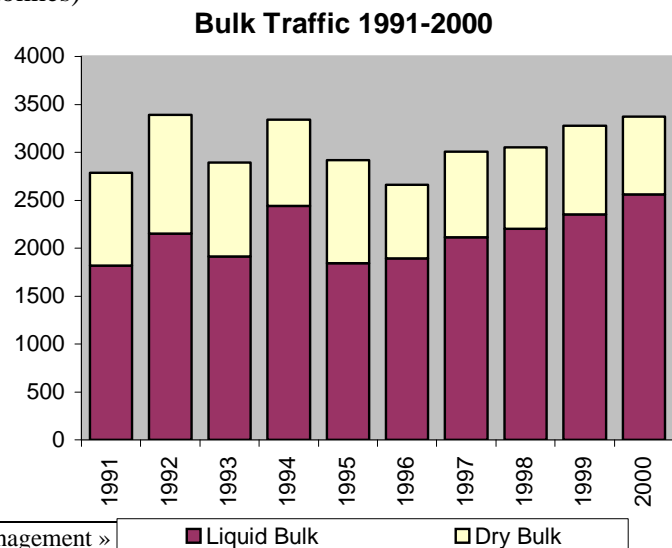
- Examples of bar charts

They are simple to design and useful to visualize the relative importance of data or their evolution in time, bar charts can be vertical (columns or lines) or horizontal (bars) with the areas are always directly proportional to the statistical value. These charts suit discrete variables (separate units) and can be combined in different ways. The first of the two examples shown below illustrates a simple case indicating: liquid bulk and dry bulk

While the trend showing the relative importance is easy to visualize for the base figures (here, liquid bulk) and the total, they are more complex for the higher coordinates (here, dry bulk), each column having a different level at the start. When the columns are divided into four or five classes, reading becomes more confused. The second graph shows the comparison between the performance of each class from one year to another (1999/2000), providing an overview of each year's trend. It is better to restrict figures to three reference periods for this type of graphs. It may be hard to determine in which two years the total traffic flow is the highest. The given chart shows the limited types of cargo likely to be presented.

Bulk traffic 1991-2000 (in thousand of tonnes)

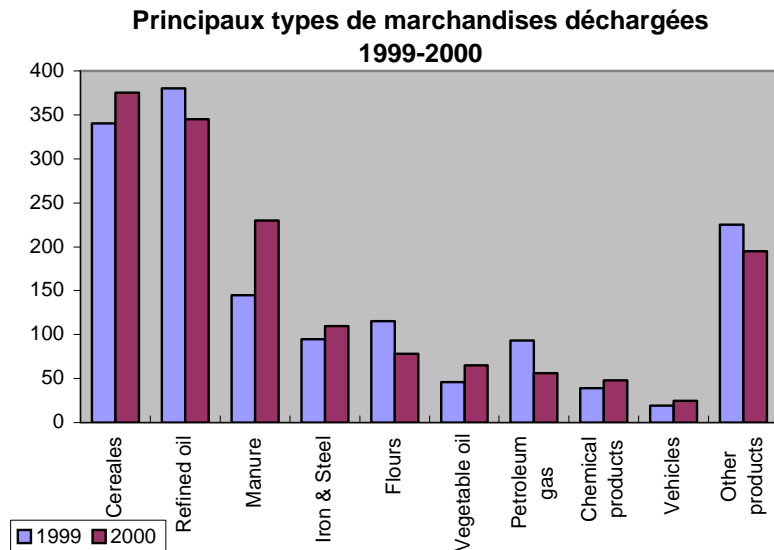
Year	Liquid bulk	Dry bulk	Total
1991	1820	965	2785
1992	2150	1240	3390
1993	1910	980	2890
1994	2440	900	3340
1995	1840	1080	2920
1996	1890	770	2660
1997	2115	890	3005
1998	2200	850	3050
1999	2350	925	3275
2000	2560	810	3370



Main types of discharged cargo 1999-2000

(in thousands of tonnes)

Type of cargo	Tonnage	
	1999	2000
Grain	340	375
Refined oil	380	345
Fertilisers	145	230
Iron & steel	95	110
Flours	115	78
Vegetable oil	46	65
Gasoil	93	56
Chemicals	39	48
Vehicles	19	25
Other products	225	195
TOTAL	1497	1527

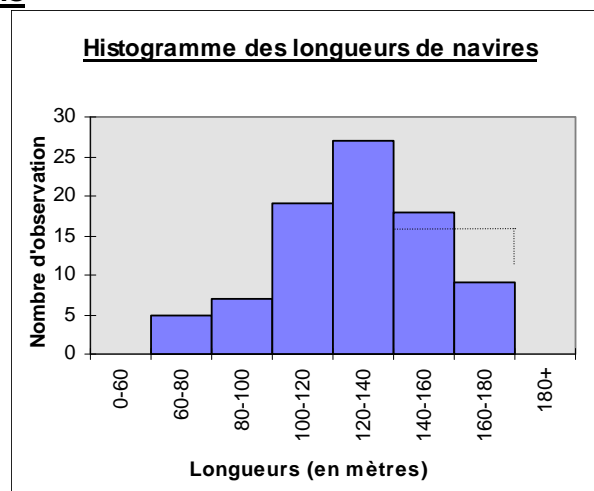


• Examples of histograms

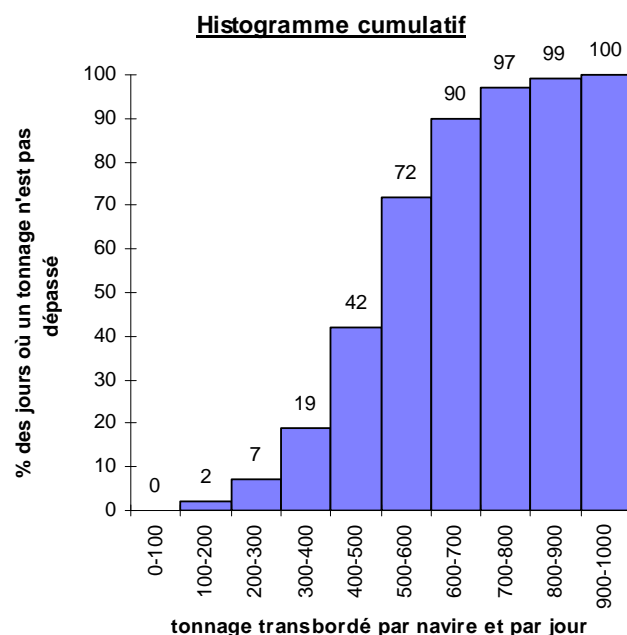
A histogram is a diagram used to present the distribution of a continuous variable (often, time, length...). It gives the frequencies for each of the ranges selected. The fact the areas are proportional to the statistical values assures an easy reading. The scales are adapted either to absolute or relative values (percentages). In the following example the ranges are all equal to 20 meters. Sometimes the ranges can fluctuate and adaptations are needed to cope with this. If in the table below, one range went from 140 to 180 meters, it would be necessary to divide the number of observation or frequencies (27) by 2 to keep the same proportion in the histogram, as it is indicated by the dotted line. The second example shows an accumulative histogram sometimes called stairs histogram.

Table: Observed ship lengths

Length in meters (shortest length of gap)	Number	
	r	%
up to 60.....	0	0
60-80.....	5	6
80-100.....	7	8
100-120.....	19	22
120-140.....	27	32
140-160.....	18	21
160-180.....	9	11
more than 180.....	0	0
TOTAL	85	100

**Tables: Distribution of tonnage rate transshipped per ship and per day**

Tonnage transshipped per ship and per day	Observation rate		
	No.	%	Total %
Up to 100	0	0	0
100-200	6	2	2
200-300	15	5	7
300-400	36	12	19
400-500	69	23	42
500-600	90	30	72
600-700	54	18	90
700-800	21	7	97
800-900	6	2	99
900-1000	3	1	100
TOTAL	300	100	100

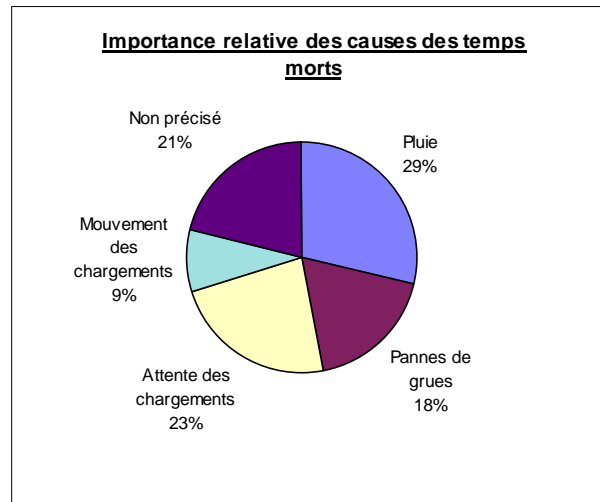


• Examples of pie charts

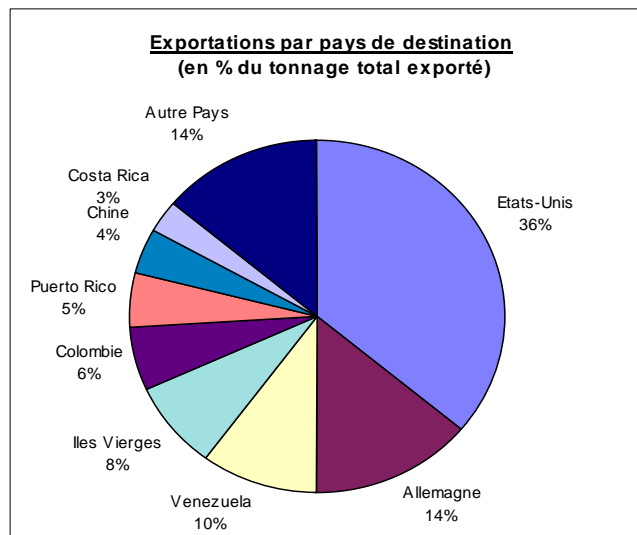
The pie charts, also called sector charts, are used to compare a limited number (up to 12) of discrete variables in relative terms when initial data have been converted into percentages. The latter are, in turn, converted into angles to determine the limits of each sector ($10\%=36^\circ$). As for previous presentations, the area of each sector is directly proportional to the value, which eases the reading of the charts. In the first example that follows, the low number of variables linked to an operational problem does not justify a table. Pie charts are efficient visual aids. In the second example, the pie chart is applied to the geographical distributions of exports from a Latin American port. Pie charts do not provide data on absolute values. Comparisons of the same structures at two different data are not possible on the same chart unless modern methods are applied (which could render reading more confused). Using two or more pie charts with their sizes being proportional to the total absolute values could bypass such obstacles.

Reason for quay idle time

Reasons for idle time	% total idle time
Rain	29
Cranes out of order	18
Loading delays	23
Loading movements	9
Others	21
TOTAL	100

**Exports per country of destination**

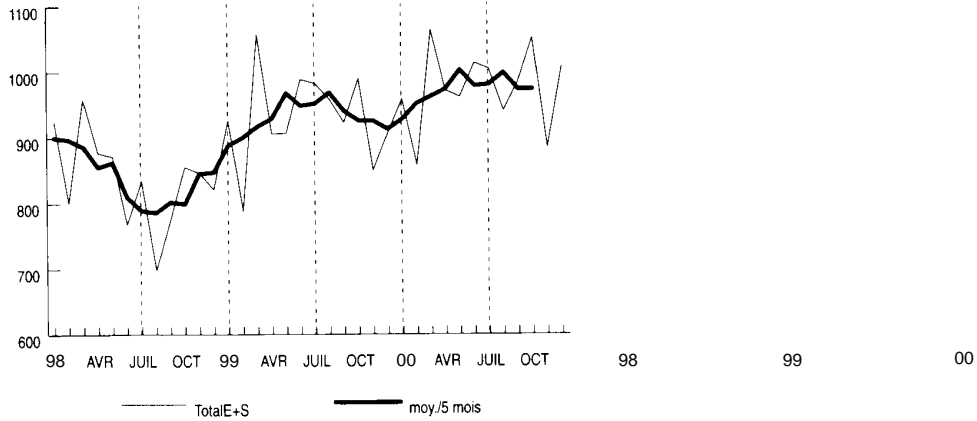
Country of destination	% of total exported tonnage
United States	36
Germany	14
Venezuela	10
Virgin Islands	8
Colombia	6
Puerto Rico	5
China	4
Costa Rica	3
Other countries	14
TOTAL	100



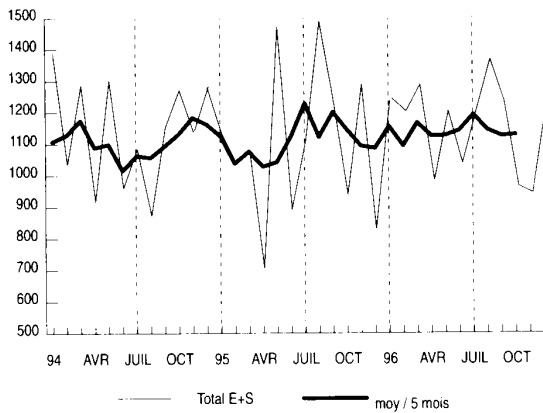
- Line graphs

This type of chart is traditionally used for continuous variables like time, when observations take place at close intervals (day, week, and month). It does not suit the purposes of discrete variables. The following examples of line charts show the trend over a span of three years of general cargo and dry bulk traffic in a European port. Each month's total is indicated by a dot on the graph and, over the years, the dots are linked (a fine see-saw curve). A curve has been drawn up to show the average traffic calculated with the five previous months. This curve better expresses the general trend of traffic than a long list of figures, especially when it brings out the sharp changes from one month to another. Both graphs with their respective curves illustrate the features of each traffic flow. They also show the fact that the follow up of graphic data must be run on a permanent basis to ensure the effective management of a modern port.

Total of various goods



Total of solid bulks



The values are in millions of tonnes