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DIONYSUS

**Integrating Danube Region into Smart & Sustainable Multi-modal & Intermodal Transport Chains**

# Study report on port pricing systems

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# 1 Introduction and scope of the report

Competitive and transparent pricing system, including port dues, is of the utmost importance for further development and inclusion of ports in a multi-/intermodal transport network. To be a sustainable element of this network, port pricing must be balanced within the high quality of services in ports and overall transport costs. In this output port pricing policy in the Danube Region will be studied in line with the corresponding Port Governance Structure, considering also the specific characteristics of each port and its hinterland area. Later, a questionnaire for pricing principles will be prepared and distributed among port authorities & port operators. Based on the information gathered an analysis of existing costing and pricing practices in Danube Region ports will be prepared. In order to combine the regional economic development of the port's hinterland with the investment decisions of the port owners, the assessment of a flexible/dynamic pricing systems as a tool for port and hinterland development will be executed and next, the tool for flexible/dynamic pricing supporting port and IWT hinterland development will be created. This tool will be developed to offer the port management an instrument which can be wisely used for increasing the IWT (cargo) market share and be competitive with other transport modes. The goal is to offer flexibility for applying different port pricing systems corresponding to the actual development objectives of the port authorities and port operators.

Activity T2.3 will provide an analysis of dynamic port tariffs as a potential tool for port and hinterland transport development. The activity will provide a thorough review of theory and practice in port pricing systems. This will be complemented by an analysis of Danube ports' models of port governance and different roles of port authorities and operators to define and charge port tariffs. Next, an overview of charges applied in DR ports ("who charges what" and "who pays what" in ports), cost accounting and calculation methods shall be produced. Additionally, two stakeholders' meetings discussing pricing systems in the DR ports and the national legal framework in force will put forward recommendations and proposals for developing dynamic/flexible pricing systems for ports. The next task provides an analysis of existing cost accounting practices applied in the DR ports. Concluding tasks within this activity will focus on elaboration and assessment of flexible/dynamic pricing systems as a tool for port and hinterland development. This suggested system will contain conditions and recommendations for the introduction of dynamic tariffs (or the so-called "sliding" tariffs) as a tool for attracting and concentrating cargo and boosting economic activities in ports and their hinterlands, discouraging congestion processes, encouraging higher utilization when needed, and an analysis of the applicability of such pricing systems in participating ports.

As a first task within this scope a literature study on port tariffs was performed. The summarized result of this study work will be presented in this report.

# 2 Literature Research Overview

## 2.1 Definition "Port Pricing" and reference list

The basic understanding of "Port Pricing" is that port users have to pay a price or tariff for the services they will consume when they use port facilities.

As there exist different ports (maritime ports, inland waterway ports, public ports or private ports, tool ports or landlord ports, …) and these ports have got a broad range of extentions and complexity there are many different aspects and basics for port pricing in practice. Thus, the literature is full of different papers regarding port pricing items. The available literature covers almost exclusively port pricing aspects in seaports, while no relevant sources are available which analyse the specifications and peculiarities of river port pricing systems in detail. Therefore, this literature study on port pricing gives a good overview of the relevant items of sea port publications, bearing in mind that the principles should be considered for river ports – even in restricted volume and much smaller levels. The aim of project DIONYSUS is to learn from the sea port systems and further develop taylor-made approaches for river ports for future applications.

For the approach of this report a shorter list of important literature sources was selected to be used as the main stock of information as these papers contain the really relevant information which is needed as the first step in the red line of the whole relevant DIONYSUS activity 2.3 "Port Tariffs – Tool for Port & Hinterland Transport Development". These sources are mentioned in chapter 8.

Al these papers and sources define the core elements and input factors of port pricing and will be excerpted, discussed and summarized in the following chapters to give a broad and condensed theoretical background derived from literature. Furthermore, one concrete example gives an idea how these principles can be applied in real business practice of a port.

The „idea behind" this task of the DIONYSUS project is very good described by a paragraph of a literature published in 1995 but today in the year 2021 the content is even more important for good economic performance of inland ports:[Ref.(2)]

**"Public port authorities provide services and lease facilities for a range of prices which yield operating revenue for the port. This revenue, together with any subsidy, determines the viability of the port. In general, subsidies are now being reduced or eliminated and so port authorities must depend more on operating revenues. Therefore services are usually priced to generate a profit or at least to break even. For the port authority to be sustainable, it must also generate sufficient revenue to allow it to renew and expand its facilities and equipment as required. Pricing is a major factor in the implementation of a port´s strategic plan. The port management concept may be viewed from three aspects: the port´s planning a development philosophy, with its goals or objectives; the port´s investment criteria and policies; and the port´s pricing policies and techniques. Two basic approaches may be taken to pricing policy: ECONOMIC or FINANCIAL. The economic approach argues for marginal cost pricing, taking into consideration the effects on all parties, including benefits derived by others. The financial approach argues for prices to be set on the basis of accounting costs, to recover fixed and variable costs and to provide an adequate rate of return. The latter approach seeks to achieve a profit. Yet another approach used is the PUBLIC ENTERPRISE one which aims to foster local development and economic activities, so as to maximize throughput; it usually requires subsidies (for example to cover part of the fixed cost of infrastructure). The original report [UN-report 1975 / REF 1] argued the case for the economic approach. The present report subscribes to the same philosophy but argues that more flexibility is desirable in setting prices on the three critical elements – COST, PERFORMANCE and VALUE – as it is necessary to improve the financial**

**and operational performance of the port in an environment that is much more competitive than ever before."**

Once more – we have to bear in mind that this literature text has been written in 1995 but is nevertheless actual for today´s situation of ports.

Summing up, this situation can be depictured as follows: Ref.(7)

- Public Port Authorities provide services and lease facilities for a range of prices which yield operating revenue for the port
- Revenues, together with any subsidy, determine the level of sustainability of the port
- Services and lease arrangements are usually priced to generate a profit or at least to break even
- In order to maintain its acceptable levels of sustainability, a Port Authority must generate sufficient revenue to allow it to renew and expand its facilities and equipment as required
- Pricing is a major factor in the implementation of a port's strategic plan

**Source: Reference (7)**

## 2.2 Preliminary work of DTP-project DAPhNE Ref.(9)

In the years 2017-2019 the DTP-project DAPhNE was performed by a group of Danube inland ports and partners aiming at improving the inland waterway business. The actual project DIONYSUS refers to this basic work and goes much deeper into development activities regarding Danube waterway and port businesses. [*Source:* Danube Ports Network - DAPhNE / WP3, Activity 3.2 "Improve & harmonize port legislation"]

Regarding "port pricing" there was done some basic work in different several national reports of Danube riparian countries which can be summarized as follows.

As far as EU port legislation is concerned the rules have generally been implemented in the Navigation Law. On the level of international law the Danube riparian countries are contracting parties to the Danube Convention (Belgrade Convention) [http://www.danubecommission.org/uploads/doc/ convention-en.pdf]. The general principle of this convention is that navigation on the Danube shall be free and open for the nationals, vessels of commerce and goods of all states, on a footing of equality in regard to port and navigation charges and conditions for merchant shipping. While the convention mainly sets out rules

regarding shipping, it also contains general rules for port fees. The Danube Convention has the quality of a federal law in the countries.

Regarding “port fees” the national reports have shown that there are different types of fees applicable in the Danube ports. In general, port fees should be based on tariffs that apply to everyone in the same way. The fees should apply as soon as the ship moors the port and uses the facilities for transhipment or mooring. The person who has the right to dispose over the ship and the skipper should both be liable for the fee. The national legislations could also consider further details on charging system and payments of port fees all over the Danube region.

The following port services should be considered for charging:

- use of the port basin and mooring facilities for the purpose of transshipment and mooring
- use of waste and oil disposal facilities
- use of sanitary facilities for the crew
- use of drinking water
- use of electrical energy
- ice-breaking service in winter.

The fees should be published on a notice board in the port area in a way that they can be accessed at all times. Additionally, to the publishing in the port area the fees should also be published on the website of the port in order to provide port users with the relevant information before they enter the port area. Port fees should be based on fixed tariffs and calculation rules. The amount of the fees could for instance depend on the quantity of handled goods in tons. Another parameter for the calculation of fees could be the highest carrying capacity in tons of freight ships or the water displacement of ships that are not used for freight. The port fees and the calculation of the port fees should be laid down in the port bylaws.

This summary of basic work was one a starting point for the actual work in DIONYSUS project. In the following chapters the theoretical background for details of port pricing will be explored (mainly literature search) and even one detailed case study for an inland port will be documented. But this work is only the first step, three further subactivities will follow within this project to elaborate a comprehensive picture on “Port Tariffs – Tool for Port & Hinterland Transport Development” aiming at given the ports better tools for improving their performance in the next years.

# 3 Function of pricing in ports

## 3.1 Basic notions of port charges Ref.(1)

In this subchapter some basic information is given regrading pricing in ports which is depictured in relevant cited literature.

Pricing is an important aspect guiding the interactions between economic actors in the port industry. The port authority (most probably a public entity), other public bodies (State or municipally operated departments or enterprises), and private companies are the three types of economic actors that offer all kinds of services and facilities in a port and are, thus, responsible for setting the prices to be paid by the port users: The services that these actors offer include:

- Infrastructural services related to the use of docks, quays, locks, port sites/concessions, etc.
- Services to vessel and cargo such as terminal operations, warehousing and distribution activities, mooring, lashing and securing, surveillance, tallying/marking/weighing, inland transport operations, forwarding and supply chain management, shipping agency activities, ship and cargo surveying, customs, sanitary services, veterinary inspection, waste disposal, bunkering, water supply, etc.
- Nautical services such as pilotage, towage, vessel traffic management, etc.

The basic principle is that port users pay a price or tariff for the services offered to them and/or the facilities they use. Price has the greatest effect on the profitability of both the providers and the users of the service and is one of the “P” components of marketing (product, price, promotion, and place).

**Common terminology** which has been established over the last decades:

| | |
|---|---|
| **Port charges** | general term covering both port dues and specific port tariffs |
| **Port dues** | charge applied either on ship or on cargo (or both) for the general use of the port, without any service being specified |
| **Port entity** | a public or private body providing some (or all) of the port services and facilities; a port may contain several port entities |
| **Port authority** | the port entity which, under various names, is responsible for the administration of the port |
| **Transit storage** | the storage of goods in transit shed or open areas, for the short period normally necessary for the carrying out of the port operation (loading/unloading, clearance, receipt/delivery) |
| **Warehousing** | the storage in warehouses or other areas of goods which, for various reasons, need to remain in the port longer than the transit storage period |
| **Line handling** | service given to ship when it approaches or leaves a berth (e.g. the mooring lines) |

A port represents a collection of *physical facilities* and *services* designed to serve as an interchange point between land and waterborne transport. The provision of the services and the provision and maintenance of the facilities create a flow of costs for the port entity. The use of the facilities and services by the users of the ports creates for them a flow of benefits and it is to obtain these benefits that they make use of the port. The port authority, or any other port entity, through its pricing policy, can tap some or all of the flow of benefits and so create a flow of revenue for the authority.

There are, then, three separate elements which are important in the port-pricing field, namely the flow of costs, the flow of benefits and the flow of revenue. The costs are borne by the port authority or other parties providing facilities and services within the port, whereas the benefits accrue to the users of the port, namely cargo owners and ship operators. The revenue which can be created by tapping the flow of benefits accrue to the port entity concerned and represents the income from which it can finance its operations.

### 3.1.1 Different flows with regard to port pricing

#### 3.1.1.1 Flow of cost

The first is the real or economic cost, which is the cost of the resources used, such as capital, land and labour, which have alternative uses – an should be clearly distinguished from “financial cost”. In the absence of marked unemployment, labour can always be used in alternative ways and thus always has an economic cost. Land may, or may not, be capable of an alternative use, although in most ports situated in densely populated areas of great economic activity the value of the alternative use of land may be greater than that of its actual use in the port. Capital, on the other hand, frequently has no alternative use. Once a quay is built, it is useless for anything other than transferring goods between ships and inland; a breakwater can provide a sheltered haven and nothing else. Where there is no alternative use, there is no economic cost. Realistically, however, a port is concerned with its own costs in the sense of the annual cash outflow. Thus, while in principle, a pricing system has only to deal with economic costs, in practice, it has to provide a cash flow to meet the payments which the port must make, whether for costs which are recognized as economic or for those which are not.

#### 3.1.1.2 Flow of benefits

The benefits become clear if the value of a product is considered at its point of production in relation to its value in the market. In many cases — and as far as raw materials are concerned, in most or even all cases — the intrinsic value of a product at the point of production is zero. It is the existence of a market, probably far removed, which gives it a positive value. The difference between the two values is the benefit which accrues from the ability to transfer the product from the point of production to the point of sale.

The cargo owner sends his cargo to the port because, by doing so, by putting it at the point where the land transport and distribution system of his own country connects with the means of ocean transport, his product acquires a higher value than it would otherwise have. The ship operator sends his ships to the port because the product can have a higher value at the land/sea connecting point in the market area than it has in the production area. The benefit of each party is thus strictly measurable. For the cargo owner, it is

the difference between the value at the point of shipment (the f.o.b. value) and the value at the point of production, minus the costs of transporting the product from one point to the other.

For the shipowner, the benefit is that part of the difference in value between the point of loading and the point of unloading which he can appropriate to himself through freight rates, minus the costs involved in effecting the physical transfer. Any port authority needs to be fully aware of at least the approximate value of these two flows of benefits since they determine the limits of its capacity to raise revenue.

#### 3.1.1.3 Flow of revenue

The revenue to the port authority is that part of the benefit created for cargo owners and shipowners which the port authority can tap. It cannot tap more than the benefits it creates. If it tries to charge cargo owners more than the benefits offered to them by the port, the flow of cargo will dry up (either by ceasing to be traded or by going to another port). If it tries to charge shipowners too much, the ships will not call. It is for the port to decide how much of the benefit if confers on ships and cargo is to be left with the ship and cargo interests and how much is to be converted into a flow of revenue to defray its own costs.

***If a port is operating economically, then the flow of benefits will exceed the flow of costs. The relationship between these two flows and the judgement of the extent to which the port is economical are independent of the actual flow of revenue to the port. The flow of revenue to the port entity is a consequence of the pricing system which is used and of the level of the various charges which are made.*** [Ref.(1)]

Pricing strategies can contribute to achieving a sustainable competitive advantage. However, developing an optimal pricing strategy is complex. This is not only a strategy about setting prices and effectively implementing pricing policies. It also includes the measurement and enforcement of prices.

Not all actors in the port have direct contractual relationships that involve the charging of prices or tariffs. For example, container shipping lines pay container terminal operators for the handling of containers at the terminal. The pricing strategy of the terminal operator is thus focused on shipping lines. Cargo owners or their representatives (such as freight forwarders or 3PLs) do not pay the container terminal operator for container handling. Instead, the shipping line heads to recover the paid terminal handling costs from its customers (cargo owners, freight forwarders) through the freight rate and relevant surcharges, particularly Terminal Handling Charges (THC). Understanding the contractual relationships between port-related actors is a prerequisite for developing effective pricing strategies.

The pricing strategies of different port-related actors influence each other. The pricing system used and the level of fees set by one actor can affect the competitiveness of other actors and the entire port. For example, a port authority that levies excessively high land fees to terminal concessionaires might force the latter to charge higher cargo handling fees to the shipping lines, negatively affecting the port's attractiveness.

A cost center is an accounting device used to group port costs satisfying a given criterion. Such cost centers facilitate a proper analysis of port costs and are indispensable when building up a pricing system.

If a port is operating economically, then the flow of benefits will be equal to or exceed the flow of costs (i.e., cost recovery principle). Pricing systems are designed to transfer the advantages gained by the

recipients of the benefits, wholly or in part, to the provider of the services in the form of a revenue flow. It is useful to use revenue centers, i.e., accounting devices that allow the grouping of all revenues of the same nature. The definitions of cost and revenue centers should be related to each other in order to facilitate the comparison between revenue and cost. If a port actor tries to charge its customers more than the benefits offered to them, the relationship is not sustainable. In practice, however, certain indirect benefits of port services cannot be readily quantified and expressed as a financial flow, which complicates the setting of the 'right' price levels.

Not all port actors react in the same way to price increases or drops. Some port users are relatively captive to the port. This is either because of the lack of alternative ports to be used or because a decision to use another port would result in high switching costs. Other users are comparatively 'footloose' and very sensitive to changes in prices and tariffs. Furthermore, with ports embedded in supply chains, some port users attach greater value to the available capacity, reliability, and overall quality of the port services from a supply chain perspective than to the price. Port service and facilities providers should understand the customer base and figure out the role port-related prices play in explaining current and potential users' behaviour.

In line with the above, port actors should measure and analyse how specific pricing schemes affect the revenue/cost variation by product, customer, segment, channel, and geography. Such exercises help segment users understand how different prices can affect these different user segments and develop customized key performance indicators (KPIs) to facilitate the right pricing decisions. Data-driven technology supports pricing analytics.

Despite observed differences in price elasticity, it often is not advisable or feasible to design customized prices for each port user or cargo flow. Port actors typically try to balance tailored approaches to specific users and/or market segments and simple, standardized pricing or tariff structures. Simple pricing structures rely on a limited number of charges and the use of a limited number of variables in the basis for each charge.

Pricing can be used to influence the behaviour of port users. Penalty pricing acts as a 'stick' to customers who do not perform well or do not follow the rules. Examples include fines to shipping lines that do not respect the waste disposal rules and the penalties for terminal operators who do not meet the pre-set throughput guarantees as included in the concession agreement with the port authority. Incentive pricing works as a 'carrot' by giving a bonus or benefit to users who meet certain thresholds in performance or compliance. The endorsement of price differentiation practices based on the environmental performance of the users of the ports and/or a specific service is part of this approach (a good example is the Environmental Ship Index (ESI) program). Port-related actors can also apply bonus malus systems whereby the collected fees from the underperformers are used to reward the strong performers (bonus means good, malus means bad).

## 3.2 Limitations of port pricing Ref.(1)

The first port-pricing constraint is the need to cover, through port charges, the costs which are incurred by the port entity. In effect, since the flow of costs represents financial obligations, the port entity will need to obtain a flow of income to enable it to discharge these obligations. In normal circumstances, this income

will be the flow of revenue obtained from port charges. In the case of the self-supporting port, the flow of revenue must be at least equal to the flow of costs. If there is an excess, it will take the form of a profit which may, or may not, be used to create a reserve to finance future investment or to meet possible future deficits.

The cost constraint may be conceived for each service separately or for the port as a whole. In the former case, where each service is self-supporting, the limits within which the re-allocation of benefit may be carried out are very narrow. Such a limitation may hinder the achievement of additional aims, for example, the proper utilization of assets. Thus, while it needs to be known, and hence be a conscious decision concerning which services are, and which are not, self-supporting, a broad cost constraint, namely, that the port should cover its costs, gives greater operational flexibility and is more conducive to economic and efficient over-all operation.

It has to be clearly specified that in some cases the cost constraint cannot be satisfied, particularly when considered for each service rather than for the port as a whole. This happens when the level of benefits resulting from a service provided by the port is below the cost of providing it. Such a situation may result from

(a) mistakes in investment planning,
(b) the initial low utilization of a new investment or
(c) the fact that certain port assets are indivisible.

In cases (a) and (c) there may be a permanent gap between revenue and costs, whereas in the case (b) the gap is normally a temporary one. In such cases, cross subsidization of one service by another may be, if possible, used for bridging the gap. Nevertheless, there is a limit to such cross-subsidization, because no user will pay for the use of an asset more than the benefit which he derives from its use, and it may be difficult to compensate for an excess of costs over revenue in one area by higher charges in another.

Additional constraints

There are sometimes additional constraints, some of which result from the administrative status of the port. For instance, the port entity may receive instructions from the public authorities to give particular treatment to certain national port-users (owners of either ships or cargo). This treatment may limit the port charges which can be applied and hence the level of the benefit that can be re-allocated. To what extent such outside intervention is or is not desirable will be examined later

An additional constraint which applies in all ports is the need to ensure a good matching of inflows and outflows of cash (liquidity), in others to ensure that cash for making payments will become available at the right time in the form of corresponding liquid financial resources. Any disequilibrium in these two financial flows will necessitate measures — for example, because the port has to borrow and hence to incur interest charges - which could have an effect on the allocation of benefits through port prices.

As a result, if there is a conflict between the constraints and the objectives, it is the realization of the objectives that will suffer. Like constraints, the pricing objectives nevertheless contribute to the defining of the level of the re-allocation of benefits.

## 3.3 Objectives of port pricing Ref.(1),(2),(4)

Every port should endeavour to ensure that its facilities are used in the most efficient manner. It is the main objective of pricing to contribute to this effort. In effect, the port users demand for services and facilities will usually be affected by the level of the net benefit which stays in their hands after port charges have been applied. Each port has the capacity to determine this net benefit at a level which will encourage the economic utilization of the port assets.

If a port asset is in short supply, it may be desirable to discourage some port users from using it. In such a case, the desired result will be achieved by a pricing system that sets prices for the corresponding service so high that only those users who utilize the asset efficiently will have a net benefit great enough to make such a use worthwhile. An illustration of how prices can contribute to improving the utilization of port assets is the case of the transit-shed service. Unless the port has excess shed capacity, a pricing policy which encourages port users to allow their goods to remain in the transit shed instead of being warehoused outside the port, leads to overcrowding of the sheds and ultimately to inadequate utilization of quays and other equipment, delays to ships, waste of gang time and so on. Higher charges which encourage shippers to remove their cargo from the transit sheds as quickly as possible will permit better utilization of other port assets, even if they yield lower revenue to the port. If, however, the port had excess transit-shed capacity, then warehousing could be a source of income to the port and relatively low charges to encourage goods to be left in the port could secure better utilization of the transit sheds without jeopardizing the utilization of any other port assets.

No general principle can be laid down about the optimum or most rational utilization of any particular part of the port since the best form of utilization will vary from port to port, depending on the equipment and capacity of the port in relation to the volume of cargo and the number and type of ships using the port. What can be said, in a general way, is that for any service which is limited in relation to the demand for it, the objective of securing a rational utilization of the assets demands that the service be charged for in such a manner that it will be used mainly for the most valuable purposes.

The objective of ensuring the most economical utilization of assets cannot always be achieved through port charges alone. The pricing system can only influence the utilization of assets in as far as the demand for the services of those assets is elastic. When demand for a service is inelastic in relation to the price, other measures, generally more authoritative than pricing, have to be found.

There are many other possible objectives which may be assigned to port pricing. However, one additional objective of port pricing of particular interest for ports in developing countries, namely, to establish charges

at a level which tends to retain in the country the benefits arising from port improvements, must be discussed. In all ports, some users are foreign, and it may happen that such users have the possibility of not passing on to the country in which the port is situated the benefits which they derive from port improvements. An illustration is the case of a foreign shipowner who is in a monopolistic position. In such cases, port pricing, by tapping all or part of the user's benefit, may contribute to ensuring that benefits will not escape the country. It will be seen later, that in some cases there are other elements which may hinder the full achievement of such a particular objective.

Another pricing objective which deserves particular attention is that of building up financial reserves for cushioning the port against unexpected falls in revenue or rises in costs. Admittedly, the constitution of reserves implies fixing port charges at a level at which the planned annual flow of revenue is greater than the expected annual flow of costs. Nevertheless, a situation may arise in which the acceptable amount of the reserve is rather limited, mainly because higher reserves would hinder the achievement of other more important objectives. For instance, the improvement of the utilization of assets may require low pricing rates, and hence permit the accumulation of only limited reserves.

Another approach for pricing objectives can be based on formulating pricing policies and establishing tariff which ports generally endeavours to incorporate the following **pricing objectives**:

- **to promote the most efficient use of the facilities**: A principal objective of port pricing is to ensure that port facilities are used in the most efficient manner. The pricing system can influence the utilization of assets particularly when the demand for the services is price elastic. When demand for a service is inelastic, other measures, generally more authoritative than pricing, have to be found;

- **to retain the benefits resulting from investment within the country**: An objective of port pricing of particular interest for ports in developing countries is to establish charges at a level that tends to retain the benefits arising from port improvements within the country;

- **to recover sufficient revenue to meet financial objectives**: A third objective relates to building up financial reserves to prepare for unexpected falls in revenue or rises in costs. Nevertheless, the acceptable amount of the reserve may be limited, if other more important objectives, for instance the improvement of the utilization of assets, are to be achieved.

Other objectives of port pricing may include minimizing total logistics costs from a national point of view, providing an incentive to port users to improve their facilities and services and ensuring that the tariff is both practical and simple.

**Principal objectives for port pricing can also be clustered as following:**

- **Commercial**
  - Increase market share in selected markets
  - Maintain market share in other markets
- **Performance**
  - Enhance performance at congested facilities
  - Encourage more efficient use of facilities
  - Equate tariff rates with direct costs

- **Financial**
  - Equate the charges for individual businesses with their stand-alone costs
  - Generate additional revenues to
    - Meet current cash flow requirements
    - Fund future investments
    - Produce an acceptable return for investors
    - Satisfy mandated financial performance criteria.

## 3.4 Who charges what and who pays what? Ref.(4),(6),(8)

**Port Pricing by (landlord) Port Authorities - General considerations**

Landlord port authorities provide infrastructural and other services mainly to three groups of port users: the cargo owner, the shipowner/operator, and the concessionaires (if applicable). The typical revenues of a (landlord) port authority are directly linked to benefits created for cargo owners, shipowners, and concessionaires, i.e., cargo dues, marine charges, and concession/land fees. The cargo dues and marine charges combined form the port dues.

In setting the prices or tariffs for the port dues and land fees, port authorities might follow different objectives:

- Macro-economic, e.g., support the economic development of the region or maximize port employment.
- Economic-logistic, e.g., insert the port in supply chains in an efficient manner.
- Port-centric, e.g., guarantee a high utilization of port resources and assets.
- Financial, e.g., build up financial reserves for future investments and/or cushioning the port against unexpected falls in revenue or rises in costs.
- Sustainability, e.g., support green supply chain management and energy transition.

There are some general factors to consider when designing and implementing pricing systems:

The pricing structure (number of charges, type of charges, charging base) of a port should be designed to last for many years, although each port charge level may be modified as conditions change. It is a complex procedure for a port to change its pricing structure, and too frequent changes may be a source of confusion for port users. Very simple pricing systems may interfere with the achievement of the pricing objectives.

The pricing system

- should, ideally, be cheap to build and operate. The charging base should also rely on measures or data that can be accurately determined and easily be provided by the customers. For example, the traditional charging units for ships (as a basis for marine charges) are the gross tonnage (GT) or net

tonnage (NT) of the vessels, as this information is readily available and supported by official ship measurement documentation.

- should be understandable and ideally comparable between ports.

In practice, there is still quite some diversity in the various pricing systems and bases for calculating port charges throughout the world, hampering comparisons and benchmarking. In some parts of the world, supranational institutions (such as the EU) or national authorities have endorsed strict rules or general guiding principles for pricing by port authorities. These include common methods of calculating charges with tariff levels left to the discretion of the local port authorities.

Port authorities should explain clearly each charge, specifying which services are included and which are excluded. Many port authorities have developed tariff books in view of providing (public) access to the pricing system used and its components.

**Port dues**

Shipowners or operators have to pay port dues when calling at a port and/or stay in the port. There are different types of port dues:

Tonnage dues or marine charges: These costs are indivisible charges calculated on the basis of the ship's tonnage.

The basis for the calculation of marine charges can be the gross tonnage (GT) or net tonnage (NT) of the vessel, although in principle it is also possible to use other ship measurements, such as the deadweight tonnage (DWT). In order to determine the marine charges, the ship operator, the shipowner, the charterer, the master or the authorized representative must submit the vessel's international tonnage certificate (1969) when the vessel calls the port for the first time or when changes in the ship's measurement occurred. Payment of the marine charges entitles the vessel to stay at the port for an uninterrupted period (for example 10 or 20 days) from the day of arrival at the port. Upon expiry of that period additional marine charges will be due. The time a vessel spends in a dry dock is usually excluded from the official port time.

The marine charges to be paid per GT or NT can vary and discounts might apply: The charges may vary per ship type and, occasionally, also per ship size. For example, quite a few ports apply lower marine charges per capacity unit for container feeder vessels compared to mainline container vessels. The tariff setting for specific ship types and sizes is influenced by the level of competition exerted by neighbouring/co-competitor ports for accommodating the same vessel class.

It is quite common to have different marine charges for liner ships (i.e. vessels operating in regular liner shipping services) and vessels operating in non-liner trade.

Discounts might apply to shipping lines who exceed a certain threshold in terms of the number of vessel calls (frequency-based discount) or the ship-related cargo volume handled in the port (traffic-based discount) per time period (month, quarter or year).

Many ports have developed voluntary programs to promote green shipping. Within the framework of such programs, the port authority usually grants a discount on the marine charges for ships that meet certain minimum environmental standards. A good example of such a voluntary program is the Environmental Ship Index or ESI.

Reduced marine charges or discounts might apply to sea-going vessels entering the port for a short period solely for bunkering, repair or disinfection purposes, sea-going vessels entering the port because of perils at sea, or vessels entering the port exclusively for transit purposes (for example, when passing through the port to reach another port upstream).

**The Environmental Ship Index program**

The port authority might decide to exempt some vessel types from paying marine charges. The following vessel types typically fall in this category: school ships, war ships, sea-going vessels that remain inactive at the roadstead, sea-going vessels that call into port solely for tank cleaning and/or degassing purposes, and sea-going vessels involved in operations on behalf of the port city or other local or national government agencies.

Cargo dues, berthing dues or wharfage dues are indivisible charges calculated on the basis of the goods unloaded and/or loaded by the vessel in port, expressed in tons.

The calculation of the cargo dues is based on the number of loaded or unloaded tons as reported on the electronic declaration. Port authorities usually charge a different tariff depending on the type of cargo. For example, separate cargo dues per ton might be applicable for containers, non-containerized general cargo and bulk cargo.

The total port costs for the port user are not limited to the port dues collected by the port authority. Other major cost factors linked to a port call include:

Costs associated with the handling of the ship's cargo at a terminal. These cargo handling fees, tariffs or costs are collected by the terminal operator.

Costs paid by the shipping line for compulsory marine and nautical services such as pilotage, berthing, and towage (tug assistance). These costs are usually incurred when entering and leaving the port, and based on vessel size. Depending on the port, these types of services are offered by the central or local government, the port authority and/or one or more private companies.

Most ports also have separate charges for waste reception at port reception facilities. These can be fixed, floating or mobile facilities which carry out reception of ship's waste or cargo residues (i.e. remnants of any cargo material on board in cargo holds or tanks). A ship's waste includes oily waste such as sludge, bilge water and used engine oil; and ship's garbage such as food waste of the crew, domestic waste and maintenance waste from the engine room. Regulations are in place to deal with waste reception in ports. For example, in accordance with Directive 2000/59/EC of the European Parliament and of the Council of 27 November 2000 on port reception facilities, all vessels calling at a port of the European Union should deliver their waste to a port reception facility before leaving the port (unless there is sufficient storage capacity on board) and have to pay a waste fee.

**Port concessions/land fees**

The port authority or government can set the fees and the fee structure for port land that has been concessioned/leased to terminal operators and other companies active in the port area. On the one hand, port users demand a transparent, uniform, and stable fee system. Such stability of the fee structure is essential in view of the investment decisions of the terminal operator. On the other hand, port authorities are tempted to apply the market mechanism in setting the fees for the use of valuable port land.

The pricing system deployed by the managing body of the port for the use of the port land tends to vary widely among ports. The options available include:

- The managing body of the port imposes a fixed rent per year on the operator for the land surface in use (for example, in USD per square meter per year). This rent is usually determined on the basis of the following parameters: condition of soil, infrastructure investments made by the port authority, location of the site and activities that are performed on the site.
- A lump sum to be paid annually regardless of the financial results from the operating activity plus a variable payment (the bigger of the sums: percentage from the total cash flow or coefficient per ton).
- A fixed rent per year on the land area plus a percentage of the revenue earned (royalty fee).
- A fixed rent for the land surface in use adjusted for a bonus/malus system, depending on an annual throughput or activity in relation to the guaranteed volume/activity.

Concession fees can change based on a substantiated review, and typically are adjusted annually in line with inflation. Payments are to be made in advance every month, quarter or year.

The following tables provide practical overview on how these above mentioned descriptions could be operationalized (examples).

**Table 1: Port of call pricing**

| Activity | Who is pricing? | Who is paying? | Variable(s) applied |
|---|---|---|---|
| Port dues<br>▪ Tonnage dues<br>▪ Mooring dues | Port authority | Shipping line | Gross tonnage (vessel)<br>Load (ton) |
| Pilotage<br>▪ Sea pilotage<br>▪ River pilotage<br>▪ Dock pilotage | Government<br>Government<br>Port authority (plus shipowners association(s)) | Shipping line | Draught (entering and leaving)<br>Draught (entering and leaving), and distance<br>Lenght of the vessel plus distance |
| Towage<br>▪ River tugboat<br>▪ Port tugboat | Private company<br>Port authority | Shipping line | Length of the vessel plus distance<br>Gross tonnage plus distance |
| Agency costs | Shipping agents | Shipping line | Job-by-job fee in case of independent agent; lump sum in case of ship owner's agent |
| Other costs<br>▪ berthing/unberthing<br>▪ ship reporting | Private company (can be linked to port authority)<br>Private company (or port authority) | Shipping line<br>Shipping line | Per port call<br>Per port call |
| Port state controll | n.a. | Government | Condition of the vessel |
| Waste reception facilities | Service company | Shipping line | Quantity and type of waste |
| Bunkering | Bunker supplier | Shipping line | Quotation international markets;<br>quantity supplied;<br>number of bunkers a year |
| Supplies<br>(water, electricity, etc.) | Supplier (may be private company, port authority, or government | Shipping line | Quantity supplied |

**Source: Reference** [6]

**Table 2: Handling pricing**

| Activity | Who is pricing? | Who is paying? | Variable(s) applied |
|---|---|---|---|
| **Cargo handling on quay** | TOC * | Shipping line through its agent if terms of sale are liner terms.<br><br>Recipient depends on the contract (free out) | Per weight (tons) or movements (containers) |
| **Transport to/from storage** | TOC<br><br>Carrier if cargo is transported to storage area outside the terminal premises | Shipping line or receiver depending on the terms of sale (see above) owner | Per weight (tons) or movements (containers) |
| **Storage** | **TOC** | Recipient of the goods | Per unit of weight (ton of TEU) and time (cf. dwell time) |
| **Delivery/receiving** | TOC | Recipient of the goods | Per unit weight or TEU |
| **Cargo moving inland** | Inland transport operator (rail operator, barge, truck) | If carrier haulage: shipping line;<br>If merchant haulage: the recipient of the goods | Per TEU unit or per ton |
| **Customs** | Customs authority | Owner of the goods via customs broker | According to value of goods and customs clarification |
| **Handling of empty boxes** | TOC | Shipping line | Per box |
| **Storing of empty boxes** | TOC | Shipping line or leasing company if boxes out of lease | Per box and dwell time |

* TOC stands for Terminal Operating Company (or stevedore)

**Source: Reference** [6]

**Table 3: Concession pricing**

| Activity | Who is pricing? | Who is paying? | Variable(s) applied |
|---|---|---|---|
| **Granting concession** | Port authority (i.e. market-based, after tendering) | Concessionaire (stevedore, industry, …) | Size of the area, location, facilities, … |

**Source: Reference** [6]

Within a port context, the carrier is billed by the port authority, the agents, stevedores, government and all other service providers. These payments may be regarded as 'out-of-pocket' costs borne by the carrier. Obviously, to a carrier, this port-of-call cost is an important consideration in setting the price for the end client, i.e. the owner of the goods and/or the forwarder.

Another literature approach is summarized as following using the types of port charges as characteristic element.

**Table 4: Different tariff categories**

| Categories | Type of charges | Changing units | Differentation |
|---|---|---|---|
| **General tariffs** | Conservancy, port dues | Vessel GRT, NRT, length, beam, draft | Type of vessel |
| | Wharfage | Freight or metric ton, cubic metre, TEU | Type of commodity |
| **Facilities tariffs** | Berth hire | Metre-hour, berth-hour, berth-day | Type of berth |
| | Transit storage (short term) | Day | Open or closed storage, days in storage |
| **Service tariffs** | Pilotage | Vessel movement | Location of pilotage starting/end |
| | Towage | Vessel movement | Vessel GRT, NRT, length, beam, draft |
| | Berthing/unberthing, mooring | Vessel movement | Vessel GRT, NRT, length, beam, draft |
| | Stevedoring, wharf-handling, receiving/delivery | Freight ton, metric ton, cubic metre, TEU, box | Form of cargo |
| | Equipment hire | Half-hour, hour, shift, half-day | Type of equipment |
| | Cargo processing | Freight ton, metric ton, cubic metre | Form of cargo before and after |
| | Warehousing (long term) | Week, month | Type of storage (open, closed, frozen) |
| | Fuel, utilities | Kg, metric ton, cubic metre | Capacity provided |

**Source: Reference** [4]

Port charges (mostly in seaports) are generally divided into three broad categories, general tariffs, facility tariffs and service tariffs, each of which are subdivided into a series of individual charges. It is common to establish a charge to recover the cost incurred in providing the facilities and services which are necessary to ensure the safe navigation of vessels within the area under the port's jurisdiction. It may include dredging, the provision of breakwaters, training walls, navigational aids and harbour surveillance facilities, but usually excludes the costs of providing pilot and tow services which are charged by separate tariffs.

- Conservancy is a port charge which is levied for the utilization of general nautical facilities in the approaches to the port (i.e., outside the port area), whereas port dues are levied for the services or utilization of facilities within the port, including channels, vessel traffic service, emergency fire services, breakwaters, pollution control and marine security. This port charge can be rarely or never found in river ports.
- Port dues on ships are based on the type and size of the vessels. The charging units would be the carrying capacity of the vessel measured in gross registered tonnage (GRT/GT*), net registered tonnage (NRT/NT*) and deadweight tonnage (DWT*) or some combination of length, beam and draft, and the unit of differentiation should be the type of the vessel.

  [*GRT is a measurement which is no longer used and represented a volume of all enclosed spaces on a ship with 100 cubic feet = to one ton. Instead, a Gross Tonnage (GT) measurement is used today and represents a measure of the ships total interior volume and is calculated by multiplying the interior volume "V" of the ship in cubic meters by a variable known as "K" (which varies depending on the ships overall volume).

  *NRT is a measurement which is no longer used and represented a measurement of volume of actual cargo storage areas when dividing the cubic volume in feet by 100 to get the "tonnage". This includes any tanks, cargo holds, etc. that are normally used for transporting cargo.

  *DWT is the weight (in tons) of all the cargo, fuel, dry provisions, supplies, etc. carried on board the ship.]

- Wharfage is normally a cargo-related charge to recover the costs associated with the provision of the basic infrastructure and superstructure of the port to facilitate the movement of cargo from shipside to hinterland and vice versa. It includes the costs of providing roadways, railways, quays, parking areas, transit shed facilities, police surveillance etc. Similar to port dues, wharfage is charged by freight ton, metric ton, cubic meters or TEU, and its differentiation unit is the type of cargo.
- Berth hire (dock or berth due) is a charge, normally related to the ship, to recover the costs associated with the berthing of the vessel and for the use of the berth for a stated period of time. It may include expenditure on the provision, maintenance and operation of docks, maintenance of dredged depths alongside and in the dock basin, fendering, provision of quays and facilities provided on the quay apron. The charging unit of the berth in seaports due is usually meter-hours, computed as the length of the vessel multiplied by the hours that the vessel is at the berth. The unit of differentiation may distinguish among the berths by their characteristics, such as alongside depth, back-up area and cargo handling capacities.
- Transit storage is the charge to recover the costs of the storage of goods in transit sheds or areas. The temporary storage rates are usually set to minimize cargo dwell time and maximize throughput. The charging unit is the amount of storage occupied multiplied by the period of storage measured in days. The storage can be differentiated based on the dwell time so as to charge higher rates for

an extended period of storage. Separate tariffs can also be used to distinguish between open and closed storage and among different types of cargoes.

- Pilotage arises in two areas: the seaway gaining access to the river estuary and the port area itself. In many instances, the pilot service is compulsory. The pilotage may be based on the GRT/GT of the vessel or a charge per ship. In general, as the cost of providing pilot service does not vary for different sizes of vessels, it is appropriate to charge pilotage simply based on the vessel's port call. However, it can be differentiated by the location where the pilotage starts and ends.
- Towage service is usually optional. Occasionally, the towage tariff is included in another charge such as pilotage. Towage is usually based either on the characteristics of the ship or the tugs performing the operation. Towing costs increase with the size of the tugboat used and the time of use. Therefore, the common practice is to charge a towage per hour and to differentiate based on the size of the tugboat used. However, in some cases it is charged as a fixed rate irrespective of the time taken for the operation and differentiated by the vessel's type and size.
- Mooring/unmooring (berthing/unberthing), also known as “line handling” is a specific tariff applied for berthing/unberthing and mooring operations. This tariff is charged simply by the vessel movement but can be differentiated by the vessel's size measured in GRT/GT, NRT/NT or some combination of length, beam, and draft.
- Stevedorage costs should be directly related to the costs involved in handling commodities. Stevedoring companies in many ports are characterized by the high level of variable costs, for example, labour and a comparatively low level of fixed costs such as mobile plant, buildings. Therefore, in stevedoring operations the marginal costs and average costs may be identical. The stevedoring charge is usually levied per freight ton, metric ton, cubic meters or TEU of cargoes. Stevedoring firms often reserve the right to calculate the charge on the volume or weight of the cargoes. It is common for all cargoes to be divided into groups according to various criteria and a uniform rate applied to each group.
- Warehousing charges: In most ports, there is a free period during which no charge is made for storage. Warehousing charges apply to goods that need to remain longer in the port and are, therefore, transported to special premises reserved for that purpose. After the free period has expired, the tariff usually takes account of the length of stay of the goods in the storage place. In some cases, this charge per unit of time, usually the day, remains constant, regardless of how long cargo remains in storage after the given free period. However, in many cases, the charge per unit of time increases with the length of time spent in storage in order to discourage any abusive lengthy storage. This charge can be differentiated by type of storage, such as open, closed or frozen storage and by different types of cargo.
- Other tariffs: In addition to these specific tariffs, some ports levy other tariffs for services to the ship or to the cargo. These services may include fuel, water and electricity supply, labour supply, rent of equipment and cargo processing, such as weighing, marking and repacking.

# 4 Pricing principles [Ref.(3),(7)]

**Charging bases**

Ports usually charge two types of fees: a general port due and charges for specific services. The general pricing principles apply equally to both. However, the transfer of the general principles into port dues and specific service tariffs relates to two important components: the price and the charging base. The charging base should reflect the amount of service that is used. The fulfilment of the user pays principle strongly depends on the right choice of the charging base. If the charging base is not available the principle cannot be fulfilled. An important aspect in the discussion of the charging basis is the structure of services that are provided in a port. The many kinds of using for different services results in variable charging bases and in an extensive tariff structure. The overall service provided by a port is the transfer of goods between sea and land, or in other words: the main activity in port is the facilitation of the movement of goods. The fact that these goods move to and from ships (or lorries, wagons) is a secondary issue.

**Table 5: Three types of port services**

| Three types of port services | |
|---|---|
| 1. Sea (River) related services | Provision of access and berthing for ships |
| 2. Land related services | The handling of cargo |
| 3. Delivery related activities | Administrative tasks, customs, and value added activities |

**Source: Reference [(7)]**

The ultimate beneficiary of the quay is the consumer of the seaborne or river-borne trade who transacts the cargo handling. The consumer has to pay for all costs of the quay, regardless whether they are separately charged on the ship or the cargo. The following typical figures show that cargo handling costs are the largest charge in transshipment:

**Table 6: Relative shares of port charges**

| Charge | Share (%) |
|---|---|
| Port dues | 5-15 |
| Pilotage, Towage, Berthing | 2-5 |
| Cargo Handling | 70-90 |
| Agent fees | 3-6 |

**Source: Reference** [7]

**The role of pricing in port management**

The efficient operation of a port requires a sound strategic plan. This has its origin in the port's management concept, which may contain:

- a planning and development philosophy, including goals and objectives
- investment criteria and policies
- pricing principles and techniques

These elements are interrelated and changes in one will significantly affect the others. A port can have many goals and objectives but, in general, one can distinguish between two main doctrines, each of them set their own objectives. According to the article one may distinct between theoretical models:

- The Continental European doctrine: ports are seen as part of general infrastructure of a country or a region and as such they play an important role in the development of trade and industry to, from and in that area.
- The Anglo-Saxon doctrine: Here ports are viewed as business enterprises, with their own responsibility to be profitable and earn enough returns to allow them to replace their assets. A further distinction may be between "Latin model" (often involving centralised governance of ports) and "Municipal Hanseatic model" (mostly applied in Germany, Netherlands, Belgium with focus on autonomous port authorities).

Under the Anglo-Saxon doctrine, an important objective may be profit maximization. This is not always the case, however, since ports may just strive to recover costs, including those of capital expenditure. This notwithstanding, such 'company ports' have to realize a profit or at least to break even to continue to exist. For the coverage of possible deficits, they cannot appeal to a central authority for assistance.

In the case of ports falling in the Continental doctrine, one important objective is to promote trade and regional development. In a function as a clear social benefit the costs necessarily don't need to be recovered by the direct users of the port, but may be recovered by a much larger group of beneficiaries in the form of taxation. As a result, port costs may be directly borne by the State in its various manifestations. Here the port does not have to break even in a strictly financial sense. In some cases, it is even pointless to try to

assess what the financial balance of a particular port is, since depreciation of assets is not included in the general accounts.

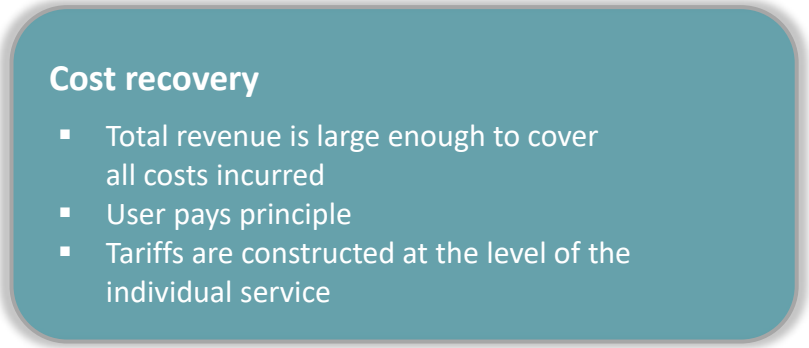
**Pricing principles**

There are four general charging principles involved in port pricing:

- **cost recovery**
- **charging what the traffic can bear**
- **promotion of specific objectives**
- **strategic pricing**

## 4.1 Cost recovery

This first principle, entails a pricing system whereby the total revenue is large enough to cover all costs incurred. It depends on the level of aggregation in the construction of the tariff system whether this leads to prices for services that reflect only the costs of those specific services. This is the objective of the 'user pays' principle. Therefore, cost recovery and the 'user pays' principle only leads to similar outcomes if tariffs are constructed at the level of the individual service. Cost recovery is not an economic, but a **financial objective**. The recovery of all costs is not at all relevant in a price-setting exercise with the objective of ensuring that resources are efficiently allocated. Thus, strict adherence to full cost recovery may break the marginal cost pricing principle in certain circumstances.




**Source: Reference** [7]

## 4.2 Charging what the traffic can bear

'Charging what the traffic can bear' builds on the principle of cost recovery. However, instead of charging an amount equal to the cost incurred, now the charge is related to the users' willingness to pay. That is why this pricing principle is also known as value bases pricing. In this way, the price is based on the actual benefits the user derives from the service, rather than on the costs incurred by the provider. "Charging

what the traffic can bear" can be viewed as a pricing structure that consists of a floor of marginal costs, which is marked up for the individual user on the basis of his particular elasticities of demand. This charging strategy is very common in monopoly industries, where the producer has the ability to charge each customer the maximum price the purchaser is willing to pay.

**Main points:**

- Users' willingness to pay
- Price is based on the actual benefits the user derives from service
- Common in monopoly industries
- Reduces economic welfare

**Source: Reference [7]**

## 4.3 Promotion of specific objectives

The promotion of specific objectives must unavoidably combine cost recovery considerations with the attainment of certain perceived societal priorities. Examples include port operations at a level of capacity utilisation, where

- port user costs are minimal,
- the promotion of the use of specific access roads,
- the optimal integration of a port in the transport network,
- the facilitation of the country's exports.

This pricing principle may not allow cost recovery at the level of individual service. Some services may have to cross-subsidise others in order to satisfy specific objectives, while total costs for the port are still completely recovered.

**Promotion of specific objectives**

- Pursuing societal priorities
- Port operations at a level of capacity utilisation where port user costs are minimal
- Facilitation of the country's exports

**Source: Reference [7]**

## 4.4 Strategic pricing or market based pricing

In contrast to the principle of 'charging what the traffic can bear' -that assumes knowledge by the port of the demand for its services- the principles of cost recovery and promotion of specific objectives are based on a more or less isolated view on the particular port. In many instances this is not realistic. For example, ports in the Hamburg-Le Havre range are in strong competition with each other. In the same sector a port's pricing decision will invariably result in some countervailing action by other ports. Nowadays it is well accepted that ports take the expected reaction of their competitors into account in their own tariff decisions. In other words, ports will employ a strategy in their pricing decisions that anticipates the reaction of other ports. Tariffs resulting from this strategic pricing may or may not satisfy the other three principles mentioned above.

**Strategic pricing**

- Pricing strategy that anticipates the reaction of other ports
- Tariffs resulting from this strategy may or may not satisfy the other three principles

**Source: Reference** [7]

# 5 Port pricing approaches Ref.(2),(4),(7)

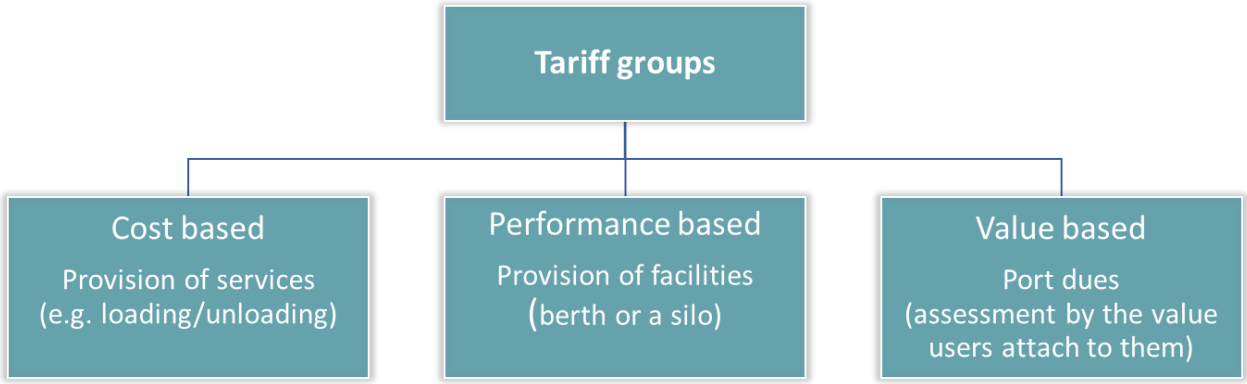
The cost, performance, value or CPV approach allows port managers through tariffs to accomplish different sets of objectives. The cost-based tariffs are used to achieve the marketing objective of maximizing the use of port services and the financial objective of covering the variable costs of these services. First performance-based tariffs are used to achieve the operational objective of maximizing the throughput of port facilities and concurrent limiting the level of congestion experienced by users. Secondly, the marketing objective of minimizing the loss of traffic owing to congestion. The value-based tariffs are used to meet the financial objective of generating sufficient revenues to cover the ports' costs and the marketing objective of limiting the loss of traffic as a result of generating these revenues.

The CPV approach also allows a more flexible view of the limits to pricing. The "floor" or minimum limit means that the port authority *must not charge* less than the incremental cost which the user incurs in serving. The "ceiling" or maximum limit means that the port *cannot charge* more than the value received by the user. Both can be changed through actions of the port authority or operators. The "floor" can be lowered through increased productivity in the provision of a service, owing to more efficient allocation of resources and procurement of more efficient resources. The "ceiling" can be raised by providing additional capacity of the facilities that will lower congestion. In general, improvements in the quality of services raise both the "floor" and the "ceiling" as the increase of the value to the user of the service or facility, is often accompanied by an increase in the cost of providing those services or facilities. The economic environment can also cause these boundaries to shift. An increase in competition can lower the "ceiling" by reducing the profitability of a trade or by providing alternative lower-cost routes and ports. Inflation and changes in currency exchange rates can modify the boundaries through changes in the marginal costs of resources being deployed or the value of commodities being shipped.

The actual tariff level lies between the two boundaries and, through the number of users, determines the level of demand for the services and facilities. In effect, the last user, also called the marginal user, is the one who receives a service, or uses a facility, which he values just equal to the price he pays for it. In so doing he takes into consideration the quality of the service and the turn-around time. Therefore, the rationale for fixing the price should take into account the incremental cost incurred by the port authority or operator to serve the marginal user which increases with the use of the service and facility and in turn is determined by the price charged. Therefore, if the price falls below that incremental cost it must be increased that the demand and the incremental cost are lowered.

This reasoning can be followed for each tariff item by employing one of the three elements of the CPV approach. The selection of the element appropriate for each tariff item may be determined by examining the tariff structure and the function, level and charging unit of each tariff category or item.

**Figure 1: Tariff groups**




**Source: Reference** [7]

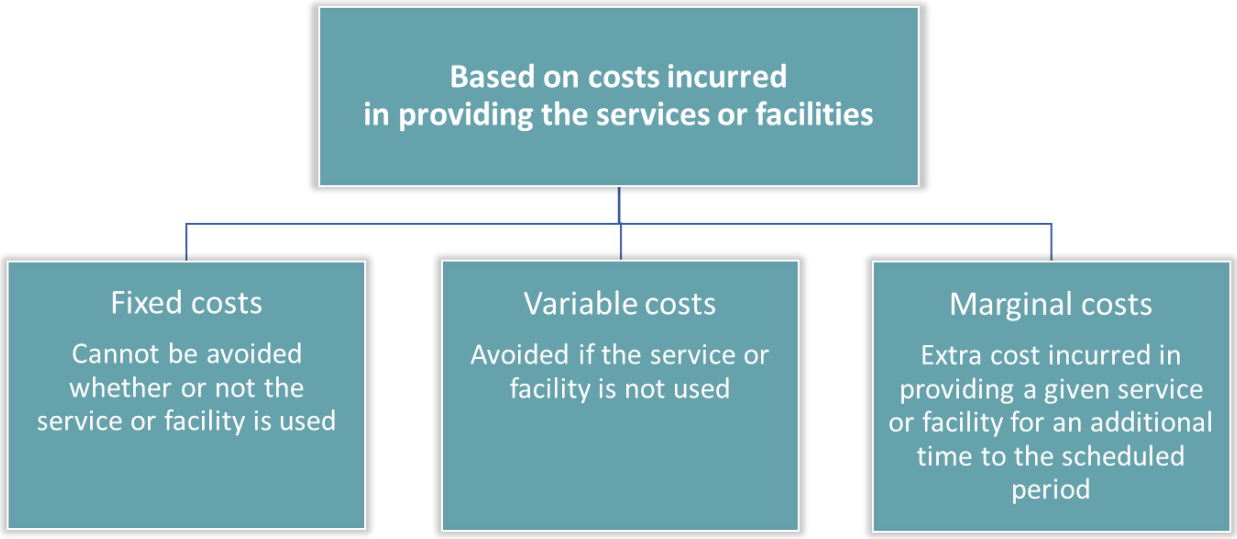
## 5.1 Cost based pricing

Port tariffs related to the provision of services include pilotage, towage, berthing/unberthing, mooring, stevedoring, wharf-handling, receiving/delivery, cargo processing etc. These service tariffs are usually determined on the basis of the costs incurred in providing the services. Different prices, however, can be obtained different types of costs are taken into consideration. Port tariff items can be divided into three groups, those related to:

- the provision of services
- the provision of facilities
- general tariff items

Different groups of tariffs can be determined by different pricing approaches.

**Figure 2: Cost-based pricing**




**Source: Reference** [7]

### 5.1.1 Average cost pricing

This pricing approach is based on average cost determined by adding the total fixed and variable costs and dividing this sum by the projected demand for the service. The advantage of these port tariffs assure that the revenues collected will equal the total costs, assuming that the projected demand is realized. This approach gives priority to achieving an overall financial target, namely a stand-alone non-subsidized price. For ports with a high proportion of fixed costs, increasing the throughput may significantly decrease the average or per unit cost. A disadvantage of average cost pricing is that there is a tendency to set prices higher when demand is weak and lower prices when demand is strong. Furthermore, this approach excludes those clients that cannot afford to pay a given price.

### 5.1.2 Variable cost pricing

Pricing based on the unit variable cost is determined by dividing the total variable costs by the projected demand for the services and the facilities. In general, this approach is only appropriate where variable costs are a large share of the total costs as in labour-intensive break-bulk cargo handling operations due to the use of casual labour. Tariffs based only on variable costs have generally not been introduced, even though they encourage efficient use of port resources. The reason is that many port services and facilities have variable costs that are too small to serve as the basis for a tariff and to cover the port's expenditures. If a tariff is based on variable costs, the losses incurred need to be offset by other tariffs. However, the pricing based on variable costs can achieve the operational objective of maximizing the use of services and the financial objective of covering the variable costs of these services.

### 5.1.3 Marginal cost pricing

Pricing based on the unit marginal cost is determined by dividing the marginal costs by the projected marginal demand for the services. The tariff based on the unit marginal cost requires that the relationship between variable costs and expected throughput demand be known for the period during which the price will prevail. Therefore, it is necessary to estimate the change in resource productivity as demand increases. This information is difficult and time-consuming to obtain. Change in variable costs over a long period of time must be correlated with variations in demand. These inherent problems and the problems due to estimation and distribution of the short- term and the long-term marginal costs, have led to unit marginal costs hardly being used to set port tariffs. Furthermore, the marginal cost pricing should be based on competitive market principles, but the port industry is characterized by monopoly. Therefore, marginal cost pricing has some limitations as a basic port pricing theory, even though it is economically efficient, flexible and the fairest pricing tool.

## 5.2 Performance based pricing

The second group of port tariff items is related to the provision of facilities, such as berths and storing facilities. The main objective of these facilities tariffs is to promote efficient use of a facility focusing on performance, which is accomplished by using the facility at an optimal level. By so doing, it equates the interest of the supplier of the facility with its users, although calculation of optimal levels of utilization is not easy to carry out for all facilities.

Rough rules of performance-based pricing are:

- increase the tariff when the level of utilization is above the optimum
- decrease the tariff when the level of utilization is below the optimum

When the level of utilization is well below the optimum level, the cost of the facility is also recovered by other tariffs, or perhaps a subsidy. However, the subsidy will encourage undesirable behaviour by users that may be difficult to correct in the future. Therefore, a minimum price, higher than that suggested by the variable or marginal cost, must be set to ensure efficient behaviour by users.

Performance-based pricing can also be applied to encourage users to follow efficient practices while occupying the facility. For instance, discounts from the published tariff can be offered to those ships that start to work, for example, one hour after berthing, and surcharges or fines can be applied to those that start after three hours.

**Performance-based pricing promotes efficient behaviour of the users**

> Shortage of properly equipped berths increases the average time vessels wait for a berth and lengthens the time at berth, thus increasing the vessel operators' costs.

> Determine the optimal number of berths by balancing the occupancy rate of berths which minimize the total cost of ship time in port with the cost of providing that number of berths.

rough rules
(i) decrease tariff when level of utilization is below optimum
(ii) increase tariff when level of utilization is above optimum.

**Source: Reference** [7]

## 5.3 Value based pricing

General tariff items in the third group, such as port dues and wharfage, can be better determined by the value added to the activities of the users by the services and facilities. The objective of value-based pricing is to generate enough revenues to cover all costs incurred in providing services and facilities, including those not covered through a variable cost-based tariff for services. The value added to users' activities is estimated through their willingness to pay for a service or a facility. In general, it is reasonable to expect that changes in tariffs levels have the same impact on all users. **Value-based pricing** is a familiar feature of pricing policy within a service sector whose benefits are heterogeneous. For example, if the volume of cargo shipped through the port is divided into several groups with different price elasticities, each cargo group can be charged a different price according to the value of the service. The port may distinguish between those trades which the port wants to promote and those which are not of interest. The effectiveness of value-based tariffs depends on how successfully the structure of the tariffs differentiates among potential users. Separate tariffs for containers, breakbulk, liquid bulk and dry bulk cargoes can be used to differentiate among cargoes according to their value and price sensitivity. Differentiation can also be accomplished among different groups of port users within a tariff category.

## 5.4 Market based pricing

An increasing number of port authorities are using the technique of market pricing. Market pricing is essentially the practice of correlating the port tariffs to potential market demand and sensitivity in order primarily to maximize cash flow, attain good utilization of facilities, counter competition, stimulate market growth and improve profitability. Examples of market pricing include discounted tariffs for volume commitment, such as a 10 percent discount on the published tariff on 100,000 tons annually, or lower tariffs in the less busy period to spread the traffic flow through the port.

In adopting market pricing, care must be taken to ensure that the full rate traffic is not diverted to the lower rate in an endeavour to generate a higher volume of business. Existing tariff levels, costs, competition, agreements with shipowners and market sensitivity should be carefully evaluated. For example, there is nothing to be gained by offering a 40 percent off season discount for particular traffic, if the market is insensitive to price. Finally, market pricing should be avoided if it leads to a tariff war. It may generate additional traffic, but the average rate will fall and there may be little prospect of increasing revenue.

# 6 Case Study on Port Pricing: Practical Example of an Austrian Inland Port

Literature research on port pricing is a quite theoretical task showing a wide field on input factors and considerations. In order to make it a little bit more understandable what can come out of the theoretical basics and how these basics will be implemented in practice, in the following chapter a practical example will be presented. One inland port on the Danube in Austria was selected for this. As the Ennshafen port (a TEN-T core node port on the Rhine-Danube Corridor) is organized in the form of a landlord port and shows very good the broad field of practical implementation of port pricing principles.

In Austria since decades the ports are organized in the legal form of a "GmbH" based on private law, even the owners of the port companies are players of the public sector. The great advantage of this status is, that the port companies are free to make decisions of pricing systems for those pricing elements, which are not regulated by public laws. Some of these laws regulate ship & port business in Austria and influence some pricing elements, the other pricing decisions are based on market elements. The detailed background and practical implementation will be described in this section.

**AUSTRIAN LEGAL BASES**

- Federal Act on Inland Navigation /Shipping Act – ["SchFG / Schifffahrtsgesetz"]
- Ordinance of the Federal Ministry of Transport, Innovation and Technology on shipping facilities and other installations and works on waterways ["SchAVO / Schifffahrtsanlagenverordnung"]
- Tariff regulations using the example of Ennshafen port

**Shipping Act [SchFG] of 2015-07-23 (BGBl. I No. 62/1997 idgF)**

In the 6th main section of the SchFG, the port charges are regulated in sections 68 to 70, which are summarised in extracts as follows:

Port charges for public and private ports (in cases of emergency and winter status):

(1) For the use of public ports by vehicles or floating objects, port charges may be charged only on the basis of tariffs which apply in the same way to everyone.

(2) The following services are covered by the payment of the port fee:

- Use of the port for handling or demurrage purposes
- Use of waste and waste oil collection points
- Use of sanitary facilities intended for the crew of the ship and drinking water supply
- Facilities of keeping the port free of ice

(3) The person entitled to use the vehicle or floating object and the skipper are obliged to pay the port fees.

(4) Determination of tariffs by legislated ordinance pursuant to § 70

(5) Publication of tariffs

Determination of port charges is made by issuing regulations on the determination of services to be compensated by port charges:

(1) Fee types (shore fee, demurrage fee and winter fee)

(2) Basics of the calculation of port charges, taking into account the handling of goods and the type and size of vehicles or floating objects

(3) Determination of port tariffs

(4) Exemption for vehicles in the public interest or of vehicles or floating objects used for port operations

(5) the claim of the fees and the date of the maturity of the port charges

**Shipping Systems Ordinance [SchAVO] of 2015-07-23 (StF BGBl. II No. 298/2008)**

In the 5th and 6th part of SchAVO the port charges for the use of public or private ports by vehicles or floating objects are regulated and summarized in extracts as follows:

**Part 5 – Port charges for public ports (§§ 41 – 51)**

**Types of port fees**

**I) Shore fee**

is payable for the use of the port for transshipment purposes due after completion of the handling. In the case of transshipping from vehicle to vehicle, half of the shore fee must be paid for each vehicle.

Basis of assessment: quantity of goods transshipped in tons.

**II) Demurrage fee**

is payable for the use of the port except during the winter period or the period without charge and is due before departure from the port.

Free berthing time includes:

- The day of arrival into the port for the purpose of transshipment and the following day. If this day is a Sunday or other public holiday, the end of the next working day marks the end of the free berthing time.

- The time necessary for the transshipment process and time spent waiting for the transshipment or time during which the transshipment is interrupted – provided that the holder or a third-party authorized by them pays port fees for the transshipment and the lawful holder of the vehicle or floating object is not responsible for the delay.

Basis of assessment:

- maximum cargo capacity in tons for vehicles intended to transport goods or maximum water displacement at the deepest permitted immersion for vehicles not intended to transport goods.
- demurrage time in days

**III) Winter fee**

is payable for the use of the port as one-off-amount during winter period from 15th December to 15th March, unless the calculation of the demurrage fee is more favorable to the payer, and is due before departure from the port.

Basis of assessment:

maximum cargo capacity in tons for vehicles intended to transport goods or maximum water displacement at the deepest permitted immersion for vehicles not intended to transport goods.

For the calculation of port tariffs, the port administration shall be granted access by the payers to the ship and loading documents.

The port charge tariffs shall be determined by the port authority, taking into account the average cost of a period of five years for the maintenance, operation, interest and amortization of the construction costs of:

- port basins
- mooring facilities
- waste and waste oil collection points
- sanitary facilities, drinking water sampling points and water abstraction points for ship crew
- facilities for keeping the port free of ice

The demurrage fee must amount to the twentieth part of the shore fee (in relation to the assessment unit).

The winter fee must correspond to the demurrage for 20 days.

**Part 6 – Port charges for private ports (§§ 52 – 53)**

Port charges (demurrage and winter fee) for the use of private ports due to flooding, ice or other adverse circumstances or official orders may not exceed the tariffs approved for a public port at most.

## TARIFF REGULATIONS USING THE EXAMPLE OF ENNSHAFEN PORT

### I) Port charges for the use of the Ennshafen port (valid from 2017-11-01)

According to the Shipping Systems Ordinance port charges are determined by the decisions of the district authority Linz-Land of 2009-01-08 for the Upper Austrian part of the port and the district authority Amstetten of 2009-05-12 for the Lower Austrian part of the port, as well as the charges for other services, for services related to the use of port facilities and services as follows:

**a) Port charges:**

- shore fee: € 0,40 per ton of handling plus VAT
- demurrage fee: € 0,02 per ton of cargo capacity per day plus VAT

taking into account the following pay-free handling times:

- handling/bulk cargo:
  - up to 600 t = 1 day
  - up to 1.000 t = 2 days
  - more than 1.000 t = 3 days
- break-bulk/general cargo:
  - up to 300 t = 1 day
  - up to 500 t = 2 days
  - more than 500 t = 3 days
- winter fee:
  - € 0,38 per ton of cargo capacity plus VAT

Each vehicle or floating object which uses shipping facilities concerned for the purpose of handling, mooring or protection must be registered by the skipper to the local port administration by presenting the ships- and loading documents (declaring the next destination) before the start and at the end of the use of the facilities.

**b) Fees for other services:**

- Drinking water supply fee: € 2,80 per cubic meter plus VAT
- Tonnage admeasurement fee: between € 60,00 and € 150,00 per admeasurement plus VAT
- Electricity supply fee: € 0,30 per kWh plus VAT

## FEES ENNSHAFEN per March 2021

(net amounts)

## PORT FEES

| | | |
|---|---|---|
| **a) Shore fee** | € 0,40 | / ton handling goods |
| **b) Demurrage fee** | € 0,02 | / ton of cargo capacity per day |
| **c) Winter fee** | € 0,38 | / ton of cargo capacity (period from 15th december to 15th march) |

## FEES FOR OTHER SERVICES

| | | |
|---|---|---|
| **a) Drinking water supply fee** | € 2,80 | / cubic meter |

**b) Tonnage admeasurement fee**

| | |
|---|---|
| During normal working hours | € 60,00 |
| With overtime between 6 am and 10 pm | € 120,00 |
| With overtime between 10 pm and 6 am | € 150,00 |
| On Sundays and public holidays | € 150,00 |

| | | |
|---|---|---|
| **c) Electricity supply fee** | € 0,30 | / kWh |

### II) Fees for handling activities

For a cargo handling activity in the Ennshafen port, a handling compensation fee ["UEE / Umschlagsentschädigungsentgelt"] is to be paid by the handling company and is due for payment after completion of the transshipment. For the calculation of the UEE, the relevant transshipment documents (= loading or unloading report) must be transmitted by the payer to the port administration.

The UEE to be charged depends on the type of handling carried out:

- direct water-land handling: UEE is charged at 100% in the case of indirect water-land handling, a separate agreement must be reached)
- water-water-handling: 80 % of the UEE is charged
- land-land-handling: 50 % of the UEE is charged

UEE rates vary according to the type of good:

- UEE for ordinary cargo:

Basis of assessment: quantity of goods handled in tons.

The UEE is based on the classification of goods in the "Goods List for transport on German inland waterways"
as of 2002-03-01/VII. Supplement – Editor: Water and Shipping Directorate West on behalf of the Federal Minister of Transport).

- UEE for heavy cargo:

Basis of assessment: quantity of goods handled in tons;

up to 16 t the tariff for ordinary goods is to be applied.

The UEE for general cargo (vehicles, cranes, container) is calculated per unit.

The amount of the UEE to be applied is determined separately with the respective handling companies in separate contracts/agreements.

### III) Charges for storage

Agreements regarding necessary interim storage in the quay area or on bordering port areas in the course of a handling operation are made separately with the respective handling company.

### IV) Lease payments (for concessions and/or long-term leases)

Standard contracts are normally used in form of renting and transshipment, several kinds of operator contracts, in combination with superaedificate or construction law, lease contracts, praecarium, concession agreements. In these contracts and papers taylor-made agreements are made separately between the contractual partners, which are the basis for corresponding payments. Due to national and international requirements these papers are bases on the principle of a non-discriminatory system.

Literature research on port pricing is a quite theoretical task showing a wide field on input factors and considerations. In order to make it a little bit more understandable what can come out of the theoretical basics and how these basics will be implemented in practice, in the following chapter a practical example will be presented. One inland port on the Danube in Austria was selected for this. As the Ennshafen port (a TEN-T core node port on the Rhine-Danube Corridor) is organized in the form of a landlord port and shows very good the broad field of practical implementation of port pricing principles.

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# 7 Conclusions

By summing up the investigated literature (Ref. 1 – Ref. 9) and today´s situation of ports in the Danube region the following conclusion can be deployed:

- many different approaches do exist on which ports can orient their pricing strategy or did it in the past (based on different countries, different economic systems, different ownerships, different users, …);
- port-pricing mechanisms are essential to promote a better utilization of the port´s assets and furthermore to enhance the profitability of port´s investments (either in the narrow case of the profitability of the port company or in the wider case of the regional economic balancing);
- port organisations and port governance systems are under development; in the past many ports were organized in a more government or municipal regime which had a focus in other port pricing basics, but now and in future ports are going to become more business unit character and bring the need of developing their port pricing basics towards more business orientation;
- strategic pricing is a good tool for helping ports to achieve competitive advantage; its use should take into account the objectives and targets of the port authorities and other corporate bodies active in ports; the need for strategic pricing is proportional to the degree of competition facing the port from neighbouring ports and to that within the port among providers of services;
- a proactive attitude on the part of the port authority and the will to understand the clients' needs should be viewed not only as a way of increasing revenues, but also of improving the utilization of port facilities, attracting traffic and, where relevant, decreasing per-unit costs;
- pricing in ports has to be reflected in the approach to setting port tariffs, namely the CPV approach (Cost - Performance - Value); one of the key assumptions of the CPV approach is that cost alone should not determine the level of tariffs;
- as the fixed costs are a large portion of total costs in modern ports, the commercial objectives should be to seek ways to recover them in the short run; this means using cross-subsidies between categories or tariff items; it is necessary to sensitize managers to the clients' perceptions of the value of services rendered;
- ports are being forced to become financially sustainable; therefore, an exact evaluation of their expenses is needed so as to allow them to set appropriate tariffs; a foundation for pricing is thus a cost accounting system that allows the port to record and monitor all costs; as ports become more accountable for their financial well-being, they also need to be given autonomy for setting tariffs;
- where privatizing services or infrastructure are under consideration, regulatory bodies must allow the operator to set prices that provide a fair return on the investment; there may be a need for control by the port authority to avoid high tariffs based on high profit or inefficient operation, particularly if there is not sufficient choice for port users or alternative ports available;
- over the long run, management must set prices to cover the port's capital and operating costs unless it is government (national / regional) policy to provide a subsidy; a key issue is whether the infrastructure is considered part of the nation's assets or wealth; if it is, a corresponding portion of the infrastructure costs may be covered by the government rather than by the port authority and

hence may not be considered to be a subsidy; a decision on such a question will obviously have an impact on the tariff levels set by the port authority, as the authority may or may not have to cover this cost;

- the actual international developments towards green mobility call for cargo shift towards sustainable forms like rail or waterway and will lead to modern, dynamic and flexible pricing systems which can react much quicker to market demands as this was the case 30 years ago (old-fashioned pricing systems have become unsatisfactory);
- Under these circumstances ports are going to become more the character of a market player in a competitive field (and not only a static element of regional infrastructure), which brings the need to investigate modern pricing systems based on various input factors like mentioned in literature and develop their pricing systems towards this modern and market-oriented direction.

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