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DIONYSUS

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

Tool for flexible/dynamic pricing supporting port and IWT hinterland development

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Executive summary

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.

This report commences with the theoretical background of port pricing, which is a very specific branch of port economics, then moves on towards the current pricing practices in the Danube ports elaborated in details in Deliverables D.T2.3.3 and D.T2.3.4 and concludes with various proposals for the changes in existing port pricing schemes, especially for port infrastructure fees, in order to achieve flexibility and more adaptable pricing systems that would be able to boost the port and IWT development and assist the shipping industry in the times of nautical hindrances.

More precisely, port pricing policy in the Danube region is studied in line with the corresponding port governance structure of each analysed port, considering also the specific characteristics of each port and its hinterland area. In addition, a questionnaire for pricing principles was 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 were 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 was examined. Finally, port authorities and port operators themselves proposed a series of proposals for more flexible port pricing to be used as a dynamic tool adjustable to variable conditions at the port and IWT market. The ultimate goal is to offer flexibility for applying different port pricing systems corresponding to the actual development objectives of the port authorities and port operators.

The report first examines the theoretical background of port pricing and specificities of charging for the use of public goods. Port and their infrastructure have the status of public goods (or similar) in most of the Danube countries and are regulated by applicable national laws. Pricing is an important aspect guiding the interactions between economic actors in the port industry. The port authority (typically 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. 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. Putting it simply, there are two basic types of charges in any port: ship related charges and cargo related charges. Quite logically, ship related charges are paid by the ship owner or ship operator, and the cargo related charges are paid by the cargo owner, that is, cargo receiver or cargo shipper. Ship related charges are usually called port dues and are charged by the port managing body, and the cargo related charges

are usually called cargo fees. In the case of cargo related charges, part of the fees is charged by port managing body (wharfage) and part of the fees (handling charges) is charged by the port/terminal operator. In both cases, the cargo related fees are typically paid by the cargo owner.

In everyday port business, port managing bodies are applying four basic pricing principles: cost recovery, charging what the traffic can bear, promotion of specific objectives and strategic paricing. Pricing principles are different from pricing approaches, among which the most popular are the cost-performance-value (CPV) approach and market based approach. In a nutshell, the Cost-Performance-Value (CPV) approach divides all port tariffs into three categories, depending on the basis of each charge. In the first group are those related to the provision of services set out on the basis of the **costs**, such as for stevedoring. In the second group are those tariffs related to the provision of facilities, such as a berth or a silo. In the past, in setting this tariff the aim was to achieve a better utilization of the facilities; in the present competitive environment, the focus has shifted onto the **performance** which it allows the other links of the logistics chain to attain. Finally, in the third group are general tariffs items, namely port dues, which were formerly set by considering the rule of what-the-traffic-could-bear, but which now, can be better assessed by the **value** that users attach to them and, on this account, are called value-based tariffs. Tariffs items in the latter group are expected to contribute most to recovering overall expenses, including a return on investments. This grouping of port tariffs is called the CPV approach because it includes three elements, costs (C), performance (P) and value (V). The merit of this new approach is that it helps the port authority use pricing as an effective tool in achieving its objectives in a competitive environment.

On the other hand, an increasing number of port authorities are using the approach 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.

Further, this report brings the overview of the currently applied costing and pricing schemes in the Danube ports of Austria, Hungary, Slovakia, Croatia, Serbia, and Romania (seaport of Constanta only).

Analysis of the applied tariff policies in the ports of the aforementioned countries began with the brief overview of status of ports in terms of legal treatment of port areas (land and infrastructure), as well as with the port governance status along with the port tariffs regulations. All of these aspects are important and have a crucial influence on the system of port pricing applied in different ports.

Participating project partners provided an insight into the track of port reforms in the recent past, as well as responsibilities, options and funding sources for financing of new investments in ports.

Various approaches to port pricing and applied port pricing principles are analysed, revealing an insight into the objectives of port pricing in each country. In addition,

standard types if infrastructure fees were discussed and explained, including the unit basis for charging as well as differentiation methods currently in use.

Last, but not least, alternative pricing methods for charging the use of, primarily, port infrastructure fees are proposed by project partners from participating countries. The reason for focusing on the infrastructure fees lays in the fact that services, usually charged by port operators, are already fully commercial fees and are, typically, aimed at creating reasonable profit margin after covering the fixed and variable costs related to the provision of port services. This means that the level of their flexibility and adaptability to market dynamics is already high. On the other hand, infrastructure fees are typically regulated fees, charged by public bodies (in most of the cases) with the aim which is not always purely commercial. Depending on the legal setup of port governance in each Danube country, port infrastructure fees are regulated by legal acts and are compulsory publicly available.

In *Austria*, having the port governance system fully commercialized, port tariffs are regulated by a specific law related to port and inland navigation. Applied pricing approach is economic, while port pricing is based on empirical intuition and past trends based pricing. In terms of proposed alternative pricing method for infrastructure use, Ennshafen proposed the so-called green incentives, offering various discounts to vessel using alternative fuels leaving near zero or zero emissions.

In *Slovakia*, port governance system is intended to match the landlord port management model, whereas the private operator owns both suprastructure and infrastructure, while the port land is owned by the state-owned port authority. Infrastructure fees in public ports on the Slovak section of Danube are collected by port authority, state-owned VPAS in accordance with approved legislation. In existing ports, new investments are primarily made by private operator, while the port authority can invest in the port land which is not leased to any operator. Approach to port pricing is mixed, financial approach and public body approach. Port infrastructure fees are charged on a cost recovery basis. In terms of proposed alternative pricing method for infrastructure use, VPAS proposed a mixture of cost-based pricing, value-based pricing and performance-based pricing.

In *Hungary*, the port governance system is extremely complex. There are public and private ports, whereas public ports are either leased to private operators or managed by an independent company (acting as a port authority) which, in certain cases, can lease port areas to private operators. Ports also differ in the type of services they provide to third parties. While public ports are open to the public, private ports do not generally provide transhipment facilities for third parties. While public service and freight ports focus primarily on the provision of public services, fully privatised ports serve the needs of the private sector. Leased ports have a mixed image, seeking to balance the interests of the public (port operators) and private (port companies). In the case of Centroport Dunaújváros, infrastructure fees, cargo related services fees and nautical-technical service fee are also the responsibility of the port operator. In the case of the Port of Budapest-Csepel, the infrastructure fees and the nautical-technical service fee are determined on the basis of the GKM Decree 49/2002 (XII. 28.), while the cargo related service fee is determined by the port operator at its own discretion. According to the GKM Decree, the fees payable for the use of the port, as well as the method and conditions of payment, must be published in a clearly visible place in the port. The operator may require advance payment of the port fees.

Floating installations seeking shelter in the port in response to the contents of the storm and waiting for up to 30 minutes for the arrival of an authority for an official inspection are exempt from the payment of port fees. In terms of alternative pricing of port infrastructure, HFIP proposed a harmonization of vessel-related tariffs for larger ports, according to the typical vessel types. In addition, it is proposed that the differentiation is based on the environmental impact of vessels and that the port fees are calculated purely on the basis of maintenance and investment costs + profit.

In *Croatia*, inland ports are primarily organized as landlord ports, governed by port authorities (acting as landlords), while they are operated by independent public operators, largely private. In public ports, port authorities are obliged to ensure business sustainability and financial stability, taking into account the economic criteria for valuing the port services market. Port authorities in a public port must ensure, within the limits of available capacities, equal conditions for the use of services to all vessels and to all persons without discrimination. With regard to port charges, the maximum amount determined for port dues is defined by the ministerial order, and the amount of port dues is determined by the Port Authority up to the maximum amount defined by the order. The Port Authority charges port dues, while port tariffs (transhipment service) are charged by the concessionaire. In terms of alternative pricing schemes, PAV proposed the so called GREENCENTIVE - an incentive for the use of scrubbers and alternative fuel sources applied on the quay usage dues.

In *Serbia*, the port governance system is organized a landlord system where the State owns the port land (in designated port areas) and port infrastructure in several ports. In other ports, port infrastructure is owned by private operators. Ports are administratively governed by the Port Governance Agency (PGA), acting as a national port authority. Law on navigation and ports on inland waters regulate charging of Concession fees and fees for Operational usage of port, paid by Port Operators/Concessionaires. Basic parameters and principles for the methodology of the fee determination are given within the Law, but the exact fee determination is elaborated/given in each Concession proposal or Licence for Port Operations. On the other hand, infrastructure fees are regulated by the Law on Charges for the Usage of Public Goods, which defines the Port Governance Agency as a fee regulating (and charging) institution, responsible parties for reporting and paying fee for the use of ports, types of fees, methodology of calculation and amounts. In terms of alternative pricing of port infrastructure, the PGA proposed the sliding fee scale for the wharfage fees for containers, differentiated according to the volumes (number of TEU), whereas the cargo owner (shipper or receiver) gets discounts when determined cargo volumes are reached. Moreover, a 20% discount is proposed for the wharfage fee and berth fee in case of vessels using alternative clean fuels.

In *Romania*, only seaports are analysed in this report, while no inputs were received for the Danube ports. Port of Constanta is a typical landlord port, being a public-private maritime port owned by the Romanian State which is responsible for its regulation and function. The National Company "Maritime Ports Administration" S.A. Constanta (MPAC) is a company under the authority of the Ministry of Transports and Infrastructure and acts as a corporatized port authority. The company's own sources are obtained from the distribution of the company's net profit and from the depreciation of the fixed assets in the company's records and are used to achieve the objectives of infrastructure, superstructure, endowments and modernizations in the

port. The budget allocations are approved by the State Budget and are received at the company level through the budget sheet from the Ministry of Transport and Infrastructure and aim at port infrastructure objectives. Port fees are regulated by applicable laws and by-laws, and the port pricing principles are cost-based and performance-based. MPAC did not provide any proposals for alternative port pricing schemes for the use of port infrastructure.

No inputs were received from Ukraine, due to the ongoing conflict.

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3 Abbreviations

Abbreviation	Explanation
PA	Port Authority
PO	Port Operators
IWT	Inland Waterways Transport
CPV	Cost-Performance-Value
OPS	Onshore power supply
SSPS	Shore-side powers supply

4 Introduction

4.1 Scope of the output

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 is studied in line with the corresponding port governance structure of each analysed port, considering also the specific characteristics of each port and its hinterland area. In addition, a questionnaire for pricing principles was 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 were 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 was examined. Finally, port authorities and port operators themselves proposed a series of proposals for more flexible port pricing to be used a dynamic tool adjustable to variable conditions at the port and IWT market. 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.

In order to fulfil this goal, this report provides an overview into the economic theory of port pricing, briefly examines the port governance structures in the Danube countries then dives into the existing pricing of port fees and present the proposed alternative methods of port pricing, as proposed by participating port authorities.

4.2 Reasoning behind the quest for flexible port infrastructure fees

The reason for focusing on the infrastructure fees lays in the fact that services, usually charged by port operators, are already fully commercial fees and are, typically, aimed at creating reasonable profit margin after covering the fixed and variable costs related to the provision of port services. This means that the level of their flexibility and adaptability to market dynamics is already high. On the other hand, infrastructure fees are typically regulated fees, charged by public bodies (in most of the cases) with the aim which is not always purely commercial. Depending on the legal setup of port governance in each Danube country, port infrastructure fees are regulated by legal acts and are compulsory publicly available. In many countries, not only of the Danube region but also globally, ports are rightly treated as strategic objects of national transport infrastructure. As such, ports are subject to public sector regulation in terms of governing, developing, exploitation (operation) and charging policies. Whereas contemporary ports are largely open to private sector, or to various forms of public-private partnerships, in the aspects of operation, the governance aspects of ports are, rightfully reserved for the public sector. Port governance may take various forms. In the Danube area, virtually all port management models are represented: from fully public ports to fully private ports, where the latter are an exception rather than a rule.

Port governing bodies, typically known as port authorities, in the Danube area range from governmental bodies or agencies to publicly owned commercialized or corporatized port authorities, with the exception of Hungary where links to governmental overwatch are very weak, and no public port authorities as such exist in any form. However, as already mentioned, the Hungarian case is an exception rather than a rule and therefore will be treated as such.

Apart from providing an insight into different port pricing schemes applied in the Danube region, this deliverable will attempt to provide different views on potential alternative pricing methods for port infrastructure fees, in order to make them less rigid and more flexible and adaptable to dynamic changes at the waterborne transport market. These dynamic changes may be caused by market volatility, physical restrictions of navigation or even induced by strategically planned focus on, say, exports of certain type of goods using waterborne transportation. This is necessary in order to keep the existing port users loyal to ports and to the option of waterborne transport, as well as to attract new users and therefore trigger additional potentials for port development thanks to the increased cargo volumes handled in ports. Doing this, dynamic and flexible port pricing will become a tool for the development of ports and, consequently, hinterland transport.

5 Theoretical background of port pricing

5.1 Functions of port pricing in ports

Pricing is an important aspect guiding the interactions between economic actors in the port industry. The port authority (typically 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).

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.

Three types of port services	
Sea (river) related services	Provision of access and berthing for ships
Land related services	The handling of cargo

Three types of port services	
Delivery related activities	Administrative tasks, customs and value-added activities

Table 1: Basic types of chargeable port services

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:

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

Table 2: Approximate share of different port call costs

5.2 Who charges what and who pays what?

Putting it simply, there are two basic types of charges and any port: ship related charges and cargo related charges. Quite logically, ship related charges are paid by the ship owner or ship operator, and the cargo related charges are paid by the cargo owner, that is, cargo receiver or cargo shipper. Ship related charges are usually called port dues, and the cargo related charges are usually called cargo handling fees.

In special cases, when a port is conceded to an independent port/terminal operator, such operator pays a concession fee (or similar) to an authority that conceded the port to an operator.

Basically, in spite of the differences between river (inland waterways) and sea ports, a further generic division into navigation related services, berth related services and cargo related services can be made.

Service group	Component/ type of service	Charging system			
		Basis	**Units**	**Who pays?**	**Who charges?**
Navigation	Conservancy	Size of ship	GRT	Shipping line	Port
	Navigation aids fees	Size of ship	GRT	Shipping line	Port
	Pilotage	Size of ship / Time	GRT / Hours	Shipping line	Port / Pilot association
	Tug services	Size of ship / Tug time	Number / GRT / Hours	Shipping line	Port / Tug owners
	Mooring/ unmooring	Size of ship	Hours / GRT	Shipping line	Port

Table 3: Generic overview of charges for navigational services in sea and river ports

Service group	Component/ type of service	Charging system			
		Basis	**Units**	**Who pays?**	**Who charges?**
Berth	Berth fees	Time of ship alongside Size of ship	Hours / GRT	Shipping line	Port
	Wharfage	Volume / weight / size / type of cargo	Ton / m3, / TEU	Cargo owner (Consignee / consignor)	Port
	Ancillary services	Amount consumed	Various	Shipping line	Port

Table 4: Generic overview of charges for berth related services in sea and river ports

Service group	Component/ type of service	Charging system			
		Basis	**Units**	**Who pays?**	**Who charges?**
Cargo operations	Stevedorage	Volume / weight / size / type of cargo	Ton / TEU / m3	Shipping line (usually)	Service provider
	Wharf handling	Volume / weight / size / type of cargo	Ton / TEU / m3	Consignee / consignor	Service provider
	Extra-movement	Volume / weight / size / type of cargo	Ton / TEU / m3	Consignee / consignor	Service provider
	Special cargo handling	Volume / weight / size / type of cargo Handling type	Unit / Types	Shipping line or consignor	Service provider
	Storage	Time / weight / measurement	Ton / TEU / m3 / Days	Consignee / consignor	Service provider
	Packing / unpacking	Volume / weight / size / type of cargo	Ton / TEU / m3 / Type	Consignee / consignor	Service provider
	Equipment / service / facility hire	Hours of use by item	Hours	Stevedore	Equipment / service / facility owner

Table 5: Generic overview of charges for cargo related services in sea and river ports

5.3 Pricing principles – generic definitions

In everyday port business, port managing bodies are applying four basic pricing principles.

Cost recovery	Charging what the traffic can bear
• total revenue is large enough to cover all costs incurred • user pays principle • tariffs are constructed at the level of the individual service	• users' willingness to pay • price is based on the actual benefits the user derives from the service • common in monopoly industries • reduces economic welfare
Promotion of specific objectives	**Strategic pricing**
• pursuing societal priorities • port operations at a level of capacity utilization where port user costs are minimal • facilitation of the country's exports	• pricing strategy that anticipates the reaction of other ports • tariffs resulting from this strategy may or may not satisfy the other three principles

Table 6: Basic port pricing principles

This first principle, **cost recovery**, 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.

Charging what the traffic can bear principle 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.

The **promotion of specific objectives principle** 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.

Strategic pricing principle can be broadly defined as the use of pricing as a mechanism for achieving competitive advantage, and basically it foresees tariffs strategy that anticipates the reaction of other ports. Strategic pricing in ports is reflected in a new approach to setting port tariffs, namely the CPV approach (Cost - Performance - Value), discussed in the next section.

5.4 The CPV pricing approach

In a nutshell, the Cost-Performance-Value (CPV) approach[1] divides all port tariffs into three categories, depending on the basis of each charge. In the first group are those related to the provision of services set out on the basis of the **costs**, such as for stevedoring. In the second group are those tariffs related to the provision of facilities, such as a berth or a silo. In the past, in setting this tariff the aim was to achieve a better utilization of the facilities; in the present competitive environment, the focus has shifted onto the **performance** which it allows the other links of the logistics chain to attain. Finally, in the third group are general tariffs items, namely port dues, which were formerly set by considering the rule of what-the-traffic-could-bear, but which now, can be better assessed by the **value** that users attach to them and, on this account, are called value-based tariffs. Tariffs items in the latter group are expected to contribute most to recovering overall expenses, including a return on investments. This grouping of port tariffs is called the CPV approach because it includes three elements, costs (C), performance (P) and value (V). The merit of this new approach is that it helps the port authority use pricing as an effective tool in achieving its objectives in a competitive environment.

5.4.1 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:

[1] UNCTAD (1995), "Strategic Port Pricing", United Nations Conference on Trade and Development, (UNCTAD/SDD/PORT/2)

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

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

5.4.1.1 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.

5.4.1.2 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.

5.4.1.3 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.

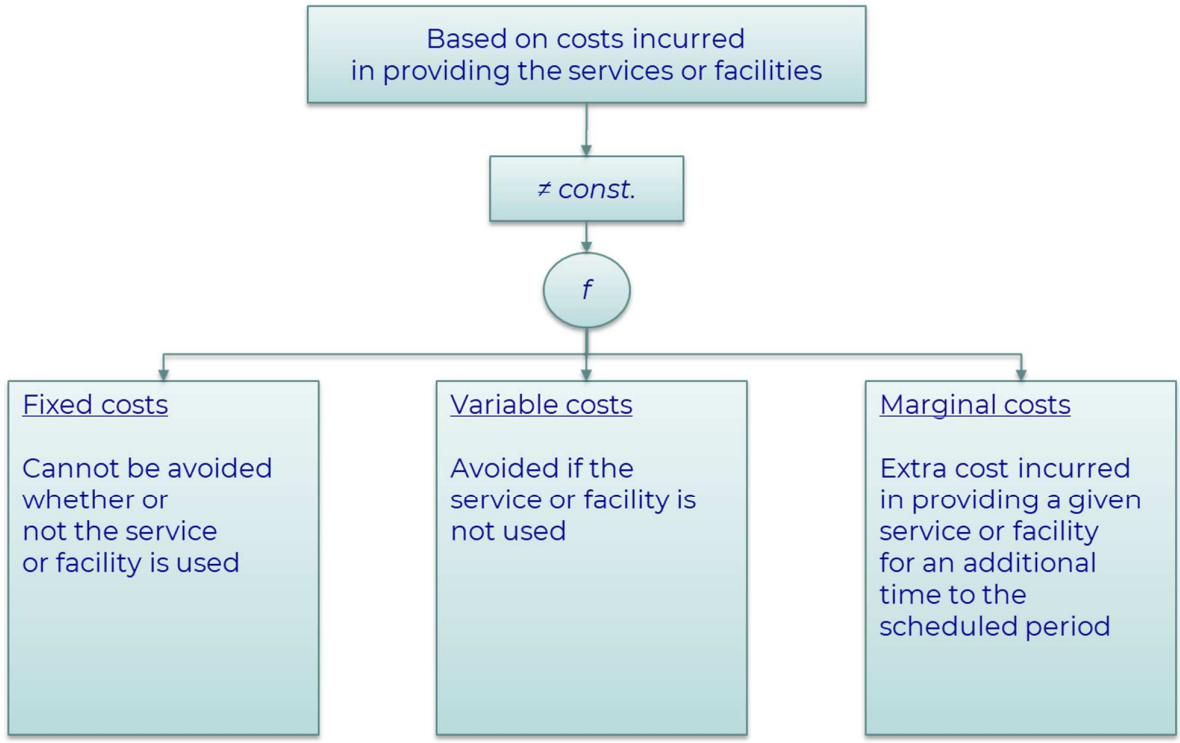

Figure 1: Types of costs in ports

5.4.2 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, immediately after

berthing, and surcharges or fines can be applied to those that start after, say, two hours.

5.4.3 Value based pricing

General tariff items in the third group, such as port (navigation aids) 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.

5.5 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 Current pricing practices in Danube ports

6.1 Overview of port governance systems in analysed ports

Out of 13 analysed ports in 9 Danube region countries, only one country, Moldova, has fully privatized its ports, meaning that both port governance and port operations are in the hands of fully private companies. However, the land is not sold but leased for 99 years. Hungary has an extremely complicated mixture of port governance systems, where some ports are fully privatized (land included), while some are corporatized and managed and operated by an independent company which is in majority public ownership.

In Austria, ports are operated by independent companies which may be either in private or public ownership, while the port authority function is delegated to the corporatized port authorities, functioning as companies.

In Slovakia, a central port authority is in charge of port governance functions, although the situation is somewhat complex due to the way the ports were privatized during the privatization process that started in the last decade of the previous century.

In Croatia, a standard landlord port management model is established, where port authorities are public bodies and are involved only in port governance, whereas independent companies (be their public or private)

6.2 Port tariffs regulatory basis

The following table contains a summary of legislative basis for the port tariffs in the Danube countries. Details are available in the Deliverable D.T2.3.4.

Country	Legal basis	Note
Austria	• 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 regulation of each port (based on above legal acts)	Regulates the use of the port and infrastructure, does not interfere into tariffs for commercial activities (e.g. loading/unloading, warehousing, etc.)
Slovakia	• Tariff for payments for use of public ports on the waterways in the Slovak Republic	Infrastructure fees in public ports on the Slovak section of Danube are collected by port authority, state-owned VPAS.

Country	Legal basis	Note
		Service fees in ports are collected by private port operator SPaP based upon particular agreement with an individual partner, mostly cargo broker or cargo transporter
Hungary	• GKM Decree 49/2002 (XII. 28.)	GKM Decree is valid for publicly owned ports. According to this Decree, the fees payable for the use of the port, as well as the method and conditions of payment, must be published in a clearly visible place in the port. For private ports, fees are regulated by port's own regulations.
Croatia	• Law on navigation and inland ports • Acts of Port Authorities	Port fees (use of infrastructure) determined and charged by Port Authorities. Maximum determined by ministerial order. Port charges (commercial, service fees) determined and charged by port operators.
Serbia	• Law on Navigation and Ports on Inland Waters • Law on Charges for the Usage of Public Goods • Tariff book	Law on navigation and ports on inland waters regulate charging of Concession fees and fees for Operational usage of port, paid by Port Operators / Concessionaires. Infrastructure fees are regulated by the Law on Charges for the Usage of Public Goods. Service charges are fully commercial and are determined by port operators and concessionaires. Tariff book determines their minimum in order to prevent price dumping.
Romania **(Constanta seaport only)**	• Company Statute, annex to GD no. 597/2009 for the amendment and completion of the Government Decision no. 517/1998 on the establishment of the National Company "Maritime Ports Administration" - S.A. Constanta; • Law no. 235/2017 for the amendment and completion of the Government Ordinance no. 22/1999 on the administration of ports and	

Country	Legal basis	Note
	waterways, the use of public transport infrastructure belonging to the public domain, as well as the development of shipping activities in ports and inland waterways; • Regulation (EU) 352/2017 of the European Parliament and of the Council establishing a framework for the provision of port services and common rules on the financial transparency of ports, • Competition law no. 21/1999; • Law no. 227/2015 on the Fiscal Code, with subsequent amendments and completions; • Other domestic and international legal regulations specific to safety, port security and environmental protection activities: ISPS Code, Regulation no. 725/2004 of the Council of Europe, Directive 59/2000 on port installations for the reception of ship-generated waste and cargo residues, etc.	

Table 7: Summary of legislative basis for port tariffs in the Danube countries

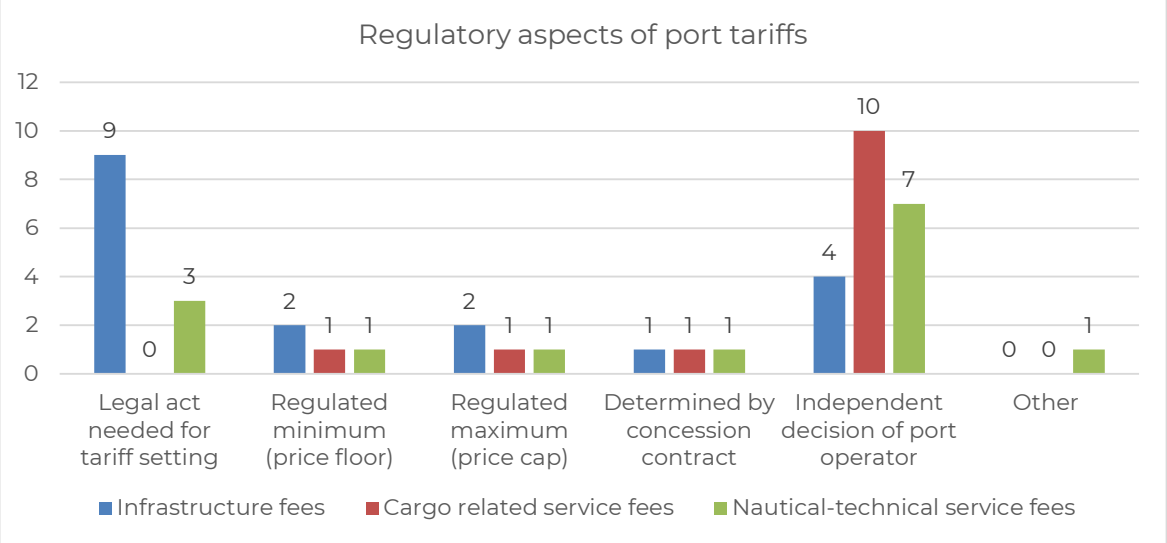

Figure 2: Basic regulatory features of the existing port tariffs in the Danube ports

6.3 Financing of new investments and maintenance of ports

Financing of new investments in ports, that is, the responsibility for such investments, largely depends on the type of assets that are being financed. For example, port infrastructure is typically financed by public sector (state, province, municipality, public port authority) or by concessionaires. Large number of cases where infrastructure is financed by operators is due to the existing contracts on port operations or due to atypical privatization schemes of ports where the protection of public interest in the domain of port governance and public service was not the highest priority.

Suprastructure and equipment are rarely financed by the actors from the public sector since these assets are more directly related to the commercial provision of port services.

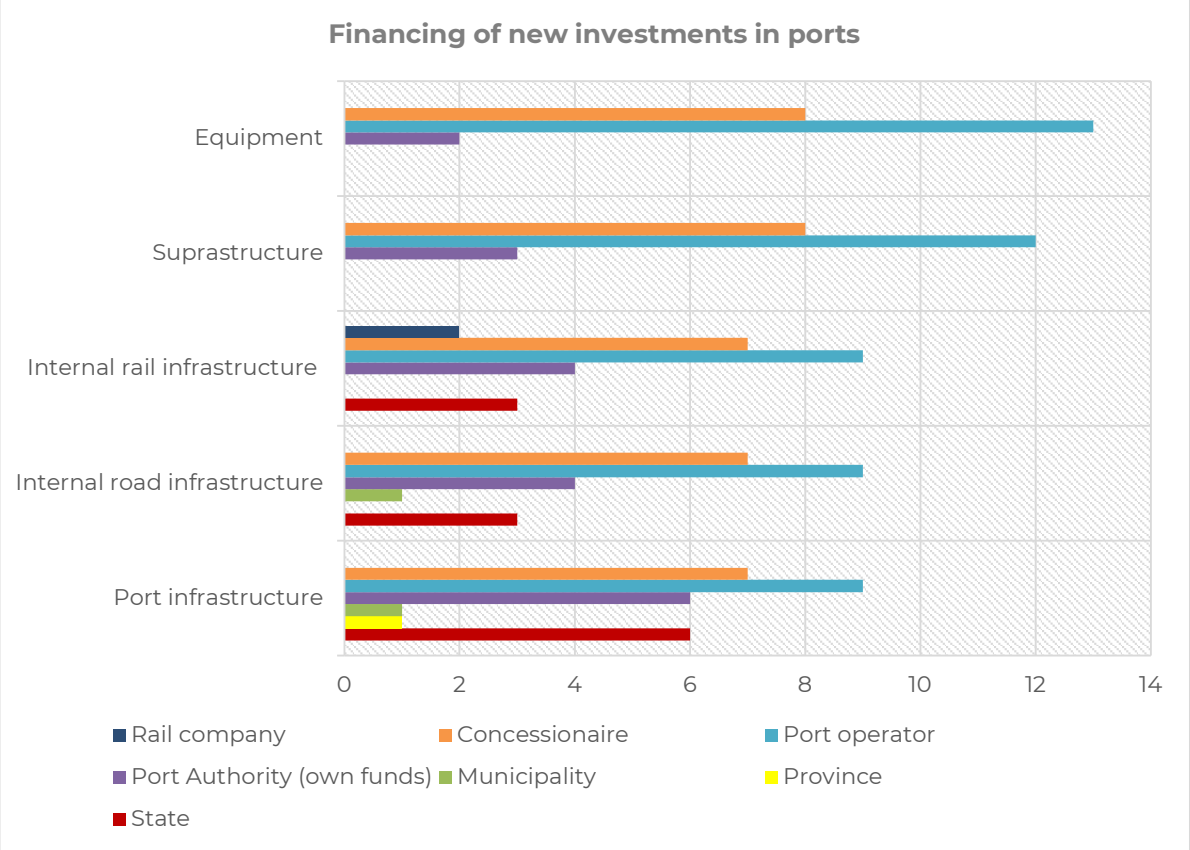

Figure 3: Financing of new investments in Danube ports

Similar relations exist in the case of financing of existing port facilities (figure below).

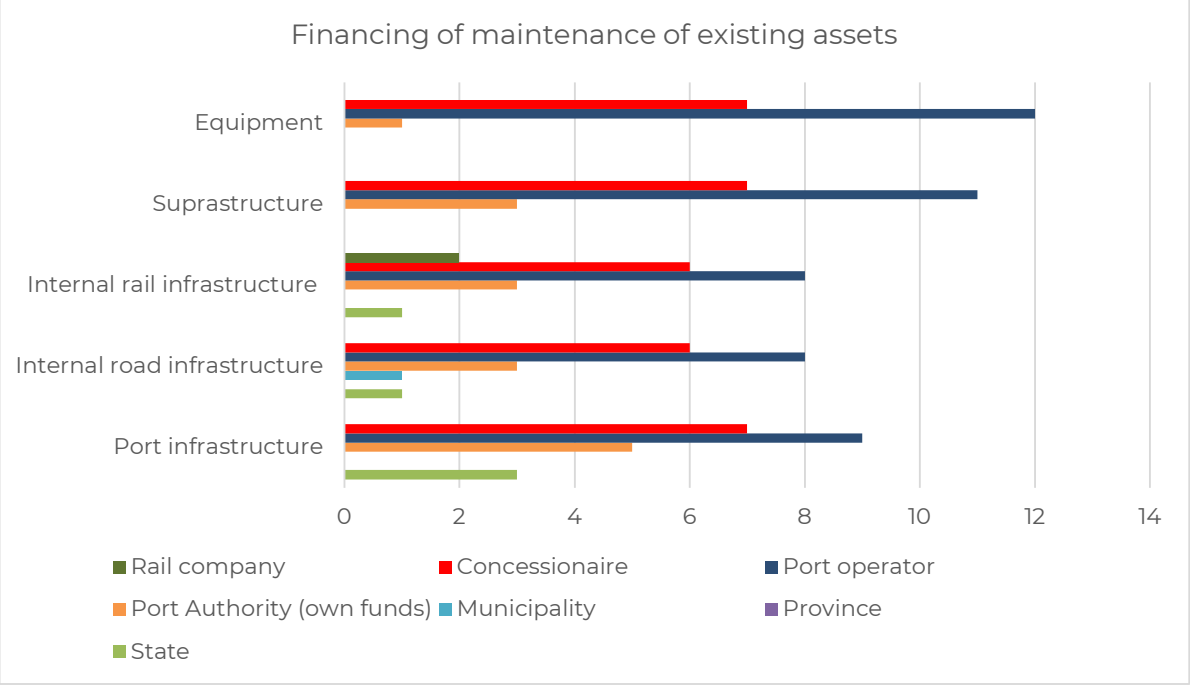

Figure 4: Financing of maintenance of existing assets in the Danube ports

6.4 Public subsidies for ports

A subsidy is a monetary transfer from a government to a private or public company active on the market, with or without conditions for services to render. Subsidies can take different forms and will in this report be categorized in three simplified categories:

- Subsidies through investments,
- Subsidies in cash flow,
- Subsidies in the form of preferential loans.

Many ports receive public subsidies for investments and projects to maintain and expand their general infrastructure. These are granted in particular for port adjustments that are needed to adapt to changes induced by shipping companies, such as increased ship size. Related adaptations to infrastructure include dredging, raising bridges and deepening and widening canals. Since the latest update of EU State Aid Rules in 2017, Member States can make public investments of up to EUR 150 million in sea ports and up to EUR 50 million in inland ports without prior checks by the Commission. The Regulation also allows public authorities to cover the costs of dredging in ports and access waterways. Also relevant here are subsidies for loss-making ports, as these are often related to port fees that do not recover investment or maintenance costs. In most cases it is difficult to detect this, as many countries have national port systems where loss-making ports cross-subsidise profit-making ports. Government financing of fossil fuel infrastructure, such as LNG bunkering infrastructure, could also be considered subsidies.

Some port infrastructure projects in Europe may be co-funded by the European Regional Development Fund (ERDF). The public funding of port infrastructure projects often consists of a 50% contribution from EDRF and 50% from national bodies. Co-funding of TEN-T projects in EU Member States is possible under the Connecting Europe Facility (CEF). Port infrastructure in some Member States may also benefit from the EU Cohesion Fund which is aimed at countries whose Gross National Income (GNI) per inhabitant is less than 90% of the EU average. The Fund aims to reduce economic and social disparities and to promote sustainable development and is often made available by regional governments.

In the Danube countries, less than 50% of ports receive some kind of subsidies from the public sector (figure below). Those ports that do receive subsidies receive them in cash flow, preferential loans and through other means, but it is interesting that no port reported receiving subsidies through investments. The authors of this study believe that this statement should not be taken for granted as there are certainly ports where direct investments from the state (or public sector in general are possible and practiced), especially for the construction and modernization of port infrastructure. Furthermore, it is believed that the sample is not statistically significant in order to encompass all possible cases, which may lead to wrong conclusions.

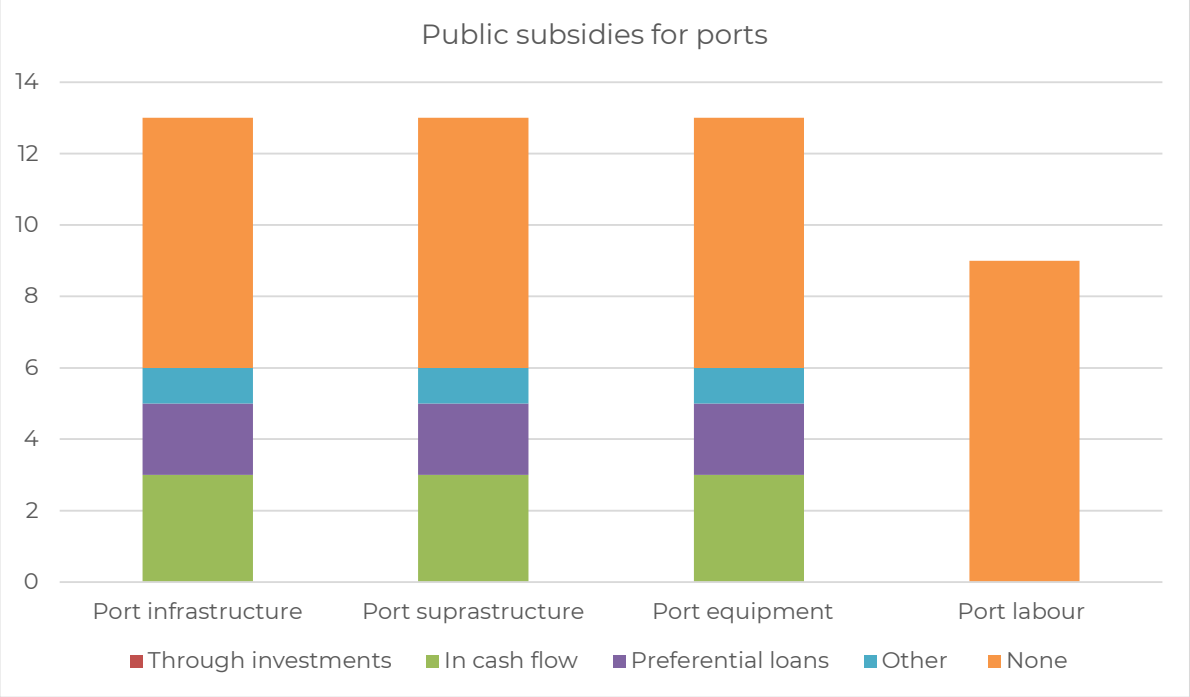

Figure 5: Existence of public subsidies for ports

It is interesting to note that, among the ports in the sample, all ports receive equal subsidies for infrastructure, suprastructure and port equipment.

6.5 Use of money from port revenues

It is interesting to observe how the revenues generated from the use of public port infrastructure are used. In most of the cases, the revenues are used for infrastructure investments and maintenance, as well as for development projects, which are the most logical uses of revenues. However, there are several cases where the part, or the total revenues are transferred to the public budget. In some cases, revenues are used to pay bonuses to the employees.

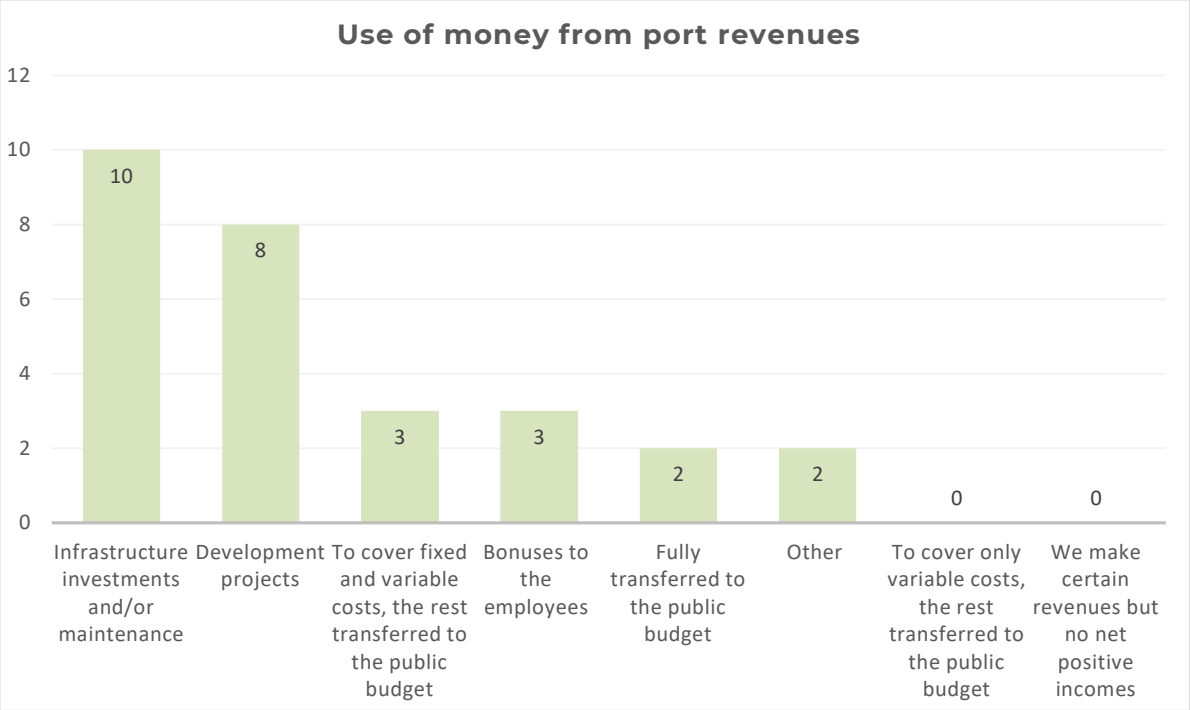

Figure 6: Use of money from port revenues

6.6 Objectives of port pricing

Port managing bodies of the analysed ports have been asked to explain what were the objectives of port pricing and the following options were given to choose from:

- Efficient/optimal use of port assets
- Provision of public service
- Pure profit generation (regardless of any expenses)
- Cost recovery 1 (operating & maintenance expenses only)
- Cost recovery 2 (1+depreciation)
- Cost recovery 3 (1+2+interest charges on loans)
- Cost recovery 4 (1+2+3+provisions for port development and improvement)
- Cost recovery 5 (1+2+3+4+rate of return)

- Maximising throughput
- Maximising employment
- Minimizing welfare losses
- Other

Below figure demonstrates that the most common objective of port pricing is the efficient use of port assets. Provision of public service and full cost recovery with a determined rate of return share the second place, while pure profit generation is the prime objective for only two ports.

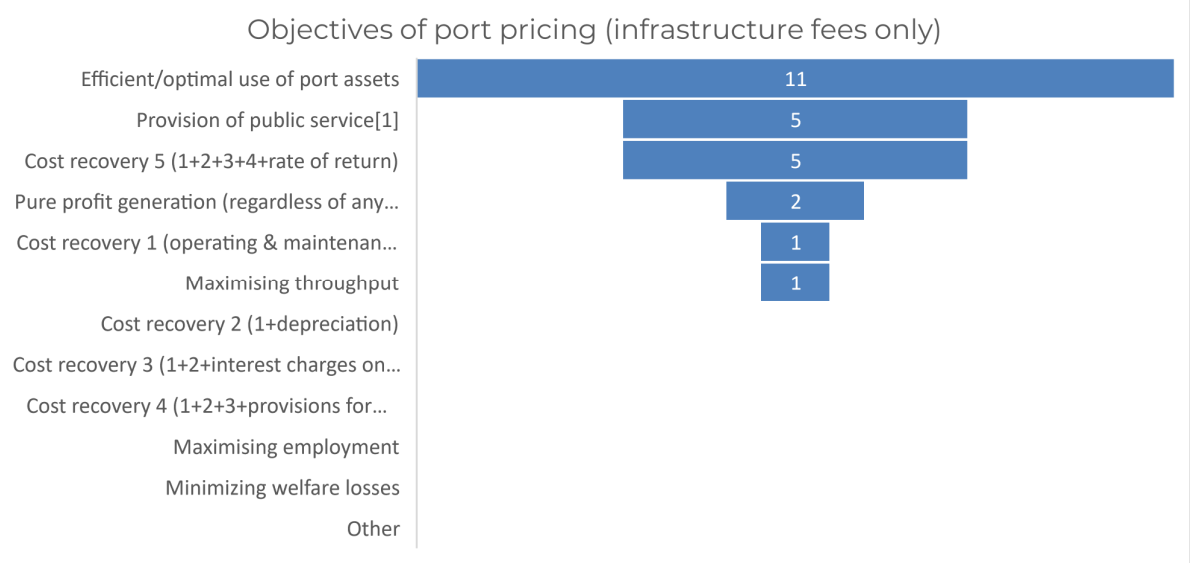

Figure 7: Objectives of port pricing

This means that, in spite of the significant influence of privatization, ports still respect the importance of being the strategic assets of national transport infrastructure, meaning that the protection of various aspects of public interest is still an important objective of port governance.

6.7 Pricing approach and pricing principles

There are basically three approaches to port pricing in port economics:

- Economic approach,
- Financial approach,
- Public body approach.

Economic approach is different from financial approach and is based on marginal costs, taking into consideration the effects on all parties, including benefits derived by others. Marginal costs in port are extremely difficult to define, but to put it simply, they represent the change in total cost associated with the unit change in the level of

activity[2]. However, since marginal costs are not only extremely difficult to define, they are also very difficult to estimate, this approach comes down to favouring the average cost-based pricing. In other words, a cost recovery-based approach.

In *financial approach*, prices are set on the basis of accounting costs, in order to recover fixed and variable costs and to provide an adequate rate of return and certain profit.

Public body approach aims to foster local development and economic activities, to maximize throughput, to maintain port services as public good in public interest; it often requires subsidies (e.g. to cover at least part of the fixed infrastructure costs).

In the Danube region, a sample of analysed ports showed that all three approaches are practiced almost equally.

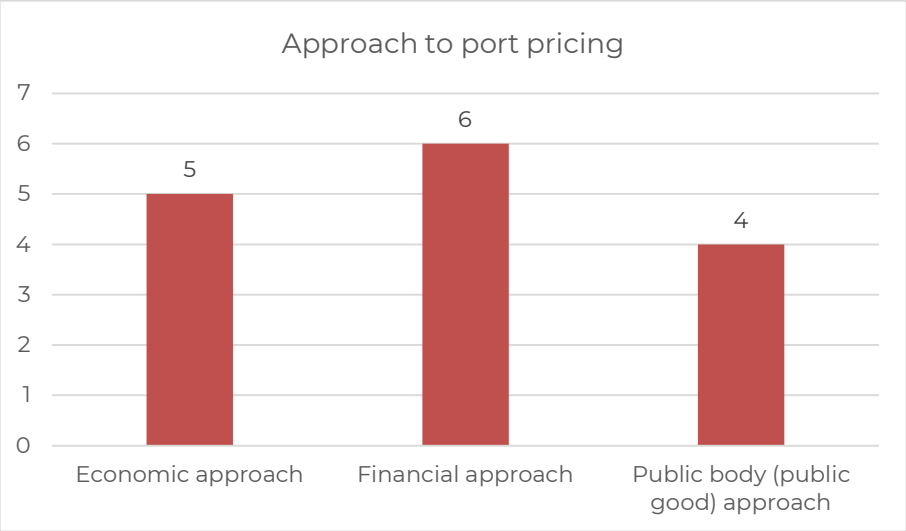

Figure 8: Approaches to port pricing as applied in the Danube ports

As regards to **pricing principles**, some of these are slightly modified with respect to the generic definitions elaborated in Chapter 5.3, in order to adjust them to the use in the Danube ports. Altogether, basic and modified principles are re-defined in the below table.

2 Goss, R.O., Stevens, H. (2001): Marginal Costs in Seaports, *International Journal of Maritime Economics*, Vol. 3, pp.128-138.

Practical pricing principle	Explanation
Cost based pricing	The simplest pricing principle, calculates prices (fees) based on simple cost (fixed, variable or even marginal) recovery, but not including the past investments. Cost based tariffs are used to achieve the marketing objective of maximizing the use of port services and the financial objective of covering the fixed and variable costs of these services.
Cost-plus based pricing	Calculates prices (fees) based on cost (fixed and variable) plus a determined profit margin.
Performance based pricing	Calculates fees based on time efficiency of usage of the service or facility (time a ship spends at berth, time a cargo spends in a base or transit storage, etc.). Promotes efficient behaviour of the users of a facility. Used to achieve the operational objective of maximizing the throughput of port facilities while limiting the level of congestion and to achieve the marketing objective of minimizing the traffic loss owing to congestion.
Value based pricing	Also known as pricing principle based on *what-the-traffic-could-bear*, but which can be better assessed by the value that users attach to them. 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.
Strategic port pricing	Used for promotion of specific objectives, such as maximization of use of the facility, attraction of a particular type of cargo, promotion of exports of certain cargoes, etc.
Pricing based on empirical intuition, "*what the others do*" and past trends	Approximate method which does not necessarily take into account the cost recovery and is believed to provide sufficient contribution for the incomes of the port authority / port operator. Pricing strategy that anticipates the reaction of other ports tariffs resulting from this strategy may or may not satisfy the other previous principles.

Table 8: Adjusted definitions of pricing principles applied in the Danube ports

Based on the above definitions and current practices, the ports analysed in Activity 2.3 (and in this report) are applying the port pricing principles as summarized in the below figure.

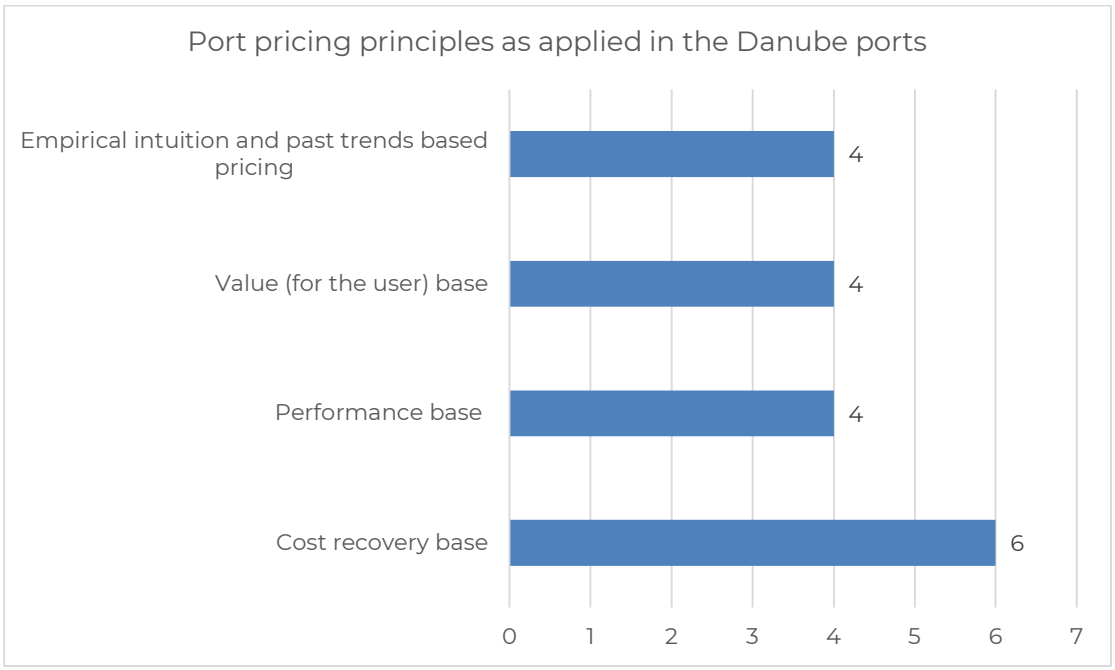

Figure 9: Port pricing principles as applied in the Danube ports

6.8 Standard infrastructure fees in the Danube ports

The analysis in the Deliverable D.T2.3.3 demonstrated that most of the analysed ports charge berth fees (for the usage of the "wet" side of the quay by ships). Second most common infrastructure fee is the idle ship fee, which accounts for the use of the berth by ships that are not loading or unloading. In order to respect the "user pays" principles, most ports share the use of the quay between the cargo owners and ship owners, by charging ship owners/operators for the use of the "wet" side of the quay and by charging cargo owners for the use of the "dry" side of the quay. The latter charge is most commonly called the wharfage fee. Other infrastructure fees charged in the Danube ports are related to the use of the port's internal rail and road infrastructure by trucks and trains. One port (sea port of Constanta) is also charging the typical seaport charged called the navigation aid fees, which is very common among seaports not just in the Danube area but all over the world.

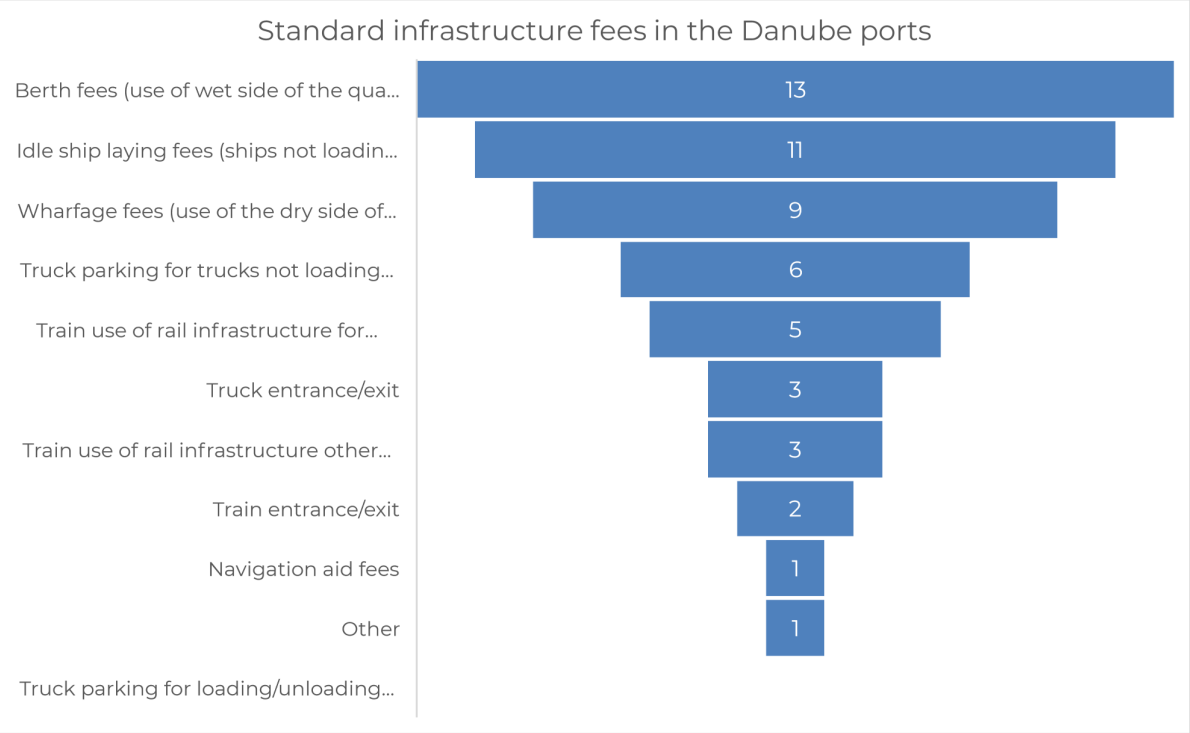

Figure 10: Standard infrastructure fees in the Danube ports

7 Proposals for alternative dynamic pricing methods

7.1.1 Pre-defined alternative pricing methods

The questionnaire[3] distributed among port authorities and port operators contained several pre-proposed alternative pricing methods, plus an option for the respondents to propose their own alternative pricing methods taking into account the objective of the entire Activity T2.3.

Pre-proposed alternative pricing methods were the following:

- Congestion based pricing
- Marginal cost based pricing
- Price differentiation – performance based (on time and/or volume)
- Price differentiation – based on quality of service
- Two-part tariffs 1 (fixed basis + variable time)
- Two-part tariffs 2 (fixed basis plus + variable amount of cargo)
- Cost based pricing (with all its variants)
- Value based pricing
- Auction based pricing – selling port slots forward
- Other

Congestion based pricing is based on the quest to achieve the optimal use of infrastructure or suprastructure assets. Basic principle is to decrease the tariffs when the use of the asset is below optimal thus attracting the prospective users to use the asset, and to increase the tariffs when the use of the asset is above optimal thus discouraging users from using the asset and avoid the potential congestion issues.

Marginal cost-based pricing only covers the variable costs of production and does not consider fixed costs. Marginal cost is the change in total cost that comes from making or producing one additional item, for example one additional hour of berthing or one additional ton of wharfage. Marginal cost is, in practice, very difficult to calculate and it is usually approximated with standard cost-based pricing, taking into account only variable costs since the change in fixed costs is zero, regardless of the additional hour of berthing or length meter of a berth.

Simplified, the calculation of the marginal cost can be done according to the following formula:

$$C_m = \frac{\Delta C_t}{\Delta Q} = \frac{\Delta C_{tf} + \Delta C_{tv}}{\Delta Q}$$

Where:

[3] DIONYSUS Project (2022), Deliverable D.T2.3.3 Questionnaire on applied pricing principles in ports, February 2022.

C_m – marginal cost

ΔC_t – change in total costs

ΔC_{tf} – change in total fixed costs

ΔC_{tv} – change in total variable costs

ΔQ – change in quantity (additional unit of cargo, or additional unit of berthing, etc.)

Fixed cost change (Δ total fixed cost) is equal to zero. Total fixed costs will be unchanged as output increases since the port can still use the same equipment to increase production and fixed costs of a berth or a crane are independent of time (the ship remains berthed) or quantity (of cargo handled). Therefore, we can rewrite the above formula to be:

$$C_m = \frac{\Delta C_{tv}}{\Delta Q}$$

Since this method does not cover the total costs, it can be used only as a short-term strategy, for example, for the achievement of a determined set of objectives.

Price differentiation method based on performance (on time and/or volume) incentivises productive behaviour of port actors (port authorities, port operators, ship owners, cargo owners, etc.) resulting in lower fees for less time spent at berth, for example. This method also incentivises cargo being stored for a shorter amount of time or loaded/unloaded faster, that is, offers time or volume rebates. It does not have a fixed part related to the tonnage of vessel or cargo type of value. If it doesn't include the fixed part (based on, say, vessel tonnage), then it misses to reflect the vessel size or, in case of cargo, the type or value of cargo, which may not be beneficial to port. If it does include the fixed part (for vessel and/or cargo), then this method becomes the *Two-part tariffs 1 (fixed basis + variable time) method* or the *Two-part tariffs 2 (fixed basis plus + variable amount of cargo) method*.

Price differentiation method based on quality of service[4] focuses on the quality of service, whereas the quality may be defined according to the need or according to the perception of the targeted users/customers. The quality dimension of port services includes elements such as total time in port, punctuality and handling with little damage. A scheme of quality pricing may give port operators the right incentives to increase efficiency. The demand for port services is variable over time, and ports do not always have full information on the schedules of incoming vessels. In this setting port costs reflect the expected time in port and the punctuality in port operations, in addition to the different port dues or payable port costs. Thus, total port costs would consist of:

$$C = d + f(t + p)$$

Where:

[4] Strandenes, S. P., & Marlow, P. B. (2000). Port Pricing and Competitiveness in Short Sea Shipping. *International Journal of Transport Economics / Rivista Internazionale Di Economia Dei Trasporti*, *27*(3), 315–334.

d = ship and cargo dues

t = duration of port stay

p = waiting time reflecting punctuality

f = costs per unit of time

The time or duration of the port stay and the punctuality are examples of quality factors. The duration depends on the time needed for handling vessels and cargoes, while quality class defines the punctuality requirements. This quality dimension can be specified, as a guarantee on total handling time for the vessels and the total time needed for the cargo to pass through the port. The value of speed and punctuality reflects the opportunity cost to shipowners of fewer fixtures per period and to shippers of having to wait for the cargo to be delivered. These opportunity costs vary with the length of the delay and the value of the goods in their final use.

Strandenes and Marlow (2000) suggest a two-part tariff to capture the two-dimensional cost structure. The two parts reflect the demand elasticities of price and of time, respectively. The first replaces vessel and cargo dues and is fixed irrespective of quality class. The second part should reflect quality class with higher prices for fast and punctual port services than for port services without any quality guarantee. Therefore, the focus here is on the opportunity cost of too little choice i.e. of not being allowed to choose from different port service qualities.

In this case it does not matter whether the fixed port due and the price paid for a specific quality class are levied on the shipowner or the cargo owner. If levied on the shipowner, the shipper will pay port costs as part of the freight rate. Whether the shipowner's outlay is covered by the freight rate in full or in part, will depend on the conditions in the freight market. This may not be welcomed by the ship owners so it may be wise to split the ship and cargo dues. On the other hand, if port dues are levied directly on the cargo owner, this implies that the freight rate is a net transport cost to the shipper for the waterborne transport only. Both the fixed element and the quality dependent port price may of course be split between the ship and the cargo owners.

The above scheme is not only relevant to congested ports where vessels may have to wait before being discharged or loaded. Generally, some over-capacity in ports is economical. Ports with ample berthing capacity may also differentiate their service by guarantees on the total handling time and the total time for goods to pass through the port, i.e. to ration capacity when the port faces bottlenecks hampering the flow of goods through the port. Such pricing schemes give the port incentives to increase their efficiency in port operations by being able to offer time guarantees to time sensitive users.

The above principle is valid when the time and punctuality are chosen as indicators of quality. Those indicators, as mentioned earlier, can be different, such as low percentage of damaged cargo, various value added-services for both vessel and cargo which may be included in the variable part of the fee, etc.

Two-part tariffs 1 (fixed basis + variable time) method is very similar to the pricing method based on quality of service, with the difference in the fact that when ship-borne dues are in question, the ship owner can incentivise (in different ways) the

cargo owner to seek for faster turnaround of a vessel in port. With this pricing method, the port can manage the time a vessel or cargo spends in port.

Two-part tariffs 2 (fixed basis plus + variable amount of cargo) method incentivises those users who move larger quantities of cargo through a port, that is, it includes volume rebates.

Cost based pricing method encompasses several variants, depending on what type of costs are included in this method, and whether any future costs (e.g. for port development) are included in the price or not. Last, but not least, a port can add a profit margin to the cost-based pricing method thus clearly aiming not only at cost recovery but also at creating a reasonable amount of profit above the cost recovery. Basic variants of cost-based pricing are the following:

- Cost recovery 1 (operating & maintenance expenses only)
- Cost recovery 2 (1+depreciation)
- Cost recovery 3 (1+2+interest charges on loans)
- Cost recovery 4 (1+2+3+provisions for port development and improvement)
- Cost recovery 5 (1+2+3+4+rate of return)

Value based pricing method is based on the value added to the activities of the users of the services and facilities. This method aims at generating 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. Value based tariffs can include both port dues for ships (berthing fees) and port dues for cargoes (wharfage). Ship borne value-based dues are based on the type and size of the vessels, that is, based on the value to the ship operator of calling at the port. In this way the ship dues take into account the potential earnings from the port call which is compared to the daily cost of the vessel. In case of cargo-borne port dues (wharfage), this method takes into account the monetary value of cargo, as measured in terms of CIF/FOB value, with the unit of differentiation based on the direction of movement, e.g. import, export and transhipment. Cargo dues cover the costs for development and maintenance of land-side infrastructure which is used by cargo and therefore separate tariffs for containers, break-bulk, liquid bulk and dry bulk cargoes can be used to differentiate among cargoes according to their value and price sensitivity.

Auction based pricing (selling port slots forward) method is a method that is suggested for very busy ports. This method is significantly adapted from the air transport industry, where no plane can take off from the departure airport unless it has a reserved time slot at the destination airport. In waterborne transport, the ship owners would be allowed to bid for the most attractive time slot for berthing and even to pay for it in advance. This method allows ports to have a better overview of the future demand and therefore readjust their capacities.

Port authorities and port operators who took part in the questionnaire gave their own opinion on the desired pricing policy, summarized in the below figure.

Figure 11: Proposed alternative pricing methods for ports

7.1.2 Alternative pricing methods proposed by port authorities and operators

Additional alternative pricing methods for infrastructure use in ports are given in the Deliverable D.T2.3.4 Study report on port costing & pricing in the Danube region and summarized below:

7.1.2.1 Austria

Infrastructure fee: Berth fee
Proposed alternative method: According to the targets of Green Deal and the respective deployment for Austria (fit for 55, mobility master plan, …) vessels shall reach a status of “zero emission” until 2040.

Therefore, vessels which fulfil this future standard may have significant reduction of berth fee in an Austrian port. There could be a reduction of 80 % of the actual value for a period of 3 years, then probably 50 % for additional 3 years, then other 30 % for the next 3 years, …. [the figures are only examples, there could be developed a very sophisticated system with between-levels, …., percentual CO2-reduction ,….] Meaning that in the first appr. 10 years of coming with "clean vessel" into Austrian ports the ship owners really save money and get a benefit of being a frontrunner as sustainable vessel user. But the Austrian ports need this money (for CAPEX, OPEX), therefore the ports shall get back the money of the government, financed by funding of CO2-emission trading and tax systems. In total the emission trading system shall enable vessel business to become more greener by a solution, which is cost-neutral to the vessel owners, who are responsible for paying the berth fee. In order not to make it too complicated there should not be installed a bonus-malus-system, only a "positive approach" via bonus (the "malus part" part of the deal is taken by the CO2-pricing). Remark: this proposal is to foster the approach on ship owners towards environmentally friendly "floating business" of vessels. Beneath that, for the "resting business" of vessels within the port the OPS-solution is still valid (the pricing system for OPS is currently under development on EU-level – tax!). After finalizing of this open discussion and ongoing discussions regarding CAPEX-founding for OPS-installations in ports a similar system for incentives of OPS may be developed.
Explanation/justification: Inland waterway business will only survive if the "weakest element in the chain" (regarding profitability) – this is the vessel owner – will get enough support during the change process to reach Green deal targets. There are so many different approaches: new engines, end-of-pipe technologies, new fuels, …. – but all of them cost money. On the other hand, there is a "strong call" of NAIADES-3 (and other programs) to enhance IWW-cargo (25 % by 2030 and 50 % by 2050) – but in a lean way (zero emission). So the only way will be to find a solution which can make IWW-cargo more cleaner and not to increase cost. Otherwise, nothing will happen and targets will be only paper figures. By a new system (as described above – or something similar to this) this will create a framework which boost both cargo and sustainability for everybody within this logistic chain.
What needs to be done: explain here what needs to be done in order to implement the proposed alternative pricing method Presentation and discussion of the idea in Austrian gremial boards (IGÖD, PDA, ….) and ministerial departments, even on Danube Region levels.

Table 9: Proposed alternative pricing method for berth fee in Austria

7.1.2.2 Slovakia

Infrastructure fee: Obstacle / Danger fee
Proposed alternative method: Cost based pricing
Explanation/justification: In recent history of ports there have been cases when some vessels only by its technical condition or position in port caused restriction or danger to port operation or to safety and security of other vessels, cargo, equipment or personnel. Objective of this fee is to have a measure to calculate and shift risk and costs towards the responsible vessel owner/operator.
What needs to be done: Tariff for payments for use of public ports on the waterways in the Slovak Republic to be updated and approve by Ministry of transport and construction of the SR.

Table 10: Proposed alternative pricing method for being obstacle / causing danger

Infrastructure fee: Stay fee
Proposed alternative method: Value based pricing
Explanation/justification: This is considered change of current Tarif that charges each commenced day. If the vessel enters the port minutes before midnight or leave few minutes after, two days will be charged / invoiced. Intent is to charge this fee for every 24 hours completed.
What needs to be done: • Tariff for payments for use of public ports on the waterways in the Slovak Republic to be updated and approve by Ministry of transport and construction of the SR. • Automated registration of entrance must be in place. Either through RIS, port monitoring system or independent direct registration (mobile app, QR code etc.) • Direct integration of DAVID form to invoicing software • Notifications for Port authority

Table 11: Proposed alternative pricing method for Stay fee

Infrastructure fee: Passenger fee
Proposed alternative method: Performance based pricing
Explanation/justification: This fee is relevant for passenger transportation. Currently the Port authority charges only fixed stay fee for cabin vessel. Capacity of the vessel or number of passengers aboard is not relevant. Idea is to adopt generally used approach to implement fee mirroring either capacity of the cabin vessel or number of passengers onboard.
What needs to be done: • Tariff for payments for use of public ports on the waterways in the Slovak Republic to be updated and approve by Ministry of transport and construction of the SR. • Automated registration of entrance must be in place. Either through RIS, port monitoring system or independent direct registration (mobile app, QR code etc.)

Table 12: Proposed alternative pricing method for Passenger fee

7.1.2.3 Hungary

Infrastructure fee: Charges based on cargo capacity
Proposed alternative method: Fees for typical vessel types could be harmonised in the larger domestic ports (cca. 30 port)
Explanation/justification: Tariffs in domestic ports would be more predictable
What needs to be done: A higher level of cooperation between ports is needed

Table 13: Proposed alternative pricing method for Carges based on cargo capacity

Infrastructure fee: Differentiation based on the environmental impact of vessels
Proposed alternative method: We can make a distinction based on the environmental impact of the vessel, if the vessel is more than x years old, you will have to pay a 5-10% surcharge. The opposite might be that if the boat is a "green boat", i.e. hybrid powered, using shore power you get some discount on the fees.
Explanation/justification: Transport companies may be more motivated to make their fleet more sustainable.

What needs to be done: Further elaboration of the proposal is needed, calculating exact charges for different types of vessels.

Table 14: Proposed alternative pricing method for environmental impact of the vessels

Infrastructure fee: The investment and maintenance costs of the port determine the tariffs.
Proposed alternative method: Port fees are calculated purely on the basis of maintenance and investment costs + profit.
Explanation/justification: For example, the dredging of a harbour costs HUF 20 million every 10 years, which is normally the cost of the port operator, but it may not always be paid by the port operator. So, if there is one, it can be included in the cost and divided by the turnover so that all vessels contribute equally to the use of the port at the same quality. Where dredging costs are not paid by the port operator, there are no such costs.
What needs to be done: It is necessary to calculate the financial and economic impact of such a measure.

Table 15: Proposed alternative pricing method for investment and maintenance costs based pricing

7.1.2.4 Croatia

Infrastructure fee: Due for using quay
Proposed alternative method: Due for using quay – incentive for use of scrubbers and alternative fuel sources – GREENCENTIVE
Explanation/justification: Since the port dues differentiation has been the subject of a market driven and very competitive environment, it is necessary to focus on strategic differentiation to understand the current practises and to identify potentials for reaching local environmental goals and standards. In this context, port infrastructure charges and their strategic differentiation might be an intermediate step, creating incentives at the local level to improve environmental performance and encourage more environmentally sound behavior on the part of port users. The concept of strategic differentiation of infrastructure charges to encourage more environmentally sound behavior, reduce emissions or promote technological change can be used as a tool for moving towards a greener economy. Keeping this in mind, a proposed measure for the Vukovar port in this instance would be an incentive programme rewarding port users which are in compliance with green(er)

energy alternatives. Measure such as an installed scrubber on a ship would bring a 20% discount on the due for using quay, whereas ships which are completely fueled by an alternative energy source such as hydrogen would benefit with as much as 30% discount. The proposed measures aim at incentivization of first-movers in the sector where the rest following would cause a highly desired environmental shift towards zero-carbon society and sustainability of a port and industry in general.
What needs to be done: The approach to differentiated port charges can be driven by a port's own strategic decision or can be voluntary in order to anticipate developments driven by external influences (such as environmental policy at the national level). The main difference between strategic and voluntary differentiation is that, in theory, a voluntary differentiation scheme has to be revenue-neutral to be attractive for implementation and should not negatively impact competitiveness with other ports. For this idea to come to fruition, Port Authority Vukovar would have to revise their currently applicable Decision on the amount of port dues in ports and harbours.

Table 16: Proposed alternative pricing method for Vukovar

7.1.2.5 Serbia

Infrastructure fee: Wharfage, transhipment of containers
Proposed alternative method: Sliding fee scale
Explanation/justification: In order to stimulate multimodality and bring more containers on waterways, some kind of discount could be applied. Example: If the user/client has transshipped more than 1000 TEUs he gets 5% discount, for 3000 he gets 10%, etc. Since these could not be applied retroactively, achieved numbers would entitle user/client for the discount on next year throughput.
What needs to be done: change of the Law on Charges for the Usage of Public Goods

Table 17: Proposed alternative pricing method for Wharfage for containers

Infrastructure fee: Wharfage
Proposed alternative method: 20% discount for all cargo shipped by vessels using alternative fuels
Explanation/justification: In order to stimulate achievement of European Green Deal goals and Fit for 55 plan, discount should be given to all users/clients using vessels on

alternative fuels.
What needs to be done: change of the Law on Charges for the Usage of Public Goods

Table 18: Proposed alternative pricing method for Wharfage for cargo shipped by vessels using alternative fuels

Infrastructure fee: Berthing
Proposed alternative method: 20% discount for all vessels using alternative fuels
Explanation/justification: In order to stimulate achievement of European Green Deal goals and Fit for 55 plan, discount should be given to all vessels using alternative fuels.
What needs to be done: change of the Law on Charges for the Usage of Public Goods

Table 19: Proposed alternative pricing method for Berthing of vessels using alternative fuels

7.1.2.6 Romania

No input received.

8 Conclusions

This report yet again proved the complexity of port pricing as a very sensitive and complicated part of port economics. For this reason, the entire work in this activity did not insist on a "one size fits all" approach in determining alternative pricing methods for the port fees, primarily for infrastructure fees.

Aside from providing an insight into different port pricing schemes applied in the Danube region, this activity provided different views on potential alternative pricing methods for port infrastructure fees, in order to make them less rigid and more flexible and adaptable to dynamic changes at the waterborne transport market. The adaptability of the port infrastructure fees is required due to the market volatility, physical restrictions of navigation or even induced by strategically planned focus on, for example, exports of certain type of goods using waterborne transportation.

The level of dynamism of the proposed alternative pricing methods is limited. Proposals range from those focused on boosting the alternative clean fuels usage, via CPV (cost, performance, value) based tariffs, to harmonization of port fees in larger ports and offering discounts in wharfage fees for the certain types of cargoes and their volumes. These sliding fees, or the market-based pricing, require care that 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.

Both pre-defined proposed alternative pricing methods and those proposed by ports themselves revealed that there is significant room for improvement and that the current port fees do not reflect the necessary flexibility in order to buffer the dynamic market conditions. Several proposals included the contribution of ports and inland waterway transportation in general to the ongoing quest of reduction of carbon footprint of port and IWT industry.

Quite surprisingly, not a single port authority proposed the port fees to be used for promotion of specific objectives, such as financial alleviation for ship and cargo owners through proportionally lower port fees during periods of low water and inability to use the maximum payload of ships and barges, attraction of a particular type of cargo, promotion of exports of certain cargoes, etc. None of the proposed alternative methods took into account various nautical hindrances that may occur throughout the year and which would be a good reason to introduce the dynamic infrastructure fees. This dynamic nature of the port infrastructure fees could have been achieved on the basis of, say, maximum payload that can be loaded at a given water level – meaning that if, due to the low water period, ship operators can load, say, 25% less cargo than usual (at normal water levels), this would lead to a proportional reduction of unit port fees charged by port authorities. In such way, port authorities would help cargo owners and ship operators to cope with financial losses due to restricted loading capacity during low waters. Even though the port fees do not form

a larger share of the total port costs, it would certainly be welcomed by ship owners and operators. This requires further analysis in a potential follow up of this project.

Several proposals were related to reduction of port infrastructure fees for vessels using green fuels or shutting down their generators during port call, being connected to the onshore power supply (a.k.a. shore-side power supply or SSPS). Unfortunately, no ships using green fuels exist on the Danube, but reduction of port fees for vessels using OPS is one of the options for contributing to the “greening” of ports and port operations.

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