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Traffic Economics  
Review  
U. D. C.: 656.615:65.03  
Accepted: Jun. 3, 2002  
Approved: Sep. 2, 2003

## COST PRICE CHARACTERISTICS OF SEAPORT AND RIVER PORT SERVICES

### ABSTRACT

*The discussion about the various aspects of the cost price of the respective services starts from the previous knowledge about the role and significance of the sea and river ports within the traffic system, and the scope of their services. The previous knowledge includes also the knowledge about the used means of long-term assets which are in this study classified into following three groups: a) objects of infrastructure, b) objects of superstructure, and c) shopfloors and equipment.*

*The structure and functional purpose of these means confirms the high capital intensity of the sea and river port terminals, which leads to the high share of the fixed components of the costs in the cost price of these services.*

*Most of the definitions of the cost price start from the fact that it is a part of the value or price of production, i.e. services, which accounts for the price of the used means (raw materials and fixed capital) and the price of the labour.*

*The procedure of obtaining the cost price is called calculation, and certain rules or principles starting from punctuality, adaptability, updating, comparability, economic efficiency, etc. need to be complied with.*

*Due to very high fragmentation of the sea and river port services, it is difficult to harmonise all the mentioned principles, and in calculating the full cost price various methods for calculating the common costs are applied, and the suitable methods of distributing the common costs, i.e. overheads. In order to calculate these procedures as precisely as possible, appropriate indicators are used, i.e. indirect indicators, but everything would be much simpler if the differentiation were narrower, i.e. if the number of given services were reduced by an adequate procedure of levelling out.*

### KEY WORDS

*sea and river ports, sea and river port services, cost price, separation of common costs, costs of production, distribution of common costs, calculation, fixed component*

### 1. INTRODUCTION

In order to be able to discuss the cost price of port services, it is necessary to discuss first the essential

contents, means and methods of forming the services in sea- and river-port activities. Therefore, the task of this paper is to be expanded on acquiring knowledge and discussing the nature, contents and scope of a greater number of activities at seaport and river port points, which at the same time represent the services of their economic subjects.

The objective is to consider in detail and as objectively as possible the cost price of the respective services based on a comprehensive study, from all the relevant aspects, in order to be able to provide suggestions regarding rationalisation of the work and reduction in cost prices.

Regarding content, this study encompasses activities and their cost prices in sea and river port subjects, and what they have in common is that they represent terminals that connect the surface and water transport carriers. Seaports are, namely, segments of the maritime transport as well as of the other activities relying or related to maritime affairs, whereas river ports represent the same but in inland waterway (river and lakes) traffic.

Considering the greater number of tasks and activities that are usually carried out at sea and river port points, on the one hand, and the joint usage of the great part of the basic material structure (basic operating capacities) on the other, the problems in cost price calculation are reflected from the aspect of calculating the indirect and general costs. This depends to a great extent on the adequate organisational actions in these subjects, and in this case it is better if the solutions provide direct allocation of the maximum mass of costs possible to the precisely determined bearers – services.

These problems require also adequate concept of this elaboration which starts from the fact that the first part of the work discusses the purpose and role of these subjects, and their usual and possible activities as well as the structure of the basic means of operation, and then it passes to the explicit issues of the cost price.

## 2. GENERALLY ABOUT THE ROLE AND USUAL ACTIVITIES OF SEA AND RIVER PORTS

All the essential issues about these economic subjects are treated here, and particularly about their basic activity, i.e. their primary services, as well as other elements relevant for the cost price of the respective services. It is especially important to identify the basic traffic and directly related functions of the sea and river ports, because this study is focused on the cost price of the traffic and other implicit services.

### 2.1. Basic traffic functions of sea and river ports

As known, apart from the traffic function, the sea and river port points may also have the commercial and industrial functions according to which they operate as economic subjects of those activities. The sea and river port functions develop particularly as part of the free zones, within which a certain form of trading and industrial production are carried out according to certain duty and tax benefits.

However, this paper studies their traffic functions, according to which these subjects are segments of the traffic system of a country, and as part of the water transport they are the starting and end points of the transport. These are at the same time refraction points in which several traffic modes are connected and make contact, so that it would prove difficult to find a sea or river port in which there is no connection to railway or road traffic. In other words, the co-operation between the water traffic and other modes of surface, i.e. dry land traffic is established here, basically in the transportation of goods, since water transport of passengers is used only sporadically and on local relations along the coastal area.

Apart from the transportation of goods (loading, unloading, reloading, storage) numerous other activities are carried out at the sea and river port terminals, either related to different servicing of the water traffic, or other activities regarding goods handling, that will be considered in detail further in this paper. Therefore, the basic traffic functions of these subjects are classified as activities of the servicing character, and their number and diversity depend on the volume and traffic significance of the single subjects, which is otherwise very differentiated, both in internal – local and in international dimensions.

### 2.2. Most important activities and jobs at the sea and river port terminals

The massiveness and heterogeneity of jobs and activities at the mentioned terminal points are mostly re-

sult of their designated functions and gravitation zone served by them regarding transport, either in dispatch or delivery of goods. However, such knowledge is necessary because it provides the possible scope of services, both regarding massiveness and regarding their diversity.

Naturally, in this sense there may be a great number of diverse situations, ranging from the really simple ones (when only one type of load is handled and in only one direction: coast – vessel or vice versa), to the most complex situations (regarding a large and uncertain number of types of cargo and packaging, and a greater number of handling activities, and various goods handling methods). The examples of the former situation are most common in river ports, when, for instance, only sand or gravel are unloaded from the vessel, using the simplest equipment and handling devices, and the port has no other activities to perform with regard to this cargo.

Another extreme situation refers usually to seaports which are equipped and qualified not only for a much greater mass and diversity of cargo, but also for various methods of cargo handling activities regarding the storage, treatment, and processing, i.e. value adding. At the Croatian Adriatic these include first of all Rijeka and Ploče, then Koper in Slovenia, and this is especially true for the biggest European ports of Rotterdam, Hamburg, Genoa, etc. which without doubt belong to the most complex technical and technological systems of port facilities.

Besides, there are also the relatively less specialised ports in which only special types of cargo are handled, such as the port of Šibenik with the dominance of raw phosphates and artificial fertilisers, and Bakar, specialised for bulk cargo and Raša, specialised for cattle, wood and self-propelling road vehicles (Roll-on, Roll-off).

Following this general overview of the activities of sea- and river port subjects as part of their traffic function, a more comprehensive overview of the tasks and activities in the major ports is given, according to the specification in Table 1.

By looking at the presented specification in Table 1 regarding possible activities, one may notice that the primary tasks of the major ports are classified by ord. numbers 1 to 20, and in some catering-servicing activities from ord. numbers 25 to 28, whereas other activities are mainly of secondary and implicit character. When the service port activities, from column 2 are multiplied by their further differentiation in columns 3 and 4, then a much greater number of services is obtained, for which individual cost price calculation is practically not only impossible, but also unnecessary.

The presented overview of port activities with the dominance of authentic port activities such as reloading and goods storage, indicate to a great extent the

Table 1 – Summarised specification and differentiation of the activities and port services<sup>1</sup>

Ord. No.	Basic services and basic cargo groups	No. of different services	No. and type of handling activities
1	2	3	4
1	reloading: - general cargo, up to 3 t, - heavy cargo, 3 – 100 t, - vessels, 0.5 – 30 t	20 groups and packaging 5 groups per cargo mass 7 groups per cargo mass	4 H – W, W – V 4 W – S, S – V 2 H – T, T – V – H
2	storage: general cargo heavy cargo, vessels	3 covered storehouse, roofed, open-air open-air storehouse	
3	reloading: dangerous cargo (class 1-9 ZPOT)	4 types of increasing the ord. No. 1	as in 1
4	storage: dangerous cargo in special closed wire-fenced storehouses		
5	reloading: deep frozen, conditioned and perishable cargo	6 groups – types	4 as in 1
6	storage: deep frozen, conditioned and perishable cargo	2 types of warehouses	
7	reloading: cattle, specified according to species and mass	4 groups	2 V – H, V – Š – H
8	storage: cattle, and hay and straw	5 groups per number of items	
9	reloading: containers, trailers, vehicles	14 groups, per feet and mass of the vehicle	2 H – T, V – T
10	filling and emptying of containers and trailers	3 groups per mass, m <sup>3</sup> and type of goods	2 direct and indirect loading
11	storage: containers, trailers and vehicles	7 groups per feet and types of vehicles	
12	reloading: wood, logs, wickerwork	15 groups according to type and dimension of wood	4 as in 1
13	storage: various types of wood	7 groups per mass and volume in m <sup>3</sup>	
14	reloading: bulk, dry bulk cargo, bulk fertilisers	20 groups per types and standards in mass	4 as in 1 H – T, T – V, H – T – V
15	storage: bulk fertilisers and similar dry bulk cargo	1 group per ton/day	
16	packing in bags: bulk fertilisers and similar dry bulk cargo	2 groups, depending on whether single or within stor.	
17	reloading: grains and oil crops in silos	5 handling phases and transport to storehouses	4 H – Silos, sil – H, sil – V, V – silos
18	storage and mixing of grains / oil crops in silos	3 groups, no weighing, with weighing, packing in bags	
19	reloading: liquid cargo into/out of tanks	3 handling phases	3 H – V, H – tank, tank – V
20	storage according to special agreement, measuring of tank volume, sampling, washing and preparation of railway tank-car	10 types of various procedures with samples and vehicles	
21	fumigation services of various types of cargo in storage	6 types, regarding volume, weight and type of cargo	
22	handling cargo in storehouse: sorting, weighing, reloading from bags to bags, shifting, baling, designating, labelling	over 50 types of various procedures with a special price	transport of cargo within the basin

23	work on the ship: opening/closing of ship's cargo hold, shifting of cargo on the ship, levelling of the bulk cargo	11 different procedures with a special price	similar to operations H – W
24	work in the wagon / vehicle: setting of wagon equipment, covering of bulk cargo in open wagons, packaging of fruit...	25 different procedures	fastening of containers
25	towing of ships: port towage, deep-sea towage – coastal towage, other towing services	8 differentiated towage activities according to ship size	ships up to 2000 and over 25,000 gross tonnage
26	ship pilotage: pilotage in ship arrival / departure, pilotage in repositioning, specific pilotage through canals – straits	about 30 different sizes of pilotage ships	ship size of up to 2000, and over 150,000 gross tonnage
27	ship arrival and departure from berth: per size of gross tonnage, in repositioning	4 different methods of arrival / departure from berth	differentiated per size i.e. gross tonnage
28	acceptance of waste liquids from the ship: fixed item for hiring special ships and further per volume of waste m <sup>3</sup>	5 differentiated volumes – m <sup>3</sup>	4 operations of service ship included
29	port dues paid by the ship: the dues are differentiated by the main groups of cargo (bulk, liquid, general – break-bulk, vehicles – livestock, explosives...	6 types of different items per ship tonnage	
30	berthage for inoperative ship: paid by the ship after the standardised time of cargo handling is over, per length of quay m/day	5 differentiations per different quays and ship sizes	one-off for berthage
31	dues charged for using port surfaces paid by land carriers: dues for one-off access to road vehicles, dues for permanent annual clearance, dues for parking up to 12 hours	11 types regarding road vehicles	paid per vehicle
32	leasing of TOOLS, TECHNICAL AND OTHER MEANS: per hour, per day, etc.	great number of different standards, depending on the number of tools and equipment	technical equipment goes with an expert employee
33	numerous other services: hiring of workers per hour, providing ships with electricity, water, etc., administrative services, etc.		

Source: Tariff of services and dues in international traffic of goods, Luka Rijeka and Luka Koper, 1991

possible rounding up of jobs with the aim of determining the cost prices of single reproduction units. However, apart from the organisational assumptions, the basic material substance needs to be considered as well, i.e. the structure of the used working means, discussed further in the text.

### 2.3. Structure and description of the most important operative means in sea and river ports

For any more precise projection of the cost prices for the sea and river port services, both the characteristics, i.e. technical and functional properties, and the structure of the used means need to be considered. They, namely, cause the costs and affect the cost price

regarding several factors, through: depreciation, maintenance costs, insurance premiums, different consumption of driving power, and personnel engagement.

From the presented specification of the most frequently used objects and working means at the considered terminals (Table 2), one may notice that it is a very diverse and heterogeneous structure of the material substance.

– The first group of objects is typical infrastructure, i.e. the objects built or installed in the ground, that due to the total fixed character provide services only at the allocation point. These are mainly long-term and high-value objects, with a lifetime of 30 to 100 years, and their depreciation rate and the depreciation itself are relatively small. However, therefore,

the maintenance costs, especially the investment costs, can be very significant and of the same influence on the cost price. Along with the insurance premium these are at the same time the only costs related to these objects and dominantly of fixed nature.

- The objects and machinery of the second group (suprastructure) are quite similar to the first group, but there is also a recognisable distinction among

**Table 2 – Specification of objects and operating means used in the sea and river port complex**

<p><b>1. Objects of infrastructure</b></p> <p>1.1. constructed breakwaters, basins, channels</p> <p>1.2. quays and ship berth places</p> <p>1.3. constructed unsheltered sheds</p> <p>1.4. container terminals</p> <p>1.5. constructed parking areas</p> <p>1.6. access and local roads</p> <p>1.7. industrial rail tracks and plants</p> <p><b>2. Objects of suprastructure</b></p> <p>2.1. covered storage for general purposes</p> <p>2.2. covered storage for special purposes: for live-stock, explosives, etc.</p> <p>2.3. silos for various purposes: for concrete, grains, oil crops, etc.</p> <p>2.4. tanks for reloading of liquid cargo: concrete, steel, plastic</p> <p>2.5. workshops for servicing and maintaining mechanisation and equipment</p> <p>2.6. administration buildings and areas</p> <p>2.7. commercial facilities: customs, forwarding, agencies, etc.</p> <p><b>3. Machinery and equipment</b></p> <p>3.1. quay gantries</p> <p>3.2. autocranes</p> <p>3.3. container gantries</p> <p>3.4. floating cranes</p> <p>3.5. forklifts of various capacities</p> <p>3.6. tugboats, push-boats, tugboats</p> <p>3.7. ship loaders, grab-cranes</p> <p>3.8. tractors, trucks, trailers, fire-engines</p> <p>3.9. weighing machines, for wagons and trucks</p> <p>3.10. mixers, compressors - diesel and electric</p> <p>3.11. shunters</p> <p>3.12. pneumatic belt conveyors</p> <p>3.13. computer - information technology terminal</p> <p>3.14. equipment for processing and finishing of goods (packing, sorting, measuring, equalisation, designation)</p> <p>3.15. other equipment and machine tools</p>
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them, since these are more flexible objects and of a shorter lifetime.

As may be seen in Table 2, it refers to more complex objects, of shorter lifetime, of about 20 to 50 years, and this means also with a much greater depreciation rate. The functionality of these objects influences greatly the consumption of drive power of the mobile and dynamic capacities, and even of the workforce involved in their servicing. Regarding maintenance costs at these working capacities, the costs regarding current maintenance are greater than the costs regarding investment maintenance, but due to the depreciation and insurance costs, the fixed costs are still dominant here over the variable costs.

- The third group, as can be seen, contains the most vital part of the material substance, and these are mainly mobile and dynamic working capacities. Regarding such, i.e. dynamic characteristic, these means have a much higher depreciation rate (5% to 20%), i.e. shorter lifetime from 5 to 20 years. Apart from depreciation and insurance premium that are in no way negligible, other costs related to these means, i.e. maintenance, personnel and drive energy, are mostly variable. However, since mobile means are involved, which are more easily purchased or leased, and also sold or rented, a considerable share of the costs related to this group of means can be considered to be variable in the long run.

However, when speaking of long-term assets, it should be mentioned that besides the presented groups of material assets, the so-called non-material assets belong here as well, which e.g. encompass: founding costs, research and development costs, patents, licences, concessions, trademarks and other rights, but their share is very small, usually below 1% of the total value of the long-term assets.

### 3. MAJOR CHARACTERISTICS AND PROBLEMS RELATED TO PORT SERVICE COST PRICE

After having considered in the previous chapter the identified basic services, as well as the structure of the basic operative means or long-term assets at the mentioned points, the cost price itself of these services may be considered now with greater reliability. Therefore, the components of the cost price are discussed first, then the cost price calculation, and the specific characteristics of the sea and river port service cost prices, and eventually, the relation between the cost price and the mass character of the respective services.

### 3.1. About the content and interpretation of cost price in general

Considerations and discussions about the cost price mean in fact the analysis of certain types and certain groups and items of costs, as elements or components of the cost price of certain products and services. Therefore, the cost price consists of numerous cost items which represent the inputs, i.e. investment of the production factors to elicit certain effects which are in this reference case expressed in services. Although there are several definitions for cost price, they are mainly reduced to the fact that it is a part of the value or price of the production of goods or services, which accounts for the price of the means used in production (raw material and constant capital) and on the price of the workforce. The cost price is the most authentic indicator of the actual cost of the given effect, of the product or service.

According to Prof. Dragičević<sup>2</sup> the cost price "is part of the goods value, production price or part of the producer's price, which agrees with the value of the consumed production costs and the sum of the paid rents or payroll accounts. For a capitalist this means the consumed fixed and variable capital". This refers to a part of the production value in that the cost price does not contain the tax on products – services (traffic tax, V.A.T.), nor the profit.

The cost price is otherwise obtained by a special calculation procedure, which in the usual account-keeping terminology is called calculation. Although in practical procedures both the costs and the prices are calculated, some authors distinguish them, so that "the market knows the price, and the company knows the costs"<sup>3</sup>. However, this distinction is very doubtful, since in practice these terms are usually in interaction, i.e. they interweave and merge.

According to Jelavić<sup>4</sup>, the calculation means summing up of the cost items, so that the result is the cost price for the whole number of effects, but it would be more correct to understand the cost price as the costs per unit of effect.

The most important tasks in the cost price calculation include the allocation of costs, either according to locations or to bearers. According to Š. Babić<sup>5</sup>, the distribution of costs per locations is used to determine the productivity and economy per locations and functions, and the distribution of costs per bearers is used to determine the cost price of certain products and services.

In the calculation of costs and cost prices, the majority of the authors prefer certain principles, and Š. Babić<sup>6</sup> insists especially on these, according to whom there are several rules that need to be complied with, such as:

- punctuality – the scope of the relevant costs to a certain effect over a given period of time;

- documentation – the existence of the written proof (accounting records) for the respective costs;
- differentiation – recognition of all the relevant reasons for differentiation – per locations, per functions, per bearers of the occurrence of costs;
- adaptability – flexibility and harmonisation of calculating the cost price with the technological operating process, operation method in the plant, i.e. work unit and the respective organisational solutions;
- updating – compliance with the calculation deadline, in order to provide maximum efficiency,
- comparability – certain unification, both with the earlier periods of time, as well as with other plants and working units, so as to provide better possibilities for adequate comparison analyses;
- economy – starting from the economic justification of cost price calculation, so that it would not be more expensive than the advantages offered.

Some of the mentioned principles will be considered in more detail as part of the issues related to the scope of cost price and the distribution of costs to respective locations and bearers.

### 3.2. Some important issues and doubts related to cost price calculation

Discussing the cost price regarding its content means actually to discuss the scope of costs and their distribution, which belongs into the domain of calculation. The possibility of getting the insight into the range of the cost items, i.e. the completeness of the cost price depends on the method of calculation, i.e. to which extent this calculation is detailed and to which extent synthetic. However, this is also related to the issue of distribution, i.e. separation of individual cost groups to the respective locations and the respective bearers.

The need to distribute the costs during the cost price calculation procedure is induced by the presence of direct or individual costs on one side and the indirect, common costs or overheads on the other. The latter, i.e. indirect costs are the greater, the bigger the economic subject, with a wider range of effects and with a more complex organisational scheme.

The issues regarding adequate distribution of common costs in the interest of completing the cost price will be discussed later in the text. Now follows a wider consideration of the scope of cost items which enter the cost price according to a detailed calculation regarding the Accountancy Law<sup>7</sup>, which is presented in Table 3.

Every working unit should in fact contain the scope of the cost price, according to Table 3, regarding the location of occurrence or the location of costs allocation, as well as every operating effect, i.e. service, for which the cost price is to be calculated, or referred to.

**Table 3 - Detailed overview of cost items that enter the cost price**

Ord. No.	Description of individual cost items	Note
<b>1.</b>	<b>Used raw and other materials (material costs)</b>	
1.1.	used material	
1.2.	consumed power	
1.3.	used spare parts	
1.4.	other material costs	
<b>2.</b>	<b>Services</b>	
2.1.	transport services, postal and telecommunication services	
2.2.	services re. maintenance of the working means	can be separated into internal and external
2.3.	advertising and promotion costs	
2.4.	rents, i.e. leases	into immovable and movable property
2.5.	other services (utility, intellectual services)	
<b>3.</b>	<b>Depreciation of long-term assets</b>	
<b>4.</b>	<b>Other operating costs</b>	
4.1.	personnel incomes	
4.2.	non-production services	
4.3.	representation costs	
4.4.	insurance premiums	
4.5.	membership fees for various societies	
4.6.	taxes and contributions which do not depend on performance	
<b>5.</b>	<b>Interests and similar financial costs</b>	
5.1.	loan interests	
5.2.	bank services	
<b>6.</b>	<b>Incomes and income compensation with taxes and contributions</b>	
6.1.	gross income and wages account	
6.2.	gross income compensation accounts	
6.3.	contributions and gross income tax accounts	

When the locations of costs are considered, then the balancing of the cost price, theoretically, can go from the integral economic subject to the individual

workplace, and even to the individual employee. It is similar in case of balancing (calculating) the cost price per effect, when one can move from the total conditional (equivalent) mass of all effects, to only one phase of a certain effect.

Difficulties in the procedure of reducing the cost price calculation to lower levels, represent those categories and items of costs that are not kept originally, as costs of production, directly at these organisational levels or effects, but on other separated segments.

This occurs either due to organisational reasons that have been conditioned by economic incentives (rationalisation), or due to the impossibility of direct entering of certain costs and charging of certain bearers.

However, it should be mentioned that due to natural types in the sphere of production and the sphere of overheads (common costs), the cost structure itself is relatively similar, but this, of course, does not hold for the quantification share.

In the synthetic model this structure has the following form:

#### **1. Sphere of direct production**

- 1.1. raw and other materials
- 1.2. depreciation
- 1.3. maintenance
- 1.4. gross incomes of employees
- 1.5. other

#### **2. Sphere of shopfloor overheads**

- 2.1. material
- 2.2. depreciation
- 2.3. maintenance
- 2.4. gross incomes of employees
- 2.5. other

#### **3. Sphere of management overheads**

- 3.1. material
- 3.2. depreciation
- 3.3. maintenance
- 3.4. gross incomes of employees
- 3.5. other

As may be seen from the model, the sphere of common costs covers two levels, which is not an absolute must, but rather depends on the organisational solutions. According to some solutions, namely, when a "more shallow" vertical organisation is involved, one of the forms of common costs - overheads, can be avoided, which means that the shopfloor and management overheads can be integrated.

Similarly, the content scope of the costs in the sphere of common costs, overheads, depends on how many and which cost groups have been account-transferred to the so-called superstructure levels. Apart from those costs that originally belong to them on the basis of their own work factors (material means and employees), the transferred costs may include some

costs from the operative - shopfloor sphere, for which it would be much better if monitoring was done from one place for several shopfloors, i.e. for the whole economic subject. These are usually the financial costs - loan interests, bank services, insurance premiums, and according to some solutions also the depreciation of the means that are shared by several bearers.

Although, according to the respective literature, already mentioned here, the common costs or overheads are usually entered as total in one item, the empirical knowledge says that it would be better to enter them according to their nature or function. In this way, namely, it is possible to separate them more precisely and accurately into the adequate bearers, because it is easier to find the adequate key for separating i.e. allocating them.

### 3.3. Issues on separation of common and distribution of general costs of sea and river port services

This refers to dual problems, of which one group refers to the separation of cost price of one cargo handling location or one terminal to single services, whereas the other group refers to the distribution of common (indirect) costs among these bearers.

For the separation of the first form, adequate simple methods of calculation are used, such as division summary method, which is suitable for the same, i.e. homogeneous services. In the concrete case this would be the separation of the total cost price of a specialised cargo handling location or terminal into single reloading services per ton of cargo, such as e.g. bulk cargo, iron ore, coal, artificial fertiliser phosphates, etc. However, the mentioned method, which starts from the division of the cost price of the respective terminal by the reloaded tonnage, can be considered for usage only when one type of cargo out of the three mentioned is being dealt with.

When the reloading of all the three mentioned types of bulk cargo at the same terminal are referred to, then the previous method can be applied only if corrected by the equivalent coefficients. This procedure is indicated by Model 1.

#### Model 1

Type of cargo	Quantity of handled tons	Equivalent coefficient	Accounting quantity of handled tons	Unit cost price of handling per ton USD	Total cost price of handling per USD
Raw phosphates	500	1.0	500	15	7500
Coal	800	0.8	640	12	9600
Iron ore	1000	0.7	700	10.5	10500
$\Sigma$	2300		1840		27600

$$27600:2300 = 12$$

$$27600:1840 = 15$$

In this way, i.e. based on the empirical knowledge, the differentiation of prices is solved, between the range of services that are not actually completely identical, but they are still very similar. Based on the specification of services from Table 1, the following examples need to be highlighted: the handling of containers in three size categories (20, 30 and 40 feet), then handling services of various sizes of livestock, and certain types of grains and oil crops, and numerous other services.

Similar to the shown procedure, the cost prices of single handling phases, i.e. steps can be differentiated, into which the integral cargo handling service is usually divided, starting from the ship, storage to the dispatch vehicle. These phases in handling of the general cargo (direction unloading) usually follow the sequence: ship's cargo hold - winch or hoist (H - W), winch - storehouse (W - S), storehouse - dispatch vehicle (S - V), which is also true vice versa, for the direction of loading into the ship. Starting from the determined cost price for the integral service, which is simpler to determine, single phases are reached via equivalent coefficients according to the "ad hoc" Model 2.

Although the presented phases in the handling phase are the most common, they can also be expanded if between phases I and II a new intermediate phase is included W - local vehicle, which carries the cargo to the port storehouse. The phases can also be narrowed, if port storing of the cargo and port handling are avoided, and instead of the phase II W - S, we apply W - V.

From the equivalent coefficients, i.e. cost price per phases, it is necessary to notice that these prices are higher the closer and more related the operations are to the ship, and they fall as we go away from the ship, which is justified by the fact of the work being more difficult on and around the ship.

Determining the cost price of similar services and their phases in the way presented here, has been stipulated by the fact that it is practically impossible for every range or phase of the service to form and round up the production - work factors, that might insure separate formation of costs and prices, i.e. full cost price.

## Model 2

Cargo handling phases	Equivalent empirical coefficients	Total handling cost price 34 USD cost price per phases USD per ton	Share of single phases in %	Phase cumulating cost price USD per ton
I H - W	1	17	50.0	17
II W - S	0.6	10.20	30.0	27.20
III S - V	0.4	6.80	20.0	34.00
		34.00	100.0	

These moments must, however, be taken into consideration during distribution of general or indirect costs into respective direct costs, i.e. costs of production and adequate operation and organisation business segments. This brings up the essential question of rational, i.e. optimal organisational scheme, which would satisfy the requirements for a sufficiently reasonable reduction of the carriers of the basic traffic and implicitly related services, that would remain identifiably differentiated, but not so much fragmented that the general-overheads part of the cost price should be even bigger. Any greater fragmentation of the rounded up organisational entities, to every single service, results in greater bundling of general costs, i.e. overheads, since it is practically impossible charge directly the over-fragmented production and with the component of cost price.

Precisely therefore, it would be of advantage to manage the activities regarding the organisational issues and related questions about managing locations and allocation of single costs parallel through a co-operative and compromise relation, in order to achieve the optimum also regarding the issue of completing the cost price for single services.

However, it is certainly better to directly distribute as many costs as possible to the bearers of cost, either as organisational units or as respective services within, so that as little as possible remains for indirect distribution in the form of an additional calculation. The precision of this calculation depends, namely, on the mass of costs, i.e. on the volume of the cost price in the component of the common costs, on the method of their structuring and specification, then on the cost price elements in the production and on other available natural work indicators in the sphere of production. Apart from single calculation items of production the key to the distribution of common costs can also include some natural indicators, as machinery working hours regarding distribution of costs related to respective fixed assets (depreciation, maintenance, insurance premium, loan interests).

Other possibilities of equal usage of suitable natural indicators should be mentioned here as well, such as e.g. working hour norm in the sphere of production for possible distribution of certain material expendi-

tures, then the volume of the traffic of goods for the distribution of gross income from the overheads sphere, etc. The most important thing is to take account of the correlation between the given category of the common costs and the basis for distribution in the sphere of production. Therefore, it is sometimes necessary to conceive in the management overheads a suitable specification of costs, let us say according to a functional principle. In order to select the most adequate key for the distribution, it is necessary to know well the content and scope of the costs, i.e. of the part of the cost price in the sphere of production and the part of the cost price in the sphere of common costs. These issues are the more delicate the more developed the activity of a certain sea or river port point, i.e. the greater the number of activities and organisational and shopfloor units.

In this sense only the primary, i.e. explicit activities of one such subject need to be mentioned, and according to Table 1 this subject may have about a dozen specialised terminals and the same number of storehouses, in order to see to some extent the complexity of the system. Adding the same number, if not even more of various implicit activities, one can realise the complexity of the organisation of the accountancy sphere and other competent bases for establishing consistent relations between the shopfloor - operative (production) and common - overheads part of the cost price.

Problems and doubts in such a dynamic system can never be completely solved, including the dilemma whether in the distribution of common costs among bearers of the costs, which includes also the place of allocation, the direct charging of the end-bearer, that is the concrete service should be preferred, or the previous bearer, that is, the given production unit. Both solutions have advantages and disadvantages, although the former solution may seem simpler, because an intermediate phase in the distribution is avoided, that is the separation of common costs, but only of that part of the cost price, whereas the rest still has to be subjected to this procedure.

It is maybe better to leave these doubts to the concrete situation, when such and similar dilemmas may be more easily dealt with depending on the relevant bases.

### 3.4. Important characteristics of costs and cost prices of sea and river port services

The characteristics of costs and cost prices of the mentioned services result from the nature of the basic activity of the respective subjects, as well as on the structure of the used long-term assets, i.e. basic fixed working assets. These postulates provide the structure and dynamic of costs and cost prices for the performance of the basic handling and storage services, as well as other services at the given subjects.

Regarding the specification of the long-term assets, used according to Table 2 in the sea and river port activity, both the infrastructure (fixed) and the movable machinery and equipment, one may say that this activity belongs to the typical capital intensive activities. In the even a little bit organised and modernised points, it is almost impossible to meet a classical physical worker who used to be called a "dock worker" and stood for strength and skill in cargo handling, representing a recognisable symbol of the respective activity.

This has certainly resulted in the reduction of the overall number of the employed compared to the past, so that in the cost price structure of the majority of these subjects the income of the employees does not top the list, but rather the costs related to the fixed assets. The greatest part is the depreciation, and then the maintenance costs and insurance premiums, which from the aspect of cost dynamics are mainly of fixed nature, except for one part of maintenance.

Regarding the structure of the cost price which shows a very high share of the fixed component of costs, the sea and river port activity occupies a specific position within the whole economic structure. However, the relevant share of the fixed component is very fluid compared to the flow of the size of effects, i.e. services, that is, the utilisation level of the working capacities. This phenomenon has analogue implications in the domain of cost pricing of the respective services, preferring the law of mass production, which may influence the reduction of the unit cost price, observed in the adequate model correlations of Table 4.

Under the influence of the high share of fixed costs, as may be seen from Table 4, the increase in turnover, that is, services, including also the greater utilisation of capacities, results in the reduction of the unit cost price (see column 6 - Table 4).

The presented behaviour of the respective phenomena (fixed costs, capacity utilisation and unit cost price) have important repercussions in managing the commercial policy at those subjects, but they need to be knowingly oriented and used. This phenomenon, namely, can be used also in the inverse sense, that is, to adjust the sales prices of services in the traffic recession in a more flexible manner, regarding influence on the cost price, by stimulating the previously simulated correlations.

This is based on the long-past observation made by Emil Sax that in the economic subjects with high share of fixed cost component, the cost price, i.e. costs do not determine the selling price, but rather vice versa, the price determines the costs. The simplified interpretation of such an assumption tends to stop first the descending trend of the traffic services, and then to turn into an ascending spiral by reducing the selling prices, regardless of their current relation to the cost price. The increase in traffic, i.e. increase in services, which is to be realistically expected, the utilisation of the handling, storage and other capacities is improved, and consequently all the other previously described chain reactions.

Apart from the just considered costs and cost prices of services of the basic activities of the sea and river port subjects, the remaining so-called implicit services, specified in Table 1, Ord. No. 21 to 33 need to be mentioned as well, for which the cost price is also determined on the basis of the invested direct production factors, as well as additional calculations for common costs. For both of these cost price calculation components, i.e. direct (production) and additional, the suitable level of the expert and professional responsibility needs to be maintained, since they may have adverse impact on the acquisition power for the explicit, i.e. basic activity services.

**Table 4 - Repercussions of the high share of fixed costs on the reduction of the unit cost price**

Total traffic t (reloading)	Capacity utilisation level %	Variable costs	Fixed costs	Total costs (cost price)	Unit cost price per ton (5:1)	Share of the fixed component of cost price (4:5) %
1	2	3	4	5	6	7
1000	30	12000	120000	132000	132	91
3000	50	36000	125000	156000	52	77
5000	70	60000	125000	185000	37	68
7000	85	84000	125000	209000	30	60

Apart from the internal significance for the given subjects, such considerations in forming the cost price of the services in sea and river port activities, have significant external implications, which may be reduced to the following assumptions:

- higher or lower volume of traffic of goods through the sea and river port terminals means equal (i.e. greater) utilisation of the water traffic as the least expensive transport mode;
- also, this is true for the greater or smaller co-operation of water and land traffic modes, with the simultaneous usage of the advanced integral handling and transportation technologies, which all together reduces the price of the transport and reduces the transport costs;
- the volume of road and rail traffic that connects the sea and river ports depends on this, i.e. on the greater or smaller price and other attractive characteristics and the competitiveness of the sea and river port subjects, which in turn affects the profitability;
- the development of other tertiary activities, such as forwarding, agency, inspection, customs, financial and bank activities, etc. depend on the volume of traffic via respective terminals;
- this includes also the capability of certain sea and river ports for the development of commercial, as well as production and industrial functions within the free zones thus significantly exceeding their traffic and cargo handling role.

All that has been presented in this study shows clearly that the significance and role of the sea and river port complex is not treated only in the market correct, responsible and optimal approach in forming the cost price of their services, for their own sake, but rather with much greater government and social implications.

#### 4. CONCLUSION

The basic starting point in dealing with the presented topic is based on the previous knowledge about the role and significance of the sea and river ports as connecting segments in the traffic system, and their functions and content of operation which is represented by certain services. Apart from the traffic function, which is the most important function realised by sea and river ports within the traffic system, these terminals may have also other functions, such as commercial, industrial and production, storage and distributive, etc.

Within the traffic function, these terminals connect the traffic modes of water transport (sea and river) with the land modes (road and railway) and they allow handling of goods in combined transport among them. This traffic function results in the goods handling and storage services as the most important or ba-

sic activity of sea and river ports, that are first differentiated regarding the main groups of cargo, and then regarding the locations, and the participating machinery, and the handling method and operations. When other activities, mainly implicit activities that are understood along with the basic activity are added to these numerous services of the basic activity, then a very wide range of identified services and their assortment is obtained.

Apart from the identified services and their operating scope, the description and the characteristics of the used working means and their structure need to be considered when forming the cost price. In this study these means have been systematised in three main groups which include: objects of infrastructure, objects of suprastructure, shopfloors and equipment, but a great diversity is observed within every group, as well as functional and value specific characteristics of individual means. The presented long-term assets of the sea and river port complex witnesses very great capital intensity of this activity, which also has analogue implications on the structure of the cost price of the respective services.

Although theoreticians give several definitions regarding the cost price, they mainly start from the fact that this is part of the value or production price, i.e. creation of services, which accounts for the price of the used means (raw materials and fixed capital), and on the price of the labour force. Emphasis on the "part-of-value" bit results from the fact that the cost price does not contain the tax on products - services (value added tax - V.A.T.), nor the profit.

When speaking of calculation as a procedure of obtaining the cost price, some authors distinguish between the calculation of costs which is supposed to be immanent to the enterprise, whereas the price calculation is more immanent to the market, and this is a very doubtful interpretation. It might be rather said that the calculation of costs and the calculation of prices interact, since their values constantly merge, interweave and supplement each other.

However, author consensus can be observed in the cost price calculation procedure, according to which precise rules or principles have to be complied with, ranging from the punctuality, over adaptability, documentation, differentiation, updating, to comparability and economic efficiency. All the mentioned requirements are not simple to harmonise and fulfil due to the very fragmented differentiation, i.e. great range of services, that cannot be controlled by the adequately fragmented organisational scheme, so that in reducing the cost price to the end bearers, there is almost always the need to use various indirect indicators (keys).

This study has identified two basic levels of distributing costs (cost prices) to bearers or locations to which they belong, out of which one refers to the sepa-

ration of the total (determined) costs of a certain entity onto direct bearers - unit services, and the other level refers to the distribution of common costs - overheads, either on the direct bearers, or on the indirect (previous) bearers - organisational units.

At the first level of calculating the costs (cost prices) plain division method is used, when direct bearers (services) have the same - average cost price, and when the cost price needs to be differentiated onto the services of slight distinction (different bulk cargo), the correction division method is applied. The correction is carried out by means of empirical equivalent coefficients compared to a certain service (handling of the given cargo type) which has a positively defined price.

At the second level of distribution, i.e. of common costs - overheads, which fall onto several bearers (entities or services) it is important to select the right basis, i.e. the right indicator (key) which influences the respective item of costs or functional whole within the overheads. These bases can be single groups of costs (production incomes, depreciation in the production sphere, etc.), or adequate natural indicators (machinery working hours, labour hours norm, handled cargo tonnage, etc.).

The presented complexity of the method of separating the common and the distribution of general costs in calculating the cost price could certainly be avoided, if the excessive number of differentiated services were reduced, and an adequate levelling system applied.

Regarding the high share of the fixed component of the costs in sea and river port complex, the cost price can be strongly influenced by the flexible treatment of the selling price, so that a greater volume of traffic is attracted, which would not cause also the increase of the fixed costs. Apart from the positive influence on the mere subjects themselves, such possible moves could also have wider implications, since sea and river ports belong to the economic structures of strong external impact.

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## SAŽETAK

### KARAKTERISTIKE CIJENE KOŠTANJA LUČKIH I PRISTANIŠNIH USLUGA

Rasprava o različitim aspektima cijene koštanja odnosnih usluga polazi od prethodnog upoznavanja uloge i značaja

luka i pristaništa unutar prometnog sustava, te obuhvata i sadržaja njihovih usluga. Također u prethodno upoznavanje spadaju i korištena sredstva dugotrajne imovine, koja se u ovoj elaboraciji razvrstavaju u sljedeće tri skupine: a) objekti infrastrukture, b) objekti suprastrukture i c) postrojenja i oprema.

Struktura i funkcionalna namjena ovih sredstava svjedoči o visokoj kapitalnoj intenzivnosti lučko-pristanišnih punktova, koja dovodi do visokog udjela fiksne komponente troškova u cijeni koštanja dotičnih usluga.

Većina definicija CK polazi od toga da je to dio vrijednosti ili cijene proizvodnje, odnosno usluga, koji otpada na cijenu utrošenih sredstava (sirovina i stalnog kapitala) i na cijenu radne snage.

Postupak dobivanja cijene koštanja naziva se kalkulacijom, a pri njenom izvođenju potrebno se pridržavati stanovitih pravila ili načela, počev od točnosti, prilagodljivosti, ažurnosti, usporedivosti, ekonomičnosti, i dr.

Zbog vrlo velike usitnjenosti lučko-pristanišnih usluga, teško je sva navedena načela uskladiti, a pri kalkuliranju pune cijene koštanja koriste se razne metode svodenja zajedničkih troškova, i odgovarajuće metode raspodjele općih, odnosno režijskih troškova. Kako bi se ovi postupci što preciznije izveli koriste se odgovarajući indikatori, odnosno posredni pokazatelji, ali ipak ne sve bilo jednostavnije kad bi se suzilo diferenciranje, odnosno smanjio broj dotičnih usluga adekvatnim postupkom uprosječivanja.

## KLJUČNE RIJEČI

luke i pristaništa, lučko-pristanišne usluge, cijena koštanja (CK), razdvajanje zajedničkih troškova, troškovi izrade, raspodjela općih troškova, kalkulacija, fiksna komponenta

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