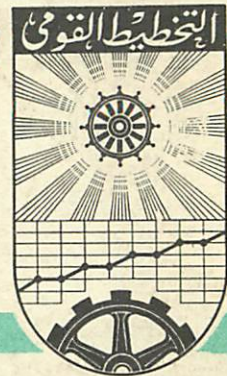


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BARGE CARRYING SYSTEM AS A FACTOR
OF IMPROVING TRANSPORTATION SERVICE
OF THE DEVELOPING COUNTRIES

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Growth in international trade among the different groups of countries, including the exchange between the industrial countries and the developing ones, has resulted in a continual increase of maritime shipping. The obvious consequence of this process is a constant rise in the size of the world merchant fleet expressed as an increase both in number and tonnage, as well as reflected in the dynamics of the technological progress in all spheres of the naval economy.

The rate of increase in the world merchant fleet and the maritime shipping was relatively high over the passed decade as it has exceeded the growth indexes of the world production and the world G N P.

Table 1. Rate of growth of the merchant fleet tonnage and the sea - borne trade in the years 1966-1976
/ a year proceeding = 100 /

Year	Growth in fleet tonnage	Rate of growth of maritime trade	
	/percentage/	/ percentage/	
		mill.tons of cargo	bln. ton - miles
1966	6,8	8,2	6,65
1967	6,4	5,2	15,9
1968	6,6	9,4	15,8
1969	9,0	9,6	11,7
1970	7,4	10,9	13,6
1971	8,7	3,8	10,0
1972	8,5	7,2	11,7
1973	8,0	12,96	17,5
1974	7,4	4,0	6,4
1975	9,9	-6,3	-6,2
1976	8,7	7,7	9,7

Calculated on the basis: Lloyd Register, Statistical Tables - BIMCO Bulletin, No.VI, 1976, p.3951; Fearnley and Egers Chartering Co., Ltd., Review, 1976, p.14.

As a result of this dynamic growth, the world merchant fleet has reached a tonnage of more than 300 million BRT in 1974, and in 1977 its size and structure were as follows:

Table 2. The world merchant fleet according to the state of June 1st 1977 /ships over 300 BRT/

Number and type of ships	Tonnage /thous. BRT/	Load capacity /thous. DWT/	Share of different ship types in the world fleet / percentage /		
			in number of ships	in tonnage	in load capacity
1. ships total 31870	357043	610527	100	100	100
2. Tankers 7099	1722780	328044	22,3	48,4	57,7
3. Ships for transport of dry cargo 24771	184263	2822482	77,7	51,6	46,3

Source: Shipping Statistic Yearbook 1977, Institute of Shipping Economics, Bremen 1977, pp. 5-6

The absolute size of the sea-borne Transport reached 3043 million tons in year 1975, and in 1976 - 3277 million tons^{1/}, while the structure of the transported cargo has shown a predominance of bulk freight, both liquid and dry; crude oil and its products were the dominating freight, which jointly constituted in year 1975 - 49%, and in year 1976 - 50,34 % of all shipments in maritime transport

Table 3. Cargo structure in maritime transport in years 1965, 1966 and 1975, 1976

Year	Cargo size mill.tons	Percent share of main cargoes							
		total	oil /crude/	oil pro-cessed articles	total oil and its pro-ducts	iron ore	coal	corn	other cargoes
1965	1638	100	33,7	10,7	44,4	9,3	3,6	5,0	37,7
1966	1772	100	34,35	11,0	45,35	8,6	3,45	5,2	37,4
1975	3043	100	41,3	7,7	49,0	9,6	4,2	4,5	32,7
1976	3277	100	43,17	7,17	50,34	8,84	3,72	4,3	32,8

Derived on the basis: Fearnley and Egers Chartering Co.Ltd.
Review 1976, p.14

^{1/} Size of freights in ton-miles amounted to: in 1975 - 15,3 bln, in 1976 - 16,8 bln.

Table 3. Cargo structure in maritime transport in years
1965, 1966 and in 1975 and 1976

Year	cargo size / mln tons/	percentage share of main freights							
		total	oil	oil-processed	total	iron	coal	corn	other
			/crude/	articles	oil & products	ore			cargoes
1965	1638	100	33.7	10.7	44.4	9.3	3.6	5.0	37.7
1966	1772	100	34.35	11.00	45.35	8.6	3.45	5.2	37.4
1975	3043	100	41.3	7.7	49.0	9.6	4.2	4.5	32.7
1976	3277	100	43.17	7.17	50.34	8.84	3.72	4.3	32.8

derived on the basis: Fearnley and Egers Chartering Co.Ltd.,
Review 1976, p.14.

The structure of demand for specific cargoes and directions of traffic form the shares of particular countries in the world navigation. The biggest share in turnover of merchandise transported by the sea is represented by the group of highly developed countries, moreover this share is lower as pertains to loadings than unloadings. The situation is reversed in the developing countries, whose share in loadings considerably exceeds disembarkations taking place in their ports. It is a result of the economic role of the Third World countries which still remain the principal exporters of raw materials to the developed countries. The said raw materials, mainly oil, are exported by sea.

Table 4a - Structure of loading in maritime shipping
in particular groups of countries in years
1950 - 1975

Year	World loadings /mil tons/	Highly developed countries		Developing countries		Socialistic countries	
		loadings	world share	loadings	world share	loadings	world share
		/mil tons/	! / % !	/mil tons/	! % !	/mil tons/	! % !
1950	550	215	39,1	308	56,0	27	4,9
1959	996	349	35,0	597	59,9	50	5,0
1970	2605	812	31,17	1628	62,5	155	5,95
1971	2699	821	30,4	1718	63,65	160	5,92
1972	2901	907	31,3	1808	62,3	159	5,5
1973	3276	1048	32,0	2061	63,0	167	5,0
1975	3175	1036	32,5	1953	61,5	186	5,9

Table 4b - Structure of unloadings in maritime shipping
as regards particular groups of countries
in years 1950 - 1975

Year	World un-loadings /mil tons/	Highly developed countries		Developing countries		Socialistic countries	
		unloadings	world share	unloadings	world share	unloadings	world share
		/mil tons/	! / % !	/mil tons/	! % !	/mil tons/	! % !
1950	549	380	69,25	154	28,05	15	2,7
1959	992	751	75,7	220	22,2	21	2,1
1970	2530	2013	79,6	442	17,4	75	3,0
1971	2649	2082	78,6	486	18,4	81	3,0
1972	2866	2267	79,1	496	17,4	97	3,4
1973	3238	2553	78,8	574	17,7	111	3,4
1974	3256	2562	78,7	590	18,1	104	3,2
1975	3081	2357	76,5	597	19,4	122	4,0

Despite certain fluctuations of the developing countries share in the volume of the loadings and anloadings in the world maritime shipping, their share in the maritime trade turnover have shown stability in reaching 40 % of this turnover in the seventies.

Table 5. Share of particular groups of countries in
the world maritime transport turnover in years 1970-75

Year	World transshipments		Share of groups of countries in world			
	/mil tons/	rate of growth %	transshipments	/percentage/	total developed countries	developing socialist countries
1970	5.13	-	100	55.0	40.5	4.5
1971	5.35	4.15	100	54.3	41.2	4.5
1972	5.77	7.8	100	55.5	40.0	4.5
1973	6.51	12.9	100	55.3	40.4	4.5
1974	6.57	0.9	100	55.3	40.3	4.4
1975	6.25	-4.8	100	54.25	40.8	4.95

source: Statistik der Seeverkehrswirtschaft, August 1977,
No.8, pp. 167-168.

Such a high share of the developing countries in the world sea-borne trade turnover visualizes very well the importance of the Third World countries in the development of the maritime shipping and in supplying raw materials as well as agricultural and food products for the developed countries. The cargo traffic from and to the developing countries is generally carried out by ships belonging to ship-owners from the developed countries. The transportation requirements are fulfilled thank to the development and tonnage growth of the principal world fleets, including so called "cheap flags". Yet from the point of view of further development of the maritime trade, the most important problem of the transport services in the developing countries is not an increment in the number of vessels or their tonnage, but an increase in handling capacity of their ports.

Unsatisfactory infrastructure development, and especially congestion of sea ports in the developing countries, constitute the main obstacle to development of maritime shipping in these countries. The present state clearly indicates that these difficulties have a tendency to intensify.

1. Main factors limiting the development of the maritime trade with the Third World countries.

The economic growth theory of the Third World countries exemplifies great many factors limiting the possibilities of acceleration, including both institutional and socio-political factors as well as the other barriers of the economic character which are connected with unsatisfactory levels of accumulation, market and production capacity development in these countries.

In the course of the growth initiation in the developing countries, especially in its second decade, the transportation barrier was revealed with a great intensity. This barrier is closely connected with the infrastructure underdevelopment of the developing countries, has a bearing on possibilities of internal and external transportation links and restricts carrying capacity as regards interdepartmental section as well as spatial systems. The transportation barrier in the developing countries has the greatest significance as regards maritime shipping. Many of these countries

are exporters of raw materials shipped overseas, and at the same time they are importers of various goods supplied by the overseas countries. The ability to cope with the international trade requirements is thus to a great extent determined by transport capacity.

Main factors limiting growth of the maritime trade in the developing countries may be stated as follows:

1. lack or underdevelopment of national merchant fleet,
2. Lack of national production and repair bases for fleet service,
3. unsatisfactory capacity pertaining to servicing and supplying ships in national ports ,
4. too small handling capacity and technological backwardness of the ports.

Solutions for the above mentioned problems may be sought in different planes, both in sphere of external linkages of the developing countries, as well as on the base of actuating their own financial and material potentialities.

A poor development of the merchant fleet of the developing countries and its unsatisfactory carrying capacity create difficulties of a bottlenck character, and above all difficulties in balances of payment, which is a result of a necessity to use foreign vessels for carrying both exported and imported goods. This situation has an effect on diminishing a degree of dispositional self-reliance of the developing countries in the field of loading and unloading organization in the ports and creates a state of dependency on foreign carriers. Though in the essence of the matter

it is principally a problem of payments , as it can be assumed that in the face of their own transport inefficiency the developing countries can use services of the foreign lines or base their sea-transport on chartering vessels from foreign ship-owners. The degree of difficulties existing in the sphere of sea-transport arises from general hardship occurring in particular countries as to condition of their trade and payments balances. There exists a number of variants for solving the problems depending on specified situation of a given country.

1. It may be accepted that there will appear transportation service rendered solely by the foreign carriers both in export and in import. Many countries importing goods from the Third World assume that for their transport, vessels of a receiving party, or vessels chartered by the said party are used.

2. There appears a variant of a mixed character, in which part of freights is carried by foreign vessels, and another part by vessels of a developing country, while concentration of the latter is possible for the shipments in particularly important connexions or the ones characterized by high freight costs. This sort of solution can be found among others in Egypt. Between 1969-1970 the Egyptian fleet carried 25% of all cargoes exported and imported in transactions with the West European countries, which constituted 20.2% of total Egyptian turnover realized by sea. Whereas in servicing

the maritime trade with the East European countries^{3/} constituting then 46.6% of the total sea-borne trade, the Egyptian fleet took part in transporting only 6% of all imported and exported freights.^{4/} This was the result of particularly advantageous freight conditions that Egypt was availed in the trade with the socialist countries.

3. Expansionary variant may appear in particularly advantageous conditions, where a developing country is able to expand a state of its fleet by means of ordering new ships, buying second-hand vessels or by making an effort to launch its own ship-building industry and start producing ships for the national fleet. This variant assumes a gradual increase of the share of national fleet in maritime trade shippings, and further, possibly taking over principal transportation tasks. The OPEC countries among others have taken a decision concerning construction of their own fleet in a pursuit of creating a fleet of tankers for their oil exports. For this purpose a ship-owning company -- United Arab Shipping Co /UASC/ was formed, whose shareholders are Kuwait, Saudi Arabia, Qatar, Oman, United Arab Emirates and Bahrain.^{5/} The oil countries by utilizing their financial resources intend

3/. Apart from the socialist countries there enter:

Greece, Cyprus, Turkey; main position being occupied

4 by Soviet Union, Poland and Yugoslavia.

4/. A.M. Farahat. An Approach Proposal for the Egyptian Problems with Emphasis on Scheduling Aspects. INP, Memo.1082, pp. 26-30

5/. Petrodollar Strength and the International Insurance Case
"Fairplay International Shipping Weekly" 9.9.76 p.59

to intensify the growth of the maritime economy by way of investments in constructions of new ports and fleet development.

4. We may finally accept a stagnation variant where a particular country is outside the sphere of interest of shipping companies, nor does it have any possibilities of development of its own merchant fleet. In this case there appear difficulties in the field of transportation preventing the freight carriage by sea; the cause for the stagnation. Resolution of this state depends on obtaining an international aid and conditions of special preference.

The lack of national repair and production base for servicing national and foreign vessels constitutes one of common phenomena in most of the developing countries. Distinguishing between repair and production functions in the shipping industry is essential. Though it may be accepted that the developing countries do not have at present and will not have in the future the proper conditions for launching their own production of sea-vessels^{6/} and consequently they must build their fleet on the basis of foreign purchases; it is necessary in these countries which show increasing needs in the field of the maritime trade to expand repair shipyard in order to ensure services

6/. Currently 22 developing countries have entered a list of ship producers / condition 1 1976/, 6 of which /Brazil, Argentina, India, Singapore, South Korea & Taiwan/ have reached a yearly output of finished ships above 30 thousand BRT.

for vessels entering their ports. Realizing the importance of this problem a number of developing countries have undertaken an effort to equip their ports with floating docks, indispensable for carrying out major repairs and surveys of ships as well as with repair workshops for handling different types of ships^{7/} -- which is of a great consequence for the countries which are in possession of ports which are situated at the important sea routes of an intense ship traffic. Creation of repair shipyards may not only become the factor inducing the ships to enter these ports, but it may as well create conditions for deriving foreign currency receipts on the score of repair services for foreign shipowners. The solution of the problems resulting from lack of repair back-up facilities in the shipyards may come about in a similar way as in the merchant fleet case. Thus there may be involved foreign or national investments or a joint utilization of the two sources for financing the repair shipyard construction. It seems, that even when making use of transport services rendered solely by foreign vessels, the developing countries still must create a repair base in their ports, at least at the level ensuring the most essential repair services. On the other hand, it may be accepted that both national fleet and foreign ships will use foreign shipyards based on the appropriate repair plans.

In broad terms it may be stated that the lack of national merchant fleet and repair shipyards does not

7/. For example, the shipyard in Alexandria bought a new dock in West Germany in 1976.

exclude a possibility of utilizing by the developing countries services of foreign shipowners. Even though this causes a great deal of complications and burdens these countries with additional foreign currency expenditures, still it does not constitute an absolute barrier in the scope of using the maritime shipping for the purpose of realizing export and import tasks.

The matter is different in case of handling capacity of the ports, providing the port services and catering the ships at a level required by the contemporary technical and exploatational demands of the maritime shipping. The present situation existing currently in the developing countries concerning the port congestion causes the emergence of very high, if not catastrophic losses, coming out of excessive prolongation of lay-time of the ships in the ports. The main reasons for the development of the port congestion may be stated as follows:

1. technical backwardness of the ports as represented by unsatisfactory length of wharfing, too small depth of port entries and harbour basins in relation to increasing size of contemporary vessels, lack of satisfactory transshipment equipment as well as of harbour service craft / tugs, pilot motor-boats, pontoon cranes, barges and dump-scows for transitory transshipments on roadstead or in outer harbour /, lack of adequate warehouse space as well as of developed land transportation network at a port area and its immediate surroundings; all these deficiencies cause unnecessary extension of transshipment time, prolong the period of idle lay-time and consequently increase losses of ship-owners.

2. technical backwardness of the ports in the field of ensuring servicing of the present-day types of ships, giving rise to the fact that the vessels representing the latest techniques in the maritime transportation, do not meet appropriate conditions for their transshipment services in ports of the developing countries and cannot as a rule be directed to these ports; this leads to exploitation of conventional small- and medium capacity vessels, which are relatively older and adapted to transshipping small freight units basing on simple port and their own facilities while taking a long lay-time.

3. deficiencies in material and organizational services and ship-provision conditions, inadequate facilities for bunker stations as well as for delivering water and steward's supplies for the ships, unsuitable organization of the cargo delivery, wrong preparation of the cargo for taking it over by ships, being the reason for lowering goods quality, their damage or even their deterioration as a result of inadequate preservation.

4. all the above factors are acting at the detriment of the ship owners and have been known for many years; still they are only aggrandizing as the state of technology of the contemporary fleet is increasing, because of the disproportion between the degree of novelty of the modern fleet and techno-economical backwardness of the ports in the developing countries.

5. in the conditions of emergence and intensification of all the above-mentioned factors, there occurred a considerable increase in the size of cargo transported by sea; as against the evidently high rate of sea-borne

trade turnover and a great share in it of the developing countries, the handling capacity of the ports grows too slowly, or in many cases remains unaltered, being the reason for the port congestion, prolongation of the lay-time and demurrage of ships waiting for transshipment.

The phenomenon of the port congestion is not the only characteristic trait of the developing countries, but in these countries it has obtained a particularly dramatic meaning. The problem of the port congestion has magnified difficulties of absorption and has appeared as a detriment to the possibilities of the economic growth especially in the case of the oil countries, which thanks to a substantial increase in their import possibilities, coming out of inflow of extra petrodollar incomes, have in a short time become recipients of a vast volume of commodities offered by the developed countries^{8/}. The above is tantamount to the fact that although many countries have obtained a capacity of increasing their supply of investment and consumer goods, still they cannot utilize them facing the transportation difficulties. These difficulties do not only block the goods inflow, but also raise to a great degree the shipping and port costs.

The "Lagos cement scandal", which caused a simultaneous demurrage of 300 anchored ships waiting for the possibility to unload their freight cargoes - the goods purchased by Nigeria, has become a symbolic example of the port congestion^{9/}. In October 1975 - the number of vessels waiting for unloading

8/ The estimates, as stated in World Financial Markets, Morgan Guaranty Trust Co. of New York assume that the OPEC imports will increase from US \$ 50 bln in 1974 to US \$ 227 bln in 1980, that is 354 %.

9/ See B. Barnard, Lagos cement scandal rocks shippers. "Seatrade", December 1975, p.13.

amounted to 400 units, of which 250 were ships carrying cement 1¹⁰/.

According to the data of the Lloyds¹¹ / Company, the demurrage time of the ships in few ports of the developing countries could be represented as follows / March - April 1977/:

Table 6. The lay - days for unloading or loading in chosen ports of the developing countries /March - April 1977/.

Port	Date of notification of the demurrage	Time - period in days	Number of ships berthed at a port
Abu Dhabi	4.4.	26-30	-
Aquaba	15.3.	7-60	8 /plus 15 notified for departure/
Doha	4.4.	40-45	-
Dubai	4.4.	0-70	110
Hodeidah	2.4.	160	-
Karachi	4.4.	18	33
Kuweit	28.3.	38 /ships in conference/ 95 /for ships not in conference/	48 52
Lagos and Apapa	31.1.	6 /for ships in conference 150 /for ships not in conference/	-
Lattakia	21.3.-5.4.	62 /for ships over 300 DWT/ 16 /for ships under 300 DWT/	106
Pireus	31.3.	minimum 21	50
Port Harcourt	2.2.	7-10 /for ships in conference/ 112 /for ships not in conference/	40
Tripolis /Libia/	13.3.	24	69

Source:

Lloyd's List and Shipping Gazette, April 13, 1977, p.3.

Totally on Lloyd's lists there were present 77 ports; this list is uncomplete and informing only about the state existing over a certain period.

10/ D.Tinsley, Problems of congestion compounded by growth."Fairplay International Shipping Weekly", 8th January, 1976, p.54.

11/ Lloyd's List and Shipping Gazette, April 13th, 1977, p.3. Periodical notifications about the phenomenon of the port congestion until the end of 1977 do not indicate any improvement of the situation in the harbours.

Totally on the Lloyd's list there were present 77 ports; the list is incomplete and informing only about a state existing over a given period.

The colossal costs borne by the importers on the score of the demurrage charges^{12/} as well as rising absorbtional difficulties appearing in all the developing countries which have achieved a certain success in the field of economic growth during the last period, meaning especially the oil countries^{13/}, induce them to search remedial measures in order to surmount the transport barrier and the port congestion.

11/. Lloyd's List and Shipping Gazette, April 12, 1977, p.3
Periodical reports depicting the problem of the port congestion during the period till the end of 1977 indicate an improvement of the existing state.

12/" In 1975 in Nigeria many ships did not obtain freight charges and berth charges; some of the ships ready for unloading refused to execute it, as a result of not having obtained the charges; in many cases tonnage was withdrawn out of charter. In spite of the fact that Nigerian National Supply Co. assigned 2 mil pounds sterling, many ships did not receive the amount dues as a result of red tape formalities. A Spanish firm which contracted to supply 480 thous. tons of cement received the amount of US \$ 60 thousand a day for the demurrage of 15 vessels with a cargo of 133,000 tons in Lagos. The Nigerian losses on this account are difficult to estimate.

13/. For ex. it is approximated that in 1981 in Saudi Arabian ports the average demurrage time will reach: in Jeddah - 140 days, in Damman - 70 days, in Irani and Iraqi ports 180 and 70 days respectively ; see D. Tinsley op. cit. p. 54

Three main courses of solving this very complicated problem may be indicated:

1. curbing the port congestion through diminishing the traffic, especially by means of reducing the crude oil consumption by the oil importing countries, which, apart from balance of payments savings could become an inflation blocking factor in the industrializing countries; this proposition seems to be illusive, because not only it is not possible putting a consistent limit on the crude oil consumption in the developed countries, but even reaching this effect would not solve the problem of industrial goods and food delivery to the developing countries, suffering the most from the congestion.
2. expansion of the existing ports in the developing countries as well as construction of the new ones in order to obtain a considerable growth of handling capacity and modernization of the port equipment to the degree which would allow for accepting up to date and great-size ships; this type of solution still has two fundamental shortcomings: the construction costs of new ports, which would have to be designed, constructed and equipped by foreign contracting parties and with their experts participating, are extremely high and they demand expense of hundreds million dollars; secondly - construction of new ports and modernization of the existing ones in the conditions of the developing countries demand the period of many years and the first symptoms of improvement could be visibly only in the mid-eighties; many poorer countries are not able to bear the

14/. This sort of suggestion is presented by many authors, among others the already quoted David Tinsley, *ibid.*

costs of new ports construction.

3. In this situation the solution of the relatively shortest accomplishment time is introducing the modern maritime transportation means in shipping relations between the developed and the developing countries.

2. The main characteristics of the integrated transportation systems in the maritime shipping.

The integrated transportation systems constitute the most modern direction of the technological progress in the maritime shipping and are characterized by great handling and carrying efficiency. Introducing the difference between the term "integrated transportation systems", as used in this paper, and the one "integrated system of transportation" seems to be necessary. The latter is used in relation to transportation as a sector of a national economy and signifies a close connexion of various branches and types of transport into one entity, interlinked by reciprocal subjections, in which entity the changes appearing in one of its component elements bring about the changes of inductive character in cooperating elements. In such a broad formulation the term "integration" may be used not only in relation to transport but in principle to every economic sphere, both in macro- and in micro-scale^{15/}.

^{15/}. "Under the term: uniform integrated transportation system of a country ought to be understood an aggregate of means and activities of all transportation branches arranged according to a plan, regardless of their gestional or organizational subordination, adjusted in its activity with the totality of a national economy and social life" - M. Madeyski, Ogólnokrajowy system ctd.p.19

Intensification of the cooperation systems coming out of the increase in specialization in all the spheres of economic activity leads to magnifying of the consolidation processes, that is of uniting into one entity displaying traits of the systems, enterprises, branches of the national economy and its sectors^{16/}. At a particular level of productive forces development, a tendency to unite the national economies of various countries into more and more uniform integrated systems is caused by integration processes at super-national scale. On this basis there emerged a tendency to abuse the term "integration" both in scientific and mass-communication writings. Thus the term "integration" in relation to various spheres of economy appears, so that it suffices to change a subject examined in a given definition, for it to become just as good as a general definition for explaining every integrated system, or possessing the properties of a joint functioning.

Therefore, it is necessary to make clear that the term "integrated transportation systems" used in this paper, has a strictly defined character and range of comprehension. It does not relate to the transportation system perceived

15/. ctd. transportowy jako podstawa polityki transportowej i prognozy rozwojowej transportu. Paper presented at a symposium "Transportation system forecasting". Warszawa 1972. p.17

16/. For explanation of concept of a system see am. oth. J. Gościński, Zarys teorii sterowania ekonomicznego. Warszawa 1977 ch.1, pp.13-46; B. Mins, Zarys systemu ekonomii politycznej. Warszawa, 1970; R. Ackoff, O system pojęć systemowych. "Prakseologia" 1973, No.2 /46/

as an entity, but it defines special methods of transportation, or transport techniques, showing a definite nature and technical and exploitational characteristics as well as definite character of internal and external linkages.

Observation of contemporary tendencies in technological progress evolution indicates, that they are characterized by a pursuance of aggregation of transportation means, of concentration into bigger and more efficient operation units, as well as in consolidation of cooperating elements with the purpose of attaining synergic effects^{17/}. Denominating some of the modern transportation methods as systems comes out of the fact that they embrace many component elements indispensable for their application, which elements are well adjusted to each other and their functioning is conditioned by cooperation of all the remaining elements.

The development of technical progress in general cargo transportation by sea -- above all in a group of general cargo vessels^{18/}, has led to an important alteration in their construction, technical and exploitational characteristics and the conditions of their utilization, mainly as a result of changes in formation and translocation of cargo methods. The changes in form, shape, weight and packing of general cargo and adjusting them into standard

17/. Synergy -- phenomenon consisting in obtaining a greater effect in a system operation than it would arise from a sum of operations of its elements.

18/. Contemporary integrated transportation systems are mainly used for transportation of general cargo and so called semi-bulk cargo, yet it does not exclude transportation of bulk cargo in the future.

size, have created impulses inducing creation of the integrated transport systems. These systems are characterized by using specific ways of reciprocal translocation and cooperation of the three basic elements of the system: ships as a means of transportation, cargo as an object of transportation and special deck and port transshipment equipment allowing for a junction between the cargo and ship. The container is an important component of integrated transportation systems. It is formed as a durable integrated system transport unit, which is not a subject to any change during the entire transportation cycle. Durability and stability of the transportation unit is achieved due to placing the cargo in a special container of standard dimensions and to specific technical equipment. The container is exchangeable among the transportation means, fit for repeated usage and it simultaneously fulfills the functions of wrappage of the cargo, storage in the course of transportation cycle and, in certain sense - of means of transportation. In certain cases, depending on a transportation system, a means of transportation may play the role of a container - it applies mainly to trucks of different types or truck ~~tail~~ trailers holding cargo during the entire transport cycle. A characteristic trait of an integrated transportation unit is its functional and dimensional adjustment to a means of transportation, so that it constitutes a mobile part of a ship hold or of a different transportation means, that is as though a "mini-hold" is placed in a constructional space of a hold or a cargo space.

Cargo formed into an integrated transportation unit is making the entire way from the moment of loading to the moment of unloading the container and is a subject to

of translocation from one means of transportation into the other as well as changing the type of transportation, without changing its own physical form, that is, weight, dimension and contents.

On the basis of the above characteristics three basic traits of the integrated transportation systems may be stated:

1. in these systems a consolidation of an integrated transportation unit with basic transportation means itself takes place, so the unit becomes as though an exchangeable element of the means of transportation, "assembled into its cargo space.
2. these systems are operating in an aggregated way, e.i. for their exploitation a cooperation of particular elements and technical equipment means is indispensable; lack of any of the substantial elements causes the halt of the system operation or considerably decreases the degree of its efficiency.
3. these systems create a chance of integrating various transportation branches, for an integrated transportation unit may make consecutive phases of the transportation cycle on different means of transportation present in various transportation branches^{19/}.

Accepting the above characteristics as sufficient for determining the very nature of the integrated transportation systems, it may be stated that currently in sea, land /both railroad and road/ and inland water transport,

19/. Integration of the land transport with the sea one and the sea transport with the inland water one are the most frequent, the air transport is included in ITS in a lesser degree.

as well to a certain degree in air transport there appear the three basic systems fulfilling the characteristics attributed to them:

1. Container transportation system is based on adopting standard, driveless containers having standard dimensions and load capacity^{20/}. The container has a shape of a big box, constructed of steel or aluminium sheets or of synthetic materials, having accepted 7 years long operation life. The container is loaded in a supplier's country and unloaded in the one of a receiver, as it makes possible fulfillment of the "house to house" transportation principle, without the necessity to perform indirect transshipment. The container itself, acting as an integrated transportation unit is the transshipment object in the course of transportation cycle; it is transmitted by means of special transshipment equipment from one means of transportation onto another, within the framework of one or many transportation branches. In the course of a complete transportation cycle, including the time of storing the containers during intervals in the way, the container fulfills the function of a stable

^{20/}. According to the ISO norms the containers have uniform heights and widths dimensions, differing in length only, applying 10 feet module; in exploitation there are 40-feet long and 20 feet long big containers and the smaller 10-feet ones; so that the bigger container constitutes a multiple of the length of the smaller one. Depending on their length they have the load capacity of 30 tons, 16-20 tons and 8-10 tons. They all have standard port size as well as uniform crane catches equipment.

package of the cargo , or fulfills the storage function, making possible keeping the containers in the open air. The basic characteristic of the system is reaching a great rate of transshipment and high level of labor productivity, which leads to a considerable labor reduction in all the phases of the transportation cycles; especially in transshipment junctions /container terminals/. The CTS is still a capital intensive and requires great capital expenditures for establishing all its component elements.

2. Ro-Ro system -- constitutes a modification and development of ferry traffic. It is founded on employing special ships of the Ro-Ro type adapted for horizontal rolling in and rolling off the wheeled vehicles to and from the hold, including trucks and other mobile vehicles as well as trailers and containers equipped with chassis. The Ro-Ro ships are provided with special loading ramps, on which the mobile integrated transportation units go into their interior; the vertical transport of the units among hold decks is effectuated by means of shipways or cargo lifts. Thanks to their constructional properties the Ro-Ro ships do not use the port transshipment facilities, they require only the wharfs of fixed possibilities of access for cargo vehicles. This system unites sea and motor transport, the Ro-Ro ships performing the carrier's functions at the sea, dividing the two transportation sectors of a land route, on which the vehicles are moving by themselves. The Ro-Ro system is characterized by a great rate of transshipment, while not placing any burden on the port transshipment equipment and largely simplifying the whole course of the transportation cycle; as with the proper, efficient transport organization

it allows for releasing the ports from transportation units storage; the port functions are limited in principle to receiving a Ro-Ro ship at a quay as they themselves constitute a transit segment of the cargo units route from the land to the ship and the other way round

3. The third and relatively the most efficient among the integrated transportation system is the barge-carrying transportation system /BTS/. It is in a certain sense a modified development of the container system and is at the same time its complement. BTS is based on using the big, floating barge-containers^{21/}, which voyage as a push train on inland waterways, while at sea- or oceanic routes they voyage on deck of a special barge-carrier equipped with its own deck transshipment facilities. Due to the above, the barge-carriers have a capacity of performing the transshipment operations on integrated transportation units -- the barges -- independently, without a necessity of not only making use of harbour transshipment facilities, but also of the port wharfs. Thus they are characterized by a full autonomy in relation to the ports, which not only differentiates the BTS from the remaining integrated systems, but also creates wide and versatile potentialities of operating the system in regions lacking the ports and surface transport subsidiary premisses.

Regardless of the overall characteristics of the integrated transportation systems they all show a certain common exploitational properties. The ships employed in

22-. In the existing systems there appear barges of loading capacity 140 t, 370 t & 850 t; The bigger ones are being designed-- of capacity up to 12000t.

these systems are utilized above all for general and semi-bulk cargo, and therefore in spite of their very specialized construction and equipment, they are usually classified as general cargo vessels. Still the container ships, the Ro-Ro- ships and the barge carriers are characterized by uncomparably higher rate of transshipment operations in relation to conventional vessels. The result is a shortening of the lay-time in the ports and therefore it gives ground for supplying the ships of the integrated transportation systems with power plants of great capacity ensuring the high speed during voyages. Both these factors: high rate of transshipment operation and high travelling speed cause a considerable shortening of the transportation cycle in the frame of the integrated transportation systems. Change in time relation between time at the sea and lay-days, to the benefit of the former leads to a great increase in economic efficiency as concerns the exploitation of the ships of the integrated transportation units in comparison to the conventional vessels in general cargo transport. A big mobility of cargo flow between the maritime transport and other branches cooperating in the systems is an additional benefit appearing in the integrated transportation systems.

3. Potentialities of barge-carriers employment in the transportation service of the developing countries

The transport difficulties appearing in the developing countries as discussed in point 1, and especially the constant growing phenomenon of port congestion induced studies carried out in many countries, over the potentialities of the integrated transportation systems for acceleration of the sea-transport in shipment to and from the developing

countries. The results of this research have allowed for a formulation of many opinions and conclusions postulating certain basing solution lines for resolving the shipping and port problems in maritime trade with the developing countries.

The main proposition lying at the core of all the studies of this problem resolves itself into the fact that the main carrying agent servicing the sea-borne trade of the Third World countries now as well as in the perspective of the next decade will be the merchant fleets of the developed countries / including the cheap flag vessels, being de facto a property of shipowners coming from the main sea-countries/^{82/}. Observation of the development tendencies of the merchant fleet permits for the statement, that in spite of a certain rise of the tonnage of the developing countries' fleets in the world tonnage, their percentile share is a subject to a slow yet visible drop. Considering a big share of the developing countries in the world maritime trade turnover we may see that the decrease in the share of their fleet in the total world fleet does not only certify a predominant position of the developed countries in the transportation serviced in the Third World, but also proves that overcoming the transportation barrier in the developing countries is feasible through intensification of the sea traffic by the developed countries.

^{82/}. see S. Kafandaris, Careful planning needed for Third World fleets. "fairplay" January 8th, 1976, p.55.

Table 7. Share of merchant fleet of the developing countries
in the world merchant fleet tonnage in the
years 1965-1974

Specification	1965	1970	1971	1972	1973	1974	diff. 1974 : 1965
World fleet tonnage/mil BRT/	146.8	217.9	239.0	260.8	284.2	306.1	+108.5
Share of the developing count. in the world sea turnover	-	40.5	41.2	40.0	40.4	40.3	-
Share of the developing count. in world fleet tonnage /%/	7.3 0.6	6.7	6.4	6.1	6.0	6.0	-1.3
in this: African fleet	3.8	3.7	3.4	3.3	3.2	3.2	-0.6
Asian fleet	3.1	2.6	2.6	2.4	2.4	2.3	-0.8
L. American fleet							

calculate on the basis : Statistik der Seeverkehrswirtschaft.
August 1977. No.8 pp.167-168; UNCTAD /1975/, Review pf
Maritime Transport 1974, Sales No.E.75.II.D.13

Data of the table 1,5 and 7 indicates that the si-
tuation concerning the maritime trade in the developing
countries tends to be abnormal. These countries during
the past 28 years have kept their share in the maritime
trade turnover at the level of 40 %, while their own
fleets extend at a relatively slower rate than the fleets
of the developed countries, which leads to a diminishing
share of the developing countries in the tonnage of the
world merchant fleet. The arguments that in the harmoniously
developing world economy shipping requirements of any
country cannot be regarded separately, but they have to
be considered as a whole, are right to the extent they
can be applied to equal partners^{23/}. The situation

^{23/}. See S.Kafandaris, op.cit. The developing countries of
limited export potentials are condemned to insufficient
utilization of their own vessels.

of the developing countries indicates that by not possessing their own fleets in the long run they are condemned to depend on the developed countries as their carriers. On this basis the problem of transport charges emerges, regardless of guaranteed benefits and allowances obtained by carrying their own cargo by foreign vessels, the developing countries must pay yearly about 10% of the value of sea trade turnover to the foreign carriers, which in relation to import of their goods bought in other countries amounts to the sum of 30% paid on the score of freights for import of the goods to their own ports. On the long run it gives rise to necessity to expand national fleets by the developing countries, yet this necessity meets three kinds of obstacles:

1. the developing countries do not have sufficient means for purchasing the ships of the tonnage complying with their requirements;
2. general problem of underdevelopment of industry and its unsuitable structure prevents them from undertaking the production of their own ships, especially the modern ones;
3. there appears a problem of crews -- the developing countries do not have potentialities of expanding their own merchant fleets, also as a result of the lack of staff; both officers and seamen, whose training in national training centers requires long time and high costs.

The oil countries being the members of the OPEC organization are in more advantageous situation than the other Third World countries, as regarded from the formal point of view. They have big funds at their

disposal allowin for purchases of the ships in the developed countries and developing their own fleets or the multi-national ones. Still the crew problems and port congestion even in these countries constitute the factors retarding a satisfactory accomplishment of undertaken aims.

In the light of the above discussion, it may be accepted that the previous statement of major role in shipment services in the Third Worlds as being played by the developed countries shall be upheld. There emerges another problem concerning the service efficiency in conditions of existing transportation barrier and especially port congestion, which cannot be overcome in the short run, when a radical increase of handling capacity both by means of expansion or of modernization is impossible.

Currently the three factors allowing for a fast solution of the congestion constraint can be singled out. They may be utilized of course with a different degree of efficiency depending on concrete conditions in particular countries and their ports.

The first one of these factors is improvement of the organization for the port activities, mainly of the transshipment operations. It requires a reorganization of port administration, granting it a bigger authority to the extent of controlling the activities of particular firms taking care of the port exploitation and controlling the ship traffic^{24/}. Employment of highly qualified experts from the developed countries is also indispensable, as they would work out the means counteracting the port

^{24/}. See B. Nagórski, Port congestion. "Terra et Aqua",

congestion. Among the others the experts' task should be organizing the cooperation principles between port administration and shipping companies in order to ensure a possibly most smooth system of entering the ports by the ships as well as performing the transshipment operations^{25/}. It requires a modification of existing rules of cargo formation and methods of its operation is then required.

The second factor which could help in solving the congestion problem is utilization of various port facilities allowing for shortening transshipment period and lay-time reduction. It applies mainly to introducing floating docks and transshipment stations constructed in the developed countries and assembled in the ports of the less developed countries. Contemporary production methods of similar floating harbour facilities permit for their speed installation, which would render possibly and increase of port capacity in a short time. A possibility of anchoring such elements in zones of suitable depth would be an additional benefit coming out of their installation, as this would diminish scope of necessary dredging operations and accelerate the time of turning the ports over for exploitation. The basis for development of the floating docks and transshipment stations are the contemporary tendencies to construct big floating isles used for installation of industrial plants at the sea^{26/}. A similar

25/. See M. Grey, "Unblocking the tubes: Fairplay", March 3rd, 1977, p.26

26/. The first floating factory was built by a Japanese concern Mitsubishi/MHI/ in the port of Abu Dhabi. The designs of floating port facilities are being worked out by Japanese and Finnish shipyards.

solution, as far as quickening of port equipment construction goes is employing at a large scale prefabricated construction elements, both for building piers and transshipment equipment. It is connected with introducing a large scale specialization of ports or particular wharfs, which are being adapted for transshipment of specified type of cargo ^{27/}. Handling and traffic capacities of the ports increase due to specialization. The necessity of a hast port expansion have caused a tendency to look for makeshift solutions based on adapting the army experience in building artificial harbours. Pontoon sets of big barges sets are used, out of which piers installed at the sea are assembled, and thus the increases in a short time length of leading berths and port areas. A consequence of similar solutions is undertaking a short term means for designing and construction of piers assembled from special steel barges equipped with consoles serving for placing the barges at the depth of 12 meters; the barges may be combined with each other thus creating a pier belt at which ships of up to 15000 DWT may be transhipped. ^{28/}

The third factor which acts towards overcoming the difficulties resulting from the port congestion is introducing into exploitation in the developing countries transportation service the modern, integrated transportation systems, than to which it is possible to hasten the

^{27/}. An example of the specialized port for bulk cargo transshipment constructed in a short term thank to using prefabricated products is the Indian port

Visakhapatnam able to handle bulk cargo vessels of tonnage up to 100 th. D WT; see T.S. Sanjeeva Rao, Indian deep draft bulk terminal commissioned. "Fairplay" 20th Jan., 1977, p. 14

^{28/}. This method was used for constructing berths in Mina Sulman port in Bahrain based on a licence of the French firm G.E.M. Hersent Co. Pier is 152 m. long constructed etc

reloading operations, shortening of the lay time and as a final outcome - general reduction of transportation cycle.

Introduction to the integrated transportation systems to the shipping service of the developing countries is possible on the part of the developed countries having appropriate financial means as well as the industry potential capable of producing vessels operating in these by

An objection has to be made that port conditions and general situation in the field of infrastructure development, accumulation and absorption capacities and employment in the developing countries, demand a separate discussion of exploitational potentialities of each of the above introduced integrated systems. From the point of view of reloading operations organization and concerning the necessary port facilities for the integrated transportation systems operation, each one of them creates a specific demand for particular port conditions which can be fulfilled to a different degree in different countries.

The Container Transportation System is currently the prevailing one among the integrated systems and its employment both at present and in the future is connected with general cargo traffic. The contemporary surveys indicate that in the course of next years the scope of containerization may reach from 80 to 90 % of general cargo line traffic²²⁹ while all the containerized cargo shall occur in all types

28%. of 8 35 meters long barges and was assembled in a very short time -- 190 days. See Unconventional short term means to overcome port congestion. "Fairplay",

20th Jan. 1977, p. 14

29/. See L. Jolmos, G^uterverkehr in einer sich wandelnden

of the integrated transportation systems ^{30/.}

The greatest intensity of the container system was reached in traffic between the developed countries which is justified by the results obtained there as well as by infrastructure requirements, indispensable for efficient container transportation system activity. There emerge

many very strong limiting factors where the container system is used in the developing countries. This system requires

both very high level of technical equipment of the ports as well as developed land transportation infrastructure.

Therefore spreading of the container system in the developing countries is possible only in those, which have

a capacity to undertake large port investments mainly concerning construction of the container terminals and

have potentialities to develop adequate network of roads and land container terminals. Thus it is observed that

observed that the containerization intensification takes place in these countries which have big ports of international range or large capital resources at their disposal ^{31/.}

One of the significant directions of technological progress occurring within the framework of CTS is introducing container vessels capable of transshipment operations due to being equipped with deck cranes for loading and un-

^{30/.} All cargo carried in the Ro-Ro system is on the barges with the BTS are always regarded as containerized cargo.

^{31/.} Container terminals were constructed, or are being constructed in Hong-Kong, Singapore, in Keelung & Kachsiung ports in Taiwan and Persian Gulf. See.

Developing port facilities for containerization. "Fairplay" Nov. 16th 1976 p. 81 ; Arabian Gulf Survey. "Shipping World and Shipbuilder", Jan 1977 p. 77-78.

loading the containers. This tendency may have a grand significance for employing the CTS in the developing countries, in order to reduce the costs of equipping the ports in transshipment facilities in favor of deck facilities installations. Still the assumption that the new container vessels shall be constructed in such a way that they would be capable of autonomous transshipments does not solve the basic limitations, hindering the spread of containers in the Third World countries. Most of these countries are characterized by occurrence of big labor surpluses and therefore they require employment of labor intensive mode of production. The container transportation system causes, in comparison with traditional methods of general cargo transport, unusually high increase of labor productivity as regards transshipment and fast progressing employment reduction. Introducing the CTS in the developing countries would reate a disadvantageous social situation. On a large scale through depriving large masses dockers of work, with simultaneous creation of demand for a small number of highly qualified workers of operating equipment utilized in the container system. Factors of social character appearing as secondary to the containerization phenomenon, apart from material and organizational barriers constitute the main obstacle to introducing the containerization as a method of overcoming transportation problems in most of the Third World countries. It can be expected that in the run of next several years the CTS shall not be developed in a wider range in the Third World countries and cannot be regarded as solution of the port congestion.

The Ro - Ro System will probably play a greater role in modernizing transportation services in the developing countries than the CTS. Its great advantage over the containerization system in the Third World is a considerably smaller degree of expenditures for port facilities. Moreover employment of the Ro - Ro system requires even less expenses for the port facilities than the conventional systems of general transportation. The scope of port equipment sufficient for employment of the Ro - Ro system is limited to undeveloped quays to which the special Ro - Ro vessels can be moved and to adequate access roads and parking sites, where the vehicles to be loaded on the Ro - Ro vessels could be kept. Nevertheless two factors may turn out to be an important constraint to employment of the Ro - Ro system in the developing countries:

1. inadequately developed road network on the land restricting an effective employment of this system and reaching a final destination point, where the vehicles would be loaded or unloaded;;
2. lack of drivers operating the cargo units being the mobile vehicles which places limitations on the traffic on the land segments of transportation routes serviced by the Ro - Ro system. As regards the directions of transport between the developed and underdeveloped countries there may appear a disproportion in the number of drivers at the destination points of a sea route / i.e. ports / causing delays of the vehicles in reaching the ports /or their reception from the ports/ at the land routes of the areas of the developing countries.

The Ro - Ro system may still prove to be very useful in the transportation service of the developing countries after having surmounted the two constraining factors. This system due to its high transportation operations rate in the sphere of cargo traffic may play a significant role in overcoming the port congestion.

It can be added that handling of loading and unloading vehicles operating in the Ro - Ro system may be carried out using the manual labor and hence its introduction should not ^{produce} a threat of the increase of unemployment of the transportation workers in the developing countries as it is in the case of C.T.S.

Barge carrying transportation system seems to be the one most useful in the process of transportation services intensification of the developing countries. This hypothesis arises from the fact that the vessels operating in the scope of BST do not entail ports as a principle. Their transshipment operations may be carried out on port canals without the necessity to moor at the berths as well as at the roadsteads, in outer harbour, in bays, in estuaries, and even on coastal water. Hence, the autonomy of the barge carrying vessels in relation to ports permits increase in freight traffic to- and from the developing countries, without the necessity of completing investments in their ports. Taking over a certain part of cargo streams by the barge carrying vessels and the barges operating in the B.S.T. would create an opportunity for alternating the burden placed on the port handling capacities and would result in increasing of total volume of freight being transported without additional investments in port facilities and berths construction.

Basic principle of barge carrying system is very simple: barges being big, floating containers are used. In the sea traffic they are carried on the boards of a mother-ship, or a large carrying vessels, of a special construction, equipped with on-deck transshipment facilities. In the inland water traffic, the barges are formed as push trains having an external driving source - a push-boat ³³. There appear two basic arrangements in the barge carrying system:

1. A partial system - interport - in which the barges are transported between sea-ports and operations of loading and unloading are made within the port area, or its proximity.
2. A full-tied system, in which the barges are loaded and unloaded in inland-ports, make their way by inland routes as push-trains and in sea-ports they are loaded on barge carrying vessels and make their way by sea on their board.

From the economical point of view the latter system ensures utilization of the relatively cheapest transportation routes by water ways on the entire way made by cargo placed on a barge. The interport system is relatively less economical, but secures a considerable time saving in transshipment operations, shortening the lay-time of the barge carrying vessels in ports and affecting a very favorable relation between the steaming time and lay time as 4:1 which is unattainable in case of other transportation systems, including C.S.T. and Ro-RO³.

³³. Reader will find exact information on principles of operation of BST and various systems utilized and designed within its framework in the cycle of articles; see "Problemy Postępu Technicznego", 1976, No.1-6 and 1977, No.1-4 and in number of papers of Maritime Institute.

34. High handling capacity of BST may be characterized by following data: The barge carrying vessel conveying 74 barges of the LASH type may handle over 54.000 tons of cargo during 32-37 hours; with 86 barges - 63.000 tons during 37-43 hours.

The possibilities of employment of barge carrying transportation system in shipping relations with the developing countries arise out of many premises:

1. Barge carrying vessels with the necessary set of barges require great investment expenditures and hence they may be used in merchant fleets of the developed countries, yet they turn out to be the most economical system in the transportation service of the developing countries ³⁵.
2. Techno-exploitational properties of the barge carrying system ensuring a high rate of transshipment have an influence on considerable increasing of port capacities and so they act in favor of counteracting the ~~fact~~ ^{situation} of port congestion.
3. Autonomy of the system in relation to ports renders possible a rise of freight volume in maritime traffic to developing countries without the necessity to bear extra expenditures for investments in modernization and expansion of ports.
4. Integration of sea transport with inland waters transport being one of the characteristic of the BST creates possibilities of taking over greater advantage of big rivers on the areas of the developing countries; it has a special significance for these countries, whose transport infrastructure is underdeveloped and hence the river transport often constitutes a sole possibility of bulky cargo deliveries deep into their territories.

³⁵. According to a survey made by ~~Swedish Studies~~ the Center for Maritime Studies of University in Liverpool, BST turned out to be the cheapest and the most efficient system among the integrated transport systems for servicing the developing countries. The same is confirmed by Swedish results.

5. Stations for transshipment of the barges employed in BST may be constructed on the areas close to the ports on the sea or at the rivers, while bearing relatively small expenses and using very simple materials and construction techniques; thus there is created a possibility of a substantial increase of the port handling capacities, obtained with very low costs and on the basis of local means of the developing countries ³⁶.
6. Ways of loading and unloading of the barges themselves are based on an alternative possibility - using either mechanical or manual work. In the conditions of the developing countries it allows maintaining high level of employment of transport workers in case of using the barge carrying system; to this extent the barge carrying system comes out to be more rational than the container system, causing inevitably a great reduction of unemployment in the ports- and transshipment works.

As appears from the analysis of the two latter premises, the barge carrying transportation system has features inherent in so-called combination techniques ³⁷. Generally taking it is a very modern system characterized by a high capital intensity. Nevertheless due to a possibility of separating the barges from operating the barge carrying vessels in the system there appears a justification for employing to a great measure direct labor, with simple technical equipment ³⁸, which can be used in transshipment

36. For the barges transshipment, there are sufficient wooden piers and wharfs of pile construction, unfurnished anchorages for the barges with simple transshipment stands of small depths, simple wooden slipways with hand operated windlass and other similar uncomplicated and cheap equipment.
37. See A. Müller, Kierunki optymalizacji technik produkcji w krajach słabo rozwiniętych, Warszawa, 1966, p.148 - 165.
38. Transshipment of the barges requires using relatively small cranes for manipulating hatch covers ~~of~~ of the barges, for ex. in the LASH system 1,5 ton cranes are needed/.

In these operations performed in the developed countries, mechanized methods are used, permitting a high degree of direct labor, saving and ensuring the minimal duration of the transshipment operations. In the developing countries labor-intensive methods may be used as they imply employment of the labor surplus and hence do not impend a reduction of shoremen occupation.

The labor intensive methods of transshipment use. . .
lation to the barges require a long period of time for preparation of a suitable set of barges. Nevertheless barge lay-time do not exert any influence of transportation cycle of the barge carrying vessels, which can operate without being on demurrage and thanks to, a high efficiency of the transport is secured. For the efficient operation of the barge carrying system, having at disposal a suitable set of barges for each particular ship and observing a necessary organizational regime is required, so that at every port, at a right time a scheduled set of barges would wait for the ship. When these principles are obeyed the system proves to be efficient and incomparably more economical not only in relation to the conventional ships operation but also in relation to the remaining integrated transportation systems.

The advantages coming out of employment of the barge carrying transportation system in the transportation service of the developing countries are connected as well with its universality volume and carrying capacity of the barges allow formation of relatively big freight units, much bigger than in the case of the C.S.T. or the Ro-Ro system. Therefore, the B.S.T. may be used not only for general cargo traffic, but

also for transportation of semibulk cargo and in the recently developed systems - even of bulk cargo ³⁹. A further pronounced tendency toward the universalization of the system is observed. Currently constructed the LASH vessels provide for their employment both, for carrying barges and containers, while the full cycle of a barge-carrying vessel conversion to container transport takes only several hours. In the Seabee system transportation of not only barges and containers is possible, but also very bulky and heavy cargo surpassing the overall dimensions of the barges as well as vehicles rolled on the board with the help of its own loading facilities. The latest West German design of the barge-carrying vessel BACO ⁴⁰ assumes a full universality of the ship within the scope of all methods inherent in the integrated transportation systems. This system is adjusted for carrying the LASH barges, the special barges BACO and the river barges of the Europa I type in specified, homogeneous sets, or in combinations arising from barge length module. The BACO ship is hence a universal barge-carrying vessel in relation to various types of barges; as a dock carrying vessel with a closed dock-hold it may be used as a unit in the Ro-Ro system. It can carry on the board, depending on the version, from 450 - 600 containers,

39. Currently the three barge-carrying systems are used: LASH - having barges of 370 tons tonnage, Seabee with barges of 850 tons tonnage and BACAT, operating the barges of 140 tons tonnage and the LASH barges. The newly designed system Stradler anticipates employment of barges of a tonnage of 12 thousand tons and in a similar Stradlee - 3 thousand tons. This size of barges may be utilized quite well for bulk cargo traffic.

40. The BACO ship designed by the deep-sea captain Müncke /W.Germany/. Construction of the 3-version of the ship is provided: carrier ships, deep-sea ships and transoceanic ships of different size and carrying capacities. See "The Motor Ship" 1977, No.9. and the Polish references made to "Problemy Postępu Technicznego", 1978, p.3 and 4.

Regardless of the fact, that the most widely spread are the barge-carrying vessels of the LASH type, the BACO systems seems to constitute such a universal solution that one can anticipate its speedy expansion and employment in various versions and various combinations for carrying the integrated transportation units. Construction and putting into operation of the BACO barge-carrying ships may play a significant role in spreading the integrated transportation systems in shipment between the developed and developing countries due to its autonomy in relation to ports and high rate of transshipments, which creates a perspective of easing the congestion barriers.

The perspectives of development and spreading of the barge-carrying transportation system in the world shipping create a necessity of undertaking projects in this field also in Poland.⁴¹ The first steps in this range have already been taken and techno-economical premises for introduction the barge-carrying vessels for service of the West African lines by the Polish Oceanic Lines were elaborated. Designs of Polish barge-carrying vessels based on the LASH system were worked out and interesting conceptions of Polish solution were created⁴². In spite of considerable advance in this projects, the Polish merchant fleet does not have any barge-carrying system in operation.

It seems that there are several reasons constraining the initiative of the Polish Oceanic Lines in this field:

1. There is a lack of information on methods of operation, technical and working properties, the economical efficiency of the barge-carrying & transportation system which limits possibilities of study its employment by the top level agencies of economical planning; due to this any initiatives

41. See "System serwisów barkowcowych Polish Linii Oceanicznych. Ośrodek Naukowo-Techniczny PLO, 1972 Gdynia, No. 35.
42. There exist a.o.a design of barge-carrying system-katamarana of prof. ~~XXX~~ J. Staszewski, patented at Polish Patent Office 1971, no. of patent - 150 335.

- on the part of shipowners do not meet with favorable acceptance.
2. difficulties in the balance of payment cause tendencies toward foreign currency savings and render impossible spending required sums for purchasing the barge-carrying vessels and the barges from foreign suppliers.
 3. The Polish shipping industry, as a result of flow, is interested in undertaking the barge-carrying vessel construction; it could be probably started up in cooperation with the Finnish shipping industry, with some equipment delivered from the U.S.A. The barge construction for BST is possible on the basis of existing productive potential of the inland water shipyards and with the development of the barge-carrying system, barge-carrying vessels and barges could be included in Polish export offer.
 4. In the total turnover of the Polish foreign trade, the share of the developing countries is still relatively small and does not constitute such a significant position, so that some special preferences would be made in order to modernize the system of their transportation service. As a result, on the developing countries lines instead of up-to-date ships exploitation, very old conventional units are used, which often condemns the Polish ships for too long lay-time in the developing countries ports.
 5. There exist currently a certain standstill in the world development of the barge-carrying transportation system mainly coming out of time impasse, the world shipment and shipbuilding industry are going through, still the perspectives

of upswing in this field seem to be on the horizon and consequently an acceleration of barge-carrying transportation system development may be expected.

Overcoming the factors hindering introduction of the barge-carrying transportation system into the Polish shipment is a necessity because any further delay may cause a time-lag, whose surpassing will conduce cost increase and will weaken the competitive capacity of the Polish shipping in the conditions of the future development of the barge-carrying system. It follows from this an indispensable condition to back up the initiatives of the Polish Oceanic Lines concerning the introduction into composition of the Polish merchant fleet the barge-carrying system. It is imperative at the earliest feasible time, in order to avoid the situation which was created in the field of containerization, when the underrating of the container-system has caused a great retardation in its putting into service, which currently has to be surmounted by defraying huge costs in order not to lose these freight markets, where the containerization is becoming a dominating transportation technique. The decisions of B.S.T. development is not delayed as yet, but it cannot be postponed.

