

ANALYSIS AND APPLICATION OF A NEW MARITIME CONTAINER LINE: A CASE STUDY

Analiza i primjena nove pomorske kontejnerske linijske plovidbe: opis slučaja

UDK 656.61:656.073.235

Stručni članak
Professional paper

Summary

Marine container transportation has shown important developments during recent years. Due to increased demands for such transportation, the related companies have to enlarge their capacities and establish new lines. The most important criterion to put in a new line is the customer's demand for such a line under marketing conditions. There would be no commercial significance for the supply if the demand is insufficient. The demand can be calculated by the present market, marketing research and cargo statistics between the two ports involved. Marketing research consists of the phases related to identify the targets and the problems, doing the research, developing the plan, collecting and analyzing the data. Another step when establishing a new line is the itinerary of the line and also which ports will be used for the line. Furthermore the present equipment of the ports, technology and possibilities play important role in the selection of the ports.

In this research the following aspects have been discussed; the factors which should be considered while the decision is being taken to establish a new container line; analysis of the operation costs; financial analyses and result for the first 5 voyages of the new container line which was established according to certain assumptions and acceptances.

Key words: maritime transport, container port, container line, port management, financial analyses.

Sažetak

Pomorski kontejnerski prijevoz pokazao je znatan napredak tijekom proteklih godina. Zbog sve većih zahtjeva za takvim prijevozom, dotične kompanije moraju povećati svoje sposobnosti i osnovati nove plovidbene linije. Najvažniji kriterij za primjenu nove plovidbene linije je potražnja kupca za takvom linijom u marketinškim uvjetima. Ponuda ne bi imala većega učinka ako je potražnja nedostatna. Potražnja se može izračunati polazeći od današnjega tržišta, na temelju njegova istraživanja i statističkih podataka o teretima između dviju dotičnih luka. Istraživanje tržišta sastoji se od faza koje se odnose na prepoznavanje ciljeva i problema, od obavljanja istraživačkoga rada, razvoja plana, skupljanje i analize podataka. Drugi korak kad se uspostavlja nova linijska plovidba je plan linije s odnosnim lukama. Nadalje, današnja oprema luka, tehnologija i mogućnosti imaju važnu ulogu o odabiru luka.

U ovom istraživanju raspravlja se o sljedećim aspektima: čimbenici koji se trebaju razmatrati dok se donosi odluka za uspostavljanjem nove kontejnerske linijske plovidbe; analiza operativnih troškova; financijska analiza; rezultat za prvih pet putovanja nove kontejnerske linije uspostavljene prema izvjesnim pretpostavkama i prihvaćanjima.

Gljučne riječi: pomorski transport, kontejnerska luka, kontejnerska linija, upravljanje lukama, financijske analize.

* Gökhan Kara, Ph. D., Istanbul University, Faculty of Engineering, Marine Transportation and Management Engineering, Turkey
** E. Gül Emecen, Ph. D., Istanbul University, Faculty of Engineering, Marine Transportation and Management Engineering, Turkey
*** Evren Esedoğlu, M. Sc., Barwil Unitor Ships Service Operations Supervisor, Istanbul, Turkey

1. Introduction

Uvod

Within the last years, world of containerization increased by approximately 8 percent per year. An estimated 15 million containers are being handled in the world [1]. Maritime container terminals form important links in the transport chain of containers. A container terminal is a facility that provides a package of activities/services to handle and control container flows from vessel to railroad, or road, and vice versa. The container terminal is the physical link between ocean and land modes of transport and a major component of the Containerization System [2].

No doubt establishing a new container line is a very risky affair, therefore the most important criterion to put in a new line is the customer's demand for such a line under marketing conditions. There would be no commercial significance for the supply if the demand is insufficient. The demand can be calculated by the present market, marketing research and cargo statistics between the two ports involved. Marketing research consists of the phases related to identifying the targets and the problems, doing the research, developing the plan, collecting data and analyzing the data. The agencies are in direct relations with the customers who would determine the demands. It is far more important that the agency which is assigned or will be assigned for the new line must be a reliable and well known in its native country. These agencies should be in very close relations with small and large producers at both ends of the line, with distributing companies, industrial markets, non profit civil organizations and governments and also hold control over economical, technological, political and cultural environments. These agencies should be well informed about the needs and necessities of the market and be very well organized from the agency clerk to the high level executives who would meet those needs and necessities, possess qualified personnel, customers and business development departments, a qualified service and an active communication and transportation network.

Another step when establishing a new line is the direction of the line and also which ports will be used for the line. The present equipment of the ports technology and possibilities play important role in the selection of the ports.

2. Research of a Container Line

Istraživanje kontejnerske linijske plovidbe

The next step will be to form a concept for this new line by discussing the situation with the present and target customers, finding a solution for their problems and at the same time deciding the frequency of the transportation and the freights that the customers may want. Then a marketing strategy should be identified following which direct purchasing should be realized when market share is decided. For the initial years,

marketing budgets, tariffs, and transportation and distribution network must be formed. While doing all these special attention should be paid to the competitive companies and to competition analyses.

As a result of the marketing analyses, if the demands are found satisfactory, then a suitable vessel, ports and the rotation of line should be decided.

In order to select the suitable port the following points should be considered; water depth, berth length, annual container capacity, container handling capacity, present equipment, technology, storage areas and possibilities, pilot age and tugging services, port facilities, hinterland, railway and highway extensions, customs possibilities, geographical location, necessary supplies such as fresh water, tariffs for the vessels and containers, annual vessel capacity, the tightness of the port, security of the port and the possibility for tracking of the containers. After the port is selected then the rotation of the line will be decided.

In order to select the appropriate type of ship, the capacity of the ship to carry TEU amount of loads within certain intervals must be considered. Other important criteria for this selection will be the speed of the vessel, its TEU capacity, daily bunker consumption, its age, its DWT/GRT/NRT, its main engine power, its length, beam and draft, its current handling equipment, cranes and efficiency of the present vessel personnel. Furthermore the ship owner's fame, his present fleet and his long term investment projects are also very important. In case of a sea accident or a breakdown of the ship, it is very important that an equivalent or sister vessel should replace the other one. Otherwise the dissatisfaction of the customers will cause them to draw away which means great losses concerning this line. Besides the selection of the appropriate ship, it is also important how the ship will affect economically this line. Generally the vessels are hired and run according to "Time Charter (T/C)" principles. But it is also possible to run a vessel which is newly constructed or which is recently launched or by purchasing a second hand vessel either on bank credit or by cash.

In this research, a recently established line with complete fulfilment at it's both ends and also with a customer's portfolio concerning other lines is analyzed.

3. Acceptances, Assumptions and Modelling

Prihvatanja, pretpostavke i modeliranje

It is assumed that the example container ship is a full container ship and it runs between 2 fixed ports regularly and with a certain tariff.

During the running of the ship and the line, the changing market conditions and parameters are not considered.

It is assumed that the freight rates are not influenced by the market conditions and stay stable.

It is assumed that USD is used as currency and the changing inflation rate and foreign currencies are not considered.

Unfavourable weather conditions, the tightness of the ports etc. and delays are not considered.

It will be assumed that the line that the ship is running, the distance between the ports, port expenses, the rate of inbound and outbound fullness, the prices of petroleum, and lubricants, personnel wages, docking or dry docking, survey expenses, freightage per TEU, insurance, storage and rents stay stable. The vessel's technical details are shown in the following Table 1 [3].

Table 1. The Vessel's Technical Details

Tablica 1. Tehnički detalji broda

VESSEL'S TECHNICAL DETAILS	
Average service speed	16,00 knot
Main engine power	6330 kw
LOA	116,73 meter
Beam	18,15 meter
Draft	6,8 meter
DWT	6541
GRT	5006
NRT	2524
DeckS-Holds	1-3
Specific bunker(ifo) consumption	181 g/kwh
Specific oil consumption	1 g/kwh
Daily IFO 380 Cst Consumption	27,5 mt/per day
Daily oil consumption	180 kg/per day
Weight of steel hull	2250 mt
Capacity of TEU	510 TEU
Capacity of FEU	200 TEU

Normally the speed of the ship service is dependent on the main engine power, weather conditions and wave resistance. In practice the service speed of the ship will gradually decrease. Therefore it will be enough to multiply the possible losses by a coefficient. We accept this as 10% in this research. Agencies supply customers for the lines and it is assumed that they receive 2.5 % commission per container.

Table 2. The Voyage Details

Tablica 2. Detalji putovanja

Voyage Details	Distance (miles)	Voyage time (days)	Port time (days)	Port expenses (USD)
Istanbul-Haifa	1288	3,69	1	6000
Haifa-Istanbul	1288	3,69	1	9000
TOTAL	2576	7,38	2	15000

It is also assumed that 3 sets of hired containers will be used for the line. A set of which stays in each port and the third set is placed on the ship. Thus the pre-loaded containers will be loaded on the ship and there will be no time-loss. Loading and discharging expenses of the full containers are at the receiver' and shipper' expense. But the expenses of the empty containers are born by the line.

The following items are included into voyage details; the line that the ship runs and the ports on this line, the distance between these ports, the duration of time needed for such distances, the time spent for loading and discharging at the ports and average expenses at these ports. We assumed that on the first voyage of this new line, since it may not be advertised enough, the fullness rate for inbound may be 40%, outbound empty, the fullness rate for inbound may be 50% and outbound 10% on the second voyage, for the third voyage fullness rate of inbound voyage may be 60% and outbound 20%, for the fourth voyage the rate of fullness for the inbound voyage may be 70% and outbound 30%, for the fifth voyage the rate of inbound fullness may be 80% outbound 40% and consequently the financial analysis is done based on these assumptions.

It is thought that the freight cost of the competitive agencies for similar rotations maybe USD 900-1000 for inbound voyage and USD 600-700 for outbound voyage but the freight rate of this new line may be lower in comparison with the other competitive.

We have assumed that the freight rate of the voyage between Istanbul-Haifa on the departure trip to be high because the rate of fullness would be high but on the return voyage the freight rate would be low because of the number of empty containers thus departure freight would be USD 900 per TEU, and for the return voyage the freight would be USD 600 per TEU on the Haifa-Istanbul voyage.

4. Line Cost Analyses

Analize troška linije

4.1. Income of Line

Dohodak linije

Gross Freight

Bruto vozarina

Total gross freight is calculated by multiplying freight rate per TEU by number of containers which has been carried on that voyage.

$Brut\ Freightage\ (income) = Number\ of\ container \times Freight\ rate\ per\ TEU$

Agency Commission

Agencijska pristojba

The agency's commission would be 2,5 % on gross freight income.

$Agency\ Commission\ (income) = Agency\ commission\ rate \times Freight\ rate\ per\ TEU$

Net Freight

Neto vozarina

In order to calculate the net freight income, the agency's commission is deducted from the gross freight income.

$Net\ Freightage\ (income) = Brut\ freightage\ (income) - Agency\ commission$

4.2. Outcome of Line

Ishod linijske plovidbe

Bunker Expenses

Troškovi bunkera

When the ship's technical details are reviewed it can be seen that full consumption of the ship is 181 g/kWh and the main engine power is 6300 kW. From these figures the daily consumption of the ship can be calculated as 27.5 mt.

According to market conditions the average IFO cost would be 180 USD/per mt and MDO cost would be 440 USD/per mt. The ship's average MDO consumptions on the sea would be 0, 60 whereas at the port it would be 1 mt/per day. By multiplying daily fuel consumptions by the duration of the time spent on the sea and at the ports the consumption per voyage can be calculated and then when this figures are multiplied by fuel costs, the total fuel expenses for departure and return voyages separately can be obtained.

Table 3. The Ship Total Fuel Expenses
Tablica 3. Cjelokupni troškovi goriva broda

	INBOUND			OUTBOUND		
	Sea		Port	Sea		Port
	IFO	MDO	MDO	IFO	MDO	MDO
Bunker Rates (USD/per.mt)	180	440	440	180	440	440
Daily Bunker Consumption (mt)	27,5	0,60	1,00	27,5	0,60	1,00
Consumption Of Per Voyage (mt)	101,5	2,214	1,00	101,5	2,214	1,00
Bunker Expenses Of Per Voyage (USD)	18270	974	440	18270	974	440
Total (USD)	19684			19684		

Container and Port General Expenses

Općeniti troškovi kontejnera i luke

The port expenses include the expenses for crossing the straits in Turkey, as well as the expenses for crossing the canal on Istanbul-Haifa voyage. For the ship which has DWT/6541, GRT/5006, NRT/2524, and the average

port expenses would be USD 6000 in Istanbul and USD 9000 in Haifa according to our estimation.

The container's general expenses consist of the following items; the number of containers with a certain rate of fullness that are dispatched on the inbound and outbound voyages, storage costs of the empty containers which are kept at the opposite ports to be dispatched on the next voyage, insurances and rents for all of the hired containers, handling expenses are calculated multiplying by number of loading and discharging empty containers to the ship and from the ship by the time spent on the sea.

Container and Port Expenses = Storage + Handling + Hiring + Insurance

Storage Expenses

Troškovi skladištenja

Storage expenses are calculated by multiplying daily storage costs per container at the opposite ports (estimated to be USD 10) by the number of containers kept at these ports and by the time spent on the sea (roughly 3,69 days).

Hiring and Insurance Expenses

Troškovi najma i osiguranja

The hiring and insurance expenses are obtained by multiplying the hiring and insurance expenses (estimate USD 5) by the time of total voyages by the total number of 3 sets of containers.

Handling Expenses

Troškovi rukovanja

The total handling expenses can be obtained by multiplying the empty number of containers loaded on the ship and discharged from the ship by the average handling costs (85 USD) and handling time (roughly the duration on the ports) after that the results are added in order to obtain the total costs of containers for inbound and outbound voyages [4].

Table 4. The Container Total Voyage Expenses

Tablica 4. Ukupni troškovi prijevoza kontejnera

	I			II			III			IV			V		
	VOYAGE			VOYAGE			VOYAGE			VOYAGE			VOYAGE		
	Istanbul-Haifa	Haifa-Istanbul	TOTAL	Istanbul-Haifa	Haifa-Istanbul	TOTAL	Istanbul-Haifa	Haifa-Istanbul	TOTAL	Istanbul-Haifa	Haifa-Istanbul	TOTAL	Istanbul-Haifa	Haifa-Istanbul	TOTAL
TEU	204	0	204	255	51	306	306	102	408	357	153	510	408	204	612
Storage Expenses (USD)	7527	0	7527	9409	1882	11291	11291	3764	15055	13173	5646	18819	15055	7528	22583
Hiring Insurance Expenses (USD)	14351	0	14351	17939	3588	21527	21527	7175	28702	25115	10762	35877	28703	14351	43054
Handling Expenses (USD)	17340	0	17340	21675	4335	26010	26010	8670	34680	30345	13005	43350	34680	17340	52020
Total Container Expenses (USD)	39218	0	39218	49023	9805	58828	58828	19609	78437	68633	29413	98046	78438	39219	117657

Voyage Cost***Troškovi putovanja***

The total outcome of the voyage is the sum of the fuel expenses plus, canal crossing expenses plus the general expenses of the containers.

Voyage Cost = Fuel expenses + Canal crossing expenses + Container expenses

4.3. The Other Determinates***Ostali relevantni čimbenici*****Gross Voyage Profit*****Bruto dobit putovanja***

The gross profit of the voyage can be obtained by deducting the voyage outcome from the net freightage income.

Brut Voyage Profit = Net freightage (income) – Voyage cost

Daily Brut Voyage Profit***Dnevna bruto dobit putovanja***

The brut voyage profit is calculated by dividing gross voyage profit into departure and return time.

Daily Brut Voyage Profit = $\frac{\text{Brut voyage profit}}{\text{Time of voyage}}$

Daily Net Voyage Profit***Neto dobit dnevno putovanja***

The net voyage profit is obtained by deducting the daily operation cost from the daily brut profit of the voyage.

Daily Net Voyage Profit = Daily brut voyage profit – Daily operation cost

Break Even Point of Freight***Najmanja moguća vozarina za puni brod***

Break even point of freight per TEU is the least freightage cost which can be demanded at the highest rate of fullness. Break even point of freight per TEU is obtained by adding the operation cost of the voyage (calculated by multiplying the daily operation cost by the duration of the voyage) to the cost of the voyage and then divided into the number of the containers dispatched on that voyage.

Break Even Point of Freight = Voyage cost + Ship operation cost of voyage

Break Even Point of Freight = $\frac{\text{Voyage cost} + \text{Ship operation cost of voyage}}{\text{Number of container per voyage}}$

Profit per TEU***Dobit po TEU***

The profit per TEU is calculated by deducting Break even point of freight per TEU from the dispatch freight per TEU which is result of the transportation capacity of the container in accordance with the assumed fullness rate.

Profit / Damage per TEU = Freight rate per TEU – Break Even Point of Freight

5. Results and Discussion***Rezultati i diskusija***

In order to calculate the total cash flow of the voyage, all the items should be the same as in the calculation of the voyage cash flow. The only difference may appear if the ship owner does not want to calculate the separate costs of the departure and return voyages but considers the voyage as a whole and thus does the related calculations and obtains the results. Daily Time Charter Equivalent Hire (TCEH) is the lowest hiring revenue to be demanded from the charter in accordance with the hiring terms which foresee that the voyage expenses belong to the chartered and which would be the equivalent of the daily gross revenue of the ship owner if the owner himself ran the ship.

Table 5. Results of the research

Tablica 5. Rezultati istrživanja

	OUTCOME	I. VOYAGE			II. VOYAGE			III. VOYAGE			IV. VOYAGE			V. VOYAGE		
		INBOUND	OUTBOUND	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL
		Istanbul-Haifa	Haifa-Istanbul	Voyage	Istanbul-Haifa	Haifa-Istanbul	Voyage	Istanbul-Haifa	Haifa-Istanbul	Voyage	Istanbul-Haifa	Haifa-Istanbul	Voyage	Istanbul-Haifa	Haifa-Istanbul	Voyage
Brut Freightage (USD)		183600	0	183600	229500	30600	260100	275400	61200	336600	321300	91800	413100	367200	122400	489600
	Agency Commission (USD)	4590	0	4590	5738	765	6503	6885	1530	8415	8032	2295	10327	9180	3060	12240
Net Freightage (USD)		179010	0	179010	223762	29835	253597	268515	59670	328185	313268	89505	402773	358020	119340	477360
	Bunker Expenses (USD)	19684	19684	39368	19684	19684	39368	19684	19684	39368	19684	19684	39368	19684	19684	39368
	Crossing Canal & Straits (USD)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Port Expenses (USD)	6000	9000	15000	6000	9000	15000	6000	9000	15000	6000	9000	15000	6000	9000	15000
	Total Container Expenses (USD)	39218	0	39218	49023	9805	58828	58828	19609	78437	68633	29413	98046	78438	39219	117567
Voyage Cost (USD)		64902	28684	93586	74707	38489	113196	84512	48293	132805	94317	58097	152414	94119	67903	171935
Brut Voyage Profit (USD)		114108	-28684	85424	149055	-8654	140401	184003	11377	195380	218951	31408	250359	263901	51437	305425
Daily Brut Voyage profit (USD)		24330	-6116	9107	31781	-1845	14968	39233	2426	20829	46685	6696	26691	56269	10967	32561
Daily Running Cost (USD)		9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000
Daily Net Voyage Profit (USD)		15330	-15116	107	22781	-9845	5968	30233	-6574	11829	37685	-	17691	47269	1967	23561
Freight Rate/ Break Even Point (USD)		525	15116/n	872	458	1582	645	414	887	535	382	656	464	334	540	418
TEU Profit		375	(-15116/n)+600	-	442	-982	-	586	-287	-	518	-56	-	566	60	-
T/C Cost				8884			14602			20321			26040			32986

6. Conclusion

Zaključak

The importance of container transportation to the economic and social dimensions of a community, nation, or region is significant, if not great. Better performing container transportation is often argued to contribute to increasing trade and development of national economies.

It is considered that time element much money for sea transportation therefore our ports must be supplied with the recent technological equipment so that loading and discharging can be done very quickly at our containers ports. It is necessary to make plans considering the developments of handling and storage capacities at the terminals.

The container terminals have become logistic centers acting as the natural points of intermodal interchange, where more than one form of transport mode (e.g. road, rail, sea, and air) is used to move containers in a global transport system. Insufficient equipment and substructure cause time loss and increase of freight rates thus making container transportation non attractive.

Efficiency is a sound indicator for measuring container terminals performance. Often, in improving container terminals productivity, management and many researchers have directed their attention to finding solutions by using a number of productivity indicators in evaluating the performance of container terminals management decisions [5].

The feasibility research which is done to open a new line shows that the cargo statistics among the ports are insufficient whereas these statistics are necessary in order to determine the demands for such a line.

Free roaming transportation is generally accepted in various developed countries in relation with container transportation. But according to the valid regulations in some country unlike the way it is accepted all over the world a container is not considered as a pallet, a package or a box but not accepted as a cargo and it is imported or exported with temporary acceptance procedures. But the bureaucratic obstacles prevent the speed of container transportation which is the most important specialty of this transportation. Customs regulations should be reviewed and the necessary elasticity should be given in order to comply with the commercial technology developing very rapidly.

References

Literatura

1. Foxcroft, A. (2002). Balancing the Books. Containerization. 35: 45-47.
2. J. Dowd., T. and M. Leschine., T. M., 1990 "Container Terminal Productivity: A Perspective" Maritime & Policy Management, Vol. 17, No.2, pp.107-12
3. <http://www.ships-register.com>
4. Lloyd's Ship Manager, (2004), Rates/Bunkers, Vol 18, December
5. Emecen E. G., Kara G., Satir T., (2004), "Performance Indicators for Container Terminals in the Marmara Sea" *International Logistics Congress 2004*, Dokuz Eylül Üniversitesi, 2004, 619-628.

Rukopis primljen: 20. 8. 2007.