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Operational Limitations of Durres Container's Terminal

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Abstract: Albania is a maritime country, and maritime transport is the backbone of its economy. In 2021 maritime transport counted for about 59% of trading volumes, and Durres port handled more than 91% of all seaborne cargoes [1]. Durres Container's terminal is the only terminal handling containers in Albania. This terminal is operating under some limitations which are affecting its performance. These limitations are the lack of container storage area, increasing the container's dwell time and creating container congestion and the immediate need for more storage spaces, limited water depth at the access channel and port basin, lack of container handling cranes, and lack of railway connections, etc. This paper will focus on terminal needs for storage areas and aims to analyze the current situation and identify the space needed for the projected cargoes 15 years ahead based on historical data and using 2021 as the base year. A multi regression analysis [2] is used to identify the demand and consequently the space needed to handle the forecasted traffic. Based on the space requirements identified by this paper, it is evident that there is an urge to decide on terminal enlargement or terminal reallocation to a new site.

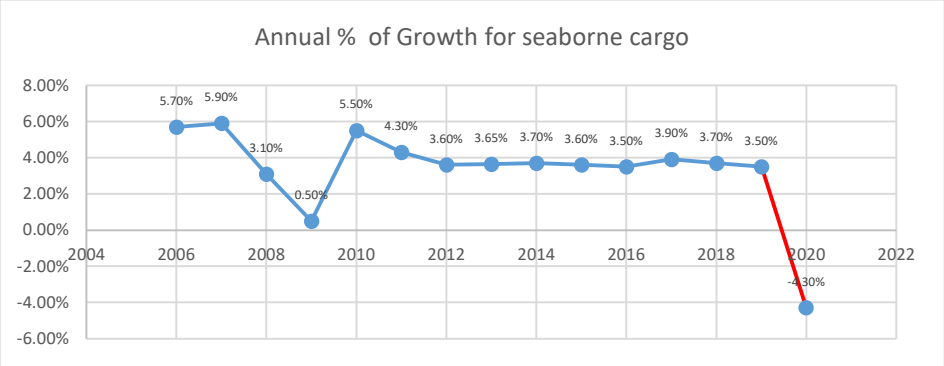
Keywords: Durres Port, Container's terminal, Congestion, Terminal space.

1. Introduction

In recent years the most technical development was the unitization of the liner shipping business. During 1960 the traditional system of the break-bulk become increasingly unable to cope with the escalating volume of world trade [3]. One of the principal benefits of containerization is that it allows bigger ships to be used, and the size of container ships has increased steadily, following much the same process of evolving into size segments we have already seen in the tanker and bulk carrier market.

Container traffic has always been growing. Even during the pandemic, due to the consumers' behavior change that was more oriented toward products than services, container traffic growth slowed down but remained optimistic. The world seaborne traffic was heavily hit by the pandemic [4]. The

following figure 1 shows the annual growth of the seaborne cargo volumes [5].



Source: Adopted by Review of maritime transport 2020 - UNCTAD

Fig. 1 – *Annual Growth of seaborne cargo*

Durres Port is relatively new in container handling. It started about 15 years ago, with the construction of a start-up container terminal. This terminal had a relatively small yard area of about 64000m^{2,} and the equipment available was limited. Initially, only one mobile crane, two reach stackers, and a few chassis to move the containers. Furthermore, the navigational parameters of the access channel and the quayside were 7,5m, not allowing bigger ships to be accommodated alongside the terminal.

2. Durres Container Terminal

Durres's container terminal is situated in wharf 6-7 of the port. It has a storage capacity of 7000 TEU. The terminal details are given in table 1 below.

Table 1 – *Terminal characteristics*

No	Description	units
1	Storage capacity	7000 TEU
2	Annual Terminal capacity	180000 TEU
3	Terminal area	64000m^2 +30000m^2 additional contract
4	Berth length	308m
5	Approach channel depth	8m
6	Terminal operation system	Solon Port
7	Quay crane productivity	45 containers/hour

Source: https://www.dct.al/terminal-information

Today, the terminal can handle up to 180000 TEU/year [6]. The overall length of the quay is 308 meters, and the water depth is 8m. The terminal is operating with the system Solon port. Two mobile cranes are operating at the terminal with a productivity of 45 Cont./hrs. Following table 2 shows the equipment available at the container's terminal:

Table 2 – *Durres terminal Equipment*

No	Description of equipment	Lift capacity	units
1	Fantuzzi MHC 130	100 T	1
2	Terex MHC 150	150 T	1
3	Reachstakers (Fantuzzi/Kal-mar		7
4	Forklift		1
5	Internal transfer vehicle		6
6	Reefer plugs		201
7	Empty container handling		1

Source: https://www.dct.al/terminal-information

The number of containers handled in this terminal is steadily growing from year to year. From a few hundred boxes in the first years of its operation, this terminal now is handling almost 150000 TEU/year. The following chart shows the number of TEUs handled during the years 2012 - 2019 [6].

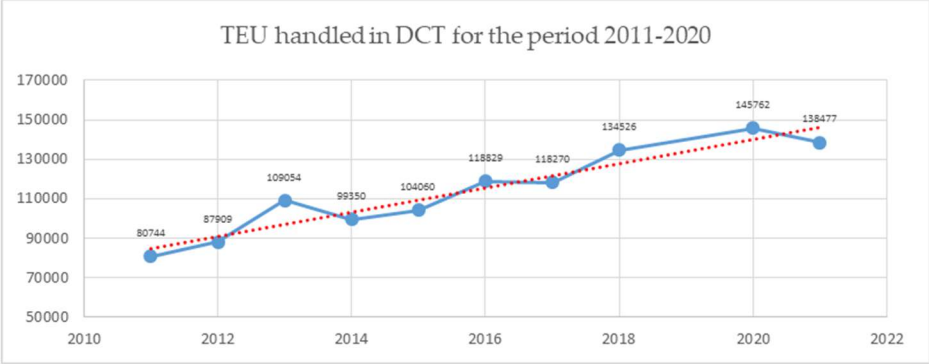
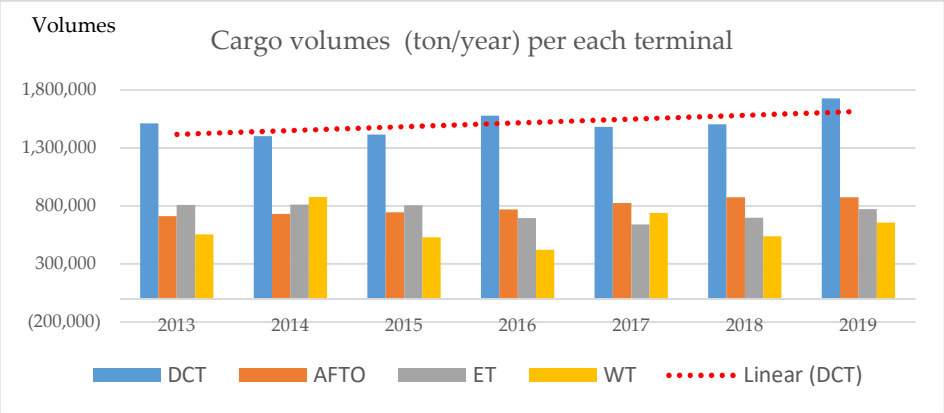


Fig. 2 – *Containers handled in DCT 2012-2019*

The trendline shows a steady growth of the container's demand. Regarding the volumes of cargoes (ton/year) handled in the port, the container terminal is the main terminal occupying the biggest share. The charts below show respectively the volumes of the cargo handled in Durres Container Terminal (DCT), Albanian Ferry Terminal Operator (AFTO), East Terminal (ET), and the West Terminal (WT) for the period 2013-2019.



Source: Durres Port Authority Statistics

Fig. 3 – *Volumes handled in Durres Port according to terminals*

The cargo share for the Containers Terminal is shown in figure No. 4:

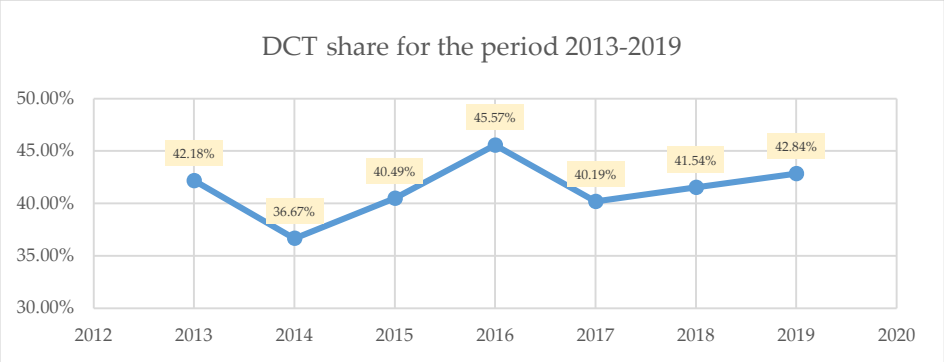
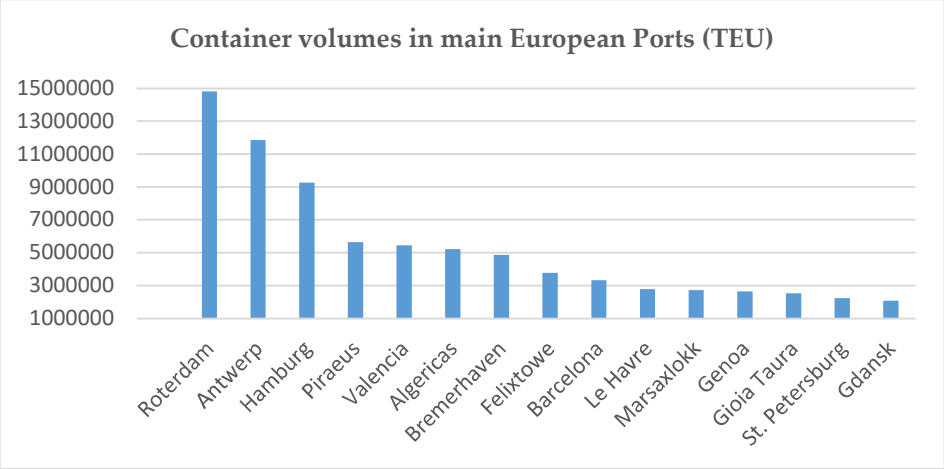


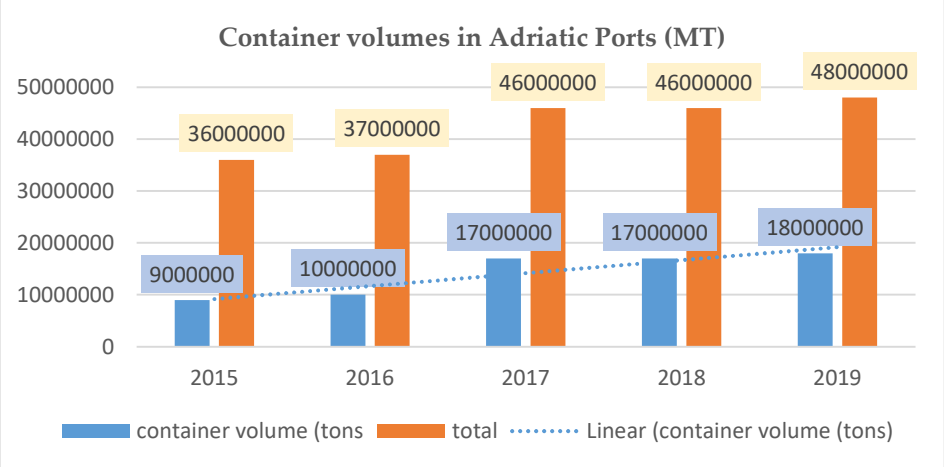
Fig. 4 – *Cargo share for container terminals*

Compared to other European ports, Durres has the same share of cargo, regarding container terminals. Figures 5 and 6 show the volume of the containers handled in the 15 biggest ports of Europe in 2019 and the share of containers in Adriatic Ports [7, 8].



Source: Port Economics retrieved from: https://www.porteconomics.eu/top-15-container-ports-in-europe-in-2019-teu-volumes-and-growth-rates/

Fig. 5 – *Top 15 container ports in Europe (2019)*



Source: https://www.statista.com/statistics/1183201/cargo-traffic-in-adriatic-sea-ports-by-type/

Fig. 6 – *Container volumes in Adriatic Ports*

It can easily be observed that the container share for the Adriatic ports is increasing respectively from 25% in 2015 to 37,5% in 2019 [8].

3. Methods and material

In this paper, we have used the quantitative method by using terminal data. To evaluate the handling capacity of the container's terminal several factors [9] need to be considered. Yard storage capacity is the dependent

variable of the number of ground slots (or otherwise the number of the containers footprint on the yard) stacking height and maximum utilization factor or coefficient. Yard maximum utilization factor varies from 60-80% in peak [10]. Other factors (independent variables) we must consider are dwell time which is the time the container stays in the yard from the day it arrives in and moves out of the yard. The longer container stays in the yard, the lower the yard capacity. Normally in Durres Containers' terminal dwell, time is about 8 days. The peak factor is the outcome of seasonal variations and the overall throughput of the terminal during a week. This factor varies from 1,2 to 1,5. In our case, we have considered the peak factor =1,2. Surge factor is observed during handling of loading/unloading operations. Normally the surge happens at the beginning of the unloading for the rate is higher and the terminal occupancy increases. It can be 1,5 - 1,2 depending on the unloading rate [11].

3.1. Discussion

Considering the volume of cargoes and the number of TEUs handled annually, Durre's container terminal is having steady growth. Because of this, terminal management decided to expand its original yard size, because the existing area of 64000m^2 was about to reach its limit. The terminal did not have enough storage space to face all the traffic. The handling capacity of the terminal with the original area size could be calculated by the following equation [12]:

$$\text{Yard Capacity} = \frac{TGS * MaxSTH * MaxUT}{Sf * Pf} * \frac{Days}{Dwt} \quad (1)$$

Where:
TGS = total ground slots
DWT = Dwell time of the containers
MaxSTH = maximum stacking height
MaxUt=maximum utilisation factor
Sf = surge factor
Pf = Peak factor
Days = working days of the year

In our case let's assume that dwell time is 8 days. The terminal is working 7/24 and there is no day off therefore the terminal works 365 days. There are 1234 TGS, max stacking height is 3,4 and average stacking is 0,8 the peak factor is 1,3, and surge factor is 1,2. [11]. If we make proper substitutions in the above equation (1), we have:

Observing annual volumes of the terminal [6], we realize that this value has been reached since 2013-2014, and ever since the annual overall TEU number handled by the terminal has been greater. Consequently, the terminal management has been forced to seek solutions for this area shortage. The terminal has hired additional areas from the adjacent terminal of the general cargoes. There are some 30000m^2 and that has made the TGS number to be

$$\text{Yard Capacity} = \frac{1234*3,4*0,8}{1,2*1,3} * \frac{365}{8} = 98166 \text{ TEU/year} \qquad (1)$$

increased and the maximum capacity the terminal can handle in the new conditions is about 180000 TEU/year.

Table 3 – *Regression statistics*

Regression Statistics				
R	0.95463	R-Squared	0.91131	Adjusted R-Squared
MSE	46,501,792.13911	S	6,819.22225	MAPE
Durbin-Watson (DW)	2.37265	Log likelihood	-101.34867	
Akaike inf. criterion (AIC)	20.66973	AICc	20.71973	
Schwarz criterion (BIC)	20.73025	Hannan-Quinn criterion (HQC)	20.60335	
PRESS	628,649,064.04527	PRESS RMSE	7,928.73927	Predicted R-Squared

ANOVA						
	d.f.	SS	MS	F	p-value	
Regression	1	3,822,482,049.7	3,822,482,049.1	82.20075	0.00002	
Residual	8	372,014,337.1	46,501,792.1			
Total	9	4,194,496,386.9				
	Coefficients	Std Err	LCL	UCL	t Stat	p-value	H0 (5%)
Intercept	-12,342,387.5	1,373,865.56	-15,510,527.18	-9,174,247.8	-8.98369	0.00002	Rejected
year	6,179.53347	681.58152	4,607.80366	7,751.26327	9.06646	0.00002	Rejected
T (5%)	2.30600						
LCL - Lower limit of the 95% confidence interval							
UCL - Upper limit of the 95% confidence interval							

This is a very temporary solution for the terminal because if we run a linear regression to make a simple forecast for the coming years it shows that the terminal is reaching this figure in less than three years (Figs. 7 and 8) [13]. Regression statistics show a strong correlation with an adjusted R square of 0.91131 which shows a very good correlation. The model is accepted because the p-value is 0,00002 and Ho is rejected.

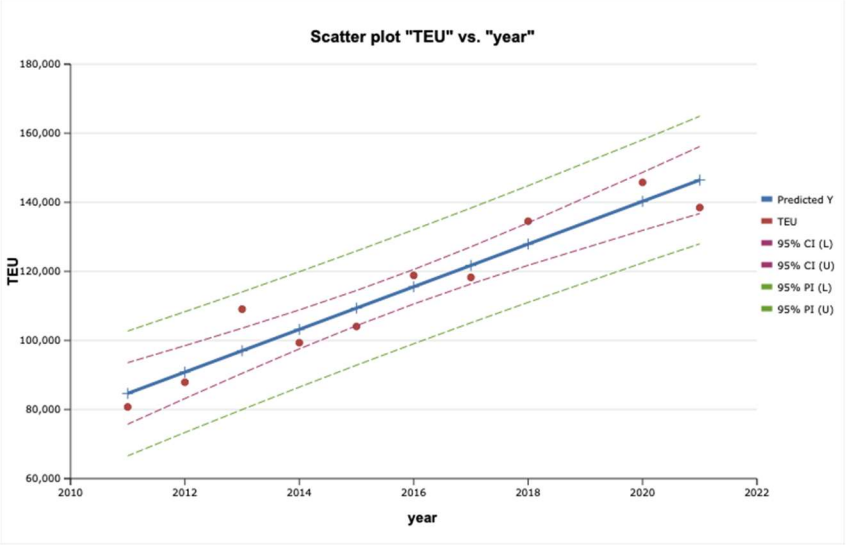


Fig. 7 – *Scatter plot*

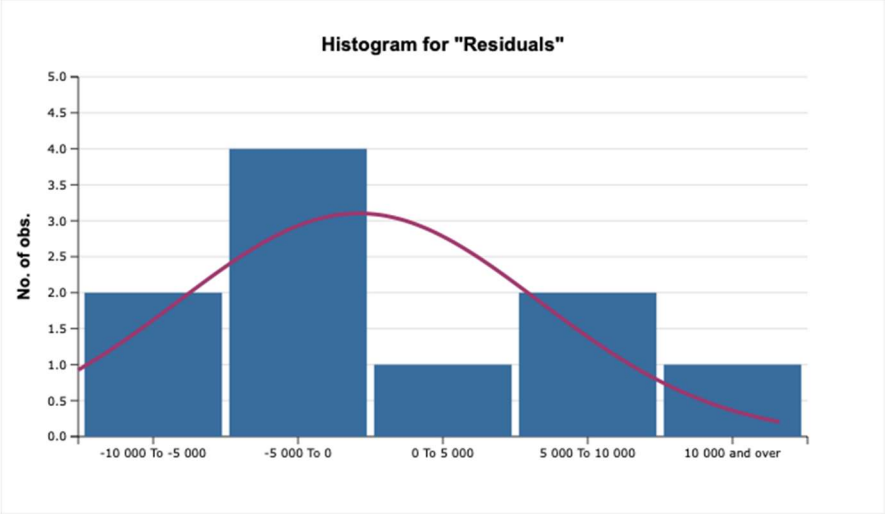


Fig. 8 – *Histogram for residuals*

The linear regression equation to calculate the volumes is as follows:

$$TEU = - 12\ 342\ 387{,}50849 + 6\ 179{,}53347 * year \quad (2)$$

Where - 12 342 387,50849 is the intercept, and 6 179,53347 is the slope and year is the period. According to this regression model [13], the output of 180000 TEU will be reached by the year 2025. The following Fig. 9 shows the actual and forecasted TEU volumes for the 15 coming years retrieved from the above regression:

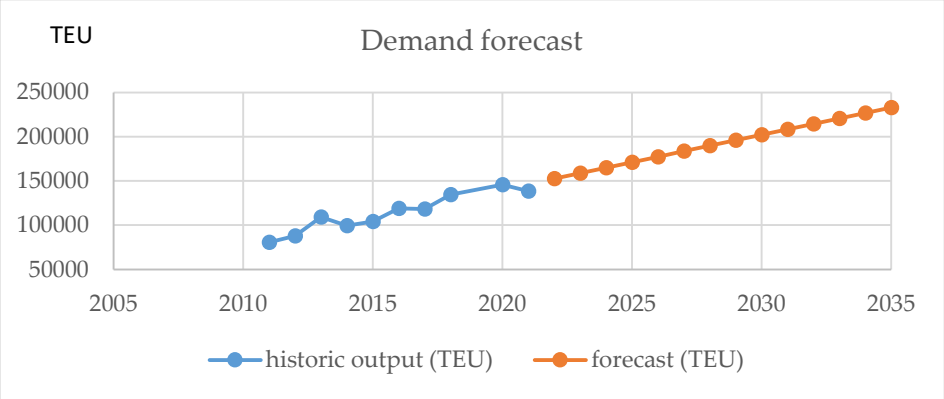


Fig. 9 – *Demand forecast*

4. Conclusions

This paper analyses the space issues of the Durres container terminal. This terminal is facing steady growing traffic and the terminal area is going to be insufficient to face the coming traffic. Investing in the same terminal is impossible for there is a lack of land for further expansion of the terminal [14]. Therefore, the terminal managers could think of dry terminals or distant yards to store the containers, but this will involve additional costs and will affect the productivity of the terminal because of the additional moves that the containers must undergo.

On the other hand, considering the navigational restrictions of that Durres's Bay, access channel, and port basin water depths, the expansion can go to a certain limit, and the terminal could not get the advantage of the economy of scale because bigger ships will have difficulties on getting in the port and berth. Therefore, it is recommended that terminal management should evaluate the alternative of building a new terminal, with a proper storage

area, sufficient water depth, and proper connections with the intended hinterland.

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