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For more information, contact
MIT Global SCALE Network

Postal Address:
Massachusetts Institute of Technology 77
Massachusetts Avenue, Cambridge, MA 02139 (USA)

Location:
Building E40, Room 267
1 Amherst St.

Access:
Tel: +1 617-253-5320
Fax: +1 617-253-4560

Email: scale@mit.edu
Website: scale.mit.edu

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Customs, Transportation and Warehousing Capabilities required in Piraeus Port to Increase Competition as a Mediterranean Logistics Hub
Ioannis Solomakakis
Customs, Transportation and Warehousing Capabilities required in Piraeus Port to Increase Competition as a Mediterranean Logistics Hub

By Ioannis Solomakakis
Thesis Advisor: Jianjun Xu, Phd

Summary: This thesis aims to identify the actions to be taken in order to minimize the transshipment turnaround time for the company’s containers at the hub port of Piraeus in Greece. To achieve that purpose, container operations at the port of Piraeus are analysed and bottleneck processes are determined. The root causes for the delays are identified and recommendations for improvements are proposed

Introduction

The economic powerhouses of China, India, and South Korea have caused radical changes in international trade routes, called the “China effect”. Global manufacturing has shifted to Asia, but the demand centers for finished products are still located mainly in Europe and North America.

Therefore, the Asia – Europe trade route is one of utmost importance. Multinational companies have established hub and spoke network operations using regional hubs in Northern Europe and the Mediterranean Sea for the transshipment of containers from long haul mother containerships. Smaller feeder containerships, as well as other modes of transport with trucks and rail predominant pick up and distribute containers to inland terminals and distribution centers within the markets the hub port provides access to (JP Rodrigue, Notteboom T, 2009).

In the aftermath of global economic crisis, mother containerships service speed has dropped from the regular 20-25 knots to slow-steaming minimum cost 12-16 knots in an attempt to minimize fuel consumption costs. Due to slower service speed, the sponsor company faces longer lead times for products from China plants and has been forced to increase inventory and safety stock levels to mitigate the risk of stockouts. The sponsor company is using Piraeus container transshipment hub port in Greece, strategically located at the Southeastern Mediterranean

KEY INSIGHTS

1. The optimal coordination of the schedule of container arrivals at Piraeus hub with the departures of smaller feeder containerships to final destinations is crucial for the minimization of turnaround time at the hub
2. There is room for improvements and simplification in customs procedures. However, customs procedures are not the main cause for delays
3. Seemingly minor details in container and order processing operations in port cross-docking facility can cause significant delays
4. Transshipment turnaround time at Piraeus hub port is low compared to other major Mediterranean container hub ports
5. Significant ongoing investment program is bound to double Piraeus hub capacity and enhance the maritime and land-based connectivity of the hub with Central and Eastern Europe, Russia and Mediterranean countries in 2016
region to reduce by 7 to 10 days the lead time for containers flowing from plants in China to Balkan countries, Russia, Levant region countries, Italy, Spain and Czech Republic. Piraeus Container Transshipment Terminal (PCT) is operated by the Chinese container liner and terminal operator COSCO and faces dynamic growth ranking 1st worldwide in the 5-year growth rate from 2009 to 2013.

The objective was to identify the bottleneck processes and root causes for delays and high container Transshipment Turn Around Times (TAT) at Piraeus hub and make proposals for the minimization of TAT by tackling the following research areas:

1) The impact of customs clearance time on transshipment turnaround time TAT at Piraeus port and comparison of customs procedures in Piraeus with those at Rotterdam
2) Identification of bottleneck processes that cause delays in the processing of customer orders from inbound containers and the preparation and forwarding of outbound containers per destination country, increasing TAT at Piraeus and identification of the root causes for delays
3) Comparison of transshipment turnaround time TAT at Piraeus with Valencia and Gioia Tauro. Development plans of COSCO Greece for the hub and for increasing container volumes both directions in Piraeus-Central Europe rail corridor

The strategic location of the transshipment hub port relative to the primary origins and final destinations of container traffic is the single most important attribute companies are looking for, but integration of maritime and land based networks is also emphasized in literature (T. Noteboom, Rodrigue JP, 2005). Adequate feeder services to and from the hub are deemed necessary, creating a chicken-and-egg situation. There must be an established network of common feeder service picking up and distributing containers and, at least one, and preferably several, major container liners calling (Bichou and Gray, 2005).

Also, companies require the hub to connect with the domestic and foreign hinterland through a multifunctional inland network comprising backward areas providing storage, sorting, resorting, processing, consolidation, forwarding and consulting services as well as multiple transportation modes including, roadway, railway and airport (Wang and Olivier, 2006).

Procedures and requirements imposed by customs frequently delay container terminal operations. The World Customs Organization (WCO) has developed standards for the simplification and harmonization of customs procedures and controls to support trade facilitation and reduce port waiting time (WCO SAFE Framework, 2012).

Methodology

TAT at Piraeus hub is broken down to the following times for discrete consecutive processes:

\[ TAT = T_{AC} + T_{CU} + T_{PCDC} + T_{WP/PCDC} \]

- \( T_{AC} \): time required from mother vessel arrival to inbound container scan-in Piraeus Consolidation and Distribution Center (PCDC cross-docking facility)
- \( T_{CU} \): time required for customs processes
- \( T_{PCDC} \): time required in PCDC facility for customer order processing from inbound containers and preparation of outbound containers per destination country
- \( T_{WP/PCDC} \): waiting time of ready to go outbound containers until pick up by trucks or feeder vessels

\( T_{AC} \) is roughly constant and does not impact TAT variability. TAT is affected by the other 3 time-variables. \( T_{CU} \) and \( T_{PCDC} \) start simultaneously and run in parallel and therefore \( T_{CU} \) is part of \( T_{PCDC} \). The impact of \( T_{CU} \) on \( T_{PCDC} \) and consequently TAT is investigated. Then linear regression models are developed to illustrate the relationship between \( T_{PCDC} \) and independent variables. Further, the schedule of order shipments from plants in China for each destination served by feeders from Piraeus hub is optimized so that mother containership arrival at Piraeus is coordinated with feeder departure, \( T_{WP/PCDC} \) and TAT are minimized and sufficient time slot for order processing and outbound container preparation is allotted based on \( T_{PCDC} \) cumulative distribution function for each feeder serviced destination.

Results

In the study period from 11/2013-7/2014, 300 outbound containers were shipped by feeders and 168 by trucks. 85% of containers loaded on feeders were shipped to Russia, Spain, Turkey and Egypt and 85% of those loaded on trucks were shipped to Italy, Serbia and Romania.
Statistics for outbound containers from Piraeus

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Standard Deviation</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{PCDC}$ (hours)</td>
<td>49</td>
<td>62</td>
<td>31</td>
</tr>
<tr>
<td>$T_{W/PCDC}$ (hours)</td>
<td>31</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>TAT (hours)</td>
<td>109</td>
<td>77</td>
<td>92</td>
</tr>
</tbody>
</table>

$T_{CU}$ and Customs Procedures

Different customs regulations and procedures apply at the ports of Rotterdam and Piraeus due to the different handling of inbound containers. At Rotterdam, they are directly transited without being opened and processed to bonded warehouses in other EU countries, such as Germany, and deconsolidated there, while inbound containers at Piraeus are scanned in and deconsolidated in PCDC bonded port cross-dock facility. The impact of $T_{CU}$ on average $T_{PCDC}$ for destinations served by feeders from Piraeus is illustrated in the figure below.

$T_{CU}$ does not cause delays in $T_{PCDC}$ and consequently TAT.

Causes for Delays in $T_{PCDC}$

The relationship of $T_{PCDC}$ for different destination countries with a number of variables is analysed developing linear regression models with ANOVA in order the causes for delays in PCDC facility operations to be identified. The linear regression models with ANOVA analysis is performed for Spain, Turkey and Italy because high $T_{PCDC}$ times were observed for those destinations with significant container volumes. Indicatively, a regression model developed for $T_{PCDC}$ for Spain is presented below:

$$T_{PCDC} = 7.1 \times \text{(number of inbound containers)} + 26.2 \quad (99\% \text{ confidence & } \alpha=1\%)$$

Optimal Scenarios for the Schedule of Order Shipments from Plants in Chongqing, China to Destinations served by Feeders from Piraeus

The number of inbound containers from which customer orders are unloaded in order to fill one outbound container for Spain has a strong impact on $T_{PCDC}$. $T_{PCDC}=7.1\times$(number of inbound containers) +26.2 (99% confidence&$\alpha=1\%$).

The optimal ocean transportation line to be used each day of the week for container shipments from Chongqing plants with orders to each destination served by feeders from Piraeus is identified. The optimal scenario minimizes the overall time from Chongqing plants to feeder departure from Piraeus for the destination with the constraints that $T_{W/PCDC}$ is minimized and the probability $P_{r}(T_{PCDC} < \text{Piraeus TAT available})$ is maximized and ideally becomes 100%. Piraeus TAT available is the time slot available for container and order processing from the arrival of the main line (mother) containership from China to the departure of the feeder service for each destination. Indicatively, the empirical cumulative distribution function of $T_{PCDC}$ for Spain and the daily shipment schedule table for orders to Spain are presented below.
Comparison of TAT Piraeus with Valencia and Gioia Tauro terminals

<table>
<thead>
<tr>
<th></th>
<th>Piraeus</th>
<th>Valencia</th>
<th>Gioia Tauro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Transshipment TAT (days)</td>
<td>4.5</td>
<td>6</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Conclusions and Recommendations

Customs procedure starts simultaneously and runs in parallel with the scanning-in and the processing of containers in PCDC facility. $T_{CU}$ is on average 4 hours for each customer order and multiple orders are cleared through customs at the same time, while $T_{PCDC}$ is on average 49 hours per customer order. Therefore, customs procedure is not the bottleneck process in Piraeus hub operations.

$T_{PCDC}$ is affected by the number of customer orders loaded in each outbound container per destination and by the number of inbound containers from which customer orders for the specific destination are deconsolidated and processed in order to fill one outbound container. $T_{PCDC}$ is also affected by the fact that plants in China build pallets to maximize container fill rate mixing destination countries and customer orders on the same pallet. Plants should be instructed to build pallets per destination country and to load pallets to destination countries served by feeders from Piraeus last. Minor details, such as the absence of cheat sheet labels including the barcodes of all items loaded on each pallet and delays in the tendering of the order release notification to COSCO significantly affect $T_{PCDC}$. The handling of damaged boxes and items identified during inbound container deconsolidation and the end customer special handling requirements regarding pallet type and height do not cause delays in $T_{PCDC}$.

The optimal schedule for order shipments from plants in Chongqing in China to Spain, Turkey, Russia, Egypt and Israel that are served by feeders from the hub should be followed, as it minimizes $T_{WPDC}$ and TAT at Piraeus. The sponsor company should extend the processing hours of its customer orders in PCDC cross-dock facility during the weekend for outbound containers preparation for Egypt, Israel and Russia. Containers to Turkey should be shifted from feeders to trucks because $T_{WPDC}$ remains high even after schedule optimization.

The hub operator, COSCO Greece, is currently investing in a 230m € project that will double both hub capacity to 6.4 million TEUs by October 2016 and feeder services frequency to at least 2 services/week. A second weekly feeder service to Spain is already operating. COSCO Greece is also negotiating contracts and has signed non-disclosure agreements with major automotive industries that operate plants in Czech Republic for container shipments both directions in Czech Republic-Piraeus rail corridor. The goal is to balance outbound with inbound container flow ratio in the rail corridor, as the ratio is currently 4:1. Last but not least, the hub operator is negotiating with government officials in the Balkan countries transited by the rail corridor for capturing container traffic in both directions.

Cited References

Bichou & Gray, 2005
Noteboom & Rodrigue, 2005
Rodrigue & Notteboom, 2009
Wang & Olivier, 2006
WCO SAFE Framework, 2012