JOURNAL OF MARITIME RESEARCH

Vol XX. No. I (2023) pp 30–33

ISSN: 1697-4840, www.jmr.unican.es

The role of the control tower in increasing the productivity in container terminal operations.

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ARTICLE INFO

Article history:
Received 31 Dec 2022;
in revised from 14 Jan 2023;
accepted 17 Jan 2023.

Keywords:
Control Tower, Average Berth Productivity, Average Crane Productivity, Container Dwell Time, Window Slippage, Dashboard, KPI. DEA (data envelopment analysis).

ABSTRACT

Container Terminal operations are very complex. They play a very important role in overall supply chain management. Increasing competition and impact of globalization has forced every port as well as container terminal to be the most efficient in its operations. Due to the complexities involved and due to the involvement of various operators and users, it has become necessary to bring end to end supply chain visibility. A Control Tower (CT) concept is comparatively new wherein 'information hubs' are created across the various cross-divisional organizations. These information hubs are system integrated. Information gathering is done with an intention to share the information across the board to detect and to quickly act on problems faced, and opportunities offered with an intention to save costs or maximize profits. CT in a Container Terminal would bring in enormous benefits to all the stake holders involved. This research paper explores the use of Control Tower in a typical Container Terminal.

1. Literature Review.

Since control tower is comparatively a new concept there is hardly any research done on Control Towers in Container Terminals. There are many software companies who have developed Control Tower for Logistics and Supply Chain. I have studied the information provided by various software companies on the subject matter. There is literature available on measurement of performance of container terminals.

UNCTAD suggests two categories of port performance indicators: macro performance indicators quantifying aggregate port impacts on economic activity, and micro performance indicators evaluating input/output ratio measurements of port operations. (UNCTAD, 1976)

Port performance measures can be divided into four categories. These are production, productivity, utilization and service measures which are discussed in the study. (Esmer, 2008)

Kevin P. B. Cullinane & Teng-Fei Wang used Data Envelopment Analysis to study the efficiency of European Container Ports. In this paper, DEA analysis has been applied to determine the relative efficiency of Europe's leading container terminals.(Wang, 2006)

Joanna BARAN and Aleksandra GÓRECKA also used (MPI) Malmquist Productivity Index while analyzing the efficiency and productivity of seaports. According to them In shipping industry, port container terminal productivity can be measured in two types of operations. First is the vessel operation, which involves discharge and loading of container onto vessel. The other one is receiving and delivering operations, where containers transfer to and from outside trucks [4]. In addition, productivity in port container operation is key determinant for the cost of providing container stevedoring services. (Joanna BARAN1*, November 2015)

2. Introduction.

2.1. Background.

With increasing number of private container terminals coming up, the competition amongst the terminals is fierce. The terminal is not only required to be operationally efficient, but also cost effective. Considering the complexities involved and

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dependency on external users, achieving efficiency and continuously keeping tab on the costs is a difficult task. Availability of information, as live as it can be, is very important. Sharing of information is not only important within the organization but also its sharing with outside stake holders. A robust system of capturing live and accurate information and usage of appropriate software to collate, process and disseminate such information across the board is important. Usage of CT in supply chain in other areas has helped organizations immensely. If implemented in container terminals, CT can play a pivotal role.

2.2. Understanding Control Tower (CT).

In fact, a Control Tower (CT) in a port or a container terminal should not be misunderstood as a physical 'lime and mortar' structure situated in a port from where the vessel movements are monitored. The CT here is a kind of a dash board of data of key business metrics and events happening in a container terminal which enables full understanding of critical issues and assign priorities in order to resolve them in real time. Sharing the information with an intention to predict future problems and provide solutions in order to reduce cost and maximize profits.

2.3. Definition of Control Tower.

"Supply chain control tower is not a stand-alone SCM application, but an integrated capability embedded in a broader SCM suite or tool. It could be an intelligent data platform providing use-case specific insights, predictions and suggestions", says Christian Titze, VP Analyst at Gartner.

IBM has defined Control Tower as:

"A supply chain control tower is traditionally defined as a connected, personalized dashboard of data, key business metrics and events across the supply chain. A supply chain control tower enables organizations to more fully understand, prioritize and resolve critical issues in real time."

2.4. Control Tower (CT) vs. Dashboard.

Many people think that CT and Dashboard are synonyms. In fact, some also think that CT's are improvised Dashboards with some additional information. However, the reality is Dashboards are more historical, static and CT's are more forward looking.

Major differences:

1. Data Analytics

Artificial Intelligence (AI) is used to analyze huge data which is collected from various sources within the enterprise as well as from outside it.

2. Context

CT break downs the data silos from various systems and gain more knowledge about why certain changes are happening, where to make improvements and how to do it.

3. Control

Dashboard gives historical data based on which decisions are taken. There is always a gap between things going wrong and actions taken. On the other hand, CT gives continuous insight in things that are happening and suggests corrective actions.

4. Dynamic

CT's are more dynamic, It provides alerts. Dashboards are more static.

5. Real-time collaboration

The data is captured in real time and disseminated to various stake holders. Anticipated bottlenecks are predicted, and corrective actions are automatically taken. CT is a collaborative tool which will bring all the teams together and set objectives. CT support ever changing business situations.

6. Forward-thinking

Even before the problem happens, the entire system is alerted, and corrective actions are suggested in CT. Predictive analyses and forward thinking are prerequisite of a CT.

3. Objectives of Study.

- Identify the usefulness of Control tower in terminal operations.
- Measure higher Efficiency of Container terminal due to Control tower.

4. CT for Container Terminal.

4.1. Assessment stage.

While setting up a CT for Container Terminal, it is important to finalize the scope of CT. Studying existing processes and information captured. understanding the interconnection between different processes. In depth study of the various departments, the decision-making hierarchy, knowing the costs for various activities. The costs should not be captured on an overall basis, but activity-based costs need to be captured in order to understand the impact of noncompliance, opportunities lost etc. To understand the role of collaborative partners and impact of their actions on the costs. In a typical Container Terminal, there are departments such as Marine department who is responsible for in and out movement of the vessels, the operations department who takes care of discharge and load operation, the Yard Operations takes care of feeding and receiving containers from the ship, the engineering department is responsible for supply and maintenance of various equipment?s such as quay cranes, yard cranes, reach stackers and container handlers etc. Tremendous amount of data is generated by all these departments. These departments work in silos. Hence there is a need to collaborate data collected by each department and share the relevant data with others. In addition to that there is data coming from outsiders such as customs department, port users, trucking companies, shipping lines etc. The data captured needs to be processed and useful data to be shared with all stake holders. At this stage the Container Terminal needs to identify and decide upon the priorities.

Usually the container terminal captures following data:

1. Berth productivity: no of containers handled on a berth in a given time period.
2. Crane productivity: Average no of containers handled per hour per crane.
3. Truck waiting time.
4. Idle time analysis for vessel, It is further divided into controllable, non controllable etc.
5. Crane down time, for preventive maintenance, for repairs
6. Crane productivity per operator.
7. Container Dwell time.

In most of the cases such data is captured 'post facto' and hence while setting up a CT, one must ensure that such data is captured live and disseminated while the vessel operations are going on, so that corrective actions can be taken.

A typical dashboard for Container Terminal looks like this:

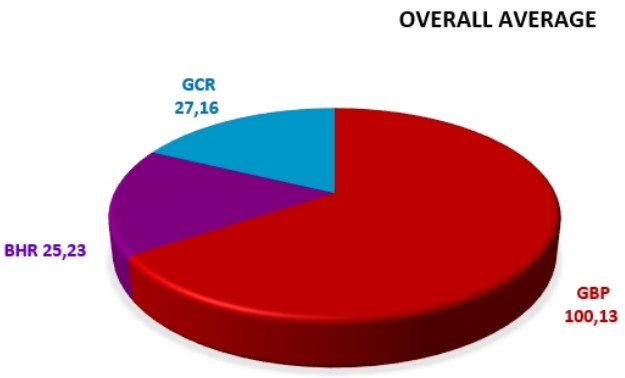
Name of the Terminal -

Dashboard for the month of -

Average Berth Productivity (in TEUs)	660
Average Crane Productivity (in moves)	30.7 moves per hour
Average Berth Utilization (in Percentage)	46%
Volumes handled ('000 TEUs)	627
Average TEU size of the Vessel:	
Feeder Vessel	510
Mother Vessel	1468
Handymax	391
Panamax	570

And graphically, the same can look like this (Figure 1).

Figure 1



The average Gross Berth Productivity and Berth Hours are graphically represented as follows in the Dashboard (Figure 2).

4.2. What is not covered by traditional dashboard?.

1. Costs incurred by waiting trucks.

This is a hidden cost not captured by any system. However, if the control tower can arrive at the cost of waiting truck per hour and no of trucks waiting, it can target to reduce the same and use it to show better customer service. It could be done via 'appointed delivery' by giving advance intimation to the terminal about the arrival of the truck.

2. 'Window slippage'.

When the vessel berths at a place other than the designated place. Here again the costs incurred due to long haulage of containers are very high. In order to control these costs, Control Tower can have a simulation model wherein while allocating the berth, the terminal planner if provided with the data relating to additional costs that will be incurred in shifting, would help him in taking the best decision from a cost perspective. Usually, the cost information is not provided to the planners at the time of decision making and hence many a times extra costs are incurred.

3. Costs incurred due to extra shifting of containers due to poor planning.

Here again CT can help in optimizing the shiftings and reduce the costs.

4. Crane down time due to non availability of spares (due to poor store management).

Crane down time affects the performance of the terminal. If CT can analyze reasons for down time, the down time can be controlled. Advance planning will help in deciding the preventive maintenance schedule of the cranes. Data analysis down by CT would help in identifying the peak usage time of cranes and non peak hours.

4.3. How CT can integrate data?.

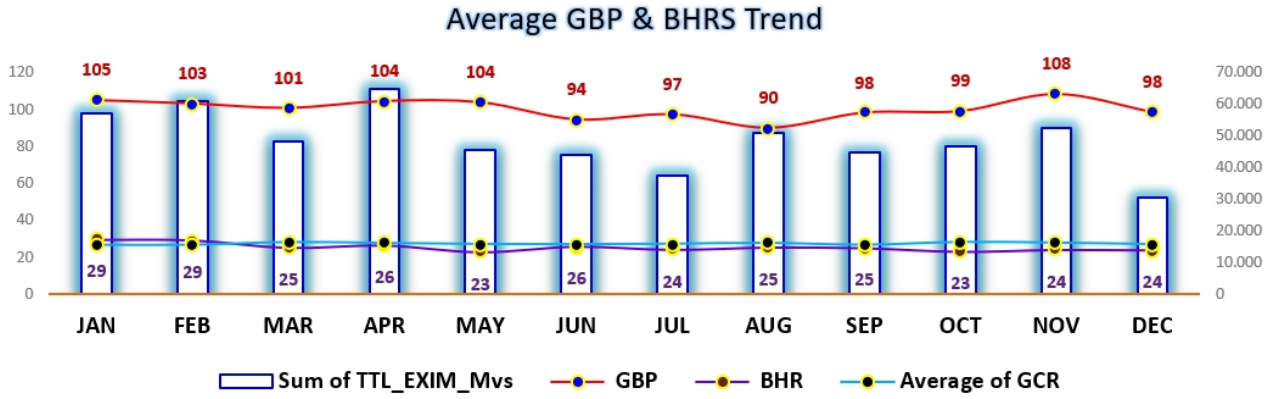
There are various data sources such as vessel arrival and departure information from Vessel Management System. Container Terminal Operations data from Terminal Operations System, truck arrival and departure information from the trucking companies or from the port users, customs clearance data from customs systems, cargo information from manifests provided by the shipping companies etc. This way huge data can be collated and shared between stake holders so that decisions are taken on real time basis.

4.4. Advantages of CT in Container Terminal Operations.

In case a ship is delayed, and advance information is captured by CT, it can suggest corrective course of action, such as berthing of another vessel. If there are no other vessels waiting, then such time can be utilized for maintenance of the equipment?s.

Similarly, if the vessel is not going to berth at the designated place due to operational exigencies and shifting of containers from the yard is inevitable, then CT would suggest the

Figure 2



best possible location where the vessel can berth so that the cost of haulage is minimal. CT tool is a proactive tool and would advise the planner in his decision making. Since the decisions are taken based on the data analysis, it would not go wrong.

Similarly, if the delays are experienced at the gates, CT can suggest alternate course of action in order to reduce the congestion at the gate. Another advantage of CT would be to give advance warning when the yards capacity is going to reach its maximum. This will help the terminal to decide whether to add more clients and still maintain the promised customer service levels.

CT would also assist in arriving at the optimal terminal capacity, it can guide what needs to be done to augment the terminal capacity. It could be by increasing the crane productivity per hour, it could be re arranging the yards or introducing additional equipment?s.

CT also can compare the terminal performance with other terminals and suggest measures to improve the performance.

CT will also identify the focus areas where management needs to pay more attention. This kind of exception planning will help the terminal in overcoming the bottlenecks, in other words, CT would advise the terminal about the future bottlenecks and will suggest corrective actions to be taken. Since it would be completely supported by data, the chances of decisions going wrong are very less.

Conclusions.

As CT has helped in logistics and supply chain industry, Container Terminals being part of the supply chain, introduction of CT in Container terminal industry would benefit a lot. The best feature of CT which suggest corrective action which will save time and cost, will assist terminal operators in achieving their optimal utilization.

In order to implement a CT solution for a container terminal, further study of data flow, system interfaces, data flow architecture, IT strategy alignment and system maintenance issues needs to be done.

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