

Key Operational Performance Indicators for Port Authorities in Algeria: A Status Report and Recommendations

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Abstract:

Maritime transportation drives the global economy, yet Algerian seaports are struggling at present due to substantial delays. To change the momentum, this study offers a tailored dashboard with nine actionable Key Performance Indicators (KPIs) for container terminals. Our examination of the Port of Algiers is direct and focused. Poor management, instead of a lack of equipment, results in an 81% waste of critical resources. Authorities must quickly adopt these proactive KPIs to cut costs and position Algeria as a logistics center.

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1. INTRODUCTION

Maritime transport forms the absolute backbone of international trade. It drives the global economy. Today, ships move a staggering 90% of global merchandise. This massive volume encompasses dry bulk (40%), liquid bulk (38%), containers (14%), and general cargo (8%) (Laxe et al., 2022). Historically, economic pioneers like Adam Smith and David Ricardo linked European economic growth directly to maritime trade (Daddi-Addoun et al., 2021). Fast forward to today. Emerging nations in Asia build massive fleets. They forge razor sharp logistics chains to maximize their market access. In this sweeping global network, the seaport serves as the ultimate geographical crossroads. It physically connects maritime routes with inland operators (Guerrero, 2013). Seaports hold the key to supply chains. Their operational performance directly dictates a nation's economic growth and transportation costs (Clark et al., 2004; Limao & Venables, 2001). When port competitiveness drops, national shipping lines take a heavy hit.

In Algeria sea transport is crucial, for the economy. The sea handles roughly 95% of the country's foreign trade (Daddi-Addoun et al., 2021). However, the situation with the port sector is really bad. The Algerian port sector is dealing with slow operations that are causing a lot of problems. It is ranked 140th globally in port performance (Datoussaid & Hamadi, 2017). Algeria needs to stop this problem with the port sector now. Given its strategic location, the country holds immense potential. It can align its port operations with international standards. To get things started, authorities must deploy effective, proactive management, it is essential to establish Key Performance Indicators (KPIs). Consequently, this research seeks to address a significant void in the literature concerning Algerian maritime logistics. We have two primary goals. First, we streamline the theoretical framework of seaport operational performance. Second, we identify and test relevant KPIs for Algerian maritime ports. We focus strictly on container handling by port authorities. We exclude passenger services. We ask one central research question: What key operational performance indicators can effectively empower managers to steer seaports in Algeria toward success?

2. Literature review: Performance in port management

To properly evaluate port efficiency, we must first unpack the concept of « performance. »

2.1. The concept of performance

Performance fuels the main goal of every business. It competes closely with profitability (Conner, 1991; Bichou & Gray, 2004). Individuals frequently use the term. However, scholars frequently perceive it as unclear. This confusion arises from its multidimensional characteristics (Bentalha et al., 2020; Raji & Lemtaoui, 2022). Fortunately, contemporary management literature reduces performance to two fundamental elements: effectiveness and efficiency (Samsonowa, 2011; De La Villarmois, 2001). Effectiveness assesses how successfully an organization achieves its goals. It assesses customer contentment. Efficiency assesses the resources utilized. It seeks to extract the highest output from a specific collection of inputs (González & Trujillo, 2009).

2.2. Port operational performance

In the mid-1980s, researchers began injecting these concepts directly into port management (Park & De, 2015). Seaports no longer act as simple transfer points. They have turned into complex logistical hubs. They seamlessly integrate various transportation modes (Klink & Van den Berg, 1998). UNCTAD (2016) spotlights four main dimensions of port performance: human, financial, commercial, and operational.

Operational performance is the key factor. It significantly affects all other dimensions (Bichou, 2006). It concentrates intensely on reducing the wait times for ships. It improves resource use and shortens overall transit times. In this scenario, the famous management adage holds more significance than ever: « You cannot control what you cannot measure. » Port managers make active use of performance measurement. They assess organizational activities in relation to strategic objectives (Mentzer & Konrad, 1991). Equipped with this concrete information, managers make instant tactical choices. They assuredly allocate berths and arrange cranes (Carlo et al., 2013; Kim & Park, 2002).

3. Overview of the Algerian port sector

We need to consider the distinct operational context of Algerian ports. This part describes the national port facilities and their management framework. It also emphasizes the sharp contradiction between Algeria's substantial trade volume and its existing logistical constraints

3.1. Framework and Management structure

The Algerian port network dots a 1,600 kilometer coastline. It features eleven primary commercial ports. Eight facilities handle general cargo and containers. The remaining three operate as specialized hydrocarbon terminals. The national economy leans heavily on hydrocarbon exports and manufactured imports. Consequently, these critical infrastructures process about 95% of the country's total foreign trade (Daddi-Addoun et al., 2021). Historically, the government controlled everything. Nonetheless, Law No. 98-05 caused a major transformation in 1998. This legislation decisively separated public service missions from commercial handling activities. It paved the way for a « landlord port » model. This move opened the floodgates for private and international operators. Today, Groupe SERPORT oversees the public port enterprises. Meanwhile, joint ventures with global heavyweights manage several key container terminals. DP World in Algiers serves as a prime example (Mohamed Cherif & Ducruet, 2012).

3.2. The contradiction of quantity against effectiveness

Although structural reforms have been implemented, the Algerian port sector still presents a significant constraint. A vexing contradiction is present. Huge volumes of goods flow through the country. Yet, the ports process them at a snail's pace. UNCTAD (2022) has validated this. Algeria's Liner Shipping Connectivity Index consistently lags behind its regional competitors.

Algerian ports face a significant lack of competitiveness. Transporting goods to Algeria is extremely expensive. It continues to be among the priciest logistical pathways in the Mediterranean (Setti et al., 2011). Low efficiency results in this high expense. Algerian container terminals handle a slow rate of 10 containers each hour. The international benchmark

requires 25 to 30 actions each hour. To make matters worse, average transit times extend to 23 days. Countries nearby manage this within 4 to 5 days (Datoussaid & Hamadi, 2017).

Chachoua (2018) quantified this inefficiency. The research uncovered an astounding figure. Ineffective organizational methods squander 81.15% of port resources. Allow that to resonate. Costly handling equipment collects dust. Operators await administrative approvals. They maneuver through extremely crowded yards. Merely improving current resources might enhance total output by almost 50%. There's no need to create something new or purchase additional new equipment.

This finding carries massive empirical weight. The core issue is not a lack of modern machinery. It is the glaring absence of data driven management. Targeted KPIs step in to bridge this gap. By tracking specific metrics, managers can pinpoint the exact waste. Take net crane productivity versus gross berth productivity. This contrast speaks volumes. It enables managers to identify delays at the dock, the storage area, or the entrances.

3.3. Strategic priorities and the price of inaction

These delays cost a lot of money. They mean the country has to pay high fees for waiting. The Algerian consumer are the ones who pay for these delays in the end. Global trade relies on perfectly timed supply chains. Holding onto first generation methods leaves the nation logistically isolated.

Adapting Algerian ports, to standards is crucial. Algeria is getting ready to meet World Trade Organization standards. It also wants to follow the African Continental Free Trade Area agreement. This will help Algerian ports compete globally. The ports need to rise to the occasion. Algeria has the potential to convert its geographical benefits into a logistical treasure. It has the potential to develop into a very competitive maritime center. To make this vision a reality, port authorities need to implement particular KPIs.

4. Methodology for KPI selection

Modern managers are overwhelmed with data. The literature tosses around hundreds of metrics. If you just use blindly a list of metrics it can actually

do more harm than good. It causes « measurement fatigue » (De Langen et al., 2007). Therefore, we adopt an interpretive constructivist approach. We do not want to force a plan onto the problem. Instead, we create a customized KPI dashboard. We employ a strict, three stage selection procedure.

4.1. Step 1: Identification of baseline and synthesis of literature

Initially, we established a thorough foundation of operational metrics. We combed through international maritime standards. We leaned heavily on UNCTAD reports (1976; 2016) and the World Bank's Port Reform Toolkit (2007). We pulled an initial pool of over 40 distinct metrics.

4.2. Step 2: The selection criteria

Subsequently, we separated the good from the bad. We processed this list through a rigorous filtering system.

We used three criteria:

- ✓ **Criterion A: Contextual appropriateness.** The KPIs needed to address the obvious issue. They had to address ship waiting times and yard congestion. We got rid out purely financial indicators. We focused on time and productivity (Brooks & Pallis, 2008).
- ✓ **Criterion B: Measurability and Data accessibility.** A KPI remains useless if you cannot gather the data. Many Algerian ports rely on legacy IT systems. The indicators had to be simple to compute. We prioritized basic data points like time stamps and physical counts (Kent & Ashar, 2010).
- ✓ **Criterion C: Managerial actionability.** We judged the manager's control over the metric. We chose indicators that isolate specific operational failures. We split « total ship time » into « gross time at berth » and « work time at berth. » This lets managers differentiate between administrative delays and actual handling inefficiencies.

4.3. Step 3: Construction and Systemic categorization

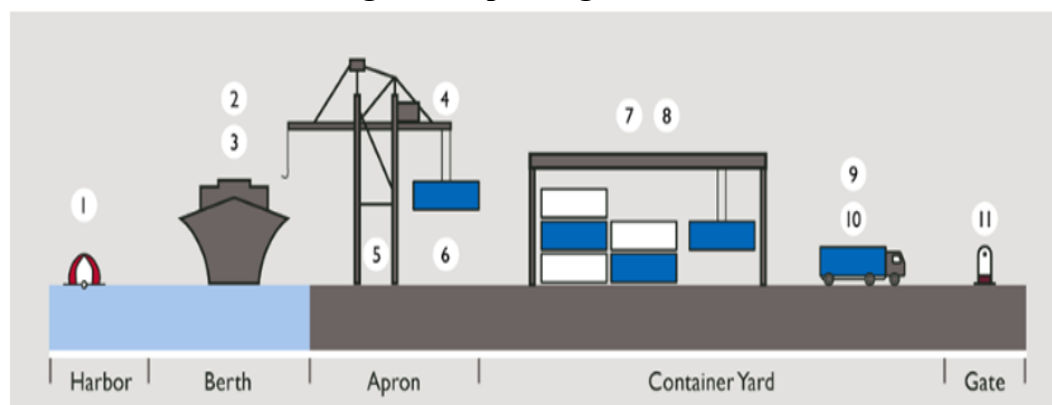
Finally, we synthesized and categorized the remaining indicators. We mapped the KPIs directly onto the physical journey of a container. We structured the indicators into three operational zones: the sea facing interface, the handling mechanics, and the hinterland facing interface.

5. Proposed operational performance indicators

5.1. Description of the logistics chain of a container terminal

To determine appropriate indicators for evaluating terminal performance, it is essential to understand the dynamic operation of terminal processes. The indicators used in the port context are generally derived from the different activities and a range of services that take place between the port entry buoy and the terminal entrance, forming the port logistics chain. The chart in Figure 1, which represents the graphical depiction of the port logistics chain, shows the sequence of 11 general activities in a container terminal.

Fig. 1. The port logistics chain

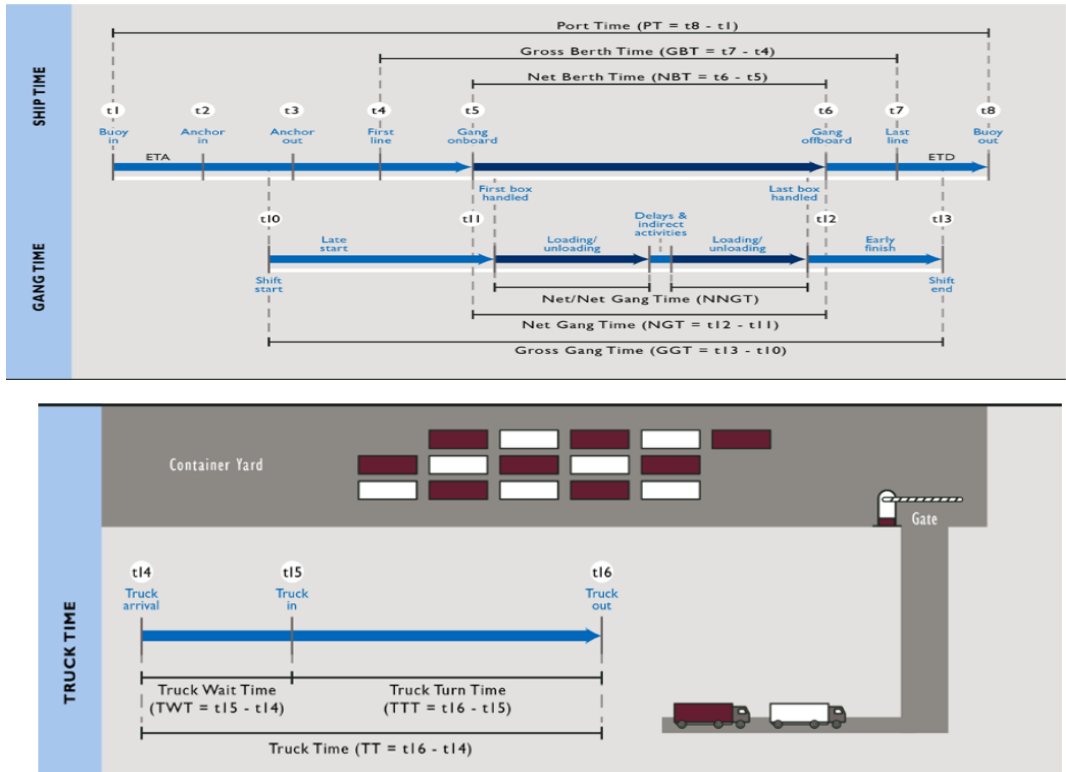


Source: Kent, P., & Fox, A. (2011). Is Puerto Limon a real lemon? Port inefficiency and its impact. In K. Cullinane (Ed.), *International Handbook of Maritime Economics* (Chapter 19). Edward Elgar Publishing.

5.2. Temporal calculation system for container terminal operations

All measures of operational efficiency are linked to processing times. The system records and defines a sequence of events during the processing, as well as the durations between these events. Most ports use this system or a similar one for operational control and have integrated it into their terminal operations reports (Kent & Ashar, 2010). Figure 2 illustrates the three main components of a terminal (quay, yard, and gate), and the events and elapsed times for each.

Fig. 2. Temporal calculation system for port operations



Source: Kent, P., & Ashar, A. (2010). Indicators for port concession contracts and regulation: The Colombian case. *Proceedings of the International Association of Maritime Economics Conference*.

Figure 2 presents two parallel timelines: the upper one represents the vessel operation (at the quay), while the lower one concerns the teams (cranes) involved in the operation. According to Kent & Ashar (2010), temporal indicators include:

- ✓ **Average mooring time:** Time elapsed between the start and end of mooring.
- ✓ **Average time spent in port ($t8 - t1$):** Measures the time the vessel spends in port, from arrival to departure.
- ✓ **Average gross mooring time ($t7 - t4$):** Measures the time the vessel is moored, from the first line to the last line release.
- ✓ **Average net mooring time ($t6 - t5$):** Measures the time between the

start and end of unloading.

- ✓ **Average mooring berth occupancy rate:** Indicates the average total duration that the vessel is docked at the quay during a specified timeframe.
- ✓ **Average idle time per shift:** Assesses the period when the vessel is not engaged in loading/unloading activities because of different interruptions (breakdowns, lack of equipment, crane adjustments, etc.) The objective is to demonstrate the functional relationships between these two elements. It is observed that overlapping time occurs only with the net delays at the quay and the net delays of the teams. Indeed, the net delay at the quay corresponds to the net time of the teams only when the team is working. A similar temporal calculation representation is also provided for the gate operation (terminal entry).

5.3. Proposed operational performance indicators

To evaluate operational performance accurately, one must grasp core terminal processes. A container terminal operates as a complex, breathing network. It features « stocks » and « flows » (Kent & Fox, 2011). The storage yard represents the stock. The movement of containers represents the flows.

Performance indicators must capture the efficiency of both interfaces. We propose a customized dashboard. It features nine KPIs for Algerian port managers.

Table 1. Key operational performance indicators for container terminals

N°	Indicator	Description	Unit of measurement
1	Time at Port	Time elapsed from arrival at the port entry buoy to departure.	Hours
2	Gross Time at Berth	Time elapsed from the first mooring line to the last line release.	Hours
3	Work Time at Berth	Net time between handling the first container and the last container.	Hours
4	Net Crane Productivity	Number of movements divided by the active work time per crane.	Movements / Hour
5	Gross Berth Productivity	Total container movements divided by the Gross Time at Berth.	Movements / Hour
6	Berth Utilization	Total Gross Time at Berth divided by	Percentage

		available time over a period.	
7	Truck Turnaround Time	Total time a truck spends at the terminal (waiting + loading/unloading).	Minutes
8	Yard Utilization	Number of occupied storage slots divided by total slot capacity.	Percentage
9	Container Dwell Time	Time between a container's offloading and its exit from the terminal gate.	Days

Source: (Adapted from Kent & Ashar, 2010; World Bank, 2007)

5.4. Indicators for quay side operations

The quay represents the first point of contact. Time at port, gross time at berth, and work time at berth track infrastructure usage. The gaps between these metrics speak volumes. If gross time vastly exceeds work time, the ship sits moored. The cranes remain frozen. This massive red flag points directly to administrative delays or missing handling teams. Furthermore, gross berth productivity and berth utilization evaluate commercial efficiency. Pushing berth utilization above 80% sounds the alarm. It wipes out buffer time and guarantees severe congestion.

5.5. Equipment productivity indicators

Port authorities must track net crane productivity. This razor-sharp metric strictly counts active container movements. It serves as an exceptional diagnostic tool. A port might suffer from abysmal gross berth productivity. Yet, it could boast high net crane productivity. The manager instantly knows the truth. The operators perform brilliantly when active. They simply spend too much time standing by. Missing terminal tractors usually trigger these pauses. The data shifts the blame from machinery to yard planning.

5.6. Land side operations indicators

Land side operations function as the lungs of the port. Yard utilization, container dwell time, and truck turnaround time interlink tightly. Container dwell time stands out as a critical metric. It shows how long a container just sits there. When dwell time gets really high, yard utilization goes up too. The terminal transforms into a low-cost storage place. This severe congestion causes problems for handling equipment. This bottleneck directly affects truck turnaround time. It makes truck drivers have to wait for a time.

5.7. Recommended performance improvement systems

Monitoring KPIs is just part of the challenge. Managers must act. Authorities should pair measurement efforts with two proactive sub-systems. First, implement the Vessel Docking Window System (VDWS). This locks in fixed time slots for arrivals. The port can actively prepare cranes and yard space. Second, launch the Truck Appointment System (TAS). This forces transport companies to book digital time slots. It helps to out the flow of trucks and reduces congestion at the gate.

6. Empirical application: A case study of the port of Algiers

We must anchor theoretical frameworks in empirical reality. To validate our proposed KPIs, we apply them directly to the Port of Algiers. This section presents a highly detailed, scientific analysis of the terminal's operational bottlenecks. We lean heavily on the empirical groundwork laid by Chachoua (2018) and Datoussaid and Hamadi (2017).

6.1. Context and Infrastructure constraints

We applied our KPIs to the operational realities of the state owned enterprise EPAL and the international operator DP World jointly manage the Port of Algiers. It serves as Algeria's undisputed commercial hub. It processes, 800,000 TEUs annually which represents more than 55% of the country's container traffic (Oxford Business Group, 2014). However, the port fights severe physical constraints. It occupies about 17 hectares in a busy area. It offers a static storage capacity of just 6,200 containers.

To mitigate these physical limits, the port of Algiers recently injected millions into the facility. They upgraded the terminal by installing with Ship to Shore (STS) and Rubber Tired Gantry (RTG) cranes (Oxford Business Group, 2014). However, the physical bottlenecks continue to be a significant issue. This perfectly validates Chachoua's (2018) central thesis. Throwing money at new hardware does not solve the underlying organizational rot.

6.2. Diagnosing operational bottlenecks via KPIs

Researchers constantly point out a problem at Algiers. The port possesses modern equipment, but it only handles 10 containers per hour which is really slow. On average it takes a 23 days to move cargo through the port

(Datoussaid & Hamadi, 2017). Traditional managers accept these numbers as inevitable delays. Applying our KPIs provides a precise, scientific diagnostic framework to dissect this failure. We can map the specific statistics from the literature directly to the terminal's daily operations:

- ✓ **Diagnosing the 23 Day Dwell Time (KPIs 8 & 9):** Datoussaid and Hamadi (2017) pointed out the problem that everyone knows about the 23 Day Dwell Time. At the port of Algiers, a 23 day Container Dwell Time (KPI 9) paralyzes the entire ecosystem. Why? Because the terminal only holds 6,200 TEUs. When importers abandon containers for three weeks, Yard Utilization (KPI 8) instantly reaches the 100%. The terminal transforms from a rapid transit hub into a static, overcrowded warehouse. Datoussaid and Hamadi attribute this massive delay to a breakdown in tacit knowledge and standardized procedures. Customs brokers, terminal operators, and truck drivers fail to coordinate. This physical traffic jam ultimately ruins Truck Turnaround Time (KPI 7). Trucks just sit there in city traffic outside the gates, completely unable to enter the saturated zone.
- ✓ **Diagnosing the 10 Containers/Hour issue (KPIs 4 & 5):** We next measure Net Crane Productivity (KPI 4). The new STS cranes at Algiers can mechanically execute 25 to 30 moves per hour. However, Gross Berth Productivity (KPI 5) remains trapped at 10. The vast gap between these two metrics isolates the root cause mathematically. The cranes simply sit idle. This empirical data perfectly proves the staggering statistic uncovered by Chachoua (2018). Through Data Envelopment Analysis (DEA), Chachoua quantified an 81.15% resource waste across Algerian ports. At Algiers, we see this waste in real time. The cranes wait for terminal tractors to navigate the congested yard. They wait for mandatory, inefficient administrative clearances. The DEA model definitively proved that we do not need more cranes; we desperately need better data management.

6.3. Recommended corrective actions

We need to manage things based on facts not just react to problems as they

happen. The scientific evidence leaves no room for debate. Equipped with this empirical assessment, the port of Algiers Authority can implement targeted measures. There isn't a perfect solution, but focused policies will make a difference.

First, management needs to address the unreasonable 23 day dwell time. They must implement a steeply progressive fee structure for containers that stay longer than five days. This policy financially penalizes importers. It actively stops them from treating the 17 hectare terminal as a cheap warehouse. By forcing the boxes out, the port immediately reclaims its operational fluidity.

Second, the port must fully deploy a digital Vehicle Booking System (VBS). Bureaucratic inertia currently stalls the physical flow of goods. A VBS forces truck drivers to book specific time slots. It synchronizes gate arrivals with yard crane availability. Managers must use the stark data from KPI 7 (Truck Turnaround Time) to push past institutional resistance. They must force evidence based reforms.

Ultimately, Chachoua (2018) was right. Optimizing existing resources can boost production by 50%. The port of Algiers does not need another concrete expansion. It needs to rigorously track Net Crane Productivity and Container Dwell Time. These KPIs act as highly practical, surgical diagnostic tools. They alone can cure the logistical paralysis. These KPIs are not ivory tower theories. They act as highly practical, surgical diagnostic tools.

7. CONCLUSION

Relying on KPIs is no longer a luxury. It is a matter of organizational survival. This paper delivers a streamlined, theoretically robust set of KPIs. We tailored them specifically for Algerian port authorities. By abandoning outdated habits, ports can track the ground truth. The Algiers case study clearly demonstrates this. Tracking metrics empowers managers to make good decisions. They can isolate root causes and fix them in a smart way. Improving these metrics will save a lot of operational costs. It will unlock hidden capacity. Using these KPIs into daily management is the mandatory first step. It will allow Algeria to step into its power as a highly competitive

logistics hub. Future research must prioritize long term field studies to benchmark these indicators continuously.

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