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BENCHMARKING PERFORMANCE OF BRAZILIAN CONTAINER TERMINALS AND THE REST OF THE WORLD

DESEMPENHO DE BENCHMARKING DOS TERMINAIS DE CONTÊINERES BRASILEIROS E DO RESTO DO MUNDO

COMPARACIÓN DEL RENDIMIENTO DE LOS TERMINALES DE CONTENEDORES BRASILEÑO Y EL RESTO DEL MUNDO

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ABSTRACT

The assessment proposed in this article, making it possible to compare different assets, are driven by reliable data available publicly. Therefore, the benchmark KPIs outlined refer to the total teu handled in a given year by the total major physical resources available in a container terminal such as the quay length and the yard space. The size and scale of terminals tend to make them more efficient as they focus on container handling by deploying all for this purpose. The performance of Brazilian terminals has proved itself usually below regional and world average. Nevertheless, Brazil has recently been through a period of significant investment improvement in the container port infrastructure, which has led the country to leave from a situation of under capacity to a current relative overcapacity.

Keywords: Port performance benchmark; Container terminal; Quay line performance; Ship-to-shore crane performance; Yard performance.

RESUMO

As avaliações propostas neste artigo, que permitem comparar diferentes ativos, são orientadas por dados confiáveis disponíveis publicamente. Portanto, os ICDs de referência descritos referem-se ao total de TEUs movimentados em um determinado ano pelo total dos principais recursos físicos disponíveis em um terminal de contêineres, como o comprimento do cais e o espaço do pátio. O tamanho e a escala dos terminais tendem a torná-los mais eficientes, pois se concentram na movimentação de contêineres, implantando todos para esse fim. O desempenho dos terminais brasileiros tem se mostrado geralmente abaixo da média regional e mundial. No entanto, o Brasil passou recentemente por um período de significativa melhoria dos investimentos na infraestrutura portuária de contêineres, o que tem levado o país a sair de uma situação de subcapacidade para um atual relativo excesso de capacidade.

Keywords: Benchmark de desempenho portuário; Terminal de contêineres; Desempenho da linha de cais; Desempenho do guindaste navio-terra; Desempenho do pátio.

RESUMEN

Las evaluaciones propuestas en este artículo, que permiten comparar diferentes activos, están guiadas por datos confiables disponibles públicamente. Por lo tanto, los ICD de referencia descritos se refiere al número total de TEUs manejados en un año dado por el total de los principales recursos físicos disponibles en una terminal de contenedores, como la longitud del muelle y el espacio del patio. El tamaño y la escala de los terminales tienden a hacerlos más eficientes, ya que se enfocan en el manejo de contenedores, desplegándolos todos para este propósito. El desempeño de los terminales brasileños, en general, ha estado por debajo del promedio regional y mundial. Sin embargo, Brasil ha atravesado recientemente un período de mejora significativa en las inversiones en infraestructura portuaria de contenedores, lo que ha llevado al país a pasar de la falta de capacidad a un exceso de capacidad relativo actual.

Palabras Clave: Punto de referencia de desempeño portuario; Terminal de contenedores; Desempeño de la línea de muelle; Rendimiento de la línea de grúa navío- tierra; Desempeño del patio.

1 INTRODUCTION

A recurring question posed by container terminal managers and government officials is how Brazilian assets perform when compared to their peers worldwide. This concern justifies especially after the last twenty years when changes in regulatory framework in Brazil paved the way to large developments in this sector, welcoming private investors and improving port labour relationships. Those changes have significantly approached Brazil to the rest of the top trading nations.

Likewise, despite local geography or market conditions, the essential operations of a standard container terminal hold its similarities as its primary function is always the same: the transfer of containers between ship and land or between land and transport modes. Furthermore, those core operations comprise the most important and expensive infrastructure at a terminal, namely: the quay line, the ship-to-shore gantry cranes, and the yard operations. The essence of these common elements makes container terminals comparable with a reasonable degree of confidence.

It is not purpose of this article to name any individual port or terminal, but to present a wider region benchmarking exercise that is genuinely fruitful to find out where eventual inefficiencies may be, raise the possible causes and help to concentrate the pursuit for improvements.

2 METHODOLOGY

2.1 CONCEPTS APPLIED TO CONTAINER TERMINALS KPIS

A variety of Key Performance Indicators (KPIs) are commonly used to measure the performance in a container terminal. First and foremost, it is important to clearly distinguish the concept of capacity and performance. The capacity refers to the maximum volume handled by a terminal, given usual commercial conditions; whereas performance comprises the actual rate at which the terminal produces its outputs within a certain time frame. The relation between these two measures results in the terminal utilisation which is calculated dividing performance by capacity. Capacity, performance, and utilisation can extensively be

used to evaluate any individual equipment or a full process such as berth, gate, or yard operations.

Terminal capacity is an important indicator for terminal operators, as it is used to determine the balance between demand and supply. Performance, in its turn, relates to the level and quality of service the terminal provides to its customers, which is crucial not only for shipping lines, but also other transport operators, as well as cargo shippers.

It is also common the use of the terms design and commercial to qualify capacity or performance rates. Design, associated with capacity, assumes the theoretical performance as if the equipment is utilised at its maximum extent under the technical constraints. Commercial, also called operational, refers to the actual output achieved, reflecting the real-world inherent conditions.

There are two other measurements internationally recognised to evaluate equipment performance under different points of view: net and gross. Gross refers to the total output (measured in moves per hour for containers) between a given start and finish time including all situations included, such as stoppages, breakdowns, delays, idleness. Net is measured during the time where the equipment is effectively operating, deducting any non-operational times.

KPIs applied to container terminals are most frequently seen in moves per hour figures, particularly by crane or berth. However, in order to calculate those indicators, one must need detailed information usually kept confidential by terminal management, such as total time of operation and number of moves for every vessel. The assessment proposed in this article, and also possible to compare different assets under the same conditions, are driven by reliable data available publicly.

2.2 BENCHMARK KPIS

Despite the fact each terminal has its own characteristics, including those not under the management control, the KPIs outlined in this article can be used to benchmark performance throughout the world in real-world figures by using the data sample to be explained afterward.

The first benchmark KPI refers to the quay-line performance. The quay is simply the interface between the ship and shore and the reason of being of any terminal, where its essential output is generated. In order to balance the different terminals regardless of size, this KPI is calculated by dividing the total teu handled in a year by the total quay length. Being a scarce and valuable asset in any port terminal, the quay-line performance provides a measure of intensity with which the quay line is actually used.

$$Quay - line\ Performance = \frac{Total\ year\ thoughput\ (TEU)}{Total\ quay\ length\ (m)}$$

Also related to the core operation in a container terminal, the following KPI is the gantry crane performance and it shows the number of moves by gantry crane in a year. The gantry crane is the primary mechanical resource in a terminal and this KPI provides a measure of actual performance achieved by each equipment, which can be a valuable information to assess crane utilisation, estimate capacity and make decisions on future equipment requirements. This can be calculated by dividing the total year throughput in teu by the number of gantry cranes.

$$Gantry\ Crane\ Performance = \frac{Total\ year\ thoughput\ (TEU)}{Total\ number\ of\ cranes\ (units)}$$

The last benchmark KPI approached refers to the intensity of yard performance, measuring another scarce resource in a container terminal. The yard works as a buffer area where containers are stored before going to the next step of their journey. The calculation takes the total throughput and divides by the terminal area in hectares.

$$Yard\ Performance = \frac{Total\ year\ thoughput\ (TEU)}{Total\ terminal\ area\ (hectares)}$$

2.3 WORLD CONTAINER TERMINALS DATA SAMPLE

Having been established as a leading international provider of research and consultancy to the maritime and shipping industry since the 1970's, UK-headquartered Drewry Shipping Consultants maintains a thorough and robust database of world's container terminals with data publicly available or estimated with a reasonable degree of confidence.

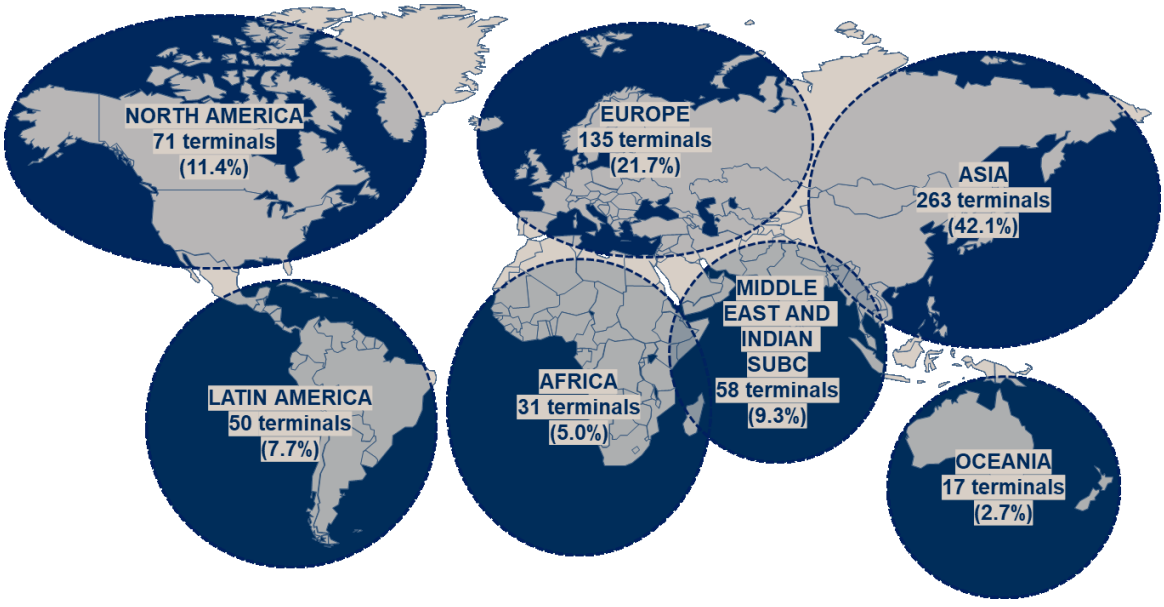
This database is an important source of company's industry analysis and market reports, and it contains relevant up-to-date yearly data ranging from total throughput to infrastructure features and number of main equipment available in every terminal.

For the purpose of this study, a sample has been extracted from the main database. The criteria for inclusion of terminals is the following:

- Year 2019
- Operational terminals
- Predominantly container operations
- Year throughput over 100,000 teu

By applying the abovementioned criteria, the sample resulted in 625 terminals which handled over 700 million teu in 2019. Those terminals are regionally represented as seen on Figure 1. With over 75% of the total, terminals are largely concentrated on the northern hemisphere, just as the major container trade routes.

Figure 1 - Sample of world terminals by region



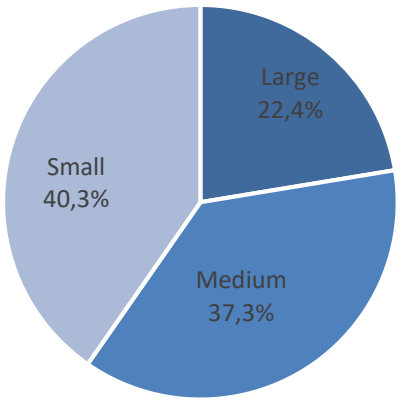
Source: Drewry Shipping Consultants (2019).

Regarding the size, terminals in the sample have been classified into three categories, according to annual throughput.

- Small: up to 500,000 teu

- Medium: between 500,000 and 1.5 million teu
- Large: over 1.5 million teu

Figure 2 - Share of world terminals by size

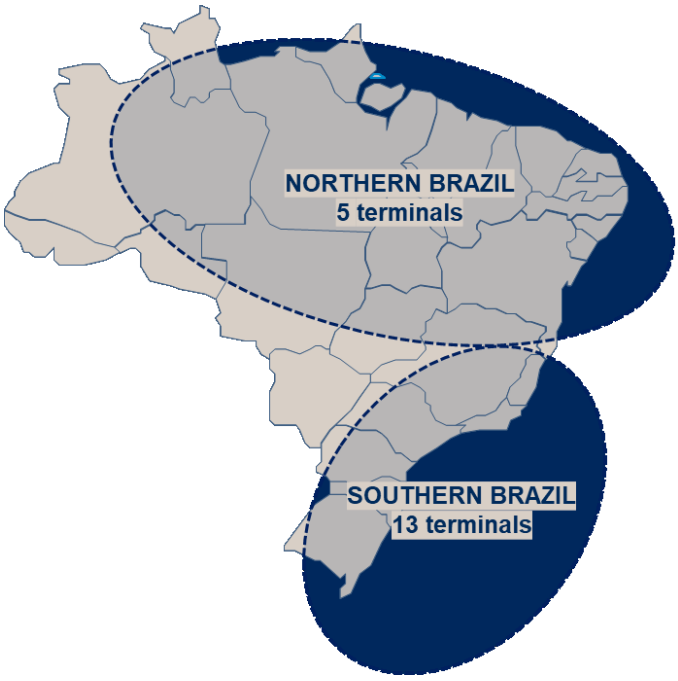


Source: Drewry Shipping Consultants (2019).

Small terminals are the most frequent, representing 40.3% of the sample with 252 terminals. Medium terminals are represented by 233 occurrences, followed by 140 large terminals, with 37.3% and 22.4% respectively.

Being the landmark for this assessment, the data sample covered a total of 18 container terminals in Brazil, following the same criteria applied to the rest of the world. These terminals, all together, handled over 10 million teu in 2019, which represented roughly the total country's container throughput for the year, according to the statistics reported by the Water Transport National Agency (ANTAQ). According to the annual throughput, 10 terminals have been considered small, with the remaining 8 terminals of medium or large size.

Figure 3 – Sample of container terminals in Brazil



Source: Drewry Shipping Consultants (2019).

Most terminals (13 out of 18) are located in the Southern part of the country and so is the largest share of throughput with over 8.5 million teu, naturally related to the concentration of population, industrial activity, and wealth.

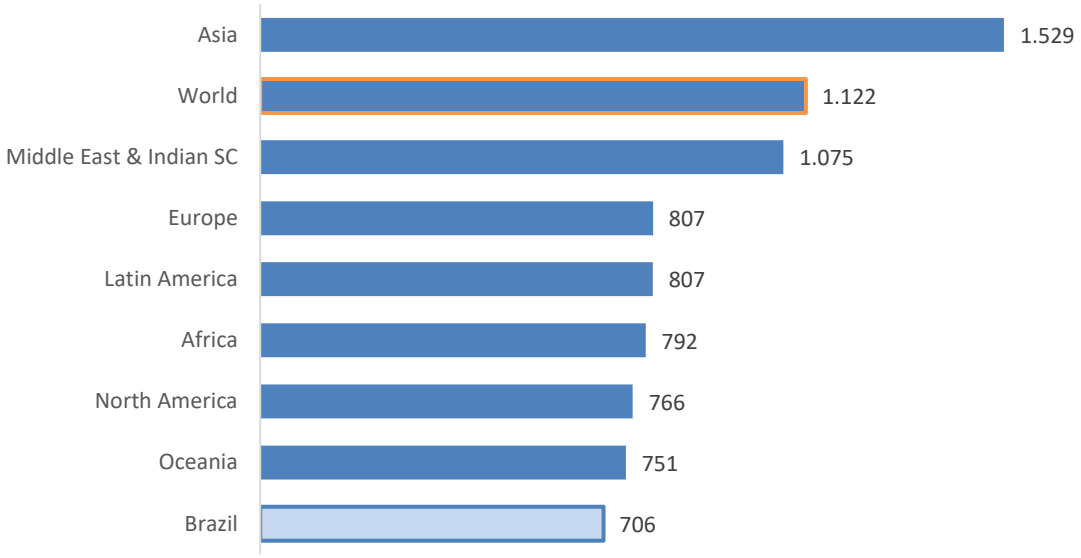
3 PERFORMANCE BENCHMARK OUTPUTS

3.1 QUAY-LINE PERFORMANCE BENCHMARKS

As a starting point for the KPIs used as a base in this article to benchmark port performance, the berth is undoubtedly the major resource for any port terminal. Figure 4 below presents the result of quay-line performance by world region, with the world average reaching 1,122 teu per linear metre of quay in 2019. There are clear regional variations, with Asia being the top performer with 1,529 teu per metre, followed by the Middle East & Indian Subcontinent with 1,075 teu per metre. The lower end of the table shows a group of regions with close average performance ranging from 751 in Oceania to 807 teu per metre of quay in Europe.

Analysed individually, Brazil presents the lowest performance when compared to the world regions with 706 teu per metre of quay. This result lies even below its own Latin America region, which performs 807 teu per metre.

Figure 4 – Quay-line Performance: Teu per linear metre of quay by world region (2019)



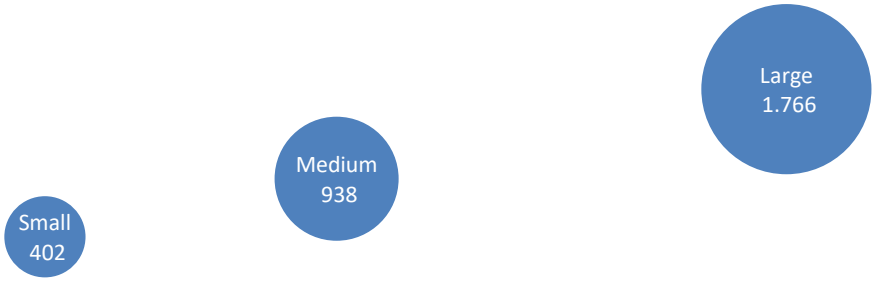
Source: Drewry Shipping Consultants (2019).

A number of factors have strong effect on quay-line performance, starting from the physical conditions of the port and terminal. Clearly, odd-shaped non straight-line quays or with distinct draughts will produce ship restrictions along the quay line, and the operation in such terminals tend to be more challenging, resulting in more queueing time for vessels and lower overall berth utilisation. Awkward quay shapes also cause inefficiencies to internal transport between the container stack and berth. And yet, strong variations on currents and tides reduce windows for vessel berthing and consequently result in lower quay utilisation and additional idle time at the berth.

Evidently, it is hard to evaluate and categorise the physical conditions of each individual terminal in the data sample. Other factors are therefore investigated to raise the hypothesis that can explain the underperformance of Brazil in the quay-line performance benchmark.

One of the major factors correlated with performance is with regards to the terminal size. Figure 5 shows that proportionally larger terminals tend to produce higher quay performance.

Figure 5 - Quay-line Performance: Teu per metre of quay by terminal size (2019)



Source: Drewry Shipping Consultants (2019).

In fact, by looking at the sample of terminals by location on Table 1, the share of large terminals in Asia partly explain why this region outperforms the others. Around 30% of the sampled terminals in Asia has average throughput of 3.7 million teu whilst large terminals in Brazil and Latin America represent only around 10% share and with significantly lower average throughput ranging from 1.6 to 1.9 million teu.

Table 1 - Quay-line performance by terminal size in Asia, Latin America and Brazil (2019)

	ASIA			LATIN AMERICA			BRAZIL		
Terminal Size	**Share of terminals**	**Average t'put (teu)**	**Teu per metre of quay**	**Share of terminals**	**Average t'put (teu)**	**Teu per metre of quay**	**Share of terminals**	**Average t'put (teu)**	**Teu per metre of quay**
Small	31.7%	265,713	489	52.0%	279,234	405	55.6%	275,929	356
Medium	37.8%	867,882	1,095	38.0%	955,450	985	33.3%	715,643	887
Large	30.5%	3,733,171	2,092	10.0%	1,902,784	1,373	11.1%	1,654,874	1,584

Source: Drewry Shipping Consultants (2019).

When specifically looking to Latin America, the region outperforms Brazil in 14%, even though the share of terminals by size is remarkably similar. Despite the large terminals in Brazil present better performance compared to the region, the medium and small terminals represent the large majority with roughly 90% of sample, and those show better average performance in Latin America than in Brazil.

Another marked feature involving terminal size is the fact that small or medium terminals usually tend to work more frequently with non-containerised cargo. Those terminals make use of mobile harbour cranes or even rely on geared vessels, as opposed to large

terminals that usually have specialised modern gantry cranes which perform with much reduced cycles and are therefore largely more productive on container operations.

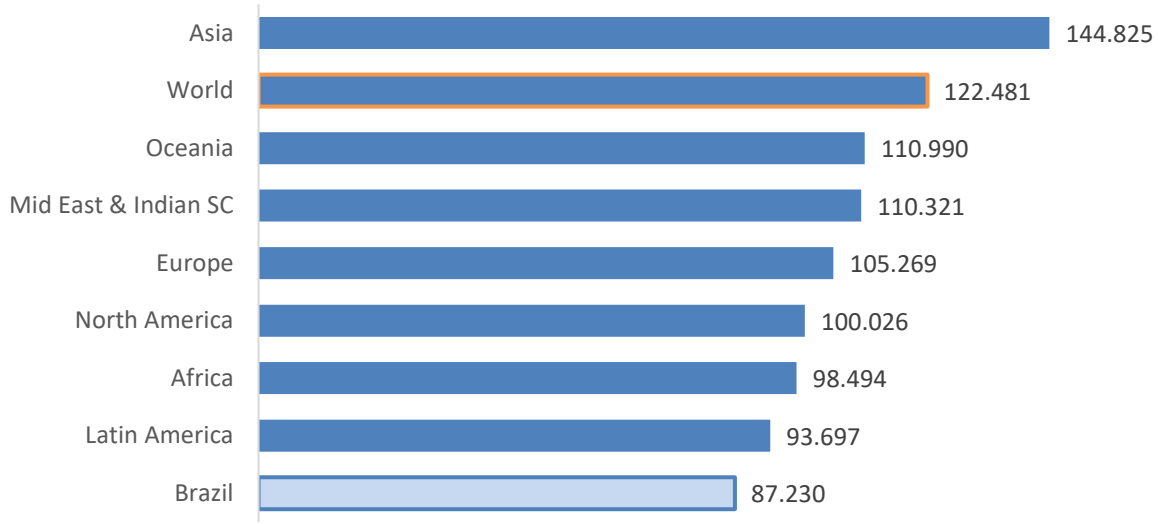
3.2 GANTRY CRANE PERFORMANCE BENCHMARKS

Prior to further exploring other possible reasons to explain the performance gap between Brazil and the rest of the world, a spotlight should be given to the next benchmark KPI, which is the gantry crane performance. This indicator takes into consideration only those terminals reporting operations with proper gantry cranes therefore taking a large extract from the original data sample, reducing the number of terminals from 621 to 563.

The overall effectiveness of a gantry crane is measured by three factors that can affect its performance capacity: (i) availability, refers to the total time which the crane is available to work, deducting maintenance, either preventive or corrective; (ii) utilisation, the time where the crane is actually being utilised, discounted the idle time or time in maintenance; (iii) productivity, which can be understood as the actual number of total cycles in a given period of time, being a cycle the movement of the crane's spreader from quay to vessel and back to the quay.

The gantry crane performance by world region is showed on Figure 6. One more time, Asia stands out as the top performing region handling an average of 144,825 teu per crane, but this time closer to the world average at 15% above, whilst the quay-line performance had been 36% difference above the world average.

Figure 6 - Gantry Crane Performance: Teu per crane by world region (2019)



Source: Drewry Shipping Consultants (2019).

Just below the world average there is Oceania and Middle East & Indian Subcontinent with 110,000 teu per crane, then close followed by Europe, North America, and Africa with mean around 100,000 teu per crane. Brazil and Latin America figure at the bottom end with more than 20% below world average. Following what had been found on quay-line performance, on the gantry crane benchmark Brazil is again positioned below Latin America, but this time with closer figures by just 7% difference against 12% difference on the quay-line performance.

Upon looking quay-line and gantry crane performance, one important aspect involving these two KPIs must be considered which is the density of cranes at the quay. This is important because it is possible that one particular terminal may present a high teu per crane ratio but poor performance per metre of quay given a scarcity of equipment along the quay. The opposite situation is also plausible, with a poor individual crane productivity but with good quay-line performance overall.

Hence, the crane spacing by region has been computed on Table 2 below, which shows the element of equipment concentration along the quay line. The world presents 110.2 metres of space between cranes, an average mostly driven by the high concentration observed in Asia, along with the Middle East & Indian Subcontinent, both regions dotted with busy container transhipment hub ports. These two regions present the largest concentration of

quay equipment on their terminals reporting one crane at every 100 metres, moderately more concentrated than the world average. Africa, Brazil, Europe, and North America hold similar concentration, all showing between 120 and 130 metres of crane spacing.

Table 2 - Crane spacing by world region (2019)

World Region	Crane spacing (m)
Asia	96.5
Middle East & Indian SC	102.6
World	110.2
Latin America	113.9
Brazil	122.6
Africa	122.9
Europe	128.0
North America	129.7
Oceania	140.9

Source: Drewry Shipping Consultants (2019).

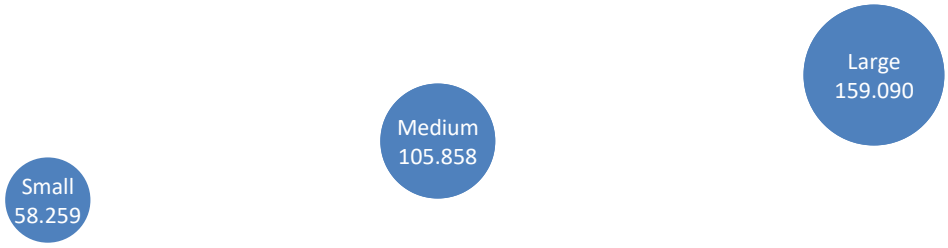
Oceania shows itself as an interesting highlight. The region appeared on the bottom end of the table to quay-line performance and on the hand stands out as the second highest performance region on teu per crane. Crane spacing partly explains such outermost performances. The region presents an average of 140.9 metres between cranes, the lowest density in the world. Even so, the terminals in Oceania manage to maintain high levels of output by quay equipment.

Latin America and Brazil are together positioned at the bottom end of the gantry crane performance with 93,697 teu and 87,230 teu, respectively. A slight outperformance for Latin America. However, it was seen that on quay-line performance, Brazil is exceeded by its region with a considerable difference of 14%, with 807 over 706 teu per metre of quay. The crane spacing data can explain part of this story. With a similar crane performance but more concentration of equipment at the quay, it is indeed expected that Latin America achieves a superior quay-line performance.

Similar to what had been observed at the quay-line performance, larger terminals outperform those that are smaller. Figure 7 shows benchmark of teu per crane proportionally to terminal size, with small terminals handling an average of 58,259 teu per crane, followed

by medium terminals 81% above with 105,858 teu per crane, and finally large terminals presenting average performance of 159,080 teu per crane, with further additional 50% above the medium size terminals.

Figure 7 – Gantry Crane Performance: Teu per crane by terminal size (2019)



Source: Drewry Shipping Consultants (2019).

There are noticeable features that typically distinguish small and large terminals, some of which particularly affect berth performance. One frequent factor is that, although the dataset used in this article has selected terminals with predominant container operations, there are a number of small or medium terminals that commonly have a certain level of general cargo or breakbulk handing, such as project cargo, palletised products, large machinery and some sorts of vehicles. By contrast, larger terminals tend to be container specialised, where time is totally dedicated to the handling of containers and resources can work more efficiently on such operations.

Upon looking only at the data sample of terminals with gantry cranes, it is again unquestionable the fact that larger terminals present better performance at the quay line. Table 3 below shows the density of quay equipment with large terminals counting an average of 20 cranes, far beyond the 8 at medium terminals and 4.8 at the small. Moreover, the large terminals have one gantry crane at every 92.3 metres in average, reasonably more concentrated than medium and small terminals with 115.2 and 147.5 metres, respectively.

Table 3 – Gantry crane features of world terminals by terminal size (2019)

	WORLD	
Terminal Size	**Average number of cranes per terminal**	**Average crane spacing (m)**
Small	4.8	147.5
Medium	8.3	115.2
Large	20.2	92.3

Source: Drewry Shipping Consultants (2019).

Concerning the teu per crane results, due to the fact that the number is shown in teu figure, the mix of 20 feet or 40 feet containers handled at the terminal obviously affect the final result. This happens because those terminals handling more 40-feet boxes (2 teu) take advantage as the crane cycle is similar regardless of container size. In other words, a crane performing 150,000 teu with a same mix of 50,000 boxes of both 20ft and 40ft sizes seems to be 50% more efficient than another crane handling 100,000 teu only with 20ft containers. Nevertheless, the crane efficiency is in fact identical.

There are other factors that may foment an enhanced performance of gantry cranes just as the operator skills level. But in a broader context, this might be more related to operations scale and specialisation of the terminal. Additional aspects will be assessed as the yard performance benchmarks have been explored.

3.3 YARD PERFORMANCE BENCHMARKS

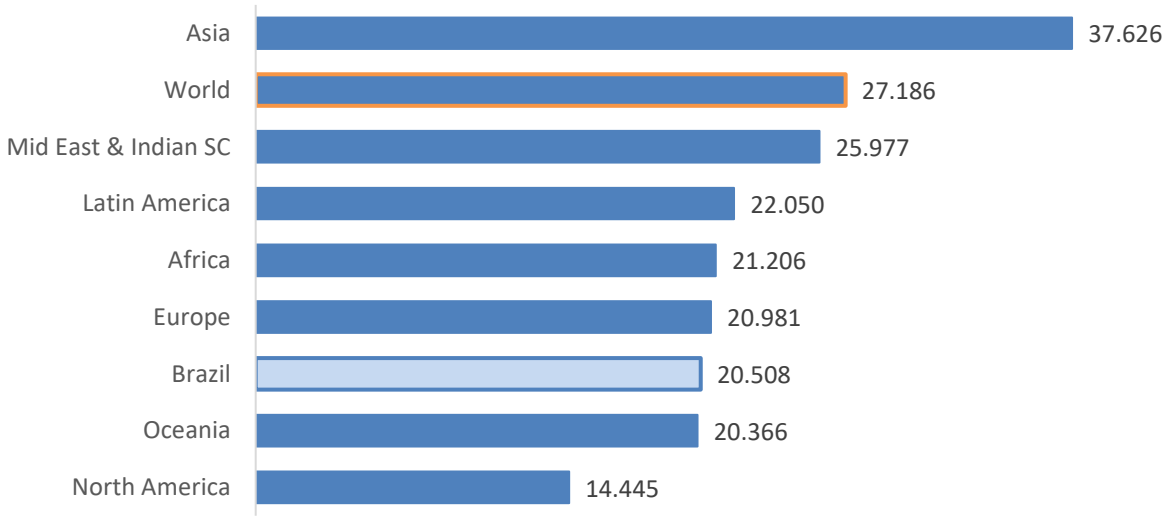
The yard static capacity is measured by the ground space times the stacking height capacity. Evidently the type of yard equipment used at the terminal significantly affect the stacking element. Therefore, it is not difficult to foresee that larger and specialised container terminals disposing of modern RTGs (Rubber-Tired Gantry Cranes) produce much more movements than those small terminals relying in mobile container handler vehicles such as reach stackers or forklifts.

The last KPI outlines how terminals perform related to their total land space, commonly a scarce and expensive asset within the port area. Figure 8 below shows again Asia region leading with the top performance, substantially above the world average by 38%. The world average, certainly driven by the strong performance of Asia, presents 27,186 teu per

hectare, followed by the Middle East & Indian Subcontinent with 25,977. Then within the range of 20,000 and 22,000 teu per hectare there are Latin America, Africa, Europe, Brazil, and Oceania.

North American region stands out with the lowest regional performance with 14,445 teu per hectare, roughly 50% below the world average. When looking closer at the figures, Europe seems to have similar average throughput per terminal with 916,000 teu against 866,000 in North America, a modest 5% difference. Meanwhile, the average yard area in North America is 59.9 hectares, 22% higher than in Europe with 49 hectares and this partly explains the performance difference.

Figure 8 - Yard Performance: Teu per yard hectare by world region (2019)



Source: Drewry Shipping Consultants (2019).

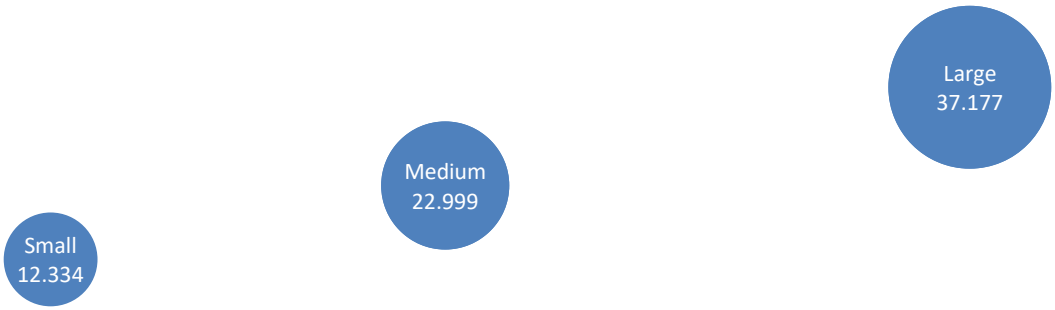
Brazil and Latin America present similar teu per hectare benchmark, with a slight outperformance of Latin America. In fact, average terminal throughput in Brazil is 575,717 teu and 21% higher in Latin America with 698,551 teu. With regards to average terminal space, the difference is at 15% more to Latin America, with 32 hectares whereas in Brazil the average yard size is 28 hectares.

Apart from the storage and container-handling capacities, dwell time is the main factor impacting yard performance. There are a number of reasons for a container to remain on the terminal and the dwell time represents the actual turnover of boxes in the yard. Not only each

trader's individual decision determines the dwell time, but other factors such as customs clearance process and storage tariff levels.

Yard performance KPI confirms again that larger terminals outperform those smaller. Figure 9 shows the benchmark where large terminals handle 37,177 teu per hectare, three times more than a small terminal which shows 12,334 teu per hectare. The pattern of large terminals presenting the top performance for every KPI is not by chance. As previously outlined, there are clear factors that induce resources to work more efficiently and the most important the fact that the terminal is container specialised.

Figure 9 - Yard Performance: Teu per hectare by terminal size (2019)



Source: Drewry Shipping Consultants (2019).

As previously stated, average yard space in Brazil is 28 hectares, similar to the average of world small terminals, as seen below on Table 4. Therefore, by performing 20,508 teu per hectare, the country is in line with the performance of medium-sized terminals, which denotes a high utilisation of terminals' yards in the country.

Table 4 - Average yard space and yard benchmark by terminal size (2019)

	WORLD	
Terminal Size	**Average yard space (ha)**	**Teu per hectare**
Small	25.1	12,334
Medium	41.7	22,999
Large	95.2	37,177

Source: Drewry Shipping Consultants (2019).

Largeness and scale are also attributes of terminals where big ships call at. Bigger ships allow large volumes being handled at regular window schedules rather than small vessels with

limited moves at random arrivals. Berthing or unberthing time is nearly similar regardless the size of container vessels. Therefore, the total time frame of moving few thousands of boxes in a single vessel is certainly less than if handling in three different vessel calls, keeping crane productivity constant.

Among other factors impacting yard performance is the presence of off-dock storage area, adjacent areas that some terminals use to handle a subgroup of containers, especially those not subject to customs inspection such as empties. The off-dock area can be also used as a preservice buffer for exporting containers before entering the primary terminal area.

Terminals with high transhipment incidence have operations almost fully dedicated to the berth. These terminals benefit from their geographical location and work as an interchange point to establish a network connecting different service loops. There are notable examples located in the Caribbean, Mediterranean and South East Asia. Such terminals take advantage by assigning resources to berth operations, where quay and yard are likely to be more productive than terminals handling a diversity of inland modes of transport with different batch of movements through random arrivals.

Other factor directly influencing yard performance is the density of stacking system, where those terminals with higher stacking capacity are able to handle more containers within a same flat space area. This is related to the type of equipment deployed at the terminal. RTGs or RMGs are the most common specialised machines usually coping a reach span up to seven lanes plus five-high container stack.

One influencing factor that can affect not only yard but any other performance KPI is the terminal's utilisation levels. New terminals still ramping up or those under-utilised where volumes have not yet materialised certainly have available infrastructure superior to cope with the actual handling figures. Instead, highly utilised or congested terminals will have higher performance throughput.

4 BRAZIL TERMINALS PROFILE DEVELOPMENTS OVER A DECADE

4.1 TERMINALS PROFILE 2010-2019

The regulatory change that happened in 1993 with the so-called "Law of ports modernisation" has dramatically changed the port sector in Brazil by allowing private investments through long term concessions and, later on, with fully privatised models from 2013 with the "Ports Law". The development container ports is possibly the most notable evidence of this change.

In 2010, the world was witnessing a rebound of the global trade after the subprime crisis. Brazil's GDP was peaking up to the highest in history whilst container ports were crossing a period of under capacity and congestion, situation found especially at the country's busiest port Santos. Over the following years, private investors and global operators aimed their resources to expand or build new facilities. Meanwhile, some terminals even exited the market.

Table 5 – Essentials of container terminals in Brazil (2010 and 2019)

	2010	2019	% change
Number of terminals (#)	16	18	+12.5%
Total quay line (m)	9,008	14,682	+63.0%
Total quay gantry cranes (#)	59	111	+88.1%
Total yard area (ha)	281	530	+88.7%

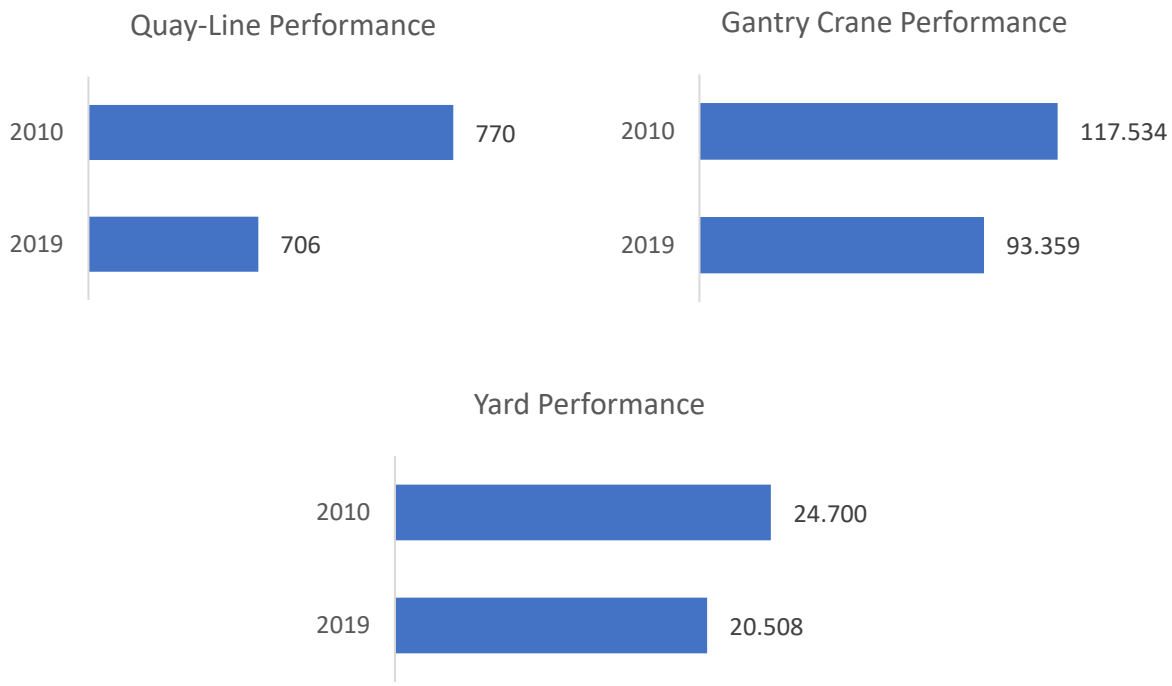
Source: Drewry Shipping Consultants (2019).

Table 5 shows the essentials of container terminals in Brazil over the last decade, highlighting the totals of major resources. Having considered only those assets with predominant container operations, the number of terminals were 16 in 2010 and increased to 18 in 2019. Despite the similar numbers, the picture is not identical whatsoever. Since 2010, two terminals have become obsolete and left the container market, three new have entered and many of them have been through considerable expansions.

4.2 EVOLVEMENT OF BENCHMARK KPIS IN BRAZIL

When it comes to the benchmarks, it is noticeable that Brazil terminals presented a decline on all KPIs from 2010 to 2019 as seen on Figure 10. The quay-line performance has been steady, with a modest decline of -8%. Gantry crane and yard performance, instead, dropped by -21% and -17%, respectively.

Figure 10 - Evolvement of benchmark KPIs in Brazil (2010 and 2019)

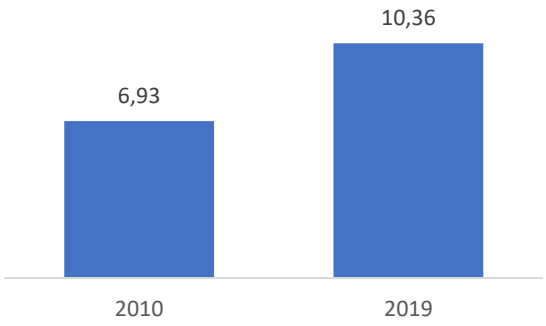


Source: Drewry Shipping Consultants (2019).

The first question that comes to mind is whether the performance has eroded in Brazil during this 9-year period. To address this hypothesis a closer look must be taken to see how the terminal related infrastructure has developed during those years and the fact is that such development has been significant.

Data presented on Table 5 above demonstrates that current total available quay line at the specialised container terminals totals 14,682 metres, a 63% growth compared to 2010. Whereas total number of gantry cranes and total yard area have improved even faster, both coincidentally showing a growth of 88%. This represented a meaningful compound annual growth rate (CAGR) at 7% since 2010. On the other hand, although noteworthy, throughput increased 49% along those nine years, from 6.9 to 10.3 million teu as seen on Figure 11, a CAGR at 4.6%.

Figure 11 - Total container throughput in Brazil (2010 and 2019)



Source: Drewry Shipping Consultants (2019).

The recent development in the sector, which included the entering of relevant new players and exiting of obsolete terminals, has entailed the country's container market a frank expansion on the terminal infrastructure whereas the throughput has grown at a slower pace.

One evidence of this progress is to look at the throughput related to the total available capacity, which results in the utilisation level. In 2019, terminals reported a combined capacity of 19 million teu. Therefore, overall utilisation level of container port assets in Brazil is 54%, even though there are specific imbalances in particular regions or ports. This demonstrates that investors and operators did their job on upgrading the facilities to the need for more capacity. Anyone familiar with the industry in Brazil is aware that the country has moved from a situation of under-capacity to a current relative overcapacity. Regarding to the benchmarks, as previously seen, the pace of quay line growth was not strong as the others, and this partly explains why the quay-line performance KPI was more stable.

5 CONCLUSIONS

The numbers presented in this article do not necessarily mean that a terminal or country has good or poor performance. Many factors influence port performance in many ways, many of those factors are not under the terminals' management control. Physical characteristics, local conditions of the sea, authorities' level of service are among the factors that are beyond any terminals' managers hands. Moreover, it has been abundantly proved that the size and scale of terminals tend to make them more efficient as they focus on container handling and deploy resources to this reason being.

All KPIs are averages that serve as a reference in the region. Being straightforward calculations, operators are encouraged to look at each individual performance and level itself to determine how it is positioned within the regional and world peers, as well as to further assess the particular reasons of differences and reflect on how to overcome those. There may be physical constraints, but also country level factors involving local authorities and governments procedures that certainly present as an opportunity for improvement.

It has also seen that container specialised terminals have the operations scale to outperform those that reserve some capacity to handle other cargoes. This has nothing necessarily to do with revenue or profitability. Depending on the port infrastructure available in the region, it may prove worthwhile for terminals to handle different types of cargo and get properly paid for such specific operation.

With regards to Brazil, performance has proved itself usually below regional and world average. However, the country has recently been through a period of significant investment improvement in the container port infrastructure. This led the country to leave from a situation of under capacity to a current relative overcapacity.

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