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JOC GROUP | PORT PRODUCTIVITY

Key Findings On Terminal Productivity Performance Across Ports, Countries And Regions

JOC Port Productivity

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The JOC Group Inc.

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INTRODUCTION

By Peter Tirschwell
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The JOC today formally introduces the Port Productivity project, the result of a five-year effort to translate casual industry understanding into cold, hard numbers.

The specific focus is berth productivity achieved at ports and terminals worldwide — a measurement of the speed at which container ships are unloaded, loaded and sent back to sea. It's one of many measurements of ports' effectiveness in moving containers — truck wait times being another — but it's the only one, thanks to carriers' willingness to share their data, that can now be measured globally based on the same criteria irrespective of where the port is located.

That makes this data new, and we think it's a breakthrough, considering there has never been the ability to compare ports and terminals globally on any measurement other than known factors such as volumes.

The release of this data, however, also makes a larger point: Marine terminal productivity in individual scenarios isn't an unalterable reality based on local circumstances of labor, capital, management, infrastructure and politics. Rather, productivity is elevated to a larger imperative, as ports themselves factor into trade facilitation — where effectiveness in productivity translates into spinoff benefits or bottlenecks in supply chains, availability of goods on store shelves, employment.

The data we introduce today points to the broader opportunity higher productivity can yield, whether it be carriers slow-steaming their vessels and cutting fuel costs and emissions as a result, terminals achieving greater utilization at their facilities, or cargo interests seeing faster movement of their products to destination.

All that said, however, the data isn't perfect or complete. The majority of the largest carriers are participating, but not all are represented. Although we will introduce additional data elements later, the measurement we're starting with — gross berth productivity between a ship's arrival and departure from berth, with no adjustments for labor or equipment down time regardless of the reason — is among the broadest definitions of productivity.

No doubt, it's a harsh number that offers no consideration to legitimate local realities that have a huge bearing on productivity. In ports such as those in the U.S., where high labor costs mean ships don't get worked at night, the numbers presented in the rankings in this whitepaper reflect a reality that won't change any time soon. Berth productivity favors terminals with large volumes that can put multiple cranes to work on large ships.

As Mark Sisson, senior port planner at AECOM told JOC, "Ports like Hong Kong and Dubai work as close to 24 hours a day as possible."

In other words, although we're starting with a broad, albeit imperfect measurement, a report like this needed to start somewhere. Only by doing so could it gain the traction needed to expand into other, more detailed measurements of productivity.

We have made progress, for example, in measurements of operating time — that is, productivity achieved between first lift and last lift, which, among other things, exposes

effectiveness in the period between arrival and the start of operations that involves customs and immigration procedures.

We're also making headway in crane density, a measurement of how well stowage planners who work with the terminal can keep all cranes in operation and thereby raise overall berth productivity levels. Other measurements could look at total port stay time, the time between when the pilot boards on the inbound leg, and when the pilot disembarks as the ship leaves port.

But the goal, regardless of measurement, is the same: to create through data, the benchmarks that carriers, terminals and ports can measure themselves against to assess where they stand and whether there may be opportunities for improvement.

And it's improvement we're after, less so in specific situations but in the aggregate. The reason? Because according to many carriers and terminals, productivity stagnated years ago and hasn't improved despite the presence of larger ships and higher volumes that demand progress just to keep up.

The losers aren't just the carriers that must wait for their ships to get turned and their customers who must wait for their cargo. It's the international trade system that, in a technical, in-the-trenches way, isn't keeping up with the growth of trade. The resulting bottlenecks create friction between ports and their local communities, which can further set back ports' effectiveness if onerous regulations are imposed.

Improving productivity at the berth is just one way of addressing this challenge, but as far as data goes, it's as good a place to start as any.

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BIGGER SHIPS AND TIGHTER SUPPLY CHAINS SHINE A NEW LIGHT ON PORT PRODUCTIVITY AND ITS IMPORTANCE TO SHIPPERS

By Bill Mongelluzzo
Senior Editor
The Journal of Commerce

This JOC Port Productivity whitepaper comes with a message that rings loud and clear: Marine terminal operators must do a better job of delivering the vessel productivity required by ocean carriers and those whose cargo is aboard their ships.

After a five-year effort, the JOC has achieved the support of 17 ocean carriers, representing more than 70 percent of the global container capacity as defined by Alphaliner, in building a database that directly compares terminal productivity performance across ports, countries and regions based on the standard measurement of gross moves per hour.

For this whitepaper, the JOC has used confidential data from more than 100,000 port calls at 600 marine terminals and 400 global ports during 2012 to rank the top 20 ports and individual terminals in three regions of the world: the Americas, Asia and Europe-Middle East Africa.

This exercise, which will continue on an ongoing basis, is intended to provide more visibility to ports, carriers and cargo interests into productivity at one of the global supply chain's most important service sectors: the marine terminal. It ultimately aims to help get ships in and out of port faster, cutting costs for carriers, freeing up terminal capacity, and supporting the fluid movement of containerized cargo.

Given the wide variation in numbers among just the top 20 ports and marine terminals "there is no doubt that there are opportunities to improve productivity," said Dennis Olesen, head of global operations at APM Terminals.

The formula for improving productivity is fairly straightforward. The marine terminal needs timely and accurate information from the carrier about the container stowage on its vessel at least 24 hours before the arrival of the vessel, and it needs the ship to show up on time. The shipping line, which has built its schedule around the terminal's promised productivity, needs its vessels to be turned as quickly as possible to maintain its schedules, to maximize slow-steaming and to have its vessel assets deployed most efficiently. "It's a shared challenge," Olesen said.

Although the formula is simple, putting the pieces together to produce superior productivity is a complex process involving a litany of factors: vessel stowage, vessel size, the volume loaded and discharged, the skills of the crane operators and other dockworkers, the cranes and other assets deployed in working the vessel, and the contractual price the carrier agrees to pay the terminal operator.

Improving terminal productivity is becoming more urgent, in large part because vessels are getting ever larger. The largest vessel afloat in 1990 could carry 4,800 20-foot-equivalent container units. Today, vessels in the major trade lanes typically carry 8,000 to 13,000 TEUs, and Maersk Line is phasing into service the world's largest container vessels, each with a capacity of 18,000 TEUs. Several carriers told the JOC that terminal productivity in the aggregate has seen little to no improvement over several years.

The rapidly increasing size of mega-ships places tremendous strain on all faces of the marine terminal, making productivity — and the industry's focus on it — all the more important.

Vessel productivity is on the radar screen of shippers for whom terminals can be a major supply chain bottleneck. "This information is extremely valuable," said Jonathan Gold, vice president of supply chain and customs policy at the National Retail Federation. "It is the key factor in getting cargo delivered on time." The JOC Port Productivity data also may be controversial, especially among U.S. port and terminal interests, because it is based on gross container moves per hour with the clock ticking during the entire time the vessel is in port. A terminal's productivity, then, is lower if it doesn't work nights. Berth productivity is a more common measurement in Europe and Asia, where terminals operate round-the-clock with little down time.

"Ports like Hong Kong and Dubai work as close to 24 hours a day as possible," said Mark Sisson, senior port planner at AECOM, a marine engineering firm that designs terminals worldwide. The closer a port comes to 24/7 operations, the higher its berth productivity numbers become given that it handles large container volumes with little down time for its operations.

Contrast an Asian port — the Far East, especially China, dominates the Port Productivity rankings — with a U.S. port such as Oakland where cargo volumes are much lower. The normal work shift at Oakland is eight hours, and berth activity ceases for the remaining 16 hours in the day, Sisson said. That down time gets reflected in Oakland's numbers.

Los Angeles and Long Beach, the two busiest U.S. ports, are ranked highly in berth productivity, as well they should be, because terminals there work two full shifts a day. When necessary, they add a costly, five-hour third shift, with longshoremen being paid for eight hours at a premium overtime rate. Long Beach (along with Elizabeth, N.J.) is the top-ranked U.S. port and 13th globally, moving an average of 74 containers per hour while a ship is at berth.

Large amounts of down time is why the focus for U.S. ports tends to be on productivity during actual operations. Ports in the South Atlantic, for example, prefer to use moves per hour achieved by individual containers versus productivity measured across the full vessel. Charleston and Savannah regularly post crane productivity of 35 to more than 40 moves per crane per hour when the cranes are working, productivity considered at the top of the range within the U.S.

Vessels calling at East Coast ports, however, typically generate fewer total container moves than those calling Southern California. In Charleston or Savannah, for example, an Asian service may generate 500 to 1,000 container moves and can be worked in one or two shifts.

(continued on page 9)

TABLE 1: TOP TRANSSHIPMENT PORTS GLOBALLY

Top 10 transshipment ports based on average 2012 container moves. Rankings based on average moves per hour while ship is in port.

PORT	COUNTRY	BERTH PRODUCTIVITY*
Qingdao	China	96
Shanghai	China	86
Jebel Ali	United Arab Emirates	81
Busan	South Korea	80
Khor al Fakkan	United Arab Emirates	74
Salalah	Oman	72
Hong Kong	China	68
Westport/Port Klang	Malaysia	66
Tanjung Pelepas	Malaysia	63
Rotterdam	Netherlands	63

Source: JOC Port Productivity Research

TABLE 2: PORT PRODUCTIVITY BY SHIP SIZE

Top global ports and terminals, based on average 2012 container moves on ships less than and greater than 8,000 TEUs. Data is based on crane moves per hour while ship is in port.

A. GLOBAL PORTS, VESSELS LESS THAN 8,000 TEUS

PORT	COUNTRY	BERTH PRODUCTIVITY*
Qingdao	China	80
Shanghai	China	79
Nhava Sheva (Jawaharlal Nehru)	India	79
Ningbo	China	77
Busan	South Korea	77
Jebel Ali	United Arab Emirates	77
Taipei	Taiwan	73
Tianjin	China	70
Salalah	Oman	70
Elizabeth	U.S.	69

Source: JOC Port Productivity Research

* Berth Productivity is defined as the number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth (time between berth arrival, or "lines down" and berth departure, or "lines up"), without adjustments for equipment and labor down time. The productivity metrics contained in these rankings are the average berth productivity for all validated and standardized vessel calls in the database for each port or terminal during calendar year 2012. For more information please see P. 15.

B. TOP TERMINALS GLOBALLY, 8,000-TEU VESSELS AND LARGER

TERMINAL	COUNTRY	BERTH PRODUCTIVITY*
Qingdao Qianwan Container Terminal	China	136
DP World-Jebel Ali Terminal	United Arab Emirates	125
Ningbo Yuandong Terminal	China	120
Ningbo Gangji (Yining) Terminal	China	119
Dalian Port Container Terminal	China	112
APM Terminals Rotterdam	Netherlands	112
Pusan Newport	South Korea	109
NTB North Sea Terminal Bremerhaven	Germany	108
OOCL Kaohsiung Container Terminal	Taiwan	108
Yangshan Deepwater Port Phases 3/4	China	107

Source: JOC Port Productivity Research

C. TOP TERMINALS GLOBALLY, VESSELS LESS THAN 8,000 TEUS

TERMINAL	COUNTRY	BERTH PRODUCTIVITY*
APM Terminals Mumbai	India	101
Qingdao Qianwan Container Terminal	China	90
Tatsumi Shokai Nanko Container Terminal	Japan	87
Kobe International Container Terminal	Japan	87
Yangshan Deepwater Port Phases 1/2	China	86
Yangshan Deepwater Port Phases 3/4	China	86
SIPG Zhendong Container Terminal	China	86
Pusan Newport	South Korea	85
Ningbo Gangji (Yining) Terminal	China	84
Ningbo Yuandong Terminal	China	78

Source: JOC Port Productivity Research

D. 2012 TOP PORTS GLOBALLY, VESSELS 8,000+ TEUS

TERMINAL	COUNTRY	BERTH PRODUCTIVITY*
1. Qingdao	China	136
2 Jebel Ali	United Arab Emirates	125
3. Tianjin	China	124
4 . Ningbo	China	117
5. Dalian	China	112
6. Kaohsiung	Taiwan, Province of China	107
7. Bremerhaven	Germany	106
8. Busan	Republic of Korea	105
9. Shanghai	China	104
10. Tanjung Pelepas	Malaysia	104

Source: JOC Port Productivity Research

* Berth Productivity is defined as the number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth (time between berth arrival, or "lines down" and berth departure, or "lines up"), without adjustments for equipment and labor down time. The productivity metrics contained in these rankings are the average berth productivity for all validated and standardized vessel calls in the database for each port or terminal during calendar year 2012. For more information please see P. 15.

In Southern California, the larger vessels generate 3,000 to 5,000 moves and are worked in five or six shifts over as many as three days. That results in fewer hours of berth down time and higher gross berth productivity, according to the JOC's definition.

Jim Newsome, president and CEO of the South Carolina Ports Authority, said the shipping lines that call at Charleston want their vessels turned in the window promised to them, at a competitive cost attained by working two cranes per vessel, each consistently producing about 40 container moves an hour. "That's what they are paying us for," Newsome said.

Likewise, Curtis Foltz, executive director of the Georgia Ports Authority, said that in measuring productivity in the South Atlantic, operating two or three cranes at 35 moves per berth hour is preferable to operating five or six cranes at 25 moves per berth hour. "It comes down to crane productivity and crane density," he said.

In their discussions with shipping executives, Newsome and Foltz said they're told their ports are the only ones in the U.S. that consistently achieve crane productivity rates that compare with those in Europe.

Nor is it wise, from a U.S. terminal operator's perspective, to add cranes in order to turn a vessel faster unless a carrier pays for the added service. Each crane requires a group, or "gang" of dockworkers, and labor costs at U.S. ports are "the highest in the world by a considerable margin," Sisson said.

Gang sizes differ on the East and Gulf coasts, where the International Longshoremen's Association contract has fixed sizes, from those on the West Coast, where the International Longshore and Warehouse Association contract requires the use of two crane drivers but states that other positions are manned as needed.

Gang sizes on the East Coast also can vary depending upon requirements for lashers and clerks, but the gangs generally range from 15 to about 20 dockworkers per crane. The total lift cost per container ranges from $250 for the most efficient ports to $450 for the most expensive. If a carrier is paying a terminal to turn the vessel in one eight-hour shift, it doesn't make sense to work more cranes than necessary to complete the work in five hours given the high costs involved.

In Southern California, however, working large vessels with six cranes in order to finish a vessel in five shifts rather than six makes sense, said Ed DeNike, chief operating officer at Seattle-based terminal operating company SSA Marine. Gangs comprise about 20 to 26 dockworkers, and the total cost of a shift is about $22,000, DeNike said.

Sometimes a crush of cargo demands that a terminal deploy more assets. Frank Capo, senior vice president and chief commercial officer at Total Terminals Inc. in Long Beach, which handles the largest vessels calling in the U.S., said TTI recorded 45,000 lifts in one busy mid-June week, compared to 25,000 in a normal week. These high volumes require the use of taller cranes, optical character readers and global positioning tracking and a computerized terminal operating system, Capo said.

Ports and terminals worldwide are investing heavily in such technology for two reasons, said Dean Davison, senior consultant at Ocean Shipping Consultants. Terminals can't meet carrier needs for productivity without technology, and they can't achieve the financial results their own companies require without improving efficiency, he said.

Carrier executives agree. Francois Peigne, head of ports and terminal operations at CMA CGM, a supporter of the JOC data, said most ports that have the water depth to accommodate mega-ships are investing in large quay cranes and more efficient yard equipment, expanded container storage areas, more truck gates and computerized terminal operating systems, and the terminals cooperate closely with the operating departments of the shipping lines.

Peigne said the market dictates which ports a carrier will call, but if berth productivity statistics indicate CMA CGM vessels are receiving service that is less than what other carriers receive, "we shall take operational decisions to improve it."

Given carriers' need to slow-steam their vessels to reduce fuel costs, terminals must improve productivity continually, said Gene Seroka, president of the Americas at APL, another supporter of the database. That's why carriers welcome this first step to publish data on vessel berth productivity, he said. Carriers also would like to see the data expanded to include other meaningful measurements such as crane productivity, he added.

Still, when carriers and especially cargo interests look at what the berth productivity numbers mean and how they were derived, they have a good indication of the importance a terminal operator places on serving its customers, APM Terminals' Olesen said, adding "We are there for the customer."

TABLE 3: TOP PORTS: GLOBALLY

PORT	COUNTRY	BERTH PRODUCTIVITY*
Qingdao	China	96
Ningbo	China	88
Dalian	China	86
Shanghai	China	86
Tianjin	China	86
Yokohama	Japan	85
Jebel Ali	United Arab Emirates	81
Busan	South Korea	80
Nhava Sheva (Jawaharlal Nehru)	India	79
Yantian	China	78
Taipei	Taiwan	77
Xiamen	China	76
Long Beach	U.S.	74
Khor al Fakkan	United Arab Emirates	74
Elizabeth	U.S.	74
Nansha	China	73
Kaohsiung	Taiwan	72
Salalah	Oman	72
Mawan	China	71
Southampton	U.K.	71

Source: JOC Port Productivity Research

TABLE 4: TOP PORTS: AMERICAS

PORT	COUNTRY	BERTH PRODUCTIVITY*
Long Beach	U.S.	74
Elizabeth	U.S.	74
Prince Rupert	Canada	68
Lázaro Cárdenas	Mexico	65
Vancouver	Canada	63
Savannah	U.S.	60
Tacoma	U.S.	58
Bayonne	U.S.	58
Charleston	U.S.	56
Norfolk	U.S.	54
New York	U.S.	52
Los Angeles	U.S.	52
Balboa	Panama	51
Houston	U.S.	50
Halifax	Canada	50
Seattle	U.S.	48
Veracruz	Mexico	48
Caucedo	Dominican Republic	43
San Antonio	Chile	43
Manzanillo	Mexico	42

Source: JOC Port Productivity Research

* Berth Productivity is defined as the number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth (time between berth arrival, or "lines down" and berth departure, or "lines up"), without adjustments for equipment and labor down time. The productivity metrics contained in these rankings are the average berth productivity for all validated and standardized vessel calls in the database for each port or terminal during calendar year 2012. For more information please see P. 15.

JOC GROUP PORT PRODUCTIVITY

TABLE 5: TOP PORTS: ASIA

PORT	COUNTRY	BERTH PRODUCTIVITY*
Qingdao	China	96
Ningbo	China	88
Dalian	China	86
Shanghai	China	86
Tianjin	China	86
Yokohama	Japan	85
Busan	South Korea	80
Nhava Sheva (Jawaharlal Nehru)	India	79
Yantian	China	78
Taipei	Taiwan	77
Xiamen	China	76
Nansha	China	73
Kaohsiung	Taiwan	72
Mawan	China	71
Fuzhou	China	68
Chiwan	China	68
Hong Kong	China	68
Westport/Port Klang	Malaysia	66
Osaka	Japan	64
Tanjung Pelepas	Malaysia	63

Source: JOC Port Productivity Research

TABLE 6: TOP PORTS: EUROPE, MIDDLE EAST, AFRICA

PORT	COUNTRY	BERTH PRODUCTIVITY*
Jebel Ali	United Arab Emirates	81
Khor al Fakkan	United Arab Emirates	74
Salalah	Oman	72
Southampton	U.K.	71
Zeebrugge	Belgium	65
Rotterdam	Netherlands	63
Bremerhaven	Germany	62
Hamburg	Germany	62
Algeciras	Spain	53
Port Said	Egypt	52
Diliskelesi	Turkey	52
Beirut	Lebanon	52
Jeddah	Saudi Arabia	51
Antwerpen	Belgium	50
Felixstowe	U.K.	49
Tanger Med	Morocco	46
Piraeus	Greece	43
Karachi/Port Qasim	Pakistan	42
Le Havre	France	41
Barcelona	Spain	41

Source: JOC Port Productivity Research

* Berth Productivity is defined as the number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth (time between berth arrival, or "lines down" and berth departure, or "lines up"), without adjustments for equipment and labor down time. The productivity metrics contained in these rankings are the average berth productivity for all validated and standardized vessel calls in the database for each port or terminal during calendar year 2012. For more information please see P. 15.

TABLE 7: TOP TERMINALS: GLOBALLY

TERMINAL	PORT	COUNTRY	BERTH PRODUCTIVITY*
APM Terminals Yokohama	Yokohama	Japan	150
Tianjin Five Continents International Container Terminal	Tianjin	China	119
Qingdao Qianwan Container Terminal	Qingdao	China	107
Xiamen Songyu Container Terminal	Xiamen	China	106
OOCL Kaohsiung Container Terminal	Kaohsiung	Taiwan	105
APM Terminals Mumbai	Nhava Sheva (Jawaharlal Nehru)	India	101
Korea Express Kwangyang Container Terminal	Gwangyang	South Korea	101
Xiamen Hairun Container Terminal	Xiamen	China	100
Tianjin Port Container Terminal	Tianjin	China	99
Ningbo Gangji (Yining) Terminal	Ningbo	China	97
Dalian Port Container Terminal	Dalian	China	94
Yangshan Deepwater Port Phases 1/2	Shanghai	China	94
Yangshan Deepwater Port Phases 3/4	Shanghai	China	92
APM Terminals Rotterdam	Rotterdam	Netherlands	92
Pacific Container Terminal - Pier J	Long Beach	U.S.	91
Ningbo Yuandong Terminal	Ningbo	China	90
Pusan Newport	Busan	South Korea	89
Tatsumi Shokai Nanko Container Terminal	Osaka	Japan	87
Kobe International Container Terminal	Kobe	Japan	87
Ningbo Beilun Second Container Terminal	Ningbo	China	87

Source: JOC Port Productivity Research

TABLE 8: TOP TERMINALS: AMERICAS

TERMINAL	PORT	COUNTRY	BERTH PRODUCTIVITY*
Pacific Container Terminal - Pier J	Long Beach	U.S.	91
APM Terminals Elizabeth	Elizabeth	U.S.	82
Total Terminals International - Pier T	Long Beach	U.S.	79
Evergreen Container Terminal-Los Angeles	Los Angeles	U.S.	75
Prince Rupert Fairview Container Terminal	Prince Rupert	Canada	68
Maher Terminals Elizabeth	Elizabeth	U.S.	68
Lázaro Cárdenas Terminal Portuaria de Contenedores	Lázaro Cárdenas	Mexico	65
Bayport Container Terminal	Houston	U.S.	63
Wando Welch Terminal	Charleston	U.S.	63
Deltaport	Vancouver	Canada	63
New York Container Terminal	New York	U.S.	62
Garden City Terminal	Savannah	U.S.	60
Global Marine Terminal	Bayonne	U.S.	58
Internacional de Contenedores Asociados de Veracruz	Veracruz	Mexico	56
DP World Callao	Caucedo	Dom. Republic	55
Norfolk International Terminal	Norfolk	U.S.	54
Colon Container Terminal	Colon	Panama	54
Terminal 18 (Seattle international Terminal)	Seattle	U.S.	53
Panama Ports Balboa	Balboa	Panama	51
North Charleston Terminal	Charleston	U.S.	51

Source: JOC Port Productivity Research

* Berth Productivity is defined as the number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth (time between berth arrival, or "lines down" and berth departure, or "lines up"), without adjustments for equipment and labor down time. The productivity metrics contained in these rankings are the average berth productivity for all validated and standardized vessel calls in the database for each port or terminal during calendar year 2012. For more information please see P. 15.

TABLE 9: TOP TERMINALS: ASIA

TERMINAL	PORT	COUNTRY	BERTH PRODUCTIVITY*
APM Terminals Yokohama	Yokohama	Japan	150
Tianjin Five Continents International Container Terminal	Tianjin	China	119
Qingdao Qianwan Container Terminal	Qingdao	China	107
Xiamen Songyu Container Terminal	Xiamen	China	106
OOCL Kaohsiung Container Terminal	Kaohsiung	Taiwan	105
APM Terminals Mumbai	Nhava Sheva (Jawaharlal Nehru)	India	101
Korea Express Kwangyang Container Terminal	Gwangyang	South Korea	101
Xiamen Hairun Container Terminal	Xiamen	China	100
Tianjin Port Container Terminal	Tianjin	China	99
Ningbo Gangji (Yining) Terminal	Ningbo	China	97
Dalian Port Container Terminal	Dalian	China	94
Yangshan Deepwater Port Phases 1/2	Shanghai	China	94
Yangshan Deepwater Port Phases 3/4	Shanghai	China	92
Ningbo Yuandong Terminal	Ningbo	China	90
Pusan Newport	Busan	South Korea	89
Tatsumi Shokai Nanko Container Terminal	Osaka	Japan	87
Kobe International Container Terminal	Kobe	Japan	87
Ningbo Beilun Second Container Terminal	Ningbo	China	87
SIPG Zhendong Container Terminal	Shanghai	China	86
Hanjin New Port Container Terminal	Busan	South Korea	80

Source: JOC Port Productivity Research

TABLE 10: TOP TERMINALS: EUROPE, MIDDLE EAST, AFRICA

TERMINAL	PORT	COUNTRY	BERTH PRODUCTIVITY*
APM Terminals Rotterdam	Rotterdam	Netherlands	92
DP World-Jebel Ali Terminal	Jebel Ali	UAE	81
Eurogate Container Terminal Hamburg	Hamburg	Germany	79
Euromax Terminal Rotterdam - ECT	Rotterdam	Netherlands	77
Khorfakkan Container Terminal	Khor al Fakkan	UAE	74
HHLA Container Terminal Tollerort	Hamburg	Germany	72
Salalah Container Terminal	Salalah	Oman	72
DP World Southampton Container Terminal	Southampton	U.K.	71
HHLA Container Terminal Altenwerder	Hamburg	Germany	68
NTB North Sea Terminal Bremerhaven	Bremerhaven	Germany	67
Container Handling Zeebrugge	Zeebrugge	Belgium	65
ECT Delta Dedicated West Terminal	Rotterdam	Netherlands	63
Jeddah-Northern Container Terminal	Jeddah	Saudi Arabia	56
Terminal de France	Le Havre	France	56
APM Terminals Algeciras	Algeciras	Spain	55
Suez Canal Container Terminal	Port Said	Egypt	55
PSA Antwerp Europa Terminal	Antwerpen	Belgium	54
HHLA Container Terminal Burchardkai	Hamburg	Germany	53
Yilport Container Terminal	Diliskelesi	Turkey	52
Beirut Container Terminal	Beirut	Lebanon	52

Source: JOC Port Productivity Research

* Berth Productivity is defined as the number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth (time between berth arrival, or "lines down" and berth departure, or "lines up"), without adjustments for equipment and labor down time. The productivity metrics contained in these rankings are the average berth productivity for all validated and standardized vessel calls in the database for each port or terminal during calendar year 2012. For more information please see P. 15.

EVOLUTION OF THE SMART PORT

By Bill Mongelluzzo
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The Journal of Commerce

U.S. container terminals have a good deal of ground to make up if they are to achieve vessel productivity numbers achieved at some terminals in Europe and Asia, the JOC Port Productivity database suggests. Automation might just be the silver bullet — or perhaps not.

The experience at European marine terminals that have invested hundreds of millions of dollars in terminal operating systems, automated transport vehicles and automated stacking cranes indicates that, although automation reduces labor costs and improves container yard efficiency, vessel operations don't always see similar gains.

This point is demonstrated in the JOC numbers that show average berth productivity numbers per hour for the top four U.S. terminals ranging from 75 to 91, and the top four terminals in Europe and the Middle East ranging from 77 to 92.

Europe Container Terminals in Rotterdam was the first operator to automate its facility in 1990 when it introduced revolutionary advances such as driverless yard tractors called automated guided vehicles, or AGVs, to shuttle containers between the vessel and container stacks.

Since then, more than 30 terminals worldwide have automated their operations to some degree, including the APM terminal in Portsmouth, Va., in 2007. APM still uses yard tractors driven by dockworkers to move containers between the vessel and the stacks, but it introduced to the U.S. the perpendicular positioning of container stacks toward the vessel berths, and the use of automated stacking cranes in the yard.

OOCL last year unveiled plans for a highly automated terminal in Long Beach to be built by its terminal-operating affiliate. At full build-out in 2020, the 3 million-TEU-a-year Middle Harbor terminal will feature AGVs, automated stacking cranes, container cranes capable of lifting two containers simultaneously and a computerized terminal operating system to tie all of the systems together.

OOCL will spend $500 million on equipment and technology, with many of the benefits and returns on investment to occur in the container yard. The automated terminal, however, also will increase container lifts per hour from 30 to 45, reduce lift costs to $74.15 from $85.34, and reduce the time mega-ships of 13,000-TEU capacity or larger spend in port to just more than two days from more than three days now, the company said.

Those metrics, if achieved, should rank Middle Harbor among the most productive terminals in the world in terms of vessel productivity at berth. Other gains in yard and gate productivity will reduce OOCL's costs and should result in improved trucker turn times for harbor drayage companies and their customers.

Because a terminal operator's only contractual relationships are with vessel operators, the question facing most terminals considering automation is how much money should be spent on automation to give carriers the service they need to turn their big ships around quickly.

Ed DeNike, chief operating officer of Seattle-based SSA Marine, believes the computerized cranes it's installing at its Southern California terminals for $8 million to $12 million each will achieve lift rates of 40 moves per crane per hour. The cranes have two computers to precisely direct movements to and from the vessel and to the ground, saving time and money.

DeNike said a terminal realizes a savings of $5 for each unit of improvement in crane productivity, so improving productivity just from 30 lifts-per-hour to 31, and multiplying the savings by the terminal's annual throughput of 1 million containers, yields a savings of $5 million.

At the end of the day, however, the container terminal is at the center of international supply chain logistics because it connects ocean, rail and truck transportation from origin to destination. Eventually, high-volume ports, especially those handling high-cost, time-sensitive freight, may have to automate their vessel, yard, gate and intermodal rail functions so they are a conduit for commerce rather than a bottleneck to trade.

"We cannot look at world-class service to shipping lines in isolation. Delivering that is closely associated to also delivering improved services to other supply chain participants and therefore there is a strong strategic link," said Martin Gaard Christiansen, interim chief commercial officer at APM Terminals. If yard and gate operations aren't operating efficiently, bottlenecks can develop quickly that will affect vessel productivity.

"The goal is to deliver world-class services to all of our customers," Christensen said.

VALIDATION METHODOLOGY

The net result of this Validation Methodology resulted in a data set of 87,000 cleansed and standardized call records for 354 ports and 588 terminals.

- Duplicate records were excluded
- Ports (port city) names validated against 2012 UN/LOCODE and standardized via proprietary methodology
- Vessel names and Ship Size Capacity by TEUs validated against Lloyd's Register of Ships
- Ports, Terminals, and Vessels that could not be validated via the aforementioned approach were excluded
- Call records of Vessels whose Lloyd's Register of Ships listed capacity is less than 100 TEUs were excluded
- Call records whose berth time is less than 5 hours or more than 168 hours (7 days) were excluded
- Call records whose calculated Berth Productivity is greater than 300 moves per hour were excluded

RANKINGS METHODOLOGY

In order to ensure an appropriate sample size of call records, a port or terminal must have at least 100 call records during the year 2012 to be considered in the rankings.

141 ports with a combined 79,800 call records met the aforementioned sample size requirements to be considered in the following rankings:

- 2012 Top 20 Ports - Americas
- 2012 Top 20 Ports - Asia
- 2012 Top 20 Ports - Europe, Middle East, Africa
- 2012 Top 20 Global Ports

207 terminals with a combined 73,900 call records met the aforementioned sample size requirements to be considered in the following rankings:

- 2012 Top 20 Terminals - Americas
- 2012 Top 20 Terminals - Asia
- 2012 Top 20 Terminals - Europe, Middle East, Africa
- 2012 Top 20 Global Terminals

34 ports with a combined 10,600 call records met the aforementioned sample size requirements to be considered in the following ranking:

- 2012 Top 10 Global Ports for 8,000+ TEU Vessels

137 ports with a combined 67,300 call records met the aforementioned sample size requirements to be considered in the following ranking:

- 2012 Top 10 Global Ports for Sub-8,000 TEU Vessels

33 terminals with a combined 8,344 call records met the aforementioned sample size requirements to be considered in the following ranking:

- 2012 Top 10 Global Terminals for 8,000+ TEU Vessels

183 terminals with a combined 60,800 call records met the aforementioned sample size requirements to be considered in the following ranking:

- 2012 Top 10 Global Terminals for Sub-8,000 TEU Vessels

31 transshipment ports with a combined 40,300 call records met the aforementioned sample size requirements, and advised as prominent by the consultancy Ocean Shipping Consultants, were considered for the following ranking:

- 2012 Top 10 Global Transshipment Ports

ABOUT THIS REPORT

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LEARN MORE ABOUT JOC PORT PRODUCTIVITY

This powerful data provides carriers with visibility into how their productivity compares to an aggregated average for the industry, revealing opportunities for improvement. It also allows ports, terminals, investors, governments, suppliers and others with an interest in container ports to compare productivity in detail within a specific port, country, region or among similar terminals.

JOC Port Productivity's Data **available by month or week*

Port Name	Terminal Name	Country Name	Region Name	Ship Size Range	Call Size Range	Month*	Berth Productivity (Moves per Hour)	Number of Vessel Calls
Antwerpen	Antwerp Gateway Terminal	Belgium	North Europe	2,500 or Less	251-500	2012-02	29	5
Manzanillo	SSA Mexico (SSAM)	Mexico	Latin America	2,500 or Less	1,501-2,000	2012-1	63	4
Ashdod	Ashdod Port Containers Terminal	Israel	Mediterranean R	2,5 -5,0	501-750	2012-07	25	5
Jebel Ali	DP World-Je Ali Terminal	United Emirates	Middle East/Africa	10,001+	2,001+	2012-08	96	4
Elizabeth	Maher Terminals Elizabeth	United States of America	East Coast/Gulf North America	2,501-5,000	751-1,000	2012-01	52	10
Long Beach	Long Beach Container Terminal	United States of America	West Coast North America	7,501-10,000				3
Yokohama	K Line Yokohama Container Terminal	Japan	North Asia	2,501-5,000				3
Singapore	PSA Singapore Terminals	Singapore	South/South East Asia	5,001-7,500				15

8 REGIONAL REPORTS
With Aggregated Weekly Or Monthly Berth Productivity By Vessel Size And Call Size.

1. **North America East Coast & Gulf**
   (19 ports and 32 terminals)
2. **North America West Coast**
   (10 ports & 29 terminals)
3. **Latin America**
   (78 ports and 128 terminals)
4. **North Asia**
   (32 ports & 100 terminals)
5. **South & South East Asia**
   (60 ports & 100 terminals)
6. **North Europe**
   (35 ports & 66 terminals)
7. **Mediterranean Region**
   (59 ports and 85 terminals)
8. **Middle East & Africa**
   (62 ports and 72 terminals)

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