Measure for measure

Comparing the quayside productivity levels of different terminals is not easy, writes Benedict Young

For most container terminals, the productivity of the quayside is a measure of overall terminal performance. However, when it comes to benchmarking quayside performance, there is a wide range of views about what constitutes high levels of productivity, and how they should be measured.

One problem is the wide array of differing definitions, terminologies and measurements used, and the lack of an accepted standard for reporting productivity. Commonly used measurements include moves per ship, moves per crane, teu per berth-metre, and overall vessel turnaround time.

In many cases, publicised statistics refer simply to a certain number of "moves" achieved, without making reference to how the "move" is calculated. We often do not know whether hatch covers, restowage or crane downtime has been included in the overall working time. As a result, terminals seeking to benchmark their performance against statistics released by other terminals often have a hard job on their hands.

According to Tom Ward, the recently appointed director and chief engineer of Marine Terminals Corp (MTC), the wide range of definitions seen in the industry reflect the wide range of audiences for the statistics gathered. "When we report productivity for a customer, such as a shipping line, it is crucial to report productivity in terms that are useful to the shipping line," he explains.

"Since the shipping line is most interested in rapid ship turnaround, 'net lifts per gross vessel berth hour' might be the most appropriate. When we report productivity to ourselves as operators, we are most interested in getting the most out of the resources we manage, so 'gross lifts per net crane working hour' is more appropriate. Neither measure is right or wrong – they just serve different purposes."

Moves per crane per hour can be an effective measurement of quayside productivity, but it may not be easily used to compare one terminal against another. Michael Schwank, president of Tideworks Technology says: "Unless explicitly stated, you can never be certain if one is referring to 'gross' moves per crane per hour, or 'net' moves per crane per hour. Additionally, the
way in which one operator calculates 'net' may be completely different from the way another
does."

This complaint is a common one, even among operators of some of the world's largest terminals. Stacy Hatfield, terminal manager – and former vessel operations manager – at Manzanillo International Terminal (MIT), Panama, says: "I completely agree that there seems to be no industry-wide standard for moves per crane per hour. Some ports calculate hatch covers and gear boxes as 'moves' when referring to crane productivity, whereas other ports do not."

According to one industry source, some terminals release deliberately misleading statistics. However, Ward argues that the marketplace would soon discover any systematic mis-statement. He says: "Instead, there is a general lack of clarity in what is being included in 'lifts' and 'hours', and some operators use this ambiguity to make themselves look better. "It is not this lack of clarity that makes benchmarking difficult, it is the fact that each terminal serves a unique set of masters, and responds to a unique set of pressures. In almost any terminal, throwing more money into resources can increase productivity, but that costs money. "Once the cost per lift rises to what the market will bear, productivity has reached its practical limit," he says.

If a terminal is able to overcome the inconsistencies, quay crane performance remains a key measurement and can be calculated by multiplying the number of cranes that can be used in parallel on a given vessel, which of course varies from place to place. Even the same vessel may get more cranes in one port because it is doing more moves. Crane productivity can always be compared on a per crane basis, even if you cannot compare two operations that are not like for like.

Mark Sisson, principal at Jordan Woodman Dobson argues that it is important to differentiate between "cycles" and "moves" when measuring crane productivity. While a "move" indicates a single container being loaded or discharged, a "cycle" refers to a complete loading/unloading circuit of the spreader. "A modern dock crane of any make can get about 40 cycles per hour on an average 17-wide ship," says Sisson. "That doesn't really change anywhere in the world because of similar drive speeds, acceleration and so on. However, higher productivity can be sustained by doing more than one move per cycle, which can be achieved using twin 20s, twin 40s, quad 20s or on a one-on-one-off basis."

Vessel turnaround time can be a very useful measure of productivity, as long as there is consistency. This is of particular interest for vessel operators. The complete berth time should be calculated from vessel tie-up to vessel cast off, in order to provide a true indication of the total time the vessel spent at the terminal.

However, Schwank argues: "Within this time period, there may be several factors outside of the control of the terminal operator or stevedore – such as tugs, pilots, even bunkering or taking on ship's stores – that may delay the sailing of the vessel. "Consequently, most terminal operators and stevedores would be more interested in a 'first move off to last move on' calculation for vessel turnaround-time, although it is really only a measure of total time of cargo operations."
When it comes to "teu per berth-metre per year", this is a useful measure of berth utilisation, but not necessarily indicative of quayside productivity. Schwank explains: "You may have a small to medium-sized terminal that has relatively low berth utilisation, simply because the volume is not there, but that is extremely productive on the quayside during cargo operations. Conversely, you may have a large terminal with a tremendous throughput and very high berth utilisation, but not necessarily very high productivity."

The fact that terminals are not all alike poses a unique challenge when trying to establish comparative benchmarking standards. Different terminal size, layout and equipment can all complicate comparison, as can the berth occupancy and the percentage of transhipment.

Yvo Saanen, partner at consultancy firm TBA Netherlands, says: "The question is what is similar, and what isn't. Moves per crane cannot be compared if the circumstances are completely different. There are terminals with three ships a week that achieve 40-plus moves. Other terminals are facing berth occupancies of over 60%, and are more difficult to plan."

Ward argues that each marine terminal serves a unique combination of waterside and landside marketplaces and customers, and each therefore responds to different cost and performance pressures. "Terminals' productivities can be compared, but unless they are serving very similar waterside and landside markets, the comparison won't tell us much of value," he says. "We frequently find such comparisons being misused by uninformed policy makers to the detriment of rational discussion about port performance. It is useful and worthwhile to compare progress in performance. If one terminal is getting 24 lifts per hour, and another 28, but both have increased by one lift per hour over the last year, that reflects well on both terminals."

Schwank suggests that from the perspective of the liner operators, "gross vessel moves per hour" is a decent benchmark for comparing terminals' productivities. He explains: "This measure completely ignores such factors as number of cranes used on the vessel, total number of moves for the terminal in question, and distribution of moves on the vessel due to stowage conditions on arrival, which all have an impact on the terminal operator's ability to be productive. However, the comparison may be easier and more valid if the vessel operator is comparing two terminals that consistently do 180 and 125 gross vessel moves per hour respectively, within the same port or the immediate region."

Hatfield agrees: "It's very important to understand the differences in ports when analysing this question. It's difficult to compare a port that is primarily transhipment, and ports that are primarily discharging full import and loading out empty containers. The type of port, and usually the region, will also determine the types of vessels calling. The ratio of mother/feeder vessels, and their average move counts and cargo types, are all factors that will ultimately have an impact on productivity."

The port rotation also has a profound impact on individual terminal productivity. Richard Clarke, director of ports at Halcrow, argues: "In Shanghai, you would expect 35 moves per hour and three cranes on a ship. But in Colombo, you won't get more than 24-25 moves because you're at the mercy of ship planners and there will be boxes across different hatches." Ward points out that productivity is strongly influenced by the mix of container movements, the total number of
container moves per ship, the split of containers across hatches, the contiguity of containers within hatches, the accuracy of the inbound stow plan, and the flexibility of the outbound stow space.

"Ports absorbing a large influx of well-stowed imports on a few big hatches full of similar containers can sustain much higher productivity than other ports," says Ward. "It is almost impossible to take this into account in benchmarking, as it is impossible to provide a clear, consistent, short-hand characterisation of all the factors that relate to rotation order and productivity."

Of course, quayside productivity cannot be measured in isolation. "It is clearly interlinked with the yard operation and, to a certain extent, the gate operation," says Saanen. "When the waiting time for the transportation system – the 'hook hanging time' – is deducted, the quay crane productivity can be measured in isolation." (see graph).

Schwank adds: "Quayside productivity may be measured in isolation, but it certainly does not happen in isolation. The rest of the activities on the terminal have a major impact on the quayside productivity. "However, from the liner operator's perspective, the 'terminal productivity' is the terminal operator's concern, as long as the vessel is in and out quickly and the boxes are moved in and out of the terminal efficiently, via rail or truck. Therefore, other metrics that may concern the liner operator are gate productivity and rail productivity."

The development of larger vessels inevitably affects productivity but Ward believes the net effect on quay crane productivity has been negligible.

He says: "Bigger ships take bigger cranes, with longer trolley travel and higher hoist height. But bigger cranes are given faster drives, so the net effect on crane duty cycle is about zero. However, bigger ships generally allow higher vessel productivity than smaller ships. "Most obviously, bigger ships can be given more cranes without causing traffic snarls on the dock. Bigger ships also tend to present more containers per hatch, allowing the crane to stand still and just plough along, without changing hatches, moving hatch covers, or making other non-productive moves. "The net result is, ports serving vessels with higher lift counts tend to have higher 'berth throughput capacity' than ports serving smaller ships."

Hatfield adds: "For the most part, any factors on a mother vessel that would seem to make the operation more difficult, compared to a feeder, are offset by greater stability, fewer obstacles such as ship's gear, and more moves per bay on average. Basically, mothers are almost always better to work than feeders."

The size of cranes can also affect productivity, and the biggest cranes are actually less efficient on the smallest ships. However, Ward argues that the impact seems to be small in most cases. He says: "Bigger cranes tend to be newer cranes, with more advanced drives and more advanced load position control. The higher trolley and hoist speeds inherent on a big crane will help to shorten the duty cycle for small ships as well as for big ships. The advanced anti-sway and load-position automation controls being put into bigger cranes can help on smaller ships as well as big ships."
With such a variety of operation types and issues affecting productivity measurements, can all terminals aspire to a certain productivity level in terms of moves per crane per hour? Schwank says: "Internationally, for gantry cranes it seems as though 27-33 moves per crane per hour is often achieved these days as 'standard', and anything in the 35 plus range is good."

Saanen argues: "In some places it is not profitable to operate at that level, because too much labour is required, though in principle, any operation could achieve 35 moves per hour."

Indeed, moves cost money, and some markets are certainly more cost sensitive than performance sensitive. Shipping lines may not benefit from productivity improvements that offer savings of only a few hours sailing time. Instead they may prefer a cheap solution for container handling in the docking window available. "Shipping lines' economics is about whether or not to add a ship to the rotation, so if you can save that, it makes a big difference, whereas an hour off the turnaround time may not make as much difference," says Sisson. "So operators are not looking to get performance at all cost, they're looking to optimise performance versus cost. In other words, why pay for a Ferrari when a Volkswagen will get the job done at a better cost."

Ward believes all terminals can, and should, aspire to steady and continuous improvement in quay crane and vessel lifts per hour. He concludes: "Consistency and clarity are the key. However you decide to measure productivity, be clear about how you're doing it, and always do it that way, everywhere."

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