

# TRANSFORMING TERMINALS IN THE MEGA-AGE



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The mega-sizing of the shipping industry, with larger ships, hub port strategies, consolidations and new alliances, drives container terminals to transform their operations to stay relevant. Furthermore, the cascading brings the mega-age effect to terminals of all types and sizes, to greenfield and existing facilities alike. This paper discusses three main mega-age drivers for container terminal change and different strategies for implementing transformation.

## IS TRANSFORMATION NEEDED?

In order to answer this question, we have identified three mega-drivers impacting container terminals over the coming years:

1. Remaining relevant: The mega-age has shifted the focus from building new terminals to re-equipping existing terminals to provide the required productivity, high peak capacity and high container storage capacity. Mega-sized cranes are needed for sufficient lifting height, reach and capacity. At the same time customers expect reduced handling cost per container. However,

some of these requirements may be in conflict, or at least inconsistent: improving crane productivity is not so simple since serving large ships is slower than serving smaller ones due to longer trolley/hoist distances and longer ropes. Maintaining high peak capacity may need extra equipment and staff, which can increase the handling cost per container.

2. The digital era customer expectations change the game: Today, shippers expect guaranteed container delivery times to multiple modalities. Shipping lines have started to diversify their service offerings by seeking premium pricing for fast or guaranteed delivery. This requires predictable productivity and sequenced operations in the terminals involved. Ability to provide real-time information online regarding the status and location of individual containers and correct information for the next actor in the chain are basic requirements in the digitalized world.
3. Safe & sustainable: Serious shipping accidents have already resulted in

enforcement of correct declaration of container weights. The recent significant increase of serious fires onboard ships has highlighted the risks with dangerous cargo, especially on mega-vessels. To limit these risks, terminals and shipping lines will be obliged to accurately track the contents and location of containers onboard. Automated - digitalized terminals are already able to comply with such requirements but new regulations may become a challenge for many manual terminals. Container terminals will be expected to be sustainable and energy efficient members of societies. Emissions, noise and light pollution on today's levels will not be tolerated. Terminals are also expected to offer a safe and comfortable working environment that promotes team work and collaboration, in a location that is easily accessible for the employees.

The drivers are diverse and, consequently so are the transformation strategies. Automation and digitalization will naturally play a critical role, but there is more to consider.



Transformed to the world leader: GCT Delta Port's intermodal yard now has the highest on-dock rail capacity in the world. The widespan cranes are equipped with ABB's automation and remote supervision system.

### TRANSFORMATION AT THE TERMINAL LEVEL

A holistic analysis of a terminal's existing operations provides a basis for re-configuring operations focusing on the weakest link(s). The weakest link is not necessarily a big-ticket item and yet addressing the weakest link often results in significant increase in a terminal's capacity. The weakest link can often be found in manual processes (e.g. at the gate/hand-offs), poorly integrated/sized yard or on-dock rail operation, lack of competence, poorly organized exception handling, or inadequate utilization of automation and logistic systems.

Terminal-level transformation can be achieved by deploying equipment in a flexible way supported by automation. Scheduling and prioritization of container moves, vehicles and cranes based on real-time information can save seconds and minutes at every move resulting in significant total productivity gains.

Optimizing the net production time is the fastest and cheapest way of improving productivity. This is enabled by crane and process automation. Deploying remote operation on all types of cranes, eliminates interruptions caused by breaks and moving staff to/from/between cranes and enables the use of higher crane motion speeds and accelerations. Remote operation provides an ergonomic working environment for the equipment operators and enables unified management of exception handling for cranes, gate and vehicle identification contributing to maximized net production time.

Digitalization is not only about big data and clouds; it also brings significant opportunities for transformation of operational processes. The numerous

systems already being used in container terminals constantly collect data about events, operational exceptions and debugging information. What the systems themselves need to 'know', they already know; it is just that they have not been able to pass on all of the information to the staff operating the terminals. Visualization of that data enables monitoring of the entire logistical flow from individual machines and immediate actions can be taken as necessary. It also provides means for analyzing and evaluating the processes execution, studying equipment performance and understanding equipment health, enabling terminals to achieve continuous operational improvements.

### TRANSFORMATION AT THE QUAY

At the quay the transformation to mega-age capabilities can be based on the equipment itself or on the re-engineering of processes. Based on the needs and the goal of the transformation there are a number of options that can be considered:

- Upgrade the existing STS cranes to increase lifting height/outreach. When considering this option, it is important to analyze if the structurally upgraded cranes will meet functional requirements in the long run, and whether components (e.g. electrical systems/equipment) should be replaced during the upgrade, considering the expected remaining lifetime of the crane.
- Automated or manual STS cranes. The taller cranes of the mega-age pose a challenge even for an experienced and skilled crane operator. Automation system supports the operators and makes every operator a good operator which makes the production

predictable.

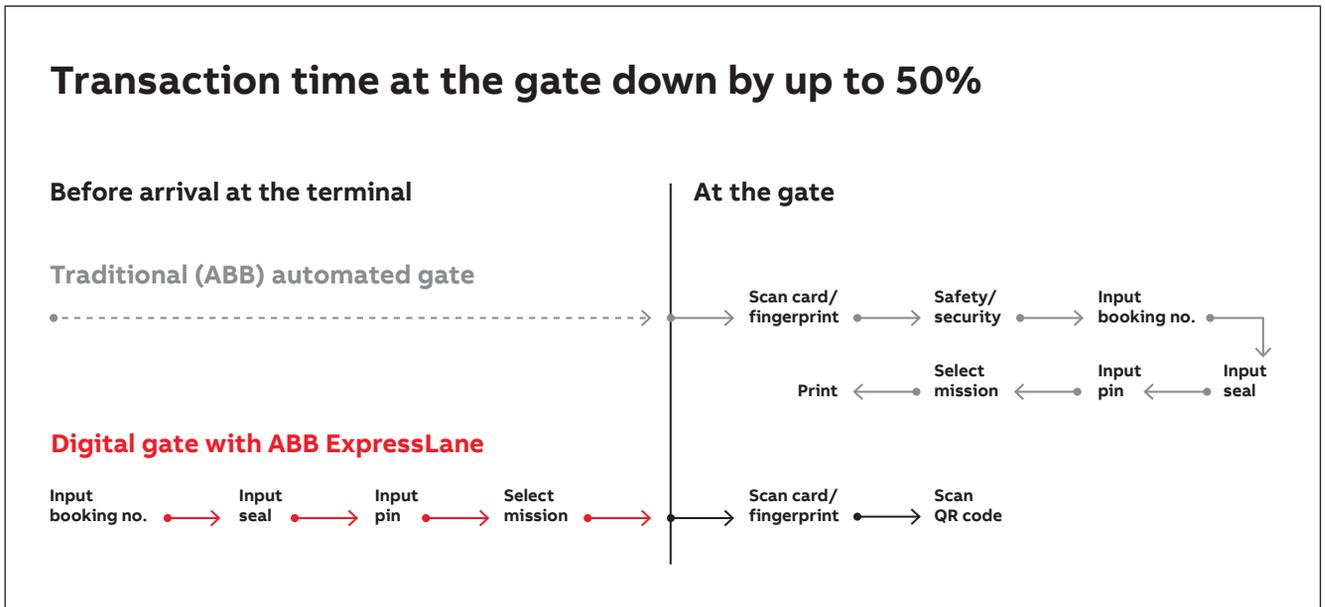
- Digitalization. By fully digitalizing the information exchange between (remote) crane operator, checker and deck-man, i.e. within the team involved in the operation of STS cranes, the entire quay operation can be digitalized and checkers become remote checkers overseeing several cranes from the control room. Digitalization brings the remote operation to the next level, supporting continuous operation by solving logistic exceptions without impacting the crane cycles.

### TRANSFORMING ON-DOCK RAIL OPERATIONS

For many terminals transformation of on-dock rail operations offers great opportunities to increase terminal capacity. Introduction of automatic intermodal yard gantry cranes (IYC) gives several significant benefits. The automated motion sequence, including landing on chassis and rail cars supported by remote operation, allows the full capacity to be utilized continuously. Additionally, the IYC shorten the transport distances in the yard and result in better utilization of yard space. Higher on-dock rail capacity means less road vehicles, which improves the sustainability of the terminal's operation but also results in a more predictable and efficient operation.

GCT Delta Port in Vancouver recently completed the re-configuration of their intermodal yard resulting in the world's highest on-dock rail capacity and an efficient layout that optimizes the terminal's traffic flow. The terminal remained fully operational throughout the project in which smaller manual RMGs were replaced with eight automated and remotely supervised widespan IYC.

# Transaction time at the gate down by up to 50%



Digital gate: ABB's Express Lane allows most of the actions to be made before arrival at the gate via mobile app/web interface.

## TRANSFORMING YARD OPERATIONS

The mega-age yard needs to be equipped to provide a cost-efficient service for both waterside and landside operations. In many terminals around the world, automated cantilever stacking cranes (ARMGs) have proven to be an efficient solution for obtaining substantially higher yard capacity and productivity. Cantilever stacking cranes can handle wider blocks, yielding up to 20% more storage capacity within a given space/stacking height compared to yards with RTG operation.

Higher motion speeds, fast automatic positioning/landing and better scheduling capabilities make automatic-unmanned cantilever stacking cranes more productive than RTGs which means less machines. They allow flexible capacity deployment within and between blocks supporting the landside and waterside operations, which increases peak and average production capacity as all cranes can be used efficiently.

With automatic single or double cantilever cranes the pick-up/landing on the internal chassis can be fully automated, and only limited supervision is needed for handling road trucks. With one operator overseeing many cranes, the overall efficiency of the operation becomes very high.

Motion control and automation systems of ARMGs log a huge amount of data. Via digitalization, everything that these systems already knew but couldn't tell us can now be visualized and analyzed. Operational data (KPIs) and all data about container moves, orders, motions, interactions and the equipment itself, is stored. Data about an individual crane or the entire crane fleet is visualized in 2D/3D presentations.

A typical yard transformation project today is an extension or re-equipment of an

existing yard. This can include transforming manually operated RMGs into automated and remotely supervised cranes. For instance, the FICT terminal in Tianjin, China, recently upgraded and automated

31 RMGs to increase the terminal's capacity by improving the efficiency of the yard operation.

## TRANSFORMATION AT THE GATE

Automated gate operation has significantly reduced the gate transaction time compared to manual operations by eliminating costly and inefficient manual processes and by enabling centralized exception handling.

However, it is possible to reduce gate transaction times by up to 50% compared to traditional automated gate by deploying digital gate. This represents a big saving in terms of time and cost for terminal operators, especially those serving mega vessel calls.

A digital gate is based on pre-arrival check-in (comparable to an on-line check-in for air travellers), which ensures that booking details are correct before the arrival at the gate. With pre-arrival check-in completed via a mobile app (by the truck driver him/herself) or web interface (by the dispatcher), the driver only needs to handle the identification if required (finger print or card scan) and scan the QR code from his mobile app and he/she is cleared to complete the mission.

## CONCLUSION

Transformation will be needed in the vast majority of terminals with varying handling concepts and needs. It is essential when selecting the strategy to avoid short term sub-optimization, and instead to specify for the future.

## ABOUT THE AUTHOR

Uno Bryfors, Senior Vice President of ABB Ports, is one of the most experienced professionals in the ports industry today. During his more than three decades long career at ABB and in the industry he has been a key person in driving the development of automation solutions for cargo handling starting from automatic grab ship unloader and fully automated yard operations to automatic and remotely operated STS cranes. Uno Bryfors joined ABB as a Development Engineer after graduation with a Master of Science degree in Electrical Engineering. Since then he has headed the R&D department, led the Crane Systems unit in Sweden, and is now responsible for ABB Ports business - from ship to gate.

## ABOUT THE ORGANIZATION

ABB Ports develops and delivers intelligent terminal automation solutions and services to make container terminals safer, greener and more productive. The solutions include automation and remote control for all types of container handling cranes, and complete OCR and electrical systems. With the track-record of the largest installed base, ABB's systems help to optimise container handling from ship to gate in greenfield installations and in existing terminals.

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