



CONTAINER TERMINAL AUTOMATION



Drewry 

PROS, CONS AND MISCONCEPTIONS

Neil Davidson, Senior Analyst: Ports & Terminals,
Drewry, London, UK

Automation when used in the context of container terminals is a broad term and means different things to different people. To some, it is interpreted in a narrow sense, i.e. the replacement of human operation of equipment with autonomous computer control ('robotisation'). However, besides robotisation there is a raft of other 'automation' which results in the replacement of human activity, for example optical character recognition replacing a checker with a piece of paper or a hand-held computer, manually recording container numbers. Beyond these aspects there are also many other applications of what should strictly speaking be termed 'technology' as opposed to 'automation', for example anti-sway systems in cranes.

MANUAL BECOMES AUTOMATIC

Some types of "automation" have been in place for many years and now largely go unnoticed; for example, vessel planning and container stack inventory functions

which were once manually done are now computerised in almost all terminals. Other types of automation are also common such as the checking of container numbers and container condition (damage) using cameras and optical character recognition at terminal gate. These were once manual functions which are now automatic through the deployment of technology.

This kind of process automation of background functions is largely invisible to the outside view. Much higher profile is automation of equipment whereby human drivers are either replaced by robotic systems and operate autonomously, or have human 'drivers' in a physically remote location from the equipment itself. The latter clearly has benefits in terms of driver safety and comfort, but does not involve replacing human drivers with robotics.

AREAS OF AUTOMATION

In terms of the physical movement of containers there are four main functional

areas of a container terminal and automation (robotisation) can theoretically be achieved in any or all parts:

1. Vessel to quay (ship-to-shore movement)
2. Quay to stack (horizontal transfer system)
3. Yard stacking system
4. In-out gate function

Robotically operated yard equipment is the highest profile aspect of terminal automation, not only visually but also in terms of cost implications (both capital and operating) and terminal automation to date has mainly focused on items 2 and 3: the quay to stack horizontal transfer and the yard stacking system.

Terminals are typically described as fully automated if both the horizontal transfer between quay and stack, and the yard stacking system are automated. If only the yard stacking system is automated (and the horizontal transfer remains with manually operated equipment), a terminal is described as semi-automated.

PROS AND CONS

There are a number of positive drivers behind terminals choosing to implement robotic equipment control – the “pros” (in no particular order):

- ✓ Greater predictability and consistency of operations
- ✓ Substitution of (usually high wage) labour costs with capital costs. The aim is to achieve lower overall operating costs and also avoid the uncertainty that manual labour can bring (for example the potential for above inflationary wage increases, the vagaries of negotiations on manning levels and conditions and the possibility of disputes/stoppage/strikes)
- ✓ Greater safety (fewer or no humans present in the equipment operating areas)
- ✓ Less downtime due to external factors (e.g. in periods of high winds, manually operated yards may have to cease operations for safety reasons)
- ✓ Longer working hours (machines can operate 24/7 without the need for refreshment and comfort breaks, and have no aversion to unsociable hours)
- ✓ Denser yard stacking as more shuffling can be carried out because it is less costly/inconvenient than manual shuffling
- ✓ Greater accuracy and avoidance of human error
- ✓ Potentially greener and more environmentally friendly (for example automated equipment is usually electric rather than diesel powered)
- ✓ Reduction in equipment and cargo damage
- ✓ Terminals do not necessarily have to pursue full automation. Semi-automated solutions exist

At the same time, terminal automation also has a number of downsides (or perhaps some would say challenges to overcome) – the “cons” (again, in no particular order):

- ✗ Automation requires a high, up-front capital outlay, significantly more so than for a manual terminal
- ✗ Automated yard equipment has to be added in large capacity ‘lumps’ rather than gradually in small increments
- ✗ Automated terminals lack flexibility. Their physical layout is difficult to change once fixed (unless it is an automated straddle carrier solution), and it is fixed for the long term. Decisions have to be made at the design stage which require judging the terminal’s needs over decades ahead. The activities of the terminal and the needs of its customers though may change markedly over time
- ✗ If activity levels temporarily fall, a manual terminal is more able to re-

trench (dockers can be laid off for example)

- ✗ The processes carried out by a terminal are not necessarily stable and homogenous. They may be volatile and change over time (from minute to minute, day to day and year to year). Automation prefers a high degree of repetition and predictability
- ✗ In some locations, union resistance may make it difficult to achieve the full extent of headcount reduction that automation in theory offers
- ✗ Automation is a highly bespoke task which varies from terminal to terminal, and the quality of the terminal management and the software behind the automated equipment is key, as is the way that it integrates with all other systems on the terminal
- ✗ Automation does not necessarily (automatically) result in faster handling and higher service levels
- ✗ Automation projects carry greater risk and are harder to implement whereas manual terminals are tried and tested

THE PRESENT SITUATION

Terminal automation is by no means a panacea therefore and it should not be regarded as inevitable that all terminals will eventually be automated. Sceptics argue that in some cases automated terminals perform worse than manual terminals, or that the required service levels and intensity of asset use can just as easily be obtained by manual terminals. At the same time, there are clearly some automated terminals that perform very well.

What is evident is that automation technology is advancing rapidly and the take up is increasing. At present, there are over 30 semi and fully automated container terminals operational worldwide today, with a number of others under development.

In this respect, perceptions can play a part in some instances. Automated terminals are high profile assets and rightly regarded as state-of-the-art and highly advanced. There can be a temptation in some locations to seek to have a high degree of automation in order to send a message to the outside world about the level of skills and technology that an operator or a country can master. Critics argue that such moves are merely vanity projects although a kinder view is that they are a proving ground and learning process, and therefore a form of investment.

MISCONCEPTIONS

There are some common misconceptions about what terminal automation can achieve. One of the main ones is that automation ‘automatically’ results in

faster vessel handling speeds - that it is some kind of cure-all. Automation is a powerful tool to be deployed, but it is not a magic bullet. Rather, automation first and foremost delivers stability, predictability and consistency of performance. This is arguably much more valuable.

Another common misconception is that automation “automatically” cures poor processes, but of course it does not. Rather, it simply results in faster execution of these poor processes. There is no gain in automating a poor process because it is the process itself that really matters; this is what has to be right. In this respect, the quality of the terminal management and the design, planning and operation of the ‘IT brain’ software behind the automated equipment is key. Ultimately therefore, it is about humans as much as it is about automation.

** This paper draws upon material published in Drewry’s 2014 report “Container Terminal Capacity and Performance Benchmarks”*

ABOUT THE AUTHOR

Neil Davidson has over 25 years’ experience in the port sector. He joined Drewry in 1997 and founded the company’s ports practice. Neil has spoken at over 80 industry conferences, seminars and private briefing sessions worldwide and regularly contributes expert insight and analysis to the trade press and British national newspapers, as well as TV and radio.

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ENQUIRIES

Neil Davidson,
15-17 Christopher Street,
London, EC2A 2BS

Tel: +44(0)20 7538 0191
Email: davidson@drewry.co.uk