



International Journal OF Engineering Sciences & Management Research

AUTOMATION VERSES NATIONAL DEVELOPMENT PLAN

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Keywords: DCT, NDP.

ABSTRACT

The Durban Container Terminal (DCT) is currently the biggest and busiest container terminal in Africa and handles about 2.7-million TEUs a year. DCT handles approximately 70% of South Africa's containers and generates 60% of South Africa's revenue (Port of Durban, 2014).

The industry move to automate is being driven primarily, though, by the need to efficiently handle big ships. This requires a step up in innovation. Increasing the automation level of a terminal with products that automate a single part of the operation or the whole process is recognised as the next step towards improving performance at today's container terminals. The benefits of automation include lower operational costs as well as improved terminal productivity, capacity, safety and security. Besides the actual automated system, there is also extensive change management within the entire organisation of the terminal, as operating an automated terminal requires a thorough change of business processes as well as different skill sets for the people operating the terminal.

The biggest hurdle though is embedding this concept in South African ports considering the fact that South Africa's National Development Plan (NDP) stipulates that government's desire to increase employment from 13 million in 2010 to 24 million in 2030 (The National Planning Commission 2012: 34).

INTRODUCTION

South Africa belongs to its entire people and the future of the country is a collective future. Making it work is collective responsibility. All South Africans seek a better future for themselves and their children. The NDP is a plan for the country to eliminate poverty and reduce inequality by 2030 through uniting South Africans, unleashing the energies of its citizens, growing an inclusive economy, building capabilities, enhancing the capability of the state and leaders working together to solve complex problems (The National Planning Commission 2012: 34).

Terminals, like DCT, that handle 1 million 20-foot container units, or more, per year must provide consistent, reliable and uninterrupted performance. However, as the day wears on, productivity can erode somewhat due to fatigue or other factors.

An automated crane may likewise do 30 moves per hour, but will perform at that level throughout the day. Unlike traditional quay cranes, in which the operator bends over and looks down at the containers as they are lifted off and on the vessel, the automated crane is operated remotely from the tower. The operator oversees the operation in front of a computer, and vision is not distorted by wind, rain or fog.

The biggest concern when implementing automated infrastructure at the Port is whether or not South Africa is ready to handle the new technology and how will this implementation affect the NDP's aim to create more jobs. An easily overlooked aspect of terminal automation is that it is in fact more of a cultural than technical issue. Whether creating a new automated terminal or converting a manual terminal to automated operation, change management is crucial. Equipment upgrades are usually planned carefully, but people-related issues are quite often overlooked, even though human behavior takes more time to adapt. Change is inevitable, so the question is how to manage it now.

OBJECTIVES OF THE STUDY

The main purpose of this study was:

- To identify whether or not automation will help achieve targets for job creation set out in the NDP
- 1. What are some of the objectives of the NDP? (The National Planning Commission 2012: 34)
- Increase employment from 13 million in 2010 to 24 million in 2030.

International Journal Of Engineering Sciences & Management Research

- Produce sufficient energy to support industry at competitive prices, ensuring access for poor households, while reducing carbon emissions per unit of power by about one-third.
- Interventions to ensure environmental sustainability and resilience to future shocks.
- Boost private investment in labour-intensive areas, competitiveness and exports, with adjustments to lower the risk of hiring younger workers.

According to the NDP in 2030, the economy should be close to full employment, equip people with the skills they need, ensure that ownership of production is more diverse and able to grow rapidly, and provide the resources to pay for investment in human and physical capital (The National Planning Commission 2012: 38)

AUTOMATION REQUIREMENTS

The most significant and immediate cost savings from automation are due to the drastically smaller number of operators required. For example, fleets of dozens of straddle carriers can be handled by only a few highly skilled operators. Automation is where IT meets engineering. In a traditional manual terminal, these are typically two separate teams that have little contact with each other. With an automation rollout, they need to start cooperating and form a joint team in which the skills and responsibilities of the people match each other and mutual responsibilities are clearly defined. An automated terminal requires a significantly different profile of employees.

Remote operation and exception handling are an integral part of automation that enables people to be separated from machines and moved from a dangerous and harsh working environment to the safety and comfort of a control room. The remote operation also creates an attractive working environment for the next generation of port staff and reduces absence (Automated container terminals are taking of 2015).

The terminals are run by a team of motion, logistics and maintenance specialists who handle the planning and manage exceptions together (Sustainable terminal automation 2015).

A different level of maintenance engineer skills is also required for the stricter maintenance standards of automated equipment. In addition, automated operations will require new, different skill sets in several other areas, including:

- Data and fact-based usage and analysis compared to operators reporting faults in equipment
- Data mining
- Understanding the operating principles of automated equipment and systems
- Competence in measuring and sensor technology that replaces the human senses
- Systematic planning of operation and maintenance work



Figure 1: remotely controlling ship-to-shore cranes

International Journal Of Engineering Sciences & Management Research

APM Terminals' Maasvlakte II (MVII) container terminal in Rotterdam have constructed a fully automated terminal (figure 2). It was officially opened in April 2015. About 300 people will work at MVII, almost all of them outside the container yard. And of the 74 machines in the yard, 63 will run on their own with no human intervention. There are 26 rail-mounted gantry cranes that will manage the container stacks with the computer systems sending them specific tasks throughout the day (Churchill 2014:1).

The ship-to-shore cranes will be operated remotely using a joystick and multiple viewing screens where cameras mounted on the cranes provide different viewing angles (figure 1). The terminal's equipment is powered by wind generated electricity for zero carbon emissions (Barnard 2015: 1)

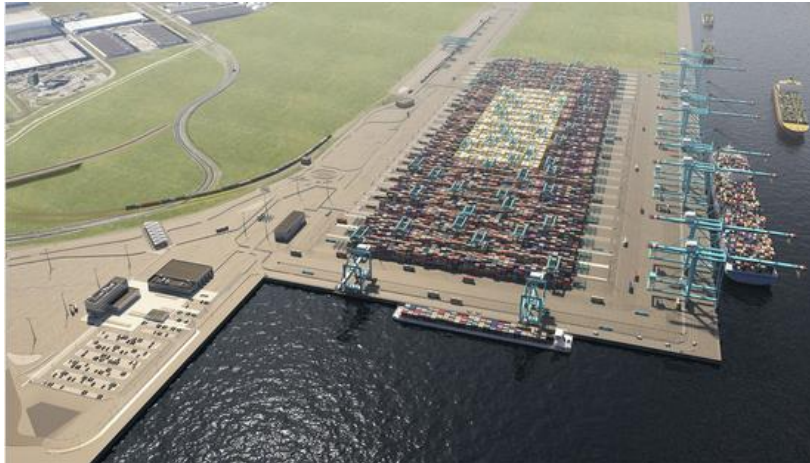


Figure 2: Model of a planned fully automated terminal in Maasvlakte II (MVII) container terminal in Rotterdam

New jobs that will need to be outsourced or insourced include automation system specialists; system optimization engineers; IT system service and maintenance professionals; and instructors for internal staff and external parties. On the other hand, significantly fewer employees will be required for basic container operation and traditional maintenance tasks.

Conditions, legislation and industry labour norms differ greatly from geography to geography. In many locations, limited availability of skilled personnel – even at competitive salaries – can also be a challenge. Automation resolves this issue, but also changes the profile and structure of the terminal staff. Successful change management requires an open dialogue with all relevant parties. Human resources need to be taken into account from the beginning. Automation provides new job opportunities, but also places additional demands on the workforce. The significant workforce impact of automation needs to be considered and planned carefully, working in cooperation with local labour organizations and other stakeholders.

The procedures for ship-to-shore (STS) operation, landside interface and reefer operation will be changing completely. Alternative processes may need to be introduced also to handle non-standard cargo that cannot be taken into the automated area, as well as for empty container handling. Change management of the workforce needs to be taken into account from the very beginning. The professional profile of the people operating and managing automated equipment will be markedly different from the staff running a manual terminal. Completely new skill sets are needed, and maintenance standards will need to be revised thoroughly

An often overlooked or underestimated fact is that automation is foremost a major culture change in how a terminal operates. For an automation deployment to be successful, managing this culture change is more crucial than the technical implementation. The job profile of the workforce will be transformed, a new maintenance approach is required, IT and engineering operations will need to converge, and business processes will need to be mapped and planned more carefully than before. Whether creating a new automated terminal or converting a manual terminal to automated operation, change management is critical.

Eliminating human error is one of the main benefits of an automated system. The result is a marked improvement in workplace safety.

Benefits of automation

- Fully automated infrastructure can operate all day, every day and cut labour costs. The unmanned automated infrastructure can operate 24/7 in almost any weather conditions, ensuring smooth flow of cargo and significant cost savings.
- Unmanned operation cuts labour costs in the terminal. Machine hours are minimised by employing automatic shutdown, which reduces idle time costs to zero. Additionally, as automated operation does not require night-time lighting, energy savings in a 40-hectare terminal can be significant.
- Safety is always paramount in any terminal operation. Automated terminals provide significant improvements in occupational safety by keeping people out of the operating area of moving heavy machinery. Collisions and other accidents due to human error are eliminated
- The quay and yard cranes can be electric, which means zero emissions and no noise. The electricity can be generated locally by wind. The cranes also generate power on the downward cycle of the crane movement.
- Reduce and possibly eliminate strike action. On 16 August 2012, South Africa saw the most gruesome killing of workers post-apartheid in Marikana during the Lonmin mineworkers' illegal strike. Thirty-four mineworkers were gunned down by police in what will go down in history as the 'Marikana massacre'. Demonstrators were calling for salary hikes from about US\$ 500 (ZAR 4,000) to US\$ 1 500 (ZAR 12,500) among other grievances of better working and living conditions and lack of concern for workers by management (Dhliwayo 2012: 1).
- An automated terminal also requires less lighting in the yard, which decreases power consumption and reduces the environmental impact of operations

Disadvantage

- Unfortunately automation is dreadfully expensive. In order to justify such an investment, container throughput is key. It is difficult to estimate how much volume is needed to achieve an adequate return on investment for automated terminals around the world because operating conditions and labor costs vary, but in countries with higher labor costs, such as South Africa, a throughput of at least 1 million TEUs a year is required.
- Jobs will be reduced.
- Manual systems will work even if they are not in perfect condition, since human operators can usually compensate for the quirks and deficiencies of each individual piece of equipment. To deliver their full potential, automated equipment and the entire system always need to be in 100% working condition.

WILL AUTOMATION LINE UP WITH THE NDP? CONCLUSION

Automation provides new job opportunities, but also places additional demands on the workforce. There are very few prospects for growth in employment in the country in the near future as the World Bank has further lowered the economic growth estimates in 2012 from 3.1% to 2.5%. This is not good news for South Africa as the high unemployment rate may lead to civil unrest which will deter investment and further cripple the economy. South Africa has an unemployment crisis at hand that threatens to cripple the Rainbow Nation. The unemployment rate in the second quarter of 2012 was 24.9% with a labour absorption rate of 40.9%. No other middle-income country has such an unprecedented rate of unemployment (Dhliwayo 2012: 1). With the Eskom crises the electricity demand on automated infrastructure will be ridiculously high.

Labor savings cannot be denied as a number of longshore jobs are eliminated due to automation. The Port of Los Angeles released a study that said automation at the TraPac terminal will eventually reduce jobs by 40 to 50 percent (Mongelluzzo 2014: 1).

As warehouse workers have become operators of automated warehouses, and engine mechanics have become engineers who can calibrate integrated sensor systems, so will port workers need to become skilled professionals in South Africa with sophisticated automated systems.

The South African Government has been promising to create jobs since 1994 but the Government cannot sustainably provide jobs and this should not be its mandate. The implementation of the Growth, Employment and Redistribution (GEAR) strategy in 1999 failed to bear fruit in the labour market until 2003 when labour absorption began to increase but progress was deterred with the beginning of recession in late 2008 as job losses increased.



International Journal Of Engineering Sciences & Management Research

Instead, Government should focus on providing an environment that encourages entrepreneurship and job creation (Dhliwayo 2012: 1).

South Africa has an education system that has been heavily criticised for being below standards and a lack of skills development. In the 2012/2013 Global Competitiveness Report by the World Economic Forum, South Africa was ranked 140 out of 144 countries in the quality of educational system category. This has resulted in the creation of a large uncompetitive labour force that becomes structurally unemployed (Dhliwayo 2012: 1).

The long-term benefits of automation are clearly evident, but these benefits come with widespread changes that will need to be addressed in a comprehensive way. This article believes that automation is the answer to boost efficiencies at the port, however the present issues in South Africa like unemployment and education must first be addressed as automated operations require radically different skill sets compared to traditional terminals.

REFERENCES

1. Automated container terminals are taking off (online). (2015). Available: <http://new.abb.com/marine/generations/technology/automated-container-terminals-are-taking-off> (Accessed 06 July 2015).
2. Barnard, B. 2015 *APM Terminals to open first fully automated terminal in Rotterdam* (online). Available: http://www.joc.com/port-news/terminal-operators/apm-terminals/new-automated-rotterdam-container-terminal-shows-just-how-far-us-lags_20150502.html
3. Churchill, J. 2014 *Robots starting to run things in Rotterdam* (online). Available: <http://www.maersk.com/en/markets/2014/august/maasvlakte-ii-coming-alive>
4. Dhliwayo, R. 2012 *The rise and fall of trade unions in South Africa* (online). Available: http://www.consultancyafrica.com/index.php?option=com_content&view=article&id=1132:the-rise-or-fall-of-trade-unions-in-south-africa-the-marikana-incident-&catid=82:african-industry-a-business&Itemid=266 (Accessed 07 July 2015).
5. Mongelluzzo, B. 2014 *US ports weigh value of terminal automation investment* (online). Available: http://www.joc.com/port-news/port-productivity/us-ports-weigh-value-terminal-automation-investment_20141002.html
6. *Port of Durban* (online). (2014). Available: http://en.wikipedia.org/wiki/Port_of_Durban (Accessed 11 March 2014).
7. National Planning Commission. The presidency. 2012. *The National development plan 2030*. South Africa: National Planning Commission.
8. Sustainable terminal automation (online). (2015). Available: <http://port2060.kalmarglobal.com/sustainable-terminal-automation/>