Is the automating of port terminals the Holy Grail, or is a more delicate balance between people, process and technology wrapped in a layer of intelligence that elusive factor which will provide the next breakthrough in our industry?

Automation brings consistent levels of operation, increased safety and perennial levels of efficiency, yet it doesn't offer much opportunity to exceed the designed output. How then do we blend components of automation, people, operational equipment and pervasive technology in order to consistently outperform norms that are achievable with full automation? There is a fine line between putting a terminal at a competitive advantage, or at a total disadvantage.

The problem
The challenge for terminal operators employing little-to-no automation is the lack of consistency in performance, and as a result, decreased customer satisfaction. These inconsistencies are largely a result of a deviation from standard operating procedures, unplanned outages and limited operator skill. Furthermore, because terminal operators compete with one another, it is difficult to benchmark performance indicators across the industry because the required information such as business models, long term strategic plans and cost structures are largely kept confidential.

Customers expect faster and more reliable services, full traceability of goods, online access to information and accurate billing information. They are also interested in the effort terminals are making towards ‘greening’ their environment to ensure future sustainability while accommodating ever-increasing vessel size demands.

The overarching requirement is a consistent level of performance, customers want to know definitively that vessels will be worked according to plan, whatever that plan is, in order for them to offer a reliable service to their customers. In addition, the safety of terminal operators can’t be compromised in any way, a balance between productivity and safety is a significant requirement. This is achievable by creating an intelligent port.

IntelliPort
According to a study completed by Yunjian and Xiong in 2012, entitled ‘Basic Functional Modules of the Intelligent Port: Study on Intelligent Port under the Construction of Smart City’, the basic functional modules of an intelligent port include:

- Customer service
- Production management
- Operation management
- Electronic commerce
- Transportation management
- Port resources
- Port management

In addition to these, and to make the solution more applicable to terminal operations, Transnet Port Terminals (TPT) has included an Internet of Things (IoT) functional module. The purpose of this module will be to gather information about operating equipment in a terminal and to provide data exchange with systems of record to create a real time foundation for real time decision making to enhance performance and increase efficiency.

IntelliPort will combine technology, applications, software, tools, equipment, energy and people to seamlessly execute its duties.

The solution
At the core of the solution is the ‘Systems of Record / Operations’ layer. This layer is the most critical component of the solution, and seeks to exploit operational systems and equipment to their fullest extent. Full integration and communication between all components in the core is the keystone to success.

TPT currently employs best of breed systems for all of its business processes. In order to achieve the best functionality from these systems we have devised a strategic roadmap that will increase the utilisation of functionality that is currently available, and
includes amongst other things, an upgrade from Navis v2.3 to v2.6. The technology and networks employed to host the systems of record will be configured in an active-active manner to ensure seamless failover in the event of failure of any single node.

In addition to world-class systems of record, the terminal operating equipment should have embedded sensors in order to connect to a terminal network. All quayside operating equipment is currently either factory fitted with sensors to gather and transmit information about itself, or is in the process of being custom fitted to ensure the capability. This includes information such as lifts performed and distance travelled, maintenance status, breakdowns, and driver behavior patterns. Linking the information collected with real time location detection means a business can exactly what is going on at any given time. Therefore it can be more effective in day-to-day operations and facilitate timely action in the event of unplanned outages.

Integration between the systems of record and the operating equipment will provide the required level of 'informatisation' and the mechanism to remove the current perceived disconnect between systems and business operations. Informatisation will increase efficiency in the yard and berth operations and improve equipment utilisation. Information obtained in real time will provide the inputs to generate better operational instructions to improve efficiency and quality of customer service.

More significant is the plan to wrap the basic functional modules, systems of record and operational equipment information in a layer of intelligence that can be integrated into 'Smart Port', 'Smart City' and 'Smart Road and Rail' solutions, making the entire supply chain more efficient and reliable. This can be achieved with cooperation between participants from each segment of
About the author

Deirdre Ackermann is General Manager: Enterprise Information Management Systems, Innovation, Sustainability, Continuous Improvement and Change Management at Transnet Port Terminals, head-quartered in Durban South Africa. Currently her team are working on an integrated strategy that will facilitate components of an intelligent, predictive port terminal, named IntelliPort. The use of alternative/renewable power sources features highly on her priority list.

About the organisation

Transnet Port Terminals is one of five operating divisions of Transnet SOC Limited, South Africa’s state-owned freight transport and handling company. TPT is responsible for commercial handling services of sea-route freight across imports, exports and transhipments in containers, bulk, break-bulk and automotive. TPT operates terminals in seven South African commercial ports, namely Richards Bay, Durban, East London, Port Elizabeth, Ngqura, Cape Town and Saldanha. Operations cover import and export operations across the following cargo sectors: containers, mineral bulk and agricultural bulk, and Ro-Ro.

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the supply chain once there is a common understanding of challenges and problems and a united goal on how to use technology to address the issues.

The results of intellectualising TPT’s operations includes expanding the value added service range, determining appropriate pricing structures and the ability to develop more innovative service models. There is also a requirement to synchronise multiple actors by providing real time feedback in order to better coordinate efforts. In order to cater for the level of complexity, a framework has been developed in order to achieve intellectualisation that includes:

- The Acquisition Layer: points of collection of data such as wireless access points, camera, bar code readers, wireless sensor networks, RFID and big data collected from the operational IoT
- The Network Layer: communications networks, intranet, internet, management centres, operations centres and information centres
- The Business Layer: customer service systems, ERP systems, terminal operating systems, port planning systems, berth planning systems, traffic management systems and business intelligence systems
- The Presentation Layer: command centres, terminal hotline, terminal devices, mobile equipment, laptops, tablets and desk top computers

Once a level of intellectualisation has been achieved, artificial intelligence and self-learning algorithms can be applied in order to better identify bottlenecks and operational inefficiencies, thereby offering resolution scenarios in real time with accurate data models. The TPT Central Heterogeneous Artificial Port Intelligence (C.H.A.P-I) system will offer real time recommendations to berthing, planning, landside operations, manpower and quayside equipment in order to ensure levels of performance consistently achieve better than expected outputs.