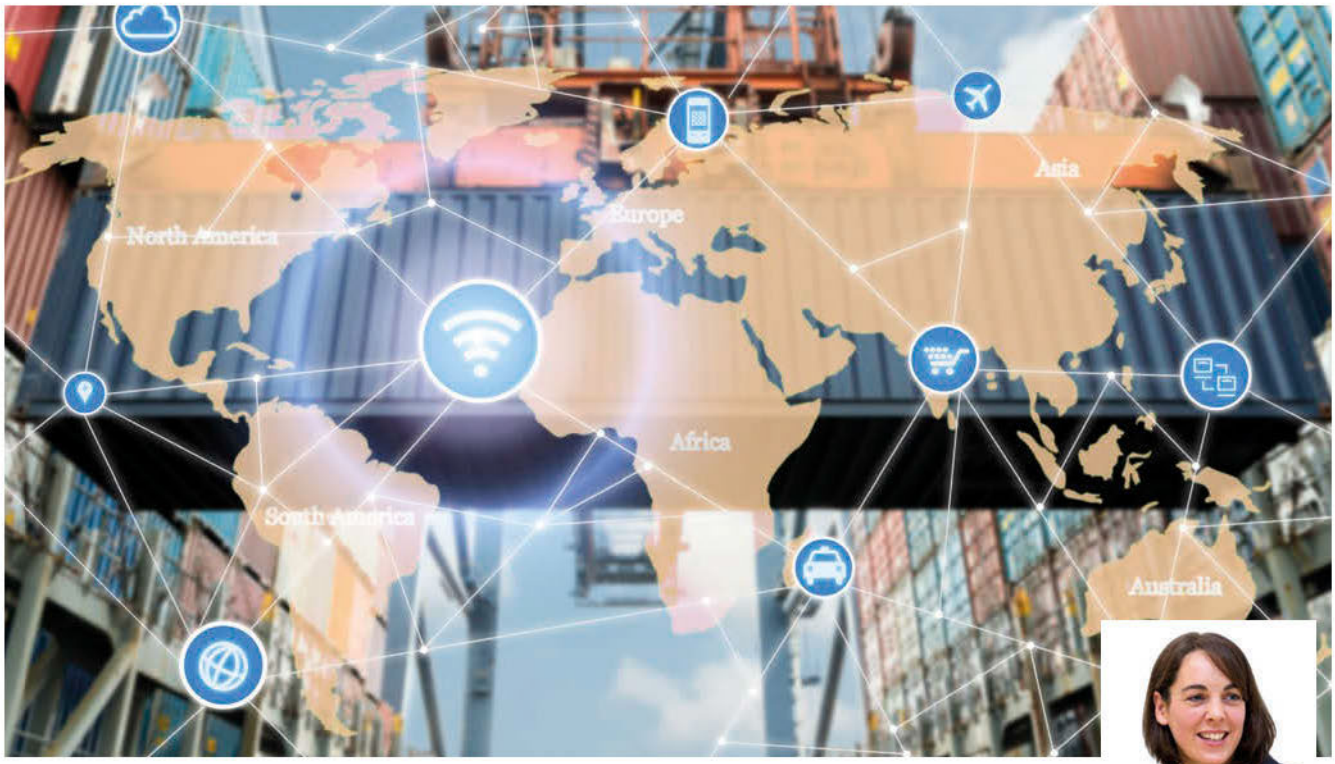


BUILDING SMART PORTS

THROUGH MANY SMALL STEPS

Nicola Clay, Smart Ports & Business Development Director, Royal HaskoningDHV, London, UK

Smart ports is a topical theme in the maritime industry as ports, terminals, shipping and the logistics chain seek to understand and take advantages of technology to improve the productivity of all aspects of their businesses. As one of the world's leading maritime consultancies, we've seen momentum building and minds awaken to the gravity of what smart solutions can provide and how they can change our industry, as well as the world itself.

The contemporary ports and terminals sector is a technology spectrum, we see highly automated terminals to extremely traditional ports with limited IT systems and manual/paper based processes. Yet all ports and terminals are operating within the context of the global trends of digitalization, electrification and automation whilst trying to achieve the required short-term return on investment.

The concept of 'Smart Ports' is immense and could feel overwhelming to many operating in the relatively traditional maritime sector. Most businesses will not be able to make the investment from their status quo to a smart port overnight – instead they are likely to make many smaller steps that come together to create a unique application of a smart port in each location. Other industries, for example transport, aviation, and mining, have already started to embrace technology and ports will be able to draw upon the experience from these sectors.

GENERATING VALUE FROM DATA

With the wide range of devices connected via the internet, and the large amount of data that can be collected, it is becoming increasingly important that the value extracted from the collected data is maximized. The more value that can be extracted from data, the more efficiently and economical the operations associated with that data can be carried out. By maximising the value of data ports and terminals can continue to be more competitive.

SMART OPERATIONS

Many port assets were planned and built a long time ago and this puts limitations on vessel sizes that can be accommodated. While berthing may be possible, it is under restricted conditions only. For example, modern smart operations allow the combining of state-of-the-art mooring knowledge with information on the assets and the weather forecast to allow port operators to schedule vessel calls and associated services much more efficiently.

SMART DESIGN

Today's ports operate in a competitive environment where security, safety, efficiency and sustainability are vital for operational excellence and profitability. These areas are key priorities for all ports and an area where technology plays a key role. New and existing ports can be designed to utilise the latest technological advances to support these goals. We believe it's imperative to create data, voice and security networks that are connected to control, safety and security systems within ports. With these most advanced systems all communicating with each other the operational, maintenance and security teams have full port visibility.

Furthermore, tablets connecting to the site wide Wi-Fi provides remote site status, equipment monitoring, alarms and notifications. By connecting the tablets to

the site, Wi-Fi enables the tablets to be linked to the company intranet to be able to download the latest operation manuals.

SMART ASSET MANAGEMENT

The importance of regular maintenance of infrastructure is often overlooked by port operators. This may be due to budgetary constraints, or due to the owner of the asset not being aware that maintenance is needed. If regular maintenance is not carried out, the asset may need to be prematurely replaced or reconstructed, often incurring a significant cost (also in terms of the operational implications). Technologies that provide a better indication of the health of a structure, or ways in which maintenance requirements can be reduced, will result in reduced operational costs. Technologies that allow for remote monitoring of assets will lead to improved safety, improved operability, and reduced costs.

Lock and dock gates in some ports can have a life span of many decades – these gates are critical assets for a port and failure of such gates would have significant implications for the operation of the port. This presents challenges for monitoring and maintenance of the gates. By being 'smart', port engineering managers (PEM) can use technology to gain greater knowledge about the day to day operation of their gates. For example, by installing automated sensors that collect data remotely, it is possible to measure the actual loading on the gates. This data allows an understanding about what factors are affecting the gate. A solid defence against operational dysfunction are sensors that monitor how the gate performs against expected norms, with an automated system that reports trends and abnormalities. Systems can detect:

- Obstructions in the gate
- Geometrical misalignment
- Vessel impact

Further, a visualisation tool (including a 3D digital model) allows a PEM to see, in real time, the loading on key elements and understand whether they are within acceptable limits.

SMART OPERATIONS: ENERGY MANAGEMENT

Fluctuating energy costs and the need to continually maintain a competitive edge in a rapidly changing economic environment represent challenges for port operators. In addition, the port sector is subjected to a range of environmental legislation both domestically and internationally as it faces increased pressure to reduce pollutant emissions and improve air quality.

SHORE POWER

The ability to connect vessels when alongside to a shore-side electricity supply allows auxiliary generators to be switched off. The benefits of this include energy savings; improved air quality through reduced pollutant emissions; reduction in noise and vibration (leading to improved living conditions for employees and local residents); reduced generator maintenance costs and extended plant lifetimes.

Shore power is nearly always technically feasible – the exception being zones with an explosion risk. However, taken on its own, it will be extremely difficult for shore power to be considered as economically feasible. The economics of installing the shore power system cannot be competitive with the existing diesel power arrangements as the reduced costs of the electricity will not cover the infrastructure costs in a reasonable timescale.

Assuming shore power doesn't become obligatory (through regulatory or another driver) there are other opportunities to demonstrate a wider economic feasibility case:

- Quantify social and environmental benefits, for example: reduced cost of healthcare due to less emission of particles.

Components of Smart Ports

Security systems are crucial for all ports

Using sensors to monitor mitre gates

Assessing the potential for shore power in Port of Mombasa

- Include consequential profits in the economic analysis, for example the revenues from a site close to the port that can be used for housing due to shore power being provided.
- Commercial benefits that can be achieved when a port shows that they care about environment and climate. If renewable power generation is combined with shore power this becomes even more relevant.

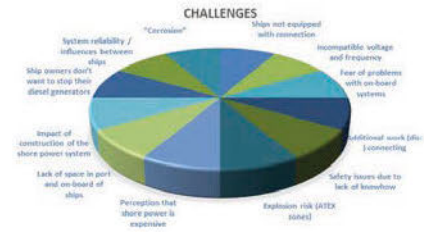
These economic benefits cannot always be quantified objectively. This makes the use of these benefits in business cases complicated. However, as the pressure on emissions and heavy energy usage continues and legislation evolves to meet the requirements of society, shore power must surely form a part of future energy management solutions in smart ports. As previously discussed, solutions in each port will take different forms, for example shore power for smaller vessels, shore power combined with energy storage or renewable energy sources or in publicly funded projects shore power to deliver wider community benefits.

RTG EFFICIENCY ASSESSOR TOOL

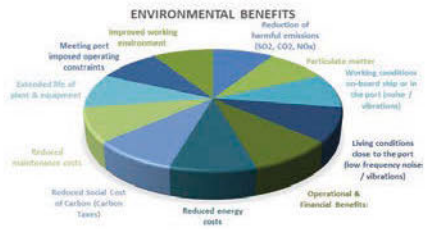
Continuing the theme of multiple small steps to deliver a smart port there is the opportunity to manage the energy and emissions of individual pieces of port equipment. As an example, Royal HaskoningDHV has focused on developing an integrated computational model that quantifies energy consumption and greenhouse gas emissions during the use of RTG (rubber tyred gantry) cranes.

Annually, a vast fleet of RTG cranes handles hundreds of millions of containers in sea ports around the world. Most RTGs are powered by large displacement diesel generators, expending a huge amount of energy as they move containers around the port 24 hours a day, seven days a week. The cranes lose energy when lowering containers and this energy is converted to heat and wasted as the containers are laid down – energy which could be captured and re-used when the next container is lifted. RTG cranes are a contributor to maritime port emissions and port operators are facing increasing pressure from regulators, clients and the surrounding community to reduce their impact on climate change and local air quality. Add to this the potential impact of high fuel prices, and it's no surprise that container terminals are keen to develop cost-effective solutions to reducing the impact which RTG cranes have on their operations.

The energy use and losses of RTGs can be reduced through measures such as RTG electrification (e.g. cable reel, bus bar), energy harvesting, storage and reuse (e.g. flywheel, supercapacitor or battery), or RTG genset downsizing. This provides tangible improvements in energy efficiency. Typically, this can be in the region of 40-60% in fuel savings, with a consequent reduction in emissions (greenhouse gases, SOx, NOx and particulate matter).



Challenges related to shore power



Environmental benefits when using shore power

RTG Efficiency Assessor Tool being used in Port of Valencia

WHAT'S THE NEXT 'SMART' STEP?

Developing a smart port is all about knowledge and understanding. The managers of individual ports and terminals are at the centre of a fast-moving community of technology manufacturers, start-ups, researchers and more, each with the objective to sell their own products or services.

At the port manager's side are the consultants with whom they have long standing relationships, independent of product or technology. Far from being pushed out of the smart port circle, consultancies have a hugely important role to advise forward-thinking ports.

Developing smart ports will empower port operators to gain greater insight into how their equipment works, how their infrastructure assets perform and deteriorate, as well as how data and technology can help with fine tuning performance and forecasting how external factors affect efficiency.

ABOUT THE AUTHOR

Nicola Clay is Smart Ports & Business Development Director at Royal HaskoningDHV leading the development of digital services to enhance the efficiency and productivity of ports for our maritime clients. She is also responsible for providing strategic knowledge and direction about market sectors and clients for our UK business as well as acting as Project Director or Technical Director on port and maritime projects.

ABOUT THE ORGANIZATION

Royal HaskoningDHV is an independent, international engineering consultancy providing services for the entire living environment. Our work contributes to the sustainable development of the communities we work in all over the world. We believe meaningful solutions cannot be created without collaboration with our partners, clients and other stakeholders. We enhance society together.

ENQUIRIES

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