Ports must continually invest in infrastructure and efficient equipment to remain competitive. The largest ports in particular have made substantial upgrades to serve mega-vessels, for example triple-e vessels carrying more than 18,000 TEUs. Port container terminals have been transformed into mega-terminals capable of handling more than 3.5 million TEUs per year.

In parallel, mega-terminals have increased port resources for serving ships and enlarged their capacity to manage their hinterland transport. Mega-terminals are highly concentrated in the Far East – North Europe routes, mainly involving China, Singapore, South Korea, UAE and the Netherlands-Germany ports.

In order for mega-terminals to berth 18,000 TEU vessels, quay draught must be at least 18 meters, container yards must be enlarged, and other critical infrastructure investments must be made. The development of mega-terminals is thus directly linked to, although not only linked to, an increase in trade tonnage and the size of vessels. The economics of operating a mega-vessel requires mega-terminals to manage their resources in a way that allows immediately berthing these vessels on arrival at the harbor and minimizing their stay within the port.

These capital investments should be at the forefront of the agenda when a port is making the decision to maximize its efficiency and competitiveness. Many other operations need to be synchronized in order to optimize the length of a vessel’s port stay and minimize the costs to operators of mega-vessels.

CHALLENGES

Obviously, more resources are required to manage and operate a mega-terminal compared to a regular terminal. This is a great opportunity to use digital technology to facilitate the increased need for coordination and optimization and to reach the necessary levels in a sustainable way.

There are usually approximately 25 unique actors involved in a port call, and no system is better than its weakest link. Even though heavy investments are made to ensure higher capacity and efficiency of terminals – both in physical and digital infrastructure – it will not be enough if just terminal operations are made efficient, involving all operations throughout the port call process, from a vessel approaching through to its leaving.
VTS, NAVIGATION, MOORING AND BERTHING

has been established. New initiatives including the ports of Gothenburg, Valencia, Barcelona, Cyprus, and
validated throughout 13 European ports, Collaborative Decision Making (PortCDM), project, which runs from 2015-2018, Port
Empowered by the STM validation pressuring ports to acknowledge TTT as a
Total Turnaround Time (TTT) for port calls,
or are in the process of, projects to reduce
asset intensive mega-vessels. In fact, major
ensure fast turn-arounds, particularly for
industry is likely to favor ports who can
visit could be reduced by as little as 30
minutes. Thus, it is not surprising that the
economies if the total turn-around for a port
visit could be reduced by as little as 30
minutes. Thus, it is not surprising that the
industry is likely to favor ports who can
ensure fast turn-arounds, particularly for
asset intensive mega-vessels. In fact, major
shipping lines have already implemented,
or are in the process of, projects to reduce
Total Turnaround Time (TTT) for port calls,
presuring ports to acknowledge TTT as a
Key Performance Indicator (KPI).

THE SOLUTION
Empowered by the STM validation project, which runs from 2015-2018, Port Collaborative Decision Making (PortCDM),
software is being demonstrated and validated throughout 13 European ports, including the ports of Gothenburg, Valencia, Barcelona, Cyprus, and
Stavanger, with promising results.

To cater for maintaining the concept of PortCDM, an international PortCDM council has been established. New initiatives
are now being taken by different actors
associated with maritime operations and
service provisions to adopt PortCDM and
thereby building on principles that
take the maritime sector towards adoption of
inter-operable standardizations across
the self-organized ecosystem of maritime
operations.

The PortCDM solution is one of several
concepts of Sea Traffic Management (STM) catering for connectivity within
and between ports, ships, and between
ports and hinterland operators. Digital connectivity is the key to sustainable
multimodal transport systems.

The PortCDM approach allows involved
actors to share real-time information about
coordination points in a standardized
format.

The overall goal with PortCDM is to
enhance predictability for core operations
in the port call process providing vast
benefits for involved stakeholders. This
is driven by two sets of demands 1) contemporary demands by shipping lines,
the customers of the port and the terminal,
to shorten TTT and to perform just-in-
time operations, and 2) contemporary
demands from involved actors to be
co-ordinate and optimize their activities
related to a vessel’s
visits. For instance, from a terminal’s
point of view, it is essential to know
precisely when terminal operations for a
ship can be started and when the quay
will be available for the next incoming
ship. Terminals both rely on conditions provided
by others and determine conditions for
others’ operations, shown in Figure 1.
The concept of PortCDM acknowledges
six KPIS; Duration time, waiting time, berth productivity, capacity utilization,
predictability, and punctuality. These are
derived from time stamp data exchanges
for a particular port call shared by
machine-to-machine interaction between
different systems using the payload format
of a time stamp data standard. Time stamp
data consists of a time type, i.e., estimate,
actual, recommended or targeted, and this
data is combined with one or more data
points regarding the status of a resource,
such as its location, service provided,
or administrative procedure completed.
An example of a location time stamp is an ETA_Vessel_Berth, and an example
of a service time stamp is an ETA_cargo
operations_commmenced.

The progress of a port call process can
be described by a set of related states that
are designed to achieve execution of the
port call process, see Figure 2.

At the core of the port call process is
the vessel making a visit for a particular
purpose. PortCDM is based on several
approaches to enhance precision in time
stamps, for example combining multiple
data sources.

High precision in time stamps provides
better planning horizons for approaches
to be served. This is all part of the
emerging field of maritime informatics.
Digitization of port operations and
digitized connectivity among all actors will
create gigabytes of data. The exploitation
of these data, particularly with regard to
the mega-components of shipping, is a
foundation for improved port and vessel
efficiency with sustainable ecological
and economic improvements as well as
enhanced transparency for cargo owners.
The mega-terminal will become a gigabyte
foundry.

THE GIGA FUTURE
There is a need for mega-terminals to fully
digitize their assets so that each resource
emits a time stamped digital data stream.
The real-time merging and processing

Figure 1: Terminal operations and navigational operations in context
of these data streams by advanced data analytics tools and machine learning applications is the solution to handling the complexity of the new mega-vessel environment and generate greater port handling efficiencies.

A new level of situational awareness for all actors is possible in the digital data streaming era. It can support look-ahead situational awareness to explore likely port operations in the immediate future, and it can support look-back situational awareness to learn how to improve operations and identify lessons hidden in historic data. Most importantly, it enables "look-now" situational awareness to optimize ongoing activities. Gigabytes make for mega-efficiency.

ABOUT THE AUTHORS

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ABOUT THE ORGANISATIONS

RISE Viktoria in Sweden is a non-profit research institute, part of RISE, enabling sustainable mobility by use of digital technologies. The aim is to contribute to a worldwide development that takes care of the great challenges for the automotive and transport sector organized in five application areas; Cooperative systems, Digitalization strategy, Electromobility, Sustainable business, and Sustainable Transports.

The Valenciaport Foundation for Research, Promotion and Commercial Studies of the Valencian region (Valenciaport Foundation) is a non-profit private entity and an initiative of the Port Authority of Valencia, in collaboration with various other organisations. It further expands the reach of the logistics-ports community by serving as a research, training and cooperation centre of excellence.

ENQUIRIES

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