

The future of marine terminal software

Richard Butcher, Group Marketing and Sales Director, IMS Ltd, Southampton, UK

Current market conditions

The container shipping sector has again entered unsettled times. With the world economy still in a state of flux, financial pressures are being exerted across the shipping and transportation chain. All players are looking to squeeze additional revenue and reduce operational costs.

The global carriers are seeking consolidation and economies of scale with the reduction of services, as well as moth-balling smaller vessels and looking at increased capacities for larger vessels, along with more fuel efficient engines and designs to offer some relief against the harsh market forces.

The carriers, along with all the other elements of the transportation supply chain, will be seeking areas to improve and reduce operational costs and drive efficiencies. This is where they start to turn towards newer technology to help achieve these goals.

Container terminals

The current conditions have also taken their toll on the container terminals that serve these carrier groups; they have to become ultra – efficient in order to achieve greater financial returns. Many are facing the challenges imposed by the introduction of the mega container ships: the new 12,000, 14,000 and even 18,000 TEU goliaths (ULCC) that are beginning to call their facilities.

These vessels bring challenges for the operational and planning teams: to ensure that every aspect of the port call is optimized in order to maintain the agreed service levels that their carrier principals have come to expect.

Terminals are becoming even more dependent on newer technology and although many might have sufficient solutions that cope with the cargo volumes of today, it is certain that world trade will again start to recover during the next several years. It is now that marine terminal executives should be evaluating their current and future technology requirements.

With restrictions on land usage, environmental issues and the sheer capital costs involved in expanding marine facilities, it is sometimes just not feasible for terminals to further expand the facilities they operate. Thus the pressure will be on delivering greater volume throughputs with the terminal space available. This is where the next generation software will play a critical role in the future profitability of the container terminals.

Current solutions

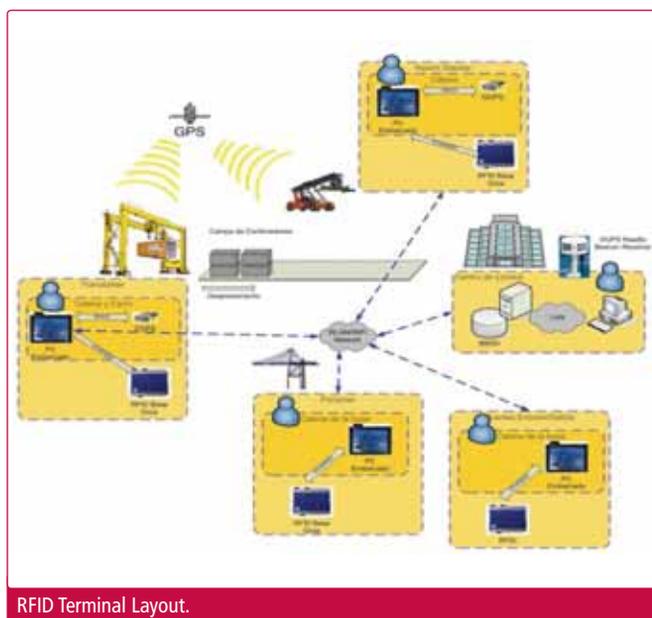
Marine terminals today are running a mixture of technological solutions, either developed internally or sourced from one of the current terminal operating software vendors. These solutions normally embrace four main elements:

1. Operations applications
2. Terminal planning
3. Gate control
4. Financial accounting

1. Operations applications

These core solutions manage the following aspects:

- Commercial contracts
- Import documentation
- Export documentation



- Gate control
- Booking and reservation systems (trucks/mother vessels/trains/feeder ships)
- Customs interface
- Electronic data interchange (EDI)
- Human resource aspects
- Equipment management (terminals handling equipment)
- Financial processing (collating all the data pertaining to expenses and feeding into a third party financial solution)
- Cargo claims/damage reports

2. Terminal planning

- Graphical view of the terminal facility
- Export stacks
- Import stacks
- Damaged stacks
- Reefer equipment
- Yard buildings (offices and workshops)
- Gates
- Quayside layout

Within the terminal planning application, certain leading players have incorporated:

- Yard optimization
- Equipment optimization
- Vessel scheduling/berth allocation

3. Gate control

- Inbound control – RFID and automated gates
- Security scanning and inspection areas
- Camera capture

4. Financial accounting

- Accounts payable
- Account receivable
- General ledger
- Financial reporting

} These tend to be ORACLE or SAP financial applications

Who currently leads the way?

When looking at these current core applications, there are really only a handful of skilled solution providers that can deliver quality solutions that have been exposed to the markets. These providers tend to come from America, with market leaders such as NAVIS. Asia also offers skilled providers, such as TSB (Total Soft Bank) and HIT with their N.GEN solutions. Europe has seen the likes of COSMOS in Belgium making a revival.

These groups tend to cater for the larger global market operators with multiple facilities and a demand for leading and cutting edge applications. They also tend to carry a high price premium.

Other second tier players are making market inroads, with Tideworks, Jade and Autostore all looking at delivering the viable cost effective applications to mid-sized terminals. Of course there are a number of other groups that have developed terminal solutions and also terminals that have developed in-house applications.

In order to achieve greater productivity within the existing terminals framework, greater emphasis must also be given towards improving the following:

- Documentation processing
- Inbound and outbound gate moves
- Better resource planning (labour and equipment)
- Yard congestion

The future of technology requirements

Keeping up with technology and looking at delivering continual cutting edge applications is paramount with both the development companies and operators that strive to achieve greater productivity whilst driving higher financial returns.

The next generation applications will indeed be focused on these areas and the IMS believes that the following solutions will make more of an impact during the next three to five years:

- Advanced revenue management engines
- Forecasting tools
- Optimization engines
- Four-dimensional graphical planning
- Integrated maintenance applications
- KPI and full dashboard monitoring solutions
- Greater utilization of RFID and real-time performance monitoring
- Resource planning applications
- SAAS deployed cloud technology

Advanced revenue management

Contract levels and margins are being squeezed and the carriers of today are looking for the following: lower rates and higher service levels, with fewer delays and quicker turn-around of vessels.

The ability to analyse the contract value and to measure the contribution levels of the carriers is paramount, as is the way in which revenue is generated. Transportation operators in other industries have been using various forms of contribution analysis models, but few have adopted full blown revenue management.

For a terminal it would be very useful to adopt the utilization space method and look to capture salient data such as:

- Service agreement levels
- Associated contribution on every container processed and handled

- Measuring fixed and variable costs against the TEU revenues and volumes
- Analysis of the various cargo mixes and revenue potential against space capacity within a terminal
- Measuring a slot value – these are associated with the stacks found in the yard. Every slot will be tied to a numerical value and these can be measured against the service contracts
- Pricing models will help analysis of the usage of yard space and allow for tighter control on space allocation
- Peak and seasonal pricing can be monitored

The data provided will help the commercial teams better negotiate contracts and have a much clearer grasp on the value of each carrier agreement they commit to.

At the heart of these revenue management solutions lies a powerful mathematical engine that can process the complex algorithms necessary to produce the information. There are a number of companies that have developed these powerful revenue management solutions, including cutting edge provider, the Dutch ORTEC group.

Forecasting engines

Today's container terminals do a fair bit of forecasting to evaluate a number of factors. These include:

- Vessel calls
- Berthing allocation
- Equipment requirements
- Staffing levels.

Mapping out the container optimizations

Much of these are done manually, or through the use of Microsoft Excel spreadsheets, and not many terminals have yet deployed the really sophisticated optimization engines. Some of the existing TOS providers have some aspects incorporated into their planning tools, but these do not have the complex mathematical engines that are found in specific solutions, such as those designed by leading players, such as ORTEC and QUINTIQ. Both of those solution providers have developed advanced algorithm engines.

The advantages of deploying these mathematically enhanced engines will allow the terminal operational teams to better prepare for vessels and help with the measuring every aspect of the containers being handled, received or shipped out, whilst also measuring the physical yard capacities.

Having resources capable of these mathematical tasks will help improve productivity and will be able to offer a more exact science of container through-puts, whilst also making certain that containers are handled in the most effective manner. These forecasting engines will also be responsible for capturing and measuring data projections and will allow terminal managers to feed into the solution a number of 'what if' scenarios. This data will provide the necessary flows for calculations and predictions on what type of resources and equipment and space will be required during a fixed or variable time frame. Much of this data capture can be fed into the four-dimensional modelling tools.

Four-dimensional planning tools

Optimal yard planning is structured around the physical constraints and looking at the way in which a yard is arranged. Of course, with established container yards, the restrictions are governed by the original layout. However, with advanced planning and graphical tools it is possible to make assessments of these yards constraints and measure what differences could be achieved through restructuring yards stacks, layouts, gates and buildings. These solutions need to be able to configure full three-dimensional terminal layouts. These types of visual and graphical planning tools are excellent for operators that are looking at the

best potential layout for a Greenfield site.

The new fourth dimension comes into play when mapping the physical data involved with growth projections of a terminal. The metrics need to be pulled from the terminals forecasting modules. This type of data would look at the projected growth patterns and what impacts would be as TEU throughput increases – it will need to also be linked to the KPI and Management Information Modules. Data such as:-

- Vessel calls
- Vessel capacities
- Current TEU volumes
- TEU volumes projected by the carriers (year on year growth)
- Stack capacities
- Gate moves
- Equipment availability
- Equipment productivity per hour
- Labor productivity

These along with regional and global economic data must be captured and analysed, thus providing terminal management with almost a 'crystal ball' solution on what potential volumes might be during a normal 25 year contract life.

This data would form the fourth dimension and projects a full graphical depiction of the terminal during the phases of its contract life. It can also demonstrate and graphically depict what the terminal used to be against what it might be in the future.

The ultimate goal will be that any new Greenfield terminal site can have the visibility of growth and see when new phases or capital investment will be required, be it for more infrastructure or handling equipment.

Integrated maintenance applications

Much focus has been given by the operators of terminals towards terminal planning and operational aspects of the business. However, it is vital for the operating machinery to be fully functioning, serviced and in prime condition to meet the demands and be able to achieve the set key performance indicators (KPIs) set by the terminals management. It comes down to the engineering department to work on the scheduled maintenance and inventory control for spare parts and consumable items.

Many of today's leading manufacturers of quay cranes, straddle carriers, RTGs, yard hustlers, front loaders, top loaders and forklift trucks all provide service manuals. These are either electronic or book format and provide critical data on the maintenance schedules that are required.

Integrated maintenance applications include:

- MES
- HYSTER
- KALMAR
- LIEBHERR
- ZPMC
- MI-JACK
- NOELL
- HYUNDAI

What seems to be lacking is an automated interface between maintenance and service schedules and operational solutions. Although many terminals are covering this very well, most are using various forms of spreadsheet data and working on maintenance programs outlined by the manufacturers.

What needs to be monitored is the overall equipment demand and this is where links to the advanced forecasting and optimization solutions will come into play.

Increased container throughputs will increase wear and hours of machines. This will create demand for more frequent inspections and services. The additional loads will also shorten the life expectancy of the machines, so it will be important to factor in the life expectancy of the equipment against the potential terminal growth.

Allowing terminal operators more time in selecting new equipment for the terminals, data should also be measured and compared as to the durability of the equipment and overall maintenance costs over the life of the equipment. If a terminal is part of a group then this data should be accessed across the group so that comparable equipment can be assessed or alternative manufacturer's data can be compared and cross-referenced, therefore allowing the terminals to select the best piece of equipment or look at potential manufacturing issues and warranty claims.

In the area of consumables, demand for components will need to be linked to current stock, and an analysis of when an order is required will be needed to avoid holdings lots of expensive spares and consumables, and so achieve minimal stock levels.

The other factor that is critical in terms of engineering is to achieve greater cost savings at a consumer level. Tyres are one of the most expensive elements that a terminal will have to purchase from a consumer point of view (after diesel and/or bio-fuels). A medium to large container terminal can spend upwards of \$4.5 to \$5 million a year on tyres. New advanced products such as the enTIRE application from VMC can help track the life cycle of a tyre, as well as analysing and monitoring every aspect of the tyre, leading to savings of between 10 to 30 percent, which can equate to \$500,000 to \$1.5 million over a 12 to 36 month period.

Market leaders VMC have designed a unique asset tracking software for the use of tyres on any moving equipment. 30 percent savings have been achieved through its deployment.

Photos courtesy: VMC Australia

It's this type of cutting edge solution that will help achieve greater productivity, reduce operational costs and achieve a longer lifetime from the current equipment.

Analysis of operations

As touched upon earlier in this article, the demand to have an accurate Business Intelligence and Management Information System is paramount. It allows the terminal managers to monitor operations. At every stage, KPIs will help measure how containers, equipment and human resources flow. Below are some of the key areas where these new solutions can help improve overall productivity:

Yard inventory performance analysis Interactive visual models allow executives to understand container movement impact analysis by container size. It will provide an analysis of blockage, in terms of how many containers are not moved in last seven to ten days. It will analyse containers entered into the yard and exited from the yard by rail or road. It will also examine of how many containers has been moved from the community and the yard, as well as vessel.

Quay crane analysis This will allow executives to understand about the quay crane productivity. It will give an analysis on load, unload and total performance ratio of quay crane in the last hour, quay crane productivity in last 24 hours, quay crane container movement in the last hour (20 footer, 40 footer, empty and full containers) and quay crane movement analysis (load, unload and total movement).

Truck turnaround time analysis This visual model allows executives to understand the collective truck turnaround time of trucks by gate, by truck, by container and container size. Executives can further analyse truck results by comparing their 12 months truck turnaround time by their container type and size. It will also give analysis of average truck turnaround time of gate to equipment, equipment to gate and gate truck turnaround time with in-time and out-time of a truck.

Vessel productivity analysis This will provide an executive with data to understand vessel productivity analysis, including an hourly comparison of container movement, and analysis on container arrival ratios. It will also give the hourly comparison of equipment performance analysis of the last five hours and analyse daily productivity of vessels. It will also give the daily analysis of how many vessels arrived and how many vessels discharged and quay crane productivity of vessels in one day.

The point of a marine terminal operations enterprise dashboard is to allow the marine terminal management to monitor yard operations in real-time and to alert them to conditions outside of normal boundaries. Marine terminal operations fall into three main areas of focus, in terms of production management:

- Crane operations from/to vessel and train/truck
- Yard production of container stacks
- Container parking and rail cars, and gate operations involving entry and departure into the terminal

These dashboards help operational users avoid congestion, such as lines of trucks awaiting access to terminals. Some examples of marine terminal KPIs are:

- Container gate moves
- Average turn time for trucks
- Yard inventory of containers
- Outbound trucks still on terminal over an hour

In the case of business intelligence, multiple databases and multiple applications can be connected to give a single unified vision of enterprise-wide data, which offers benefits such as time saving, accuracy, authenticity of report, labor saving and much

more. Business intelligence turns enterprise-wide data into actionable information. It helps monitor, measure and analyse the health and performance of terminal operations.

The main point, obviously, is that time equals money.

Users of business intelligence could be:

- Shift managers
- Gate managers
- Maintenance heads
- Finance users
- Commercial managers
- Department heads

Functional areas that can be targeted with business intelligence include:

- Operations
- Railway movement
- Internal and external truck movement
- RTG movement
- Quay crane movement
- Berth productivity
- Ship production
- Shift production

Commercial areas to target with business intelligence are:

- Service revenue
- Service, line and voyage productivity

Claims and contracts areas are:

- Vendor data analysis and comparison
- Claims for accidents and near misses
- Third party as well as own claim tracking

Financial areas are:

- Profit and loss analysis
- Outstanding receivables/payables
- Customer/vendor ageing
- Balance sheet comparisons and analysis
- Budget versus actual, and monitoring
- HR – head count reports
- Attrition rate
- Blue/white collar analysis

Cranes are the bread and butter of the terminal freight service industry. So reports like these should be provided by the Management and Information Systems solutions:

- Gross/net crane rate
- Crane idle hours
- Avoidable/unavoidable delay
- Scheduled/un-scheduled crane maintenance.

The following are some of the KPIs that should be tracked by the terminal management and continually measured to maintain service and quality levels.

Port terminal performance

KPIs are very important for Port managers in providing direction for business. The following parameters may help with an overall analysis of business if compared against 'actual', 'forecast' and 'variance' on a monthly or quarterly basis.

- Headcount – white/blue collar/total
- Hectare
- Total slots available (80 percent of maximum)



Courtesy: KPI Monitoring

- Quay (Wharf) length in meters
- Number of quay cranes
- Number of material handling cranes
- RTG or straddle carriers
- Number of RMGC
- TEU per hectare/quay meter/headcount
- Container moves per quay crane/RTG/straddle carrier (vessel and road)/RMGC
- Total number of accidents and incidents
- Number of lost work day cases
- Number of lost work days
- Accident frequency rate
- Safety related claims and incident cost
- Quay crane utilization, availability, emergency maintenance or planned maintenance percent
- Material handling crane utilization, availability, emergency maintenance or planned maintenance percent
- RTG/straddle carrier utilization, availability, emergency maintenance or planned maintenance percent
- RMGC utilization, availability, emergency maintenance or planned maintenance percent
- Yard stack utilization – percent full/empty
- Yard stacking factor
- Yard shifts percent
- Container dwell time – import, export, transshipment, total or empty
- Gate container moves – truck, rail or total
- Gate truck turn-around time (minutes)
- Gross crane productivity – main/others
- Berth productivity – mainliners/others
- Berth utilization (percent of available meters)
- TEU/vessel container moves ratio
- Vessel container moves/quay crane cycle moves/import/export/transshipment/shifting/total quay crane
- TEU – total throughput

Resource planning solutions

Most resource planning solutions have resided within more integrated ERP applications, like the ones produced by ORACLE, SAP and SAGE. However, the fundamental elements within any of these solutions are the following:-

- Purchasing
- Inventory
- Finance
- Customer relations
- Sales

Purchasing

Avoid overspending by ensuring that you get the right price, from the right supplier.

- Manage requests for tender and responses, contract and blanket orders, comprehensive supplier rating and classification, and statistics
- Create free pricing criteria and associated rules
- Plan and order with or without MRP replenishment
- Create delivery scheduling and receiving
- Control commitments against budget
- Open item management and tracking
- Manage payment term scheduling and mass payment campaigns
- Create user-defined payment processes

Inventory

Simply and easily manage your inventory from movements and transactions to quality control and replenishment. With the inventory system you will have:

- A multi-level warehousing and location management system and the inventory system
- Flexible location management so that you can use dedicated, suggested, or random storage for single or multiple item location
- Stock management by physical location, lot and sub-lot, quality status, serial numbers, expiration dates and potency
- Consigned inventory and third party inventory
- Inventory replenishment with or without MRP

- Intra-company movements
- Forward and backward traceability
- Cost accounting

Finance

Capture and analyse every detail of your company's financial status and make decisions, fast. Sage X3 ERP gives you:

- User-defined fiscal calendars, general ledger accounts, and analytic dimensions
- Extensive budgeting capabilities
- Financial extraction, reporting and intercompany consolidation
- Employee expenses entry and management
- A complete audit trail available across the entire ERP system
- Detailed risk analysis

Customer relationship management

Get a 360 degree view of all your customers across sales, marketing, customer service and support.

- Build strong relationships with customers
- Create effective marketing campaigns
- Build contact management strategies
- Manage your sales pipeline
- Deliver outstanding customer service
- Support call centre capabilities
- Manage warranties and service orders
- Create and share customer information from 'quote to cash'

Sales

Create a sales order process designed to meet your individual needs.

- Manage quotes, contracts, blanket orders, orders, inventory allocation, delivery scheduling, shipping, returns, and invoicing
- Use a customised product configurator
- Carry out credit checking and customer ratings
- Create your own matrix of pricing rules
- Calculate sales commissions
- Track and manage all open items
- Create your own cash collection process
- Manage customer reminders

SAAS solutions

With every aspect of system deployment there will always be a fairly high initial capital cost to be taken into consideration. Terminal IT departments are under pressure to reduce their internal costs, the associated high costs of system installation and the various application configurations.

The ability for terminals to perform their own system configurations is certainly the way the world of software is heading towards. The new terminal operating solutions today need to be highly user-configurable. The central database will hold every type of potential configuration that embraces the majority of terminal operating modes.

By allowing the users to configure the solution, it saves costs and will allow for the unique tailoring of the software being deployed at each facility. Savings can be substantial for both the system vendor and for the terminal acquiring the application.

KEY BENEFITS OF DEPLOYING A SAAS APPLICATION

Security system lifecycle	Item	Company hosted	Speed to deploy	Outsourced cloud	Speed to deploy
Acquire					
	Acquire software	Capital	Slow	Zero	Fast
	Purchase servers and infrastructure	Capital	Slow	Zero	Fast
	Train technical staff	Capital	Slow	Zero	
	Configure, customize and deploy	Capital	Slow	Capital or Expense	Moderate
Maintain and support					
	Pay software support	Expense		Zero	
	Purchase upgrades	Expense		Zero	
	Pay IT to manage system	Expense		Zero	
	Pay shared cost of infrastructure	Expense		Expense shared with community	
Refresh					
	Purchase more software	Capital	Slow		Fast
	Retrain technical personnel	Expense	Slow	Zero	
	Purchase more hardware	Capital	Slow		Fast
	Configure, customize and deploy	Capital	Slow		Moderate
Business Considerations					
	Questions to ask				
	Can I change quickly	No	Slow	Yes	Fast
	Do I need capital	Yes	Slow	Minimal	Fast
	Total cost of ownership	Static		Less	
	Is the data mine	Yes		Yes	
	Security of systems	Good		Best	
	Independently audited and certified	Unlikely		Yes	
	Triple redundancy	Unlikely		Yes	
	Availability of service	Good		Best	



Trust and reliability

ELME's innovative modular spreader concept combined with design simplicity and market feedback is all characteristic of ELME. Our spreaders are supplied to lift trucks, reach stackers, straddle carriers, gantry, quayside and ship-to-shore container cranes worldwide.

ELME is well known for our historically reliable container solutions. Trust and reliability have made us the largest independent spreader manufacturer in the world. We simply offer the right spreader, for all applications, with any machine.

For more information, see contact information below or alternatively visit our website www.elme.com.

HEADOFFICE

ELME Spreader AB, Älmhult, Sweden
Phone +46 476 558 00 E-mail sales@elme.com

SALES AND SPARE PARTS

ELME Spreader Trading (Shanghai) Co. Ltd, Shanghai, P.R China
Phone +86 21 5169 8922 E-mail sales.cn@elme.cn

ELME Americas Inc., Martin, Tennessee, United States
Phone +1 731 588 02 20 E-mail sales.us@elme.com



Having a SAAS deployed application will help reduce deployment costs, save on the required hardware and will always ensure that the most up to date version of the software is being run. Online system enhancements and support can again further reduce costs of software ownership.

Conclusion

It must be said that terminal operators have to do some fairly advanced work at present, but things will have to change and pressure is on the various IT vendors to dig deeper into the new areas to drive the future of the industry. The carrier clients that these terminal operators serve will drive for greater efficiencies. They will demand that their large mega vessels will be dealt with faster and that their service level expectations will be met, as well as wanting a lower TEU throughput rate to be achieved. They will continue to be at the forefront during the next 12 to 24 months as global economies start to turn the corner to recovery.

Many terminals around the globe are trying to visualize what future growth projections might be and it is these advanced optimization and forecasting engines that will help establish a more precise business model. Revenue management will help to achieve greater returns on every contract and client served and will help to establish what works best for the terminal during the current climates.

Centralized maintenance and advanced solutions such as the enTIRE asset management software will help achieve greater continuity of service and better planning for scheduled maintenance and repairs to terminal capital equipment.

IMS also envisage that marine terminals will be seeking 'One Stop Shopping', whereby they can go to one party that provides a total turn-key solution that embraces all of the above aspects. We see that there are only a few true players in this market that have the network and infrastructure to achieve that goal and the leader of that is NAVIS LLC (Part of CARGOTEC conglomerate).

We welcome your feedback and comments to this article. It is meant to stimulate market interest and bring to the attention of the skills and industry knowledge that IMS can offer to the marine terminal sector.

ABOUT THE AUTHOR



Richard Butcher has been connected to IMS for the past 25 years, and has served in a consulting capacity during this period. Richard's background is related to the commercial, logistical and technology areas of the maritime industry. Richard has held senior roles with a number of leading edge maritime technology providers, and his exposure in these areas is considerable.

ABOUT THE COMPANY

IMS Ltd was founded in 1979 to serve the maritime community with its unique blend of industry consultants and market expertise. Over the last 33 years, our consultants have worked on a wide range of transportation and maritime related consulting projects.

ENQUIRIES

Invicta Management Services Ltd
17 William Road
Lymington, Hampshire UK
Tel: +44 (0) 5602 092451
Mob: +44 (0) 7531 621222
Email: rbutcher@invictasolutions.com
Web: www.invictasolutions.com