



IMSF April 2018

Container terminal automation & intelligent cargo handling

Cargotec in brief 2017

Megatrends:



Population growth



GDP growth per capita



Urbanisation



Energy demand



Environmental awareness



Digitalisation

SALES, MEUR

3,280

KALMAR

Kalmar offers cargo handling equipment and automated terminal solutions, software and services that are used in ports, terminals, distribution centres and various industries.

49%

Share of total sales

37%

Services and software, share of Kalmar's sales

SERVICES AND SOFTWARE, % OF SALES

31%

~160 million EUR software sales

HIAB

Hiab is the global market leader in on-road load handling solutions with customers operating in the land transport and delivery industries.

33%

Share of total sales

22%

Services, share of Hiab's sales

OPERATING PROFIT, MEUR

226.7

MACGREGOR

MacGregor provides engineering solutions and services for marine cargo and offshore load handling.

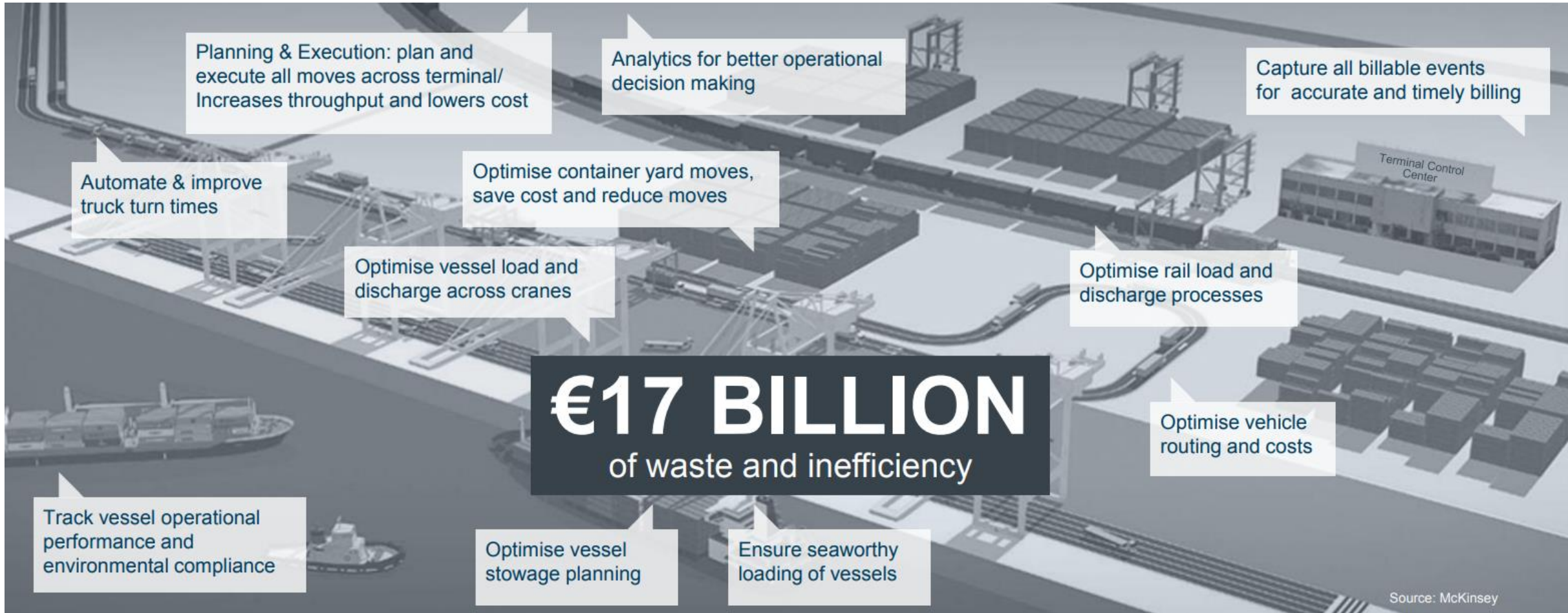
18%

Share of total sales

33%

Services, share of MacGregor's sales

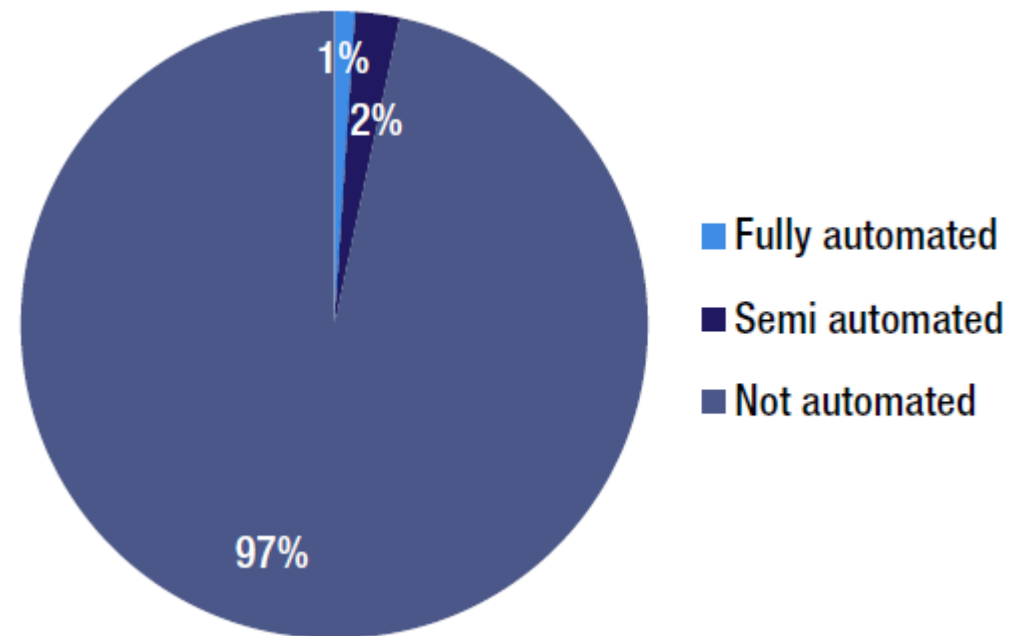
McKinsey: EUR 17 billion of waste and efficiency in ocean container supply chain



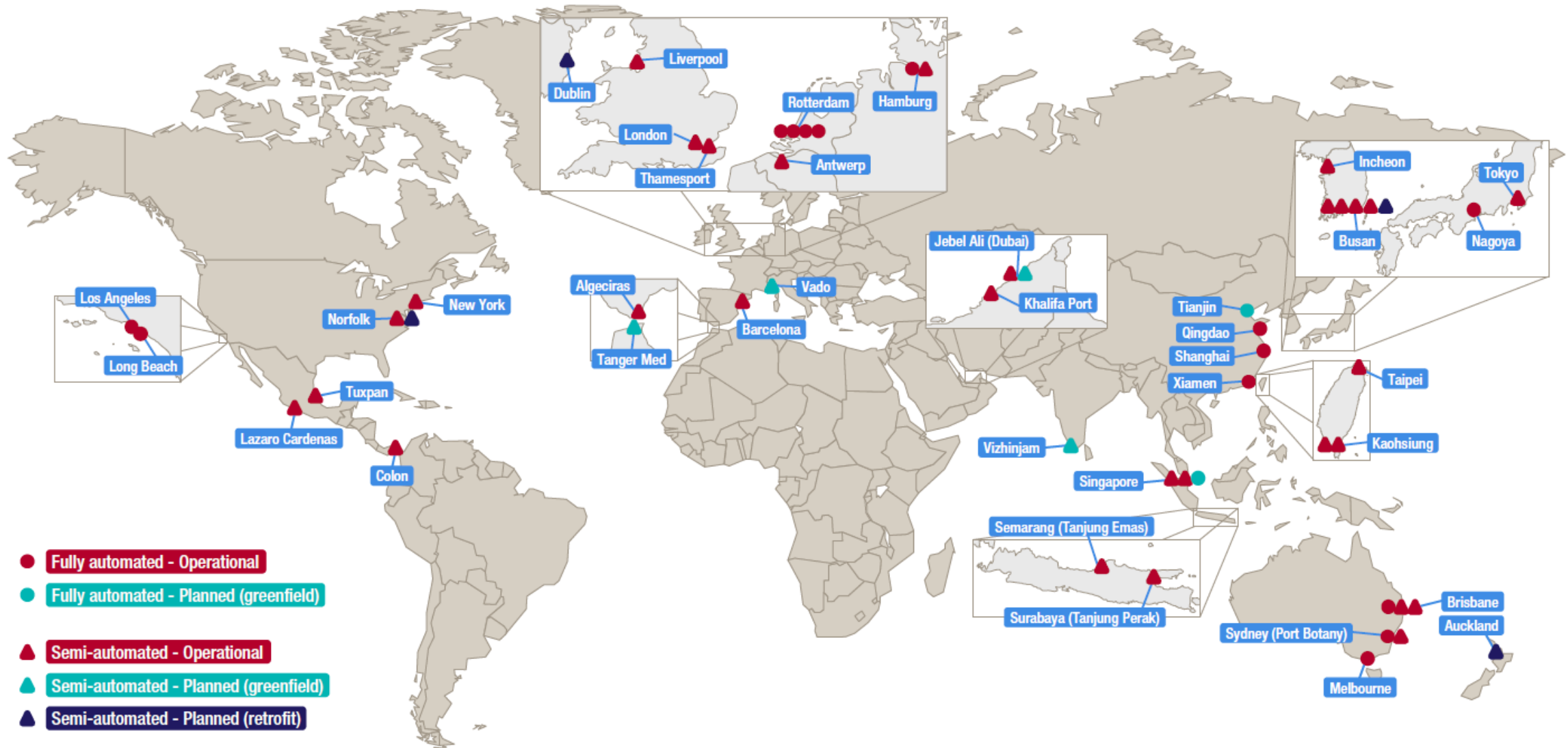
Container terminal automation - current status

- ~1,300 facilities worldwide
- Just over 3% classed as automated
- Seems disappointingly low given the high profile of automation and the potential benefits it offers.
- However, it does suggest a large potential of existing facilities that might be retrofitted with automated equipment.

**Proportion of automated container terminals worldwide
(by number of terminals)**



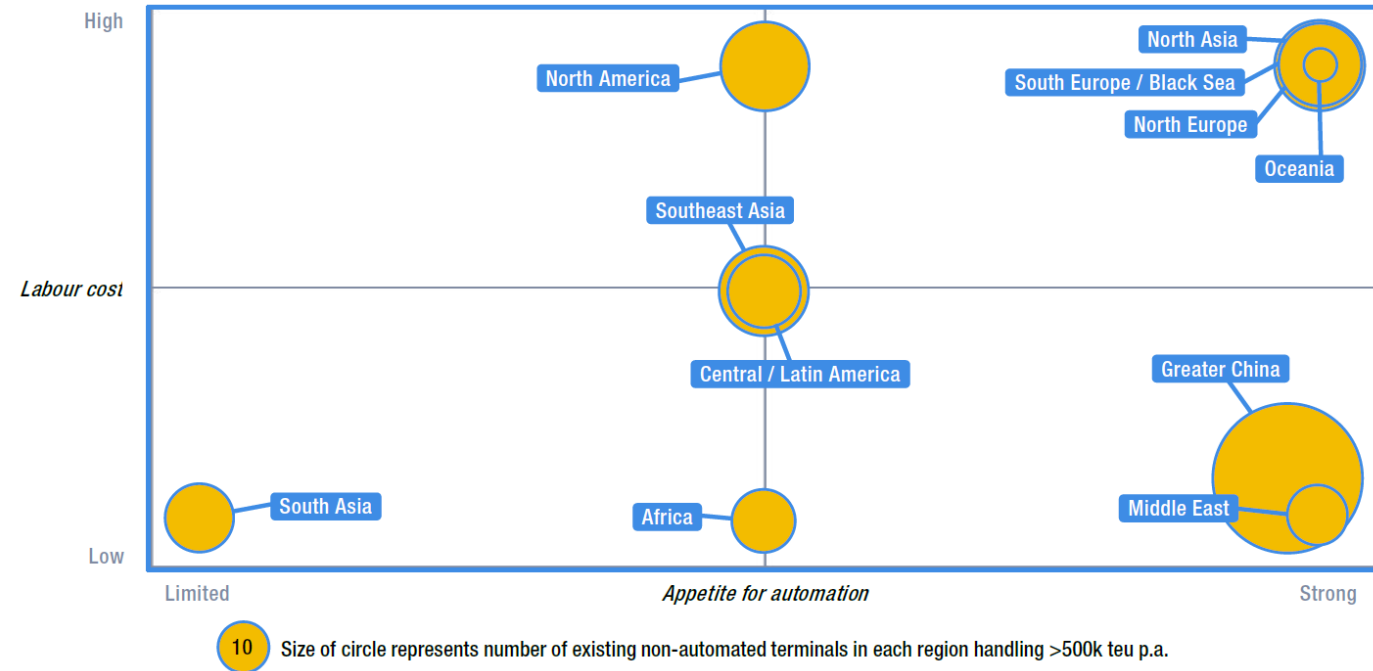
Existing and planned automated container terminals



Potential for retrofit terminal automation

- There are over 100 confirmed greenfield developments currently in the pipeline around the world, although so far only a handful have opted for automation.
- Lower container volumes, greater risks and potentially lower returns from greenfield terminal projects, has led to cautious approach by terminal operators and investors on greenfield projects. **With greenfield terminal project pipeline reduced, the opportunity of large automation projects is affected.**
- Instead there is **greater focus for optimizing existing terminals.**
- The natural focus for retrofit automation is the larger terminals, of which there are over 300 not yet employing automation.
- Best potential for brownfield automation can be with larger terminals (above 500K TEU throughput) in high wage economies.
- Low wage locations also show interest due to prestige, reputation and technological learning.
- North Asia (including China) and Europe could offer the most opportunities.

Number of potential retrofit automation terminals
(by number of terminals)



Number of container terminals (by terminal size 2016):

Up to 100k teu	516
100-250k teu	239
250-500k teu	190
500-1,000k teu	174
Over 1,000k teu throughp	193

Source: Drewry Maritime Research

Fully automated container terminals - existing and planned

Country	Port	Terminal	Operator/owner	Yard stack system	Horizontal transport system	Fully or semi-automated?	Status
Australia	Brisbane	Fishermans Island Berths 8-10	Patrick Ports	AutoStrad	AutoStrad	Fully	Operational
Australia	Sydney (Port Botany)	Brotherson Dock North, Port Botany	Patrick Ports	AutoStrad	AutoStrad	Fully	Operational
Australia	Melbourne	Victoria International Container Terminal Limited (VICTL)	ICTSI	ASC	Automated SC	Fully	Operational
China	Xiamen	Xiamen Ocean Gate Container Terminal (XOCT) *	Cosco Pacific	ARMG	AGV	Fully	Automation of existing terminal (Phase 1 operational, Phases 2 and 3 under development)
China	Shanghai	Yangshan Phase 4	SIPG	ARMG	AGV	Fully	Trial vessels handled end 2017
China	Qingdao	Qingdao New Qianwan Container Terminal (QQCTN)	Qingdao Port International	ARMG	AGV	Fully	Operational
Germany	Hamburg	Altenwerder Container Terminal (CTA)	HHLA	ASC	AGV	Fully	Operational
Japan	Nagoya	Tobishima Pier South Side Container Terminal	Nagoya Port Terminal Corporation (Tobishima Container Berth Company)	ARTG	AGV	Fully	Operational
Netherlands	Rotterdam	Delta Dedicated East & West Terminals (ECT)	Hutchison Ports	ARMG	AGV	Fully	Operational
Netherlands	Rotterdam	Euromax Terminal - (Maasvlakte)	Hutchison Ports	ARMG	AGV	Fully	Operational
Netherlands	Rotterdam	Rotterdam World Gateway Terminal	DP World	ARMG	AGV	Fully	Operational
Netherlands	Rotterdam	APM Terminals Massvalkte II	APM Terminals	ARMG	AGV	Fully	Operational
Singapore	Singapore	Tuas	PSA	Not confirmed	Not confirmed	Fully?	Planned
USA	Los Angeles	TraPac Terminal	MOL	ASC	AutoStrad	Fully	Operational
USA	Long Beach	Long Beach Container Terminal (Middle Harbor Redvelopment Project)	OOCL	ASC	AGV	Fully	Operational

Semi-automated container terminals - planned

Country	Port	Terminal	Operator/owner	Yard stack system	Horizontal transport system	Fully or semi-automated?	Status
China	Tianjin	Dongjiang	Tianjin Port Company	Not confirmed	Not confirmed	Not confirmed	Under development
India	Vizhinjam	Adani Terminal	Adani	Not confirmed	Not confirmed	Not confirmed	Under development
Ireland	Dublin	Dublin Ferryport Terminals (DFT)	Irish Continental Group	ARTG	Not confirmed	Semi	Planned automation of existing terminal
Italy	Vado	Vado Ligure	APM Terminals	ARMG	IMV	Semi	Due to be operational in 2018
Morocco	Tanger Med	Tanger Med 2	APM Terminals	ARMG	Not confirmed	Not confirmed	Under development, due to open 2019
New Zealand	Auckland	Fergusson Container Terminal	Ports of Auckland	AutoStrad	SC	Semi	Automation of existing terminal, due for completion 2019
UAE	Jebel Ali (Dubai)	Terminal 4	DP World	ARTG	IMV	Semi	Due to be operational in 2018
USA	Norfolk	Norfolk International Terminal	Virginia International Terminals	ASC	SC	Semi	Under development (partial automation of existing terminal)

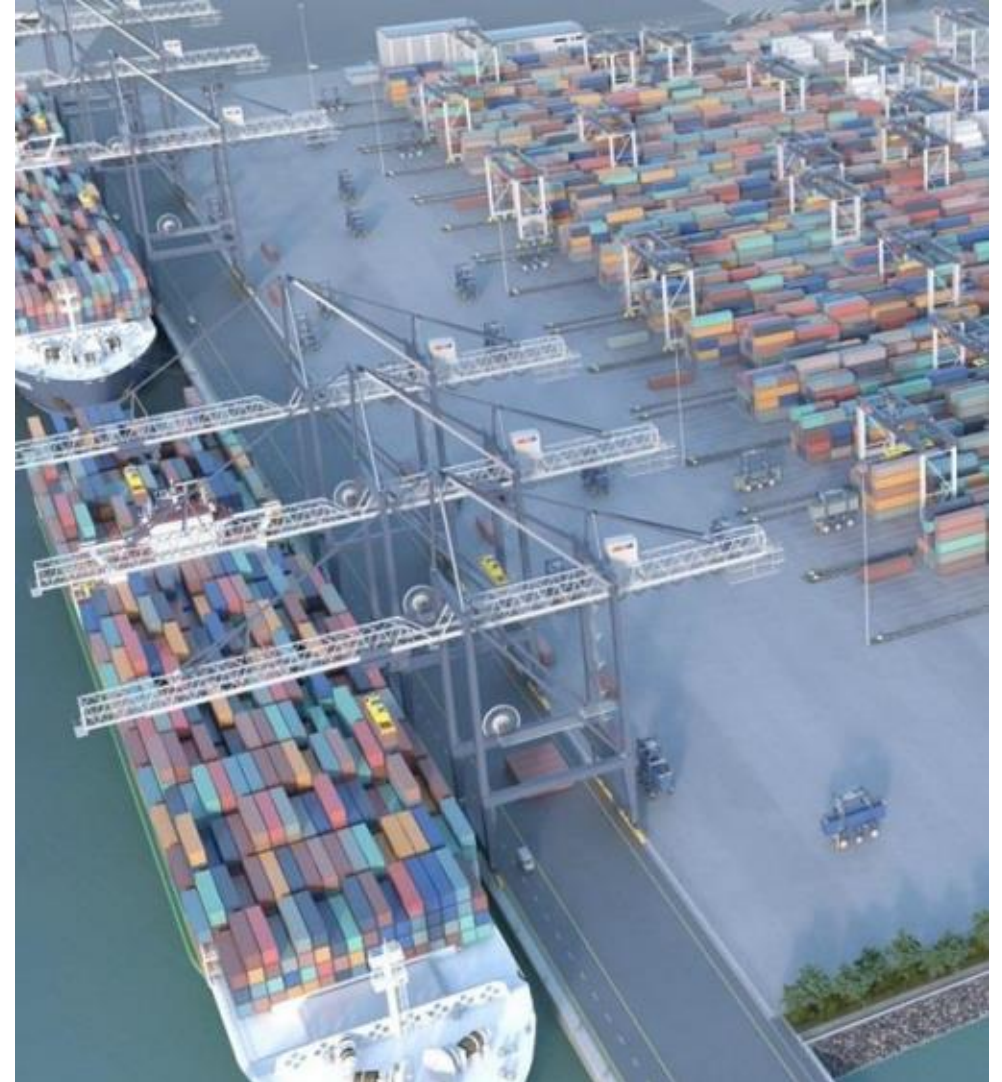
+31 already operational semi-automated terminals

in Australia, Belgium, Germany, Indonesia, Japan, Mexico, Panama, Singapore, South Korea, Spain, Taiwan, UAE, UK, USA

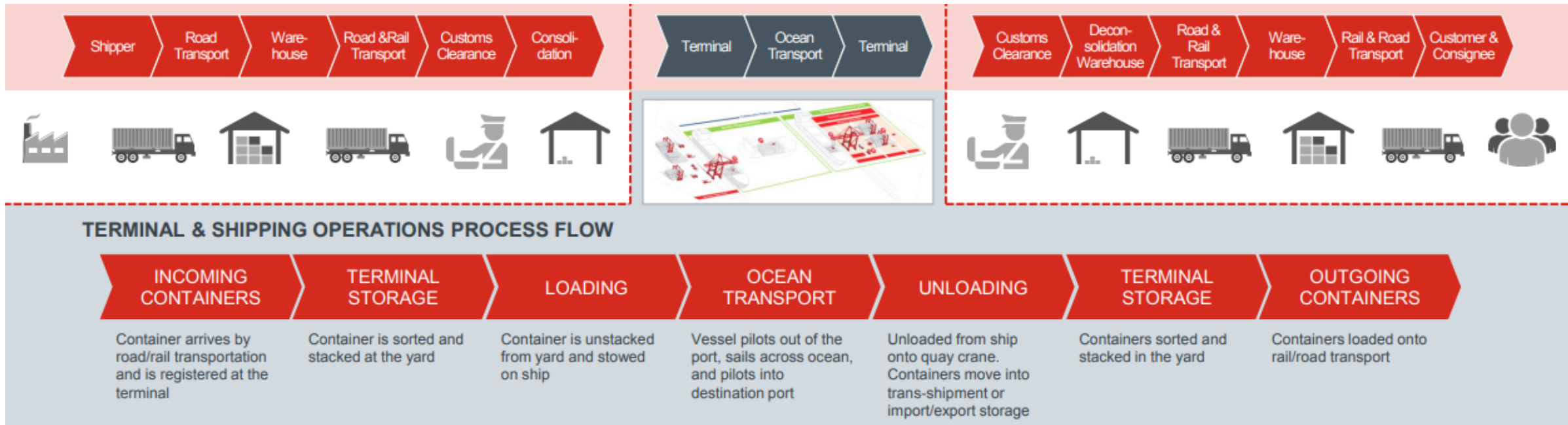
World first fully automated container terminal

- Victoria International Container Terminal (VICT), Melbourne

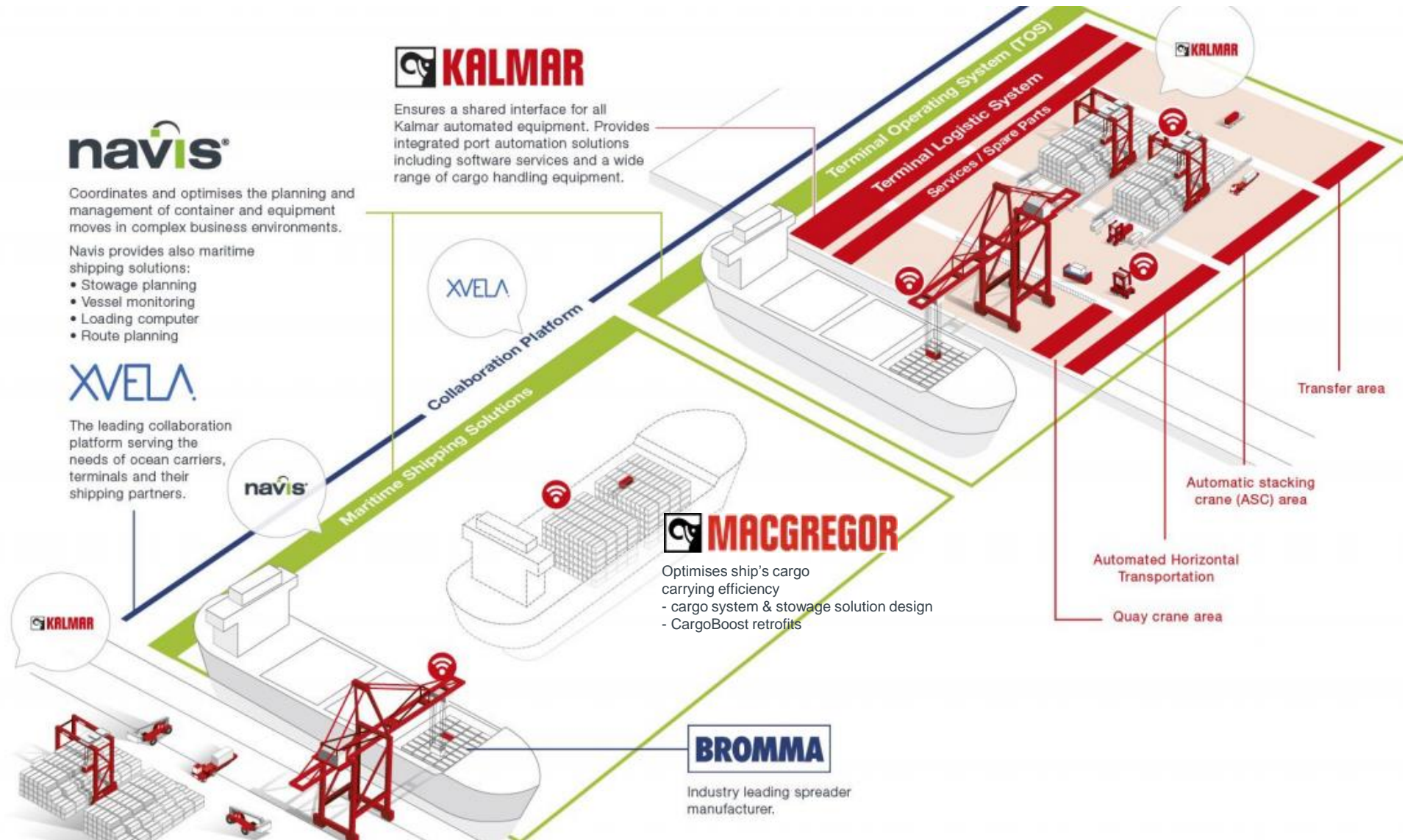
- A public-private partnership (PPP) for a 26-year concession between ICTSI / VICT and the Port of Melbourne Corp. was signed in May 2014.
- The 35-hectare terminal has an annual capacity of one million plus TEU. VICT has a straight berth of 660 meters, which can accommodate two large vessels with capacities of up to 8,000-12,500 TEUs at once.
- 'OneTerminal' automation solution, built using Kalmar's technology and Navis' software.
 - 11 Kalmar AutoShuttles
 - 20 Kalmar Automated Stacking Cranes
 - Kalmar Automated Truck Handling
 - Fully integrated Kalmar TLS with Navis N4 TOS
 - System integration services
- VICT also secured a crane spreader specialist Bromma after an automated lashing platform (ALP) was implemented with quay cranes (QC) from ZPMC.
- ICTSI's total capital investment around US\$ 450.
- <http://andromeda.wsiph.com:83/projects/victcomau/www/the-project>



Optimising end-to-end value chain



Intelligent cargo handling solutions



Optimisation of vessel cargo system performance

- Maximising vessel's cargo carrying capacity in relation to deadweight tonnage.
- Ship and its container stowage design starting from defining the cargo profile.
- Input data includes program control settings such as number of average operable days per year, crane properties, vessel data, route data including ports of call, leg distances and freight rates, port data, and other information such as fuel costs. Analysis is specific to a vessel, but benefits of scale can be reached if the whole fleet is analysed.
- Efficient cargo handling system design
 - optimises vessel earnings over lifetime, instead of just looking at the initial order price at shipyard.
 - minimises emissions for each carried commodity, thus reducing their carbon footprint.

Smart cargo handling developments ongoing e.g.:

- CargoBoost for container ships
- Multipurpose vessel breakbulk stowage planning tool
- Cloud based port efficiency tool for RoRo cargo



