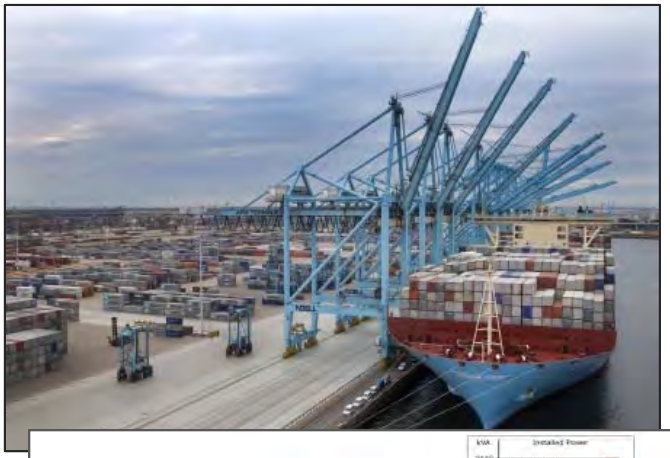
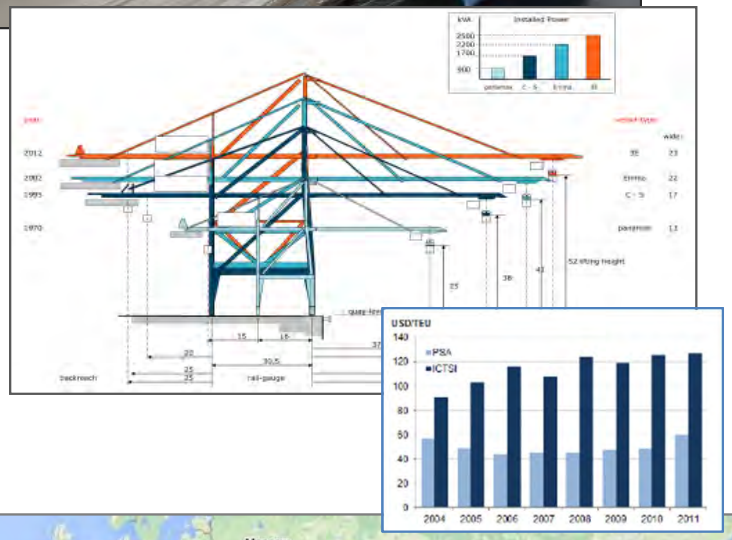




10th Indian Ocean Ports and Logistics Conference 2016

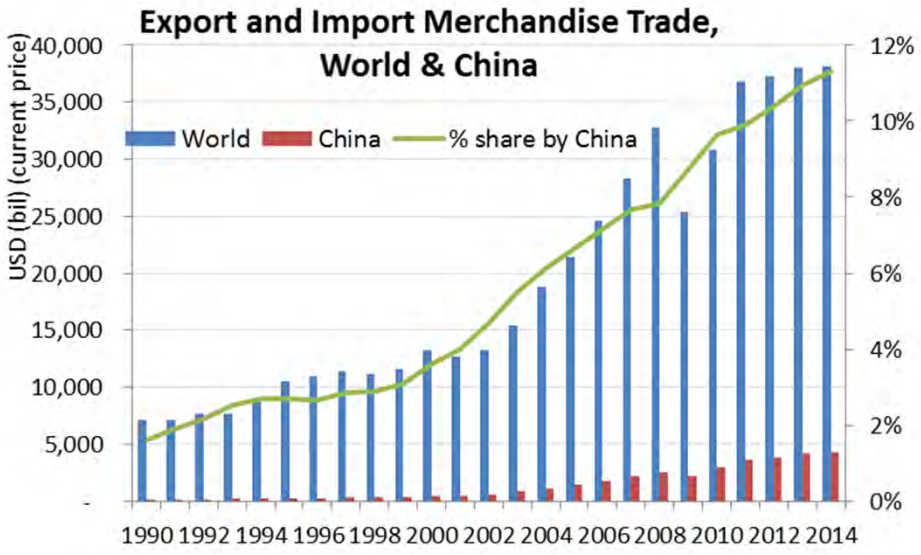
Reunion, 28th January 2016

Transhipment in an age of mega-vessels and mega-alliances – can ports afford not to play the game?

Dr Jonathan Beard, Vice President, ICF

Container Shipping Industry – Demand Remains Subdued

- 1990-99, container volumes grew 3.5x rate of global GDP growth; 2000-09 only 2.7x GDP growth; "multiplier" dropped to 2.1x, then to 1.5x in 2012 (~4.6% vs GDP growth of 3.2%)
- 2015 H1 global merchandise trade (incl. non-containerised) fell 13% yoy
- Reason for slowdown both cyclical and structural, include:
  - Economic uncertainty in Europe, US recovery relatively strong
  - China (fastest growing & 2nd largest economy) slowing down & restructuring away from dependence on exports….possible "hard landing"
  - China producing more semi-manufactured products
  - Slowing pace of trade liberalisation

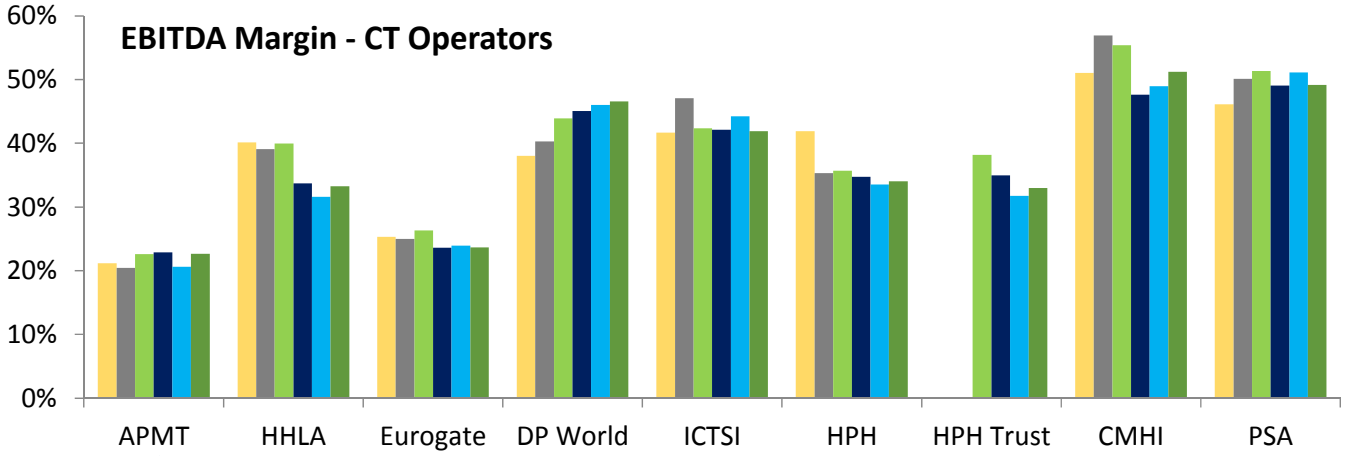


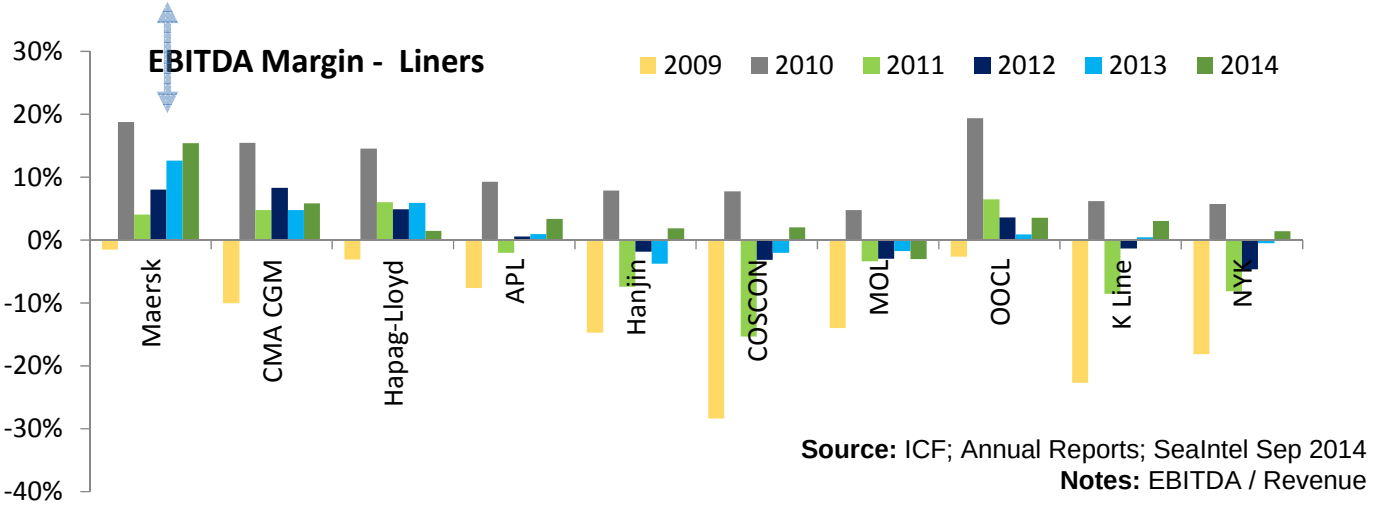
Source: ICF based on World Trade Organization (WTO) and National Bureau of Statistics China

Port Customers Continue to Struggle Financially

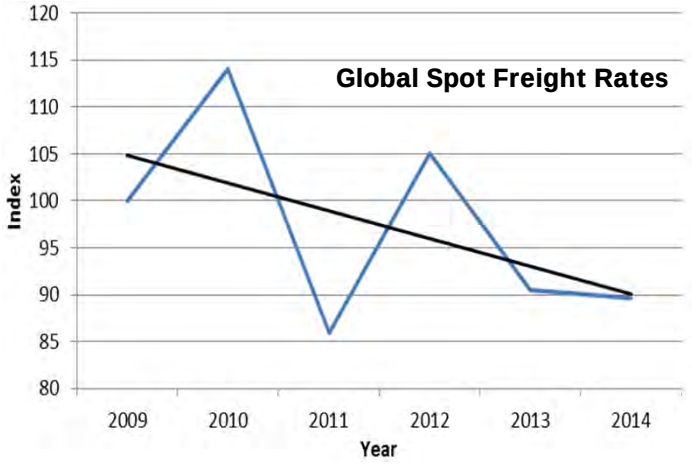
Liner unit revenue has decreased placing huge pressure on cost reduction

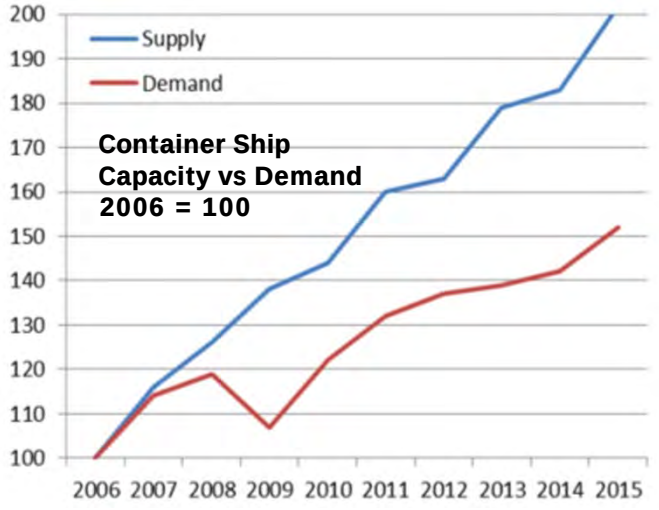
- Terminal operators have generated healthy EBITDA margins - carriers have not
- Some recovery for carriers in 2014, but decline in 2015, despite a ~50% decrease in fuel costs
- Liners have struggled to sustain any price increases, not least due to **capacity over-supply**
- With unit revenue declining, **must focus on cost reduction**





Source: ICF; Annual Reports; SeaIntel Sep 2014
Notes: EBITDA / Revenue

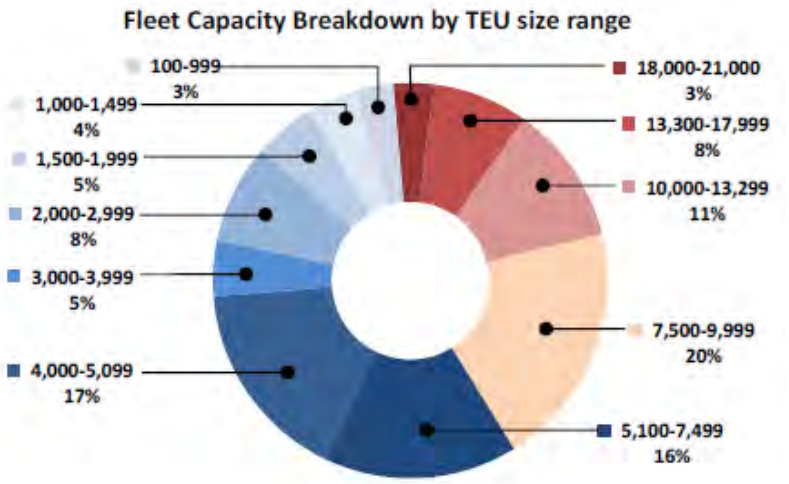




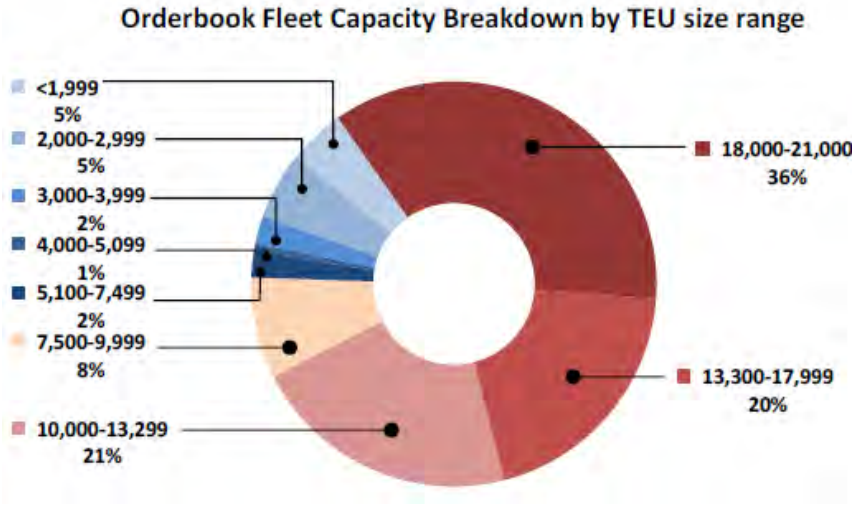
Economies of Scale to Reduce Unit Costs

Container vessels getting ever larger: Maersk EEE 18,000TEU, CSCL /MSC 19,000 TEU, OOCL 21,100 TEU

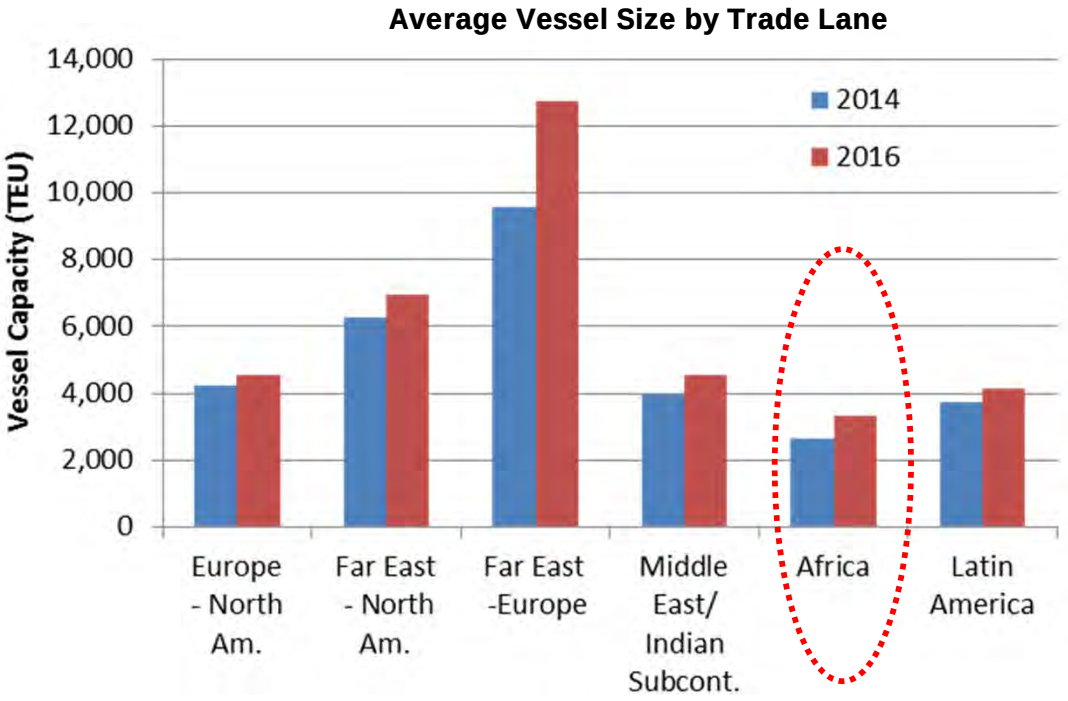
Current Fleet *at Jan 16*



Order-book *at Jan 16*



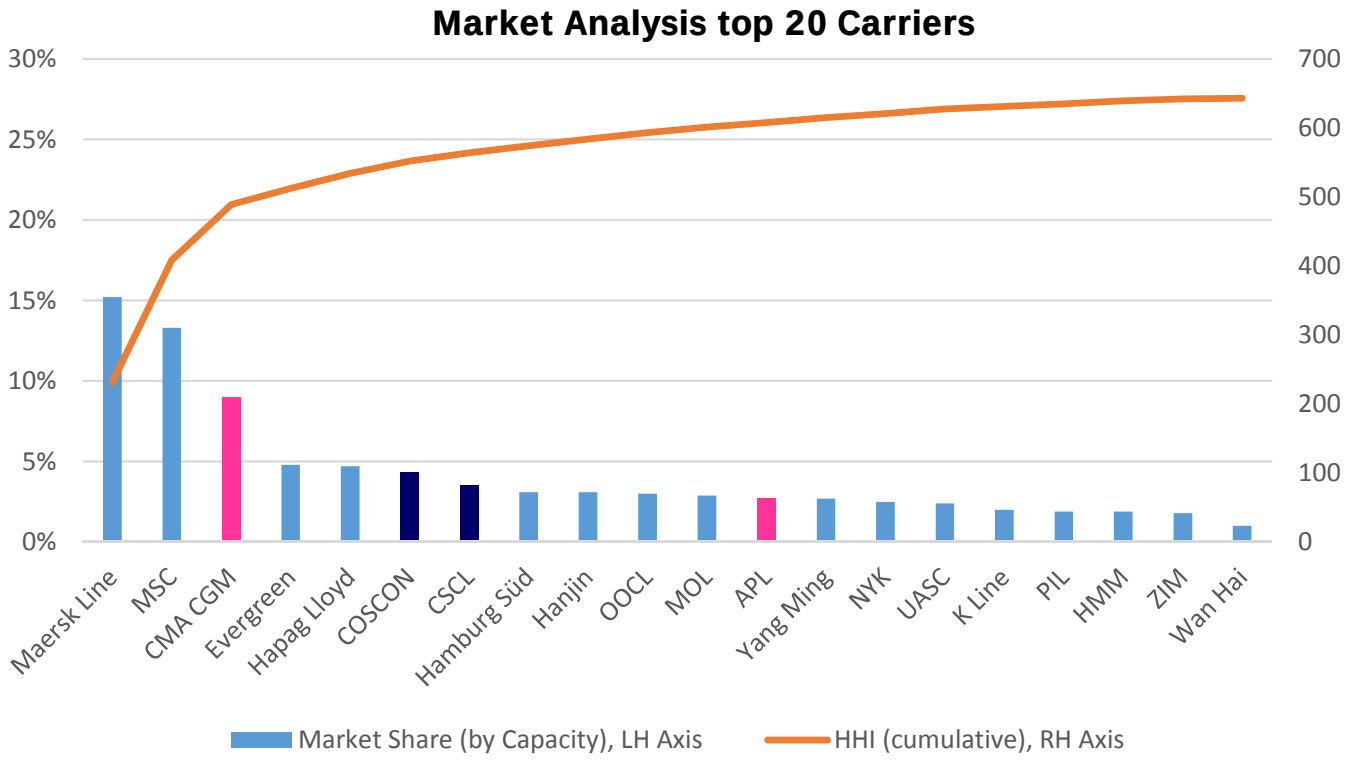
- 'Herd' mentality – where Maersk leads, others quickly follow
- OOCL order for 6 x 21,100 TEU, for delivery 2017



Note: data as of Jan 2016 and Jan 2014.
Source: ICF GHK based on Alphaliner

Container Shipping Industry Remains Fragmented….
….but is consolidation finally underway?

- Limited concentration of industry: top 5 operators account for about 47% of capacity; 86% for top 20 operators. Relatively little consolidation, but change underway?



- Herfindahl-Hirschman index (HHI) for industry of 767, well below the trigger point of 1,000
- Much higher for certain routes, where cabotage restrictions limit competition

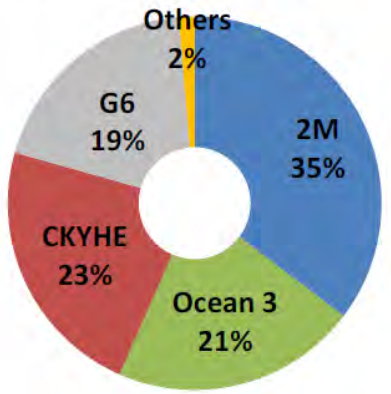
Notes: Herfindahl-Hirschman index (HHI) measure for market concentration widely used by EU Directorate General for Competition, U.S. Federal Maritime Commission (FMC) and U.S. Department of Justice. Calculated by squaring market share of each firm competing in a market, and then summing the resulting numbers. E.g. if only one firm in an industry, that firm would have 100 per cent market share, and HHI would equal 10,000 (100^2), indicating a monopoly. Or, if there hundreds of firms competing, each would have nearly zero market share, and HHI would be close to zero, indicating nearly perfect competition.
U.S. DoJ considers a market with HHI <1,000 to be a competitive; 1,000-1,800 to be a moderately concentrated marketplace; and > 1,800 to be a highly concentrated marketplace. As a general rule, mergers that increase the HHI by more than 100 points in concentrated markets raise antitrust concerns

Filling up the mega-vessels

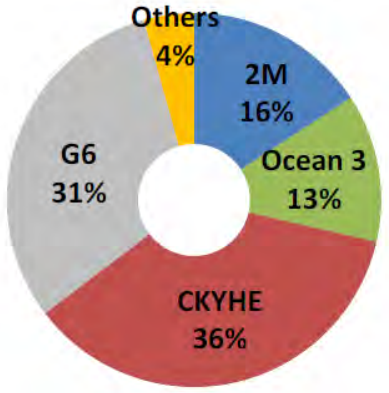
Economies of Scale via Larger Alliances

- New alliances to defray risk of introducing larger vessels in subdued demand conditions…
- …and secure enough numbers of vessels that are of same magnitude of size to offer fixed or weekly schedule
- Following P3 rejection, four major alliances created / remain:
  - **2M**: Maersk Line and Mediterranean Shipping Company (MSC)
  - **Ocean Three (O3):** CMA CGM, China Shipping Container Lines Co. and United Arab Shipping Co.
  - The **G6** (formed early 2012) serving Asia-Europe and some trans-Pacific routes: Nippon Yusen Kaisha, Hapag-Lloyd AG, Orient Overseas Container Line (OOCL), APL, Hyundai Merchant Marine, and Mitsui O.S.K Lines;
  - **CKYHE Alliance** serving Asia-Europe and trans-Pacific (i.e. Asia-West Coast North America), incorporating Cosco, "K" Line, Yang Ming, Hanjin Shipping and Evergreen.
- Account for significant portions of capacity on major trade lanes
- Fully accommodating an alliance in key transhipment markets (e.g. SE Asia) **may require 8-9 million TEU capacity**…
- ...or mitigate risk with dual hubs (at additional cost)

FE-Europe Capacity Share by Alliance



FE-N America Capacity Share by Alliance



Source: Alphaliner; ICF

Port Planning & Performance Parameters

Invest to 'play the game' or be relegated to second division?

- CAPEX for mega-vessels
  - 18m water depth
  - long straight quays (1,000m or longer): maximum flexibility
  - adequate number of cranes with outreach for 23-24 across
  - land: adequate yard to support quay face operations & large box exchanges (ideally 600-650m av. yard depth / m quay)
  - capacity to accommodate all alliances partners
  - inland connectivity (for gateway ports)

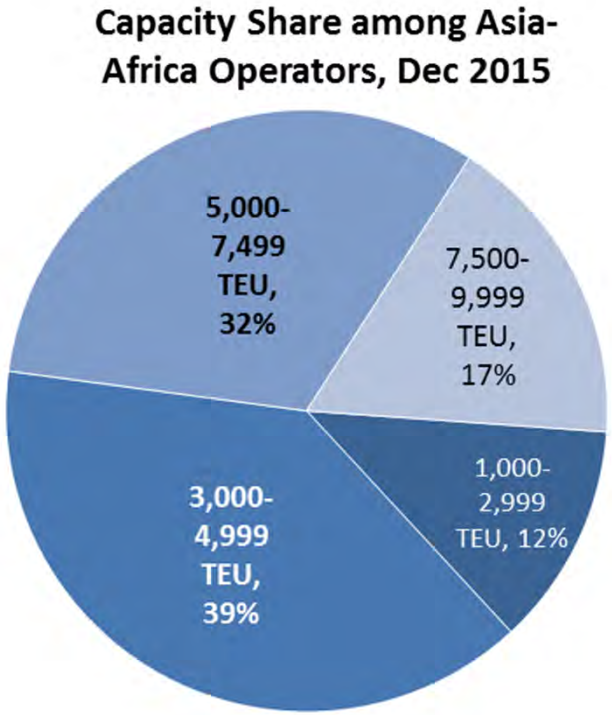
Source: Maersk

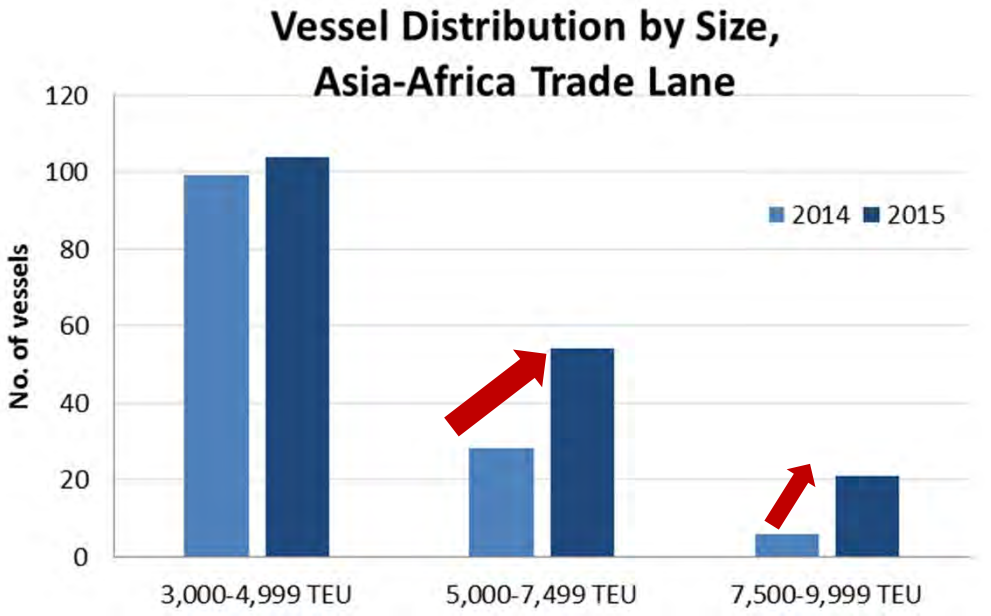
- Major shipping lines demand performance
  - > 35 moves per crane per hour, 230-250 moves/ship hr @ berth for *larger* vessels
  - Reliable berth windows and turnaround time
  - Maersk EEE seeking **6,000 moves** within 24hrs from terminals*….but this requires **adequate cargo**
- Major hub ports (& some gateway ports, e.g. Hong Kong) must efficiently accommodate variety of vessels sizes (e.g. from feeder / barges to mother vessels) - flexibility in design
- **Risk/reward:** investment requirements are higher but in the absence of **base-load import/export (IE) cargo**, incentives for largest vessels to call may be insufficient – challenge for smaller transhipment hubs, less so for the major gateway terminals…and major TS hubs?
- Possible scenario? **Winners "lock in" volume** and establish a virtuous circle, become mega transhipment (& gateway) hubs; losers see IE volume routed via a third port, increasing cost of import/export

***** Eivind Kolding, CEO Maersk Line June 2011

How Much Larger can Vessels get at African Ports?

Current port infrastructure in many African states mean ship sizes are restricted to 10,000 TEU





Source: ICF based on Lloyd's List Intelligence, December 2015

- Panamaxes (3,000-5,000 TEU) account for the majority of vessels in the Asia-Africa trade lane
- The number of larger vessels (5,000-7,500 TEU) increased by almost 2x
- The number of even larger vessels (7,500-10,000 TEU) increased by more than 3x
- Impacts on ports – appropriate infrastructure and investment scale?

Moving Goal Posts for Investment

Terminal investment is long-term, but requirements keep changing – how to future proof without over-investing?

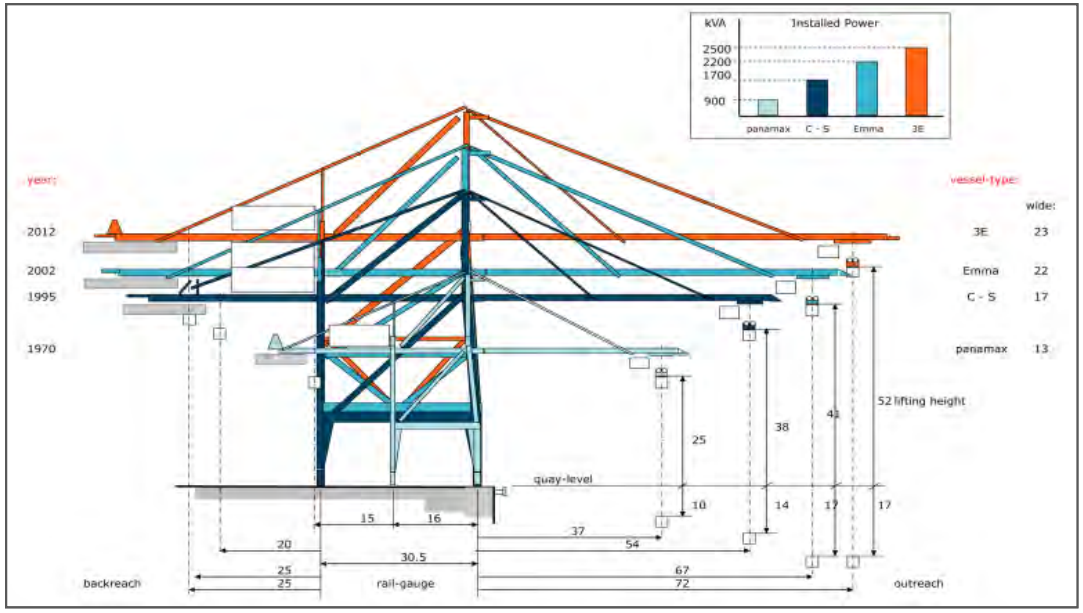
"The only way to add another 25% [carrying capacity] is in length, as the 18,000 TEU ships are very wide. Also trading flexibility and frequency must be considered; you would need a huge market share to fill them…I just don't think we can accommodate larger vessels in the foreseeable future, maybe never".

Søren Skou, Maersk CEO, quoted in Container Management, **April 2013**

However, June 2015 Maersk Line announced $1.8bn contract for 11 vessels of 20,000 TEU (LOA 400m, beam 59m and increased **draft of 16.5m**.....but now on hold & one EEE laid up)

…quickly followed by OOCL order for 6x 21,100 TEU (for delivery 2017)

- E.g. investment planning for ship to shore cranes (20-25 year life cycle)
  - Emma Maersk, 2006: 22 rows across
  - Marco Polo, 2012: 21 rows across
  - EEE, 2013: 23 rows across
- Redeploy cranes, upgrade cranes, replace, etc. Quay may also need strengthening



Mega vessels & mega alliances driving investment & competition

…especially for ports exposed to contested markets, notably at transhipment pinch points

- Carriers seek high moves per ship hour at berth to minimise turnaround times
- For all the obsession with mega vessels, productivity improvements have also been delivered for smaller vessels
- But *absolute* impact from 10,000+ cannot be ignored…likewise concerns from carriers that berth productivity improvements have peaked
- 2014 indicates productivity stagnation for the larger vessels

Asia-Pacific Berth Productivity*				N America Berth Productivity*			
Vessel Size	2012	2013	Change	Vessel Size	2012	2013	Change
10,000 & Over	110	121	10%	10,000 & Over	N/A	83	N/A
7,501 to 10,000	98	112	14%	7,501 to 10,000	78	88	13%
5,001 to 7,500	80	96	20%	5,001 to 7,500	56	66	18%
2,501 to 5,000	63	75	19%	2,501 to 5,000	44	56	27%
2,500 or Less	42	53	26%	2,500 or Less	28	36	29%

Notes: * Number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth. Comparison by call size would offer better 'standardisation'

Source: JOC Port Productivity Research 2013

Top Improvers Berth Productivity*				
	Vessel Size	2012	2013	Change
Tianjin	10,000 & Over	126	155	23%
	7,501 to 10,000	117	137	17%
	5,001 to 7,500	103	120	16%
	2,501 to 5,000	69	93	36%
	2,500 or Less	44	64	45%
Ningbo	10,000 & Over	136	157	15%
	7,501 to 10,000	107	138	29%
	5,001 to 7,500	87	103	18%
	2,501 to 5,000	73	83	15%
	2,500 or Less	45	61	34%
Nansha	10,000 & Over	72	107	48%
	7,501 to 10,000	93	115	23%
	5,001 to 7,500	73	98	34%
	2,501 to 5,000	46	86	86%
	2,500 or Less	50	97	92%

Key challenge to meet customer service requirements at *minimum* cost

…competing ports may be subsidized / compete with less regard to financial returns

Top 10 Ports TRANSHIPMENT	Berth Productivity*	TEUs /m of quay / per annum#	TEUs / QC / per annum#	Top 10 Ports VESSELS < 8,000 TEUs	Berth Productivity*
Qingdao	96	2,370	238,770	Qingdao	80
Shanghai	86	2,430	238,440	Shanghai	79
Jebel Ali	**81**	**1,770**	**174,870**	Nhava Sheva (JN)	79
Busan	80	1,410	155,180	Ningbo	77
Khor al Fakkan	**74**	**?**	**?**	Busan	77
Salalah	**72**	**?**	**?**	**Jebel Ali**	77
Hong Kong^	68	2,360	192,000	Taipei	73
Westport (Klang)	66	1,500	154,000	Tainjin	70
Tanjung Pelepas	63	1,750	162,960	**Salalah**	**70**
Rotterdam	63	1,440	163,660	Elizabeth (US)	69

- Deliver customer productivity KPIs (e.g. Berth Productivity) whilst also maintaining high utilisation (e.g. TEUs/m of quay/per annum; TEUs/Quay Crane/per annum; TEUs/hectare of yard/per annum; etc.)

Notes: * Number of total container moves (on-load, off-load, and re-positioning) divided by the number of hours during which the vessel is at berth, 2012. Data on TEUs /m of berth and TEUs per QC 2012:#2012 unless otherwise stated, rounded to nearest 10, ^HIT

For more accurate comparison berth productivity should be compared across similar vessels sizes, or ideally across similar call sizes

Source: JOC Port Productivity Research; ICF

6,000 moves per day

Glorious Carrot or Poorly Conceived Stick?

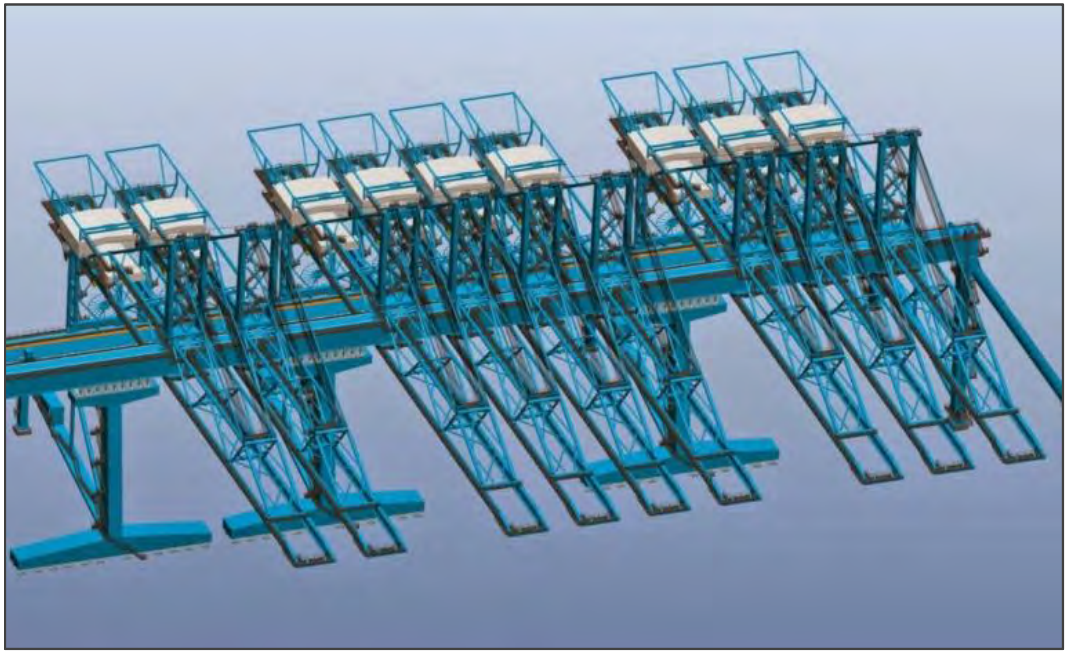
- Requires 250 moves /hr over three shifts for 24 hrs on **a regular basis**.
- 19,000-TEU ship would require **8 cranes**, each at 31-32 moves /hr, generating berth productivity of 250 moves/hr (MPH)
- 18,000-TEU box ship is only 25% longer than 7,400-TEU vessel yet has 150% more capacity, hence cranes have to reach further, but difficult to deploy more cranes
- Therefore 8 cranes per 400m or 1 per 50m: a high crane density
- Remember - travelling distances increase by 40-50% for mega vessels (13,000 TEUs+ vs Panamax) due to their scale
- Crane MPH is reduced unless shipping lines proactively plan their **stowage to support port productivity: e.g. XVELA cloud based TOS neutral collaborative aid to stowage management**

Source: MTL; ICF

6,000 moves per day

Step change in productivity required?

- Push up moves per crane per hour (e.g. new automated terminals at Maasvlakte 2 RWG & APMT: end goal 40)
- New crane operating arrangements?



E.g. APMT FastNet

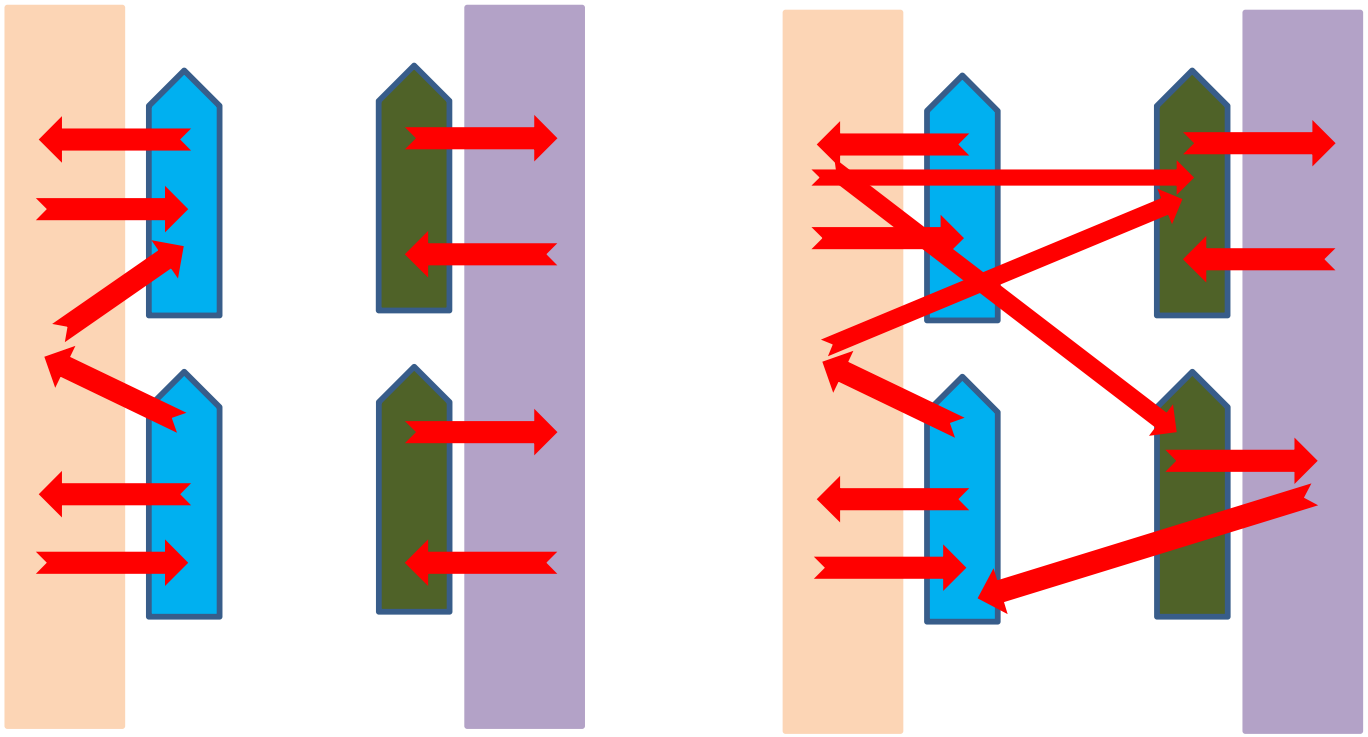
- Crane legs dictate minimum spacing of one bay, resulting in lost opportunities to maximise production
- With APMT FastNet cranes are as narrow as a 40ft container – aims to double berth productivity
- Return on investment?

Source: APMT

- Need to look at relative costs to achieve a realistic balance (best terminal operators already do this) …sensible cooperation rather than relying on market power.
- What level of productivity does the line want and will they pay for it?

Box Moves Get More Complicated with Alliances

Volumes per call increase….as does complexity



- Inter Terminal Transfers (ITT) are becoming more complex…. physically and co-ordination of stowage plans
- Challenge for ‘split ports’…..and also ports with different terminal operators
- E.g. Busan (spilt) compared with Hong Kong or Jebel Ali; Hong Kong (several operators) compared with Jebel Ali or Singapore

Transhipment Market – Determinants of Routing

*Additional cost for lines, but can be value enabler through **network optimisation***

Two different forms of transhipment cargo:

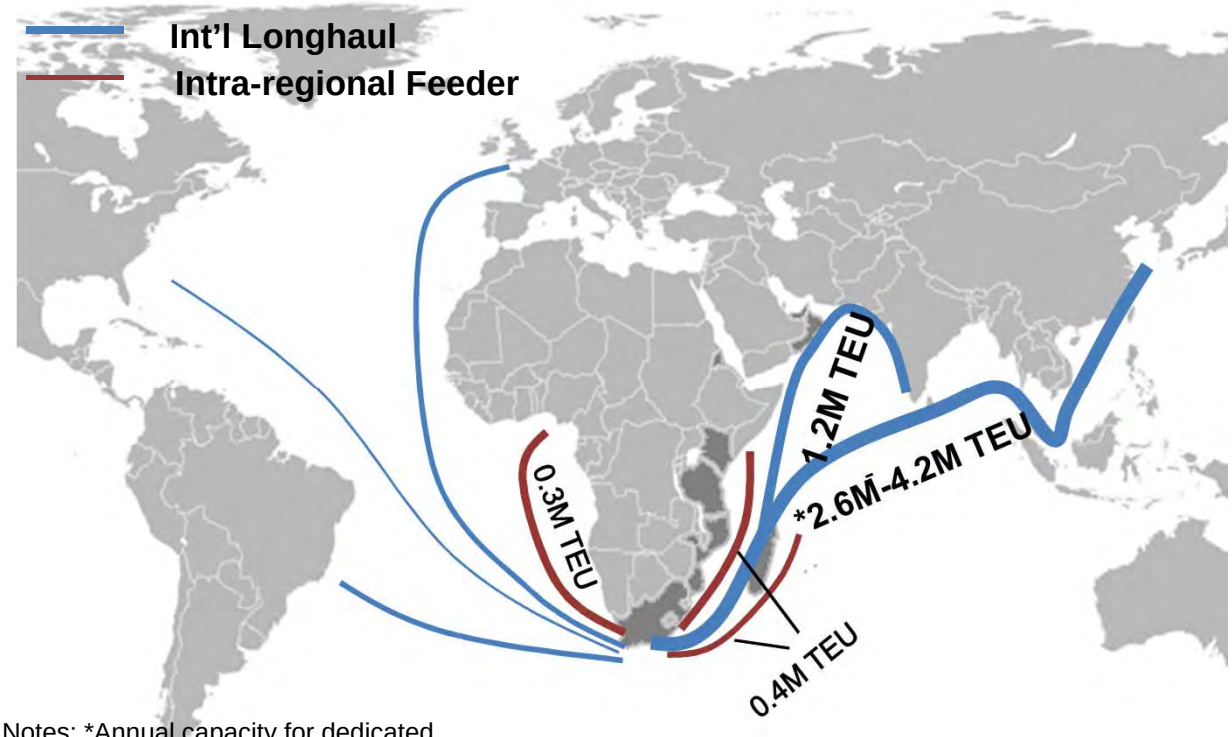
- **Hub and spoke**: Connecting between feeder services and mainline deep-sea services, volumes are captive to a region: i.e. E Coast Africa / Indian Ocean
- **Relay**: Connecting between mainline deep-sea services (e.g. East-West) - where the volumes can be connected at alternative ports on different continents. Can be very footloose.

Transhipment from the perspectives of:

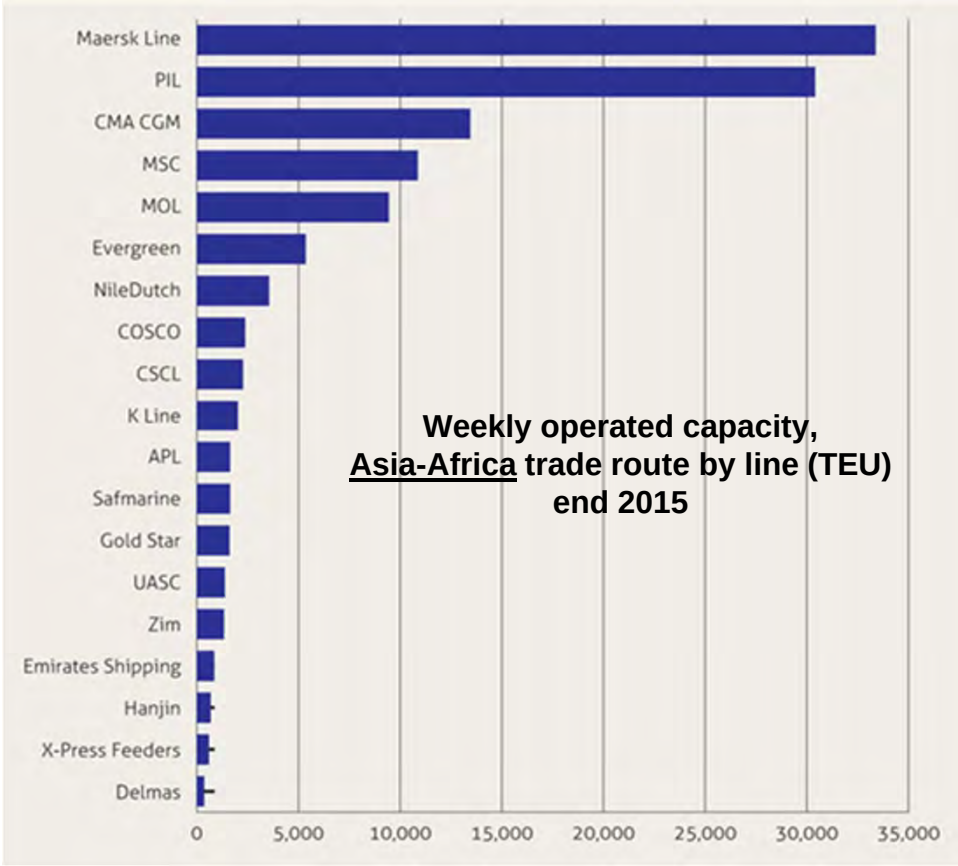
- Importers / exporters: inferior - additional time required, less attractive
- Liners: an additional cost but also a value enabler – helps save cost through network optimisation ….and handling rates are very low
- Port / terminal: footloose cargo (and lower revenue) can be handled at a number of ports within the carrier's network. Welcome top-up, but can be risky if port is dependent on this segment.
- Increasing vessel sizes – favouring mega hubs?

Container Shipping Serving East Africa & Indian Ocean (IO)

Mainly a feeder region to main line trades with top global carriers leading the market



Notes: *Annual capacity for dedicated
FE-East & S Africa estimated at 2.6-4.2M TEU
Source: ICF market analysis for 2013; Lloyd's List Intelligence, Dec 2015

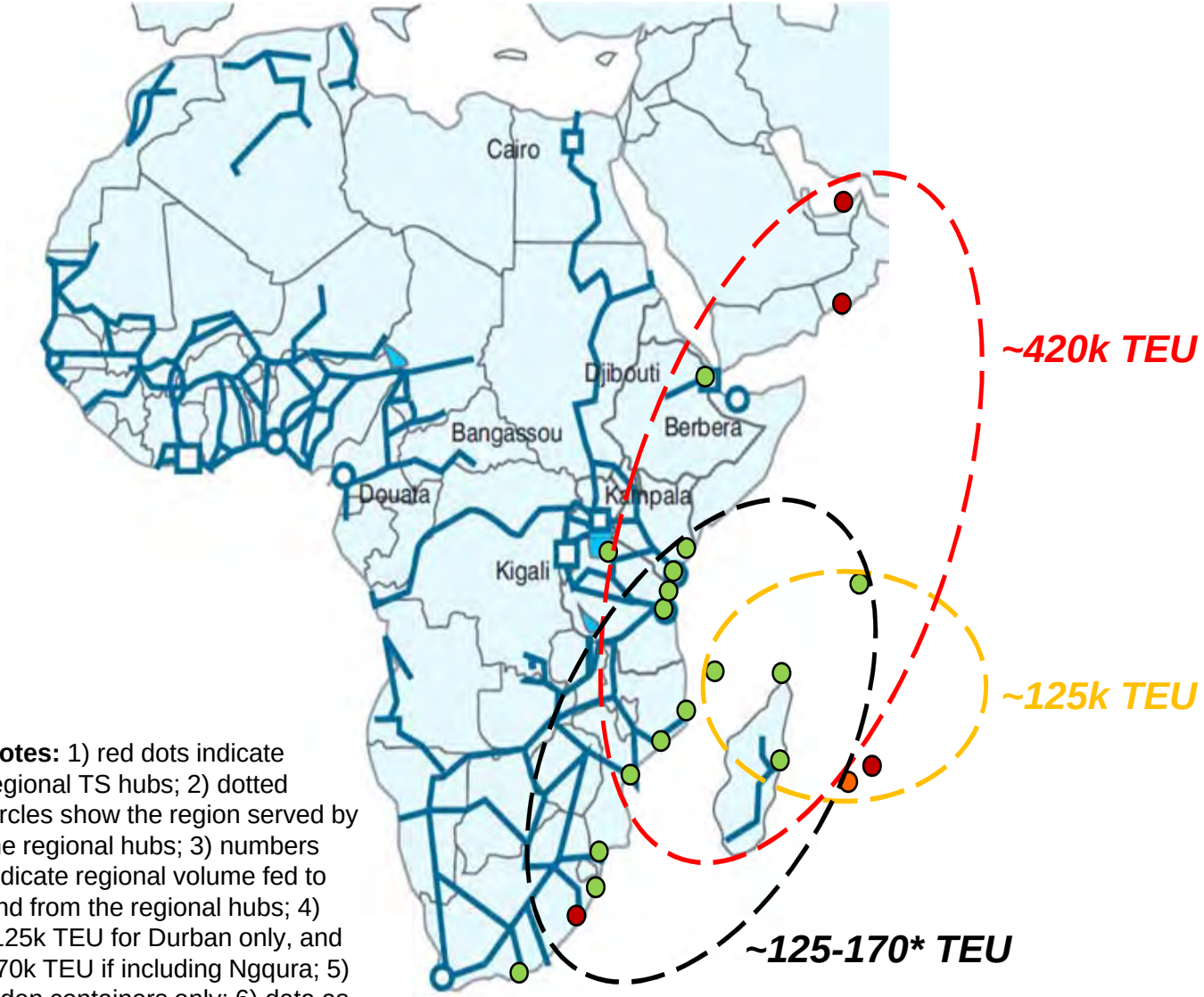


- E Africa & Indian Ocean (IO) largely a feeder region to global main line markets via transhipment in S Africa (Durban, Ngqura), Mid East (Salalah, Dubai), and IO (Port Louis, Reunion – IO transhipment for IO islands).
- Dedicated direct services mainly from Far East (some with en route call to IO); other direct services incl. FE-South Africa but with onwards carriage to South America.

- By end 2015, total 97 container services regularly calling E Africa and IO (incl. S Africa)
  - Europe: 21%
  - Intra regional feeders: 25%
  - Others: 12%
  - East Asia: 27%
  - Middle East: 15%
- Market led by top global carriers with their sub-regional subsidiaries. Regional carrier has limited market share

E Africa & IO Transhipment Market

TS market is primarily feeders with majority served from Mid East hubs



Notes: 1) red dots indicate regional TS hubs; 2) dotted circles show the region served by the regional hubs; 3) numbers indicate regional volume fed to and from the regional hubs; 4) *125k TEU for Durban only, and 170k TEU if including Ngqura; 5) laden containers only; 6) data as of 2013

Source: ICF market analysis.

- Regional TS hubs and estimated share of TS/feeder traffic
  - Salalah (34%)
  - Dubai (22%),
  - Durban (17%)
  - Port Louis (17%)
  - Others (10%)
- Intra-regional trade follows economic patterns prevalent in Sub Saharan African region with major economies (South Africa, Tanzania and Kenya) and island economies accounting for most ocean going container trade
- Fastest growing regions (CAGR) 2004-14 container port throughput: China (10.3%), **Africa (9.9%)**, S Asia (8.9%), Middle East (7.9%), Central & South America (7.2%); & SE Asia (6.3%).
- ”One Belt, One Road” may support further growth around E Coast, but significance for *all but the smaller* economies will be limited - global slowdown cannot be ignored

Competition for International Transhipment

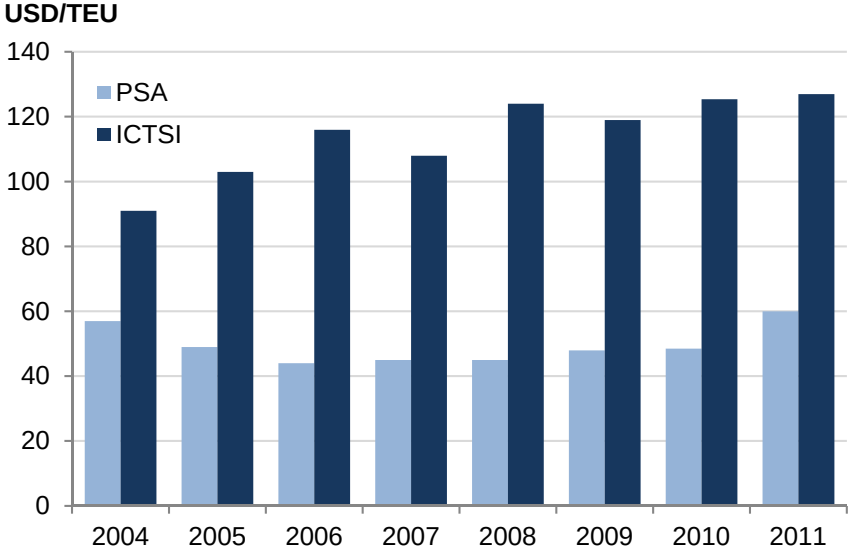
Larger geography of competition & more 'footloose' than IE cargo, but mega-alliances / vessels may be creating 'lock in'

- Key factors or KPIs for **competitive transhipment hubs** include:
  - Proximity to main shipping lanes, thus avoiding diversion costs;
  - Infrastructure to accommodate the largest mother vessels;
  - Low cost operations (container handling charges, port charges / harbour dues, etc.)
  - Streamlined customs & trade regulations, including regulation of liner activity relative to competitors;
  - No cabotage restrictions on vessels or feeder on-carriage;
  - The ability to serve a large number of small markets in the region;
  - Stable regulatory (labour, pricing, etc.) and security environment;
  - A dense network of connections & feeders – large lines or alliances may bring their own networks, but once established this network helps re-inforce or 'lock-in' competitiveness;
  - IE cargo baseload to attract direct calls – the ability for a port to service both transhipment & IE markets is an advantage, but many transhipment ports have thrived without large IE hinterland, notably Singapore, Dubai and PTP.
- Mega alliances pose challenges for terminal operators in terms of inter-terminal transfers (ITTs),
- Yield per lift for transhipment is less than for IE cargo – this has implications for terminal financial performance and the return on the major infrastructure investment typical of a major transhipment hub
- Geography of competition is broader: i.e. Dubai vs Colombo, Salalah, etc. lines can switch transhipment business between hubs, and frequently do, whereas IE cargo is more 'fixed' and usually has a limited number of port choices…**but**….
- …the onset of mega-vessels and the related alliances, is affecting the ability of carriers / alliances to easily switch volumes: **who can fully accommodate all partners of a major alliance?**

Public Funding & Port Strategy - Should Port Planning Prioritise IE or Transhipment Cargo?

- Transhipment (TS) volumes growing, in part driven by mega-vessels, but typically lower revenue and more footloose than IE cargo
- Major TS hub ports must accommodate the largest mother vessels (i.e. mega vessels) to compete hence **high capex requirements**, but **low revenue** per lift means a **tendency for public subsidy**. Even minor hubs must typically build beyond what would be needed purely for IE
- But economic benefits to the 'host country' may be limited. Example from Malaysia, Port Klang (2008):
  - Value added per TEU of IE cargo at least x1.5 higher than TS cargo ; employment impact at x2
  - But benefits from TS are net additions (i.e. would likely be lost without port). IE significant portion of benefits (e.g. trucking, freight forwarding, etc.) would remain, even without port.
- Some (e.g. Colombo, Sri Lanka) argue attracting TS ensures better connectivity for its exporters…..
- …whereas importers / exporters often complain they are subsidising 'cheap transhipment'
- Would public funds be better spent elsewhere or do the economies of scale & "lock in" offset the spend?
- "Winner takes all game" emerging with high entry requirements – **can TS hubs afford not to keep in the game…and how will the alliance evolution affect this?**

TS – Double the Volume but not Double the Revenue
ICTSI versus PSA as a Proxy for "IE Versus Transhipment"
Yield per TEU (USD)



Source: ICF; ICTSI; UBS

Thank You – Any Questions?

Ports, Logistics & Transport Services

ICF Transportation Projects

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