

Brave new world?

Container transport in 2043

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Note on methodology

This research combines the insights of the TT Club Board of Directors and other TT Club members; perspectives of customers and suppliers to the container transport industry, including “digital natives” and other start-ups; and McKinsey experts and analysis. During 2017 we interviewed over 30 industry leaders and experts, representing a wide cross-section of the industry including container liner operators, terminals operators, port authorities, freight forwarders, container lessors, financial intermediaries, suppliers of digital solutions to the transport and logistics industry, e-commerce companies, and law firms, among others. We ran a joint workshop with the TT Club Board members to further develop future scenarios. No proprietary data from the participants was exchanged or used to produce this report.

For the purposes of this report, we define the “container transport industry” as container shipping (container lines), container terminals, and freight forwarding. While freight forwarders participate in a wider part of the logistics space than containerised cargo transport, trends in container transport have a significant impact on freight forwarders.

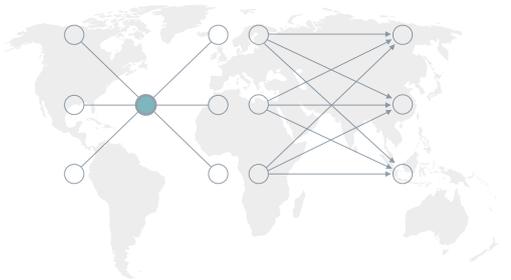
This report is structured in four chapters. Chapter One (“Where we have been”) outlines the incredible history of container transport. Chapter Two (“Where we are going”) explores the points of fundamental agreement and disagreement about the outlook for the container transport industry. Chapter Three (“Four visions of the future”) weaves together these elements to construct four potential futures that each present very different strategic implications. Chapter Four (“Preparing for the next 25 years”) provides some closing ruminations on what the container transport industry should be doing now to anticipate a range of uncertain futures.

The next 25 years: Six potential sources of future value creation

1 GREATER ECONOMIES OF SCALE



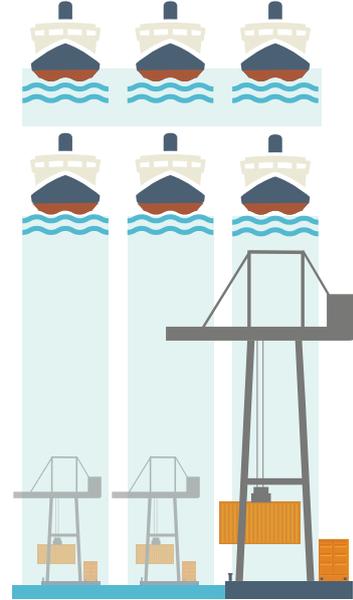
2 FLEXIBILITY



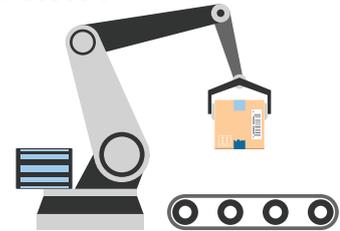
3 SUPPLY CHAIN RELIABILITY AND PREDICTABILITY



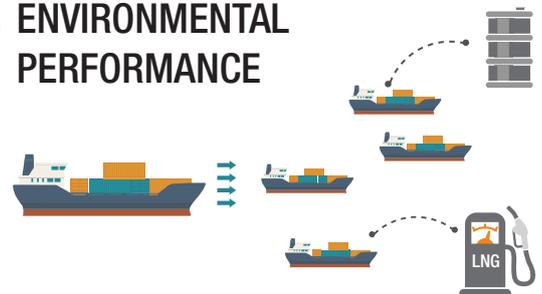
4 CONSOLIDATION AND INTEGRATION



5 AUTOMATION AND PRODUCTIVITY



6 ENVIRONMENTAL PERFORMANCE



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Executive summary

The container transport industry has been at the centre of the incredible expansion in international trade since the 1950s. Commercialised in 1956, the container's simplicity and modularity has made it the mode of choice for the transport of many goods from one place to another: containers today transport 23% of dry seaborne trade tons (and close to 100 percent of everyday goods like televisions, toys, and clothing). Consumers have benefited enormously as the real cost of transporting goods has fallen. However, the success of the container has not always meant the financial success of the industry behind it. Returns for the average container liner operator, container terminal operator, or freight forwarder have lagged the cost of capital over the last two decades – and only a select few players have managed to find a sustainable recipe for value creation.

Will the future be any different? In this joint research project between TT Club and McKinsey & Company, there were some points of broad consensus about the next 25 years: the physical aspects of the industry (containers, terminals, ships) are unlikely to change; trade flows will become more balanced between and across regions; automation will be broadly adopted; digital, data, and analytics will fundamentally shift the sources of value creation; and the industry-leading players of 2043 may well look very different from today's leading companies (though they may be the same or similar companies).

At the same time, meaningful questions were raised about:

- The future of trade growth – e.g., globalisation and trade policy, Asian industrialisation, the geography of manufacturing with robotics and 3D printing, containerisation trends, and evolving consumer habits
- What the real sources of value creation might be going forward – e.g., scale, flexibility, consolidation and integration, productivity, more predictable supply chains, environmental performance
- Who “wins” – e.g., how can today's industry leaders evolve to capture the opportunities, will players become more vertically integrated, or will “digital natives” including start-ups and/or e-commerce firms reshape the industry



In the absence of foreknowledge, we can only imagine various futures and the implications of each. We posit four possible futures:

- **Digital disruption** is a world in which the current industry is disrupted by new players who leverage digital, data, and analytics to optimise the end-to-end value chain
- **Digital reinvention** envisages that the current industry digitises aggressively and provides new value-adding services to its customers
- **Third wave of globalisation** assumes other economies, like India and Africa, realise their manufacturing and export potential, while digital reduces friction in global supply chains and spurs continued trade growth
- **“Peak container” and consolidation** imagines a future in which trade wars, geopolitical tensions, and “near-shoring” result in the peaking and absolute decline in international trade, forcing players to further consolidate

Preparing for such a range of outcomes would be taxing for even the most agile and foresighted of companies. However, there are some “no regret” moves that industry players could make now to ensure flexibility in the future, including paying more attention to the dynamics around the end-consumer (as e-commerce disrupts retail and last-mile logistics), building organisational discipline around monitoring the “trigger points” behind different futures, and radically digitising and automating.

A black and white photograph of an industrial site, possibly a steel mill or refinery. The image features several tall, complex metal structures with ladders and walkways. In the foreground, a row of spherical streetlights on tall poles is visible. A large red rectangular overlay is positioned on the right side of the image, containing white text. The background shows a cloudy sky and some brick buildings.

1. Where we have been

1968. It was the year of the Prague Spring, the Tet Offensive, and the assassinations of Dr. Martin Luther King Jr. and Bobby Kennedy. It was the year Richard Nixon was elected U.S. president, the Rolling Stones released *Beggars' Banquet*, Apollo 8 first orbited the moon, Boeing unveiled the 747, Mexico City hosted the summer Olympics, the S&P 500 touched 100 for the first time, and Yale University opened admissions to women.

China was gripped by Mao's Cultural Revolution, the United Kingdom announced the withdrawal of its military forces east of Suez, Singapore held its first election since independence, Japan was rapidly industrialising, and Dubai was taking the first steps on its impressive development journey. Real global GDP grew by 6.2% that year, resulting in a total global economic output of US\$17 trillion. Global trade amounted to 22% of global GDP and was concentrated between North America and Europe with much smaller volumes flowing into and out of East Asia, primarily Japan.

Amid all this activity, a little-noticed innovation was taking hold of global trade: the "container box," commercialised in 1956 by Malcom MacLean. By 1968, containerised trade was still miniscule: less than 1% of total trade. But it was in rapid ascent. This was the year TT Club was founded.

Trade volumes in 1967

TRADE ROUTES AND VOLUMES
(1,000 freight tons a year)

	TOTAL		U.K.		SCANDINAVIA		BENELUX		FRANCE		W. GERMANY		IBERIA		ITALY	
	Imps.	Exps.	Imps.	Exps.	Imps.	Exps.	Imps.	Exps.	Imps.	Exps.	Imps.	Exps.	Imps.	Exps.	Imps.	Exps.
North America ...	11,318	6,272	5,509	1,936	715	842	790	703	925	842	2,483	934	392	176	505	840
Central and South America	7,569	2,525	1,112	320	1,078	306	797	461	638	354	2,613	661	650	140	681	282
West Africa ...	4,130	2,373	460	411	122	169	174	258	2,488	1,229	565	156	58	30	262	119
East and South Africa	3,496	2,029	1,929	951	145	101	188	176	460	233	623	294	27	22	125	252
Mediterranean and Middle East	1,012	1,822	411	583	128	132	74	283	60	216	246	363	27	10	67	235
India and Pakistan ...	1,534	791	1,270	384	36	38	59	72	39	38	99	216	0.9	0.7	30	43
Far East ...	1,701	2,780	737	739	174	252	154	542	96	252	418	795	32	17	90	182
Australasia ...	5,108	1,496	3,079	1,029	382	95	112	90	229	50	1,030	163	14	4	263	64
U.K. ...	3,957	6,994	—	—	867	1,608	1,199	2,449	406	899	803	1,095	362	444	321	498
TOTAL ...	39,825	27,082	14,507	6,353	3,647	3,543	3,547	5,034	5,341	4,113	8,880	4,677	1,562	843	2,344	2,515

Source: "Containerization: the key to low-cost transport", A report by McKinsey & Company, Inc. for the British Transport Docks Board, June 1967.

The last 50 years have been nothing short of remarkable for the container transport industry, which has grown at breakneck speed. This has been fuelled by the expansion of global trade and by the growing share of container transport. Global trade has exploded from 22% of global GDP to 59% in 2015 – at a time when real global GDP has burgeoned from US\$17 trillion to US\$77 trillion. Japan's manufacturing- and export-led development strategy was later adopted by South Korea, Taiwan, and China. China's integration into the global economy – catalysed by establishing the Shenzhen Special Economic Zone and Deng Xiaoping's reforms in the 1980s, and culminating in its 2001 accession to the World Trade Organization – unlocked a low-cost labour force of almost one billion people. This led to a wave of offshoring and the fragmentation of supply chains, ultimately making China the “factory to the world.”

Already riding this wave, container trade also took share from breakbulk trade. Its modularity, simplicity, resistance to pilferage, and efficiency proved far too attractive for shippers of cargo; many goods are now only transported by container. Whereas fewer than one million twenty-foot equivalent units (TEUs) of containerised cargo were moved in 1968, 182 million TEUs were moved in 2016.

The industry has done everything it can to keep up with this astronomical market growth. In the early years, the box itself had to be standardised and made compatible with the assets and infrastructure of many different players. Liners recognised that containers unlocked new scale economies and invested in larger and larger ships. At a time when the first fully cellular container ships could carry approximately 1,000 TEUs, McKinsey surmised, “Containerized cargo is effectively becoming like other bulk cargoes, and is subject to the same economies of scale... If container ships follow the tanker trend, ships of more than 10,000-container capacity could be available.²” By 2017, ships with capacity in excess of 21,000 TEUs were coming onto the market. The lumpiness of adding capacity has resulted in over-expansion and regular boom-bust cycles, the most recent of which has prompted many line operators to consolidate: the top five liner companies had a 27% share of the market in 1996; today they have 64%.

² “Containerization – Its Trends, Significance and Implications”, McKinsey & Company for the British Transport Docks Board (July 1966).

The effect of larger ships has been to concentrate cargoes in leading ports and grow the share of trans-shipment volumes.³ Major regional ports like Rotterdam, Singapore, Jebel Ali, Shanghai, and Los Angeles have captured a disproportionate share of the growth while other ports have faced financial pressure and decline. For terminal operators, enjoying growth meant gaining a position in the best ports with the most efficient hinterland connections. Initially this was a local game, but over time some multi-continent terminal operators have emerged.

Rapid growth had another effect: it enabled so many players to survive across so many jurisdictions that coordinating activity amongst all of them became valuable in and of itself. Freight forwarding, which had been around since the 1800s, came of age in the post-World War II period by ensuring a relatively seamless “one-stop shop” experience for cargo shippers – something the plethora of liners, terminal operators, railroads, trucking companies, and others that physically moved the cargo proved unable or unwilling to do. Without the benefits of scale economies (the business historically was labour- and relationship-intensive), an enormous number of freight forwarders emerged, mainly serving and maintaining long-term relationships with local cargo shippers.

³ The share of trans-shipment TEUs grew from 21% in 1995 to 28% in 2012, but has since modestly declined to 26% in 2016 as overall trade growth has slowed.

The evolution and standardisation of the “container box”

The origin of multimodal containers may be traced to coal mining regions of the United Kingdom in the late 18th century. In 1766 James Brindley designed the box boat “Starvationer” with ten wooden containers, to transport coal from Worsley Delph (quarry) to Manchester by Bridgewater Canal.

Following the Great Depression, initiatives emerged to ease transport, particularly by rail, in both the United States and Europe. For example, in 1931, Benjamin Franklin Fitch designed the two largest and heaviest containers in existence anywhere at the time, the larger one measuring 20’0” by 8’0” by 8’0”, with a capacity of 50,000 pounds (22,680 kilos) in 1,000 cubic feet.

In 1933, the Bureau International des Containers (BIC) was established in Europe under the auspices of the International Chamber of Commerce, and determined a set of Obligatory Regulations for containers handled by means of lifting gear and used in international traffic, forming a first “standard.” The United States Army continued to experiment with various dimensions through to the 1950s. In April 1956 a crane lifted 58 aluminium truck trailers aboard an ageing tanker ship, “Ideal-X,” moored in Newark, New Jersey, for a voyage to Houston, Texas, where 58 trucks waited to haul these metal boxes to their inland destinations.

Initial size standards were debated by the American Standards Association, which then proposed the establishment of a committee of the International Organization for Standardization (ISO). Technical Committee 104 (TC104) first met in 1964 and over the years has continued to drive standards for freight containers in relation to safety and efficiency. There are now five core standards relating to containers.⁴ Furthermore, the concept has been extended for specialist uses, including refrigerated containers and tank containers.

Through the late 1950s and early 1960s the increase in containerised traffic grew considerably, so much so that in 1967 the International Maritime Organization⁵ (IMO) initiated a study into the safety of containerisation in marine transport. In 1972, a conference jointly convened by the United Nations and the IMO considered a draft Convention prepared by the IMO in cooperation with the United Nations Economic Commission for Europe. The outcome of the conference was the adoption in December 1972 of the International Convention for Safe Containers (CSC 1972). When the Convention was initially drafted the world-wide fleet of containers was 145,000 TEUs; by the end of 2016 the global fleet has grown to some 38.5 million TEUs.

The interaction between the IMO and ISO through the decades, often prompted by incidents or interventions made by national authorities, has sought to mitigate the risks involved in containerisation. At the time of writing, 84 countries have ratified CSC, for which the sixth edition was published by IMO in 2014.

4 These are ISO 668 - Series 1 freight containers – Classification, dimensions and ratings; ISO 1161 - Series 1 freight containers – Corner fittings – Specification; ISO 1496 - Series 1 freight containers – Specification and testing – Parts 1 to 5; ISO 3874 - Series 1 freight containers – Handling and securing; ISO 6346 - Freight containers – Coding, identification and marking

5 Known until 1984 as “Inter-Governmental Maritime Consultative Organization” (IMCO).





An uncertain glory

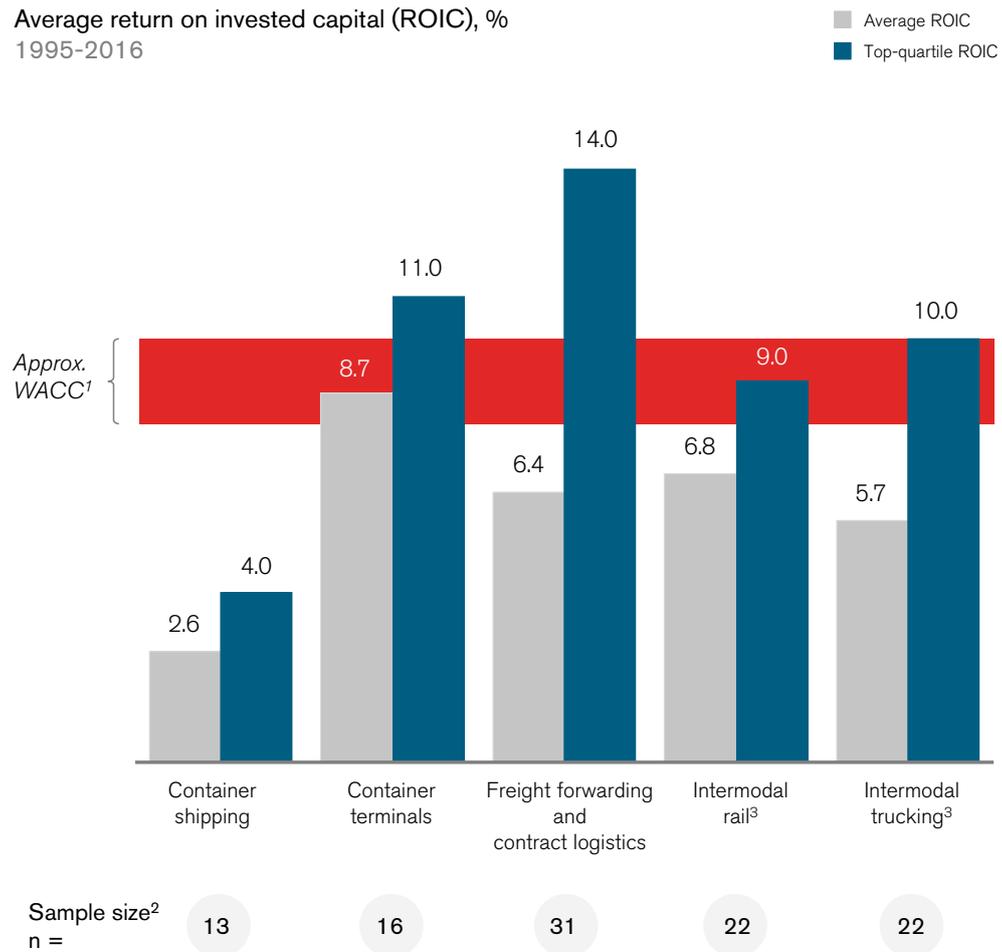
In such a bullish growth environment, industry players may have expected reasonable returns. But container transport has proved to be an extremely competitive business and margins have typically been short-lived. During the period 1995-2016, when TEU volumes nearly quadrupled, the average player in the container transport industry did not return its cost of capital (Exhibit 1).

Of course, averages deceive. Some individual companies have been able to generate returns on invested capital far more than their cost of capital over the long run. The “average” top-quartile player in all segments except container shipping has created value. Top performers in freight forwarding and contract logistics returned 14% on average; those in container terminals, 11%. The secrets to success in the face of intense competition are varied but typically relate to scale, world-class operations and the right geographic exposure. For container liners, average returns for the top players were still less than the cost of capital invested, with only a small number of global players or, alternatively, companies focused on “niche” trade routes able to squeeze out a return; a commoditised product and a mismatch between capacity additions and demand growth have proven a recipe for low returns.

Exhibit 1

The container transport industry has struggled to return its cost of capital in the last two decades

Average return on invested capital (ROIC), %
1995-2016



1 Weighted average cost of capital; estimated at 8-10%
 2 Sample size varies across years due to data unavailability
 3 Includes non-containerised transport
 SOURCE: Capital IQ, McKinsey analysis

A new era?

The global financial crisis in 2008-2009 was a major watershed for the industry. For decades containerised trade growth has been double or triple that of real global GDP growth. Container traffic had never declined year on year until 2009. Now, as the wave of globalisation has slowed, container growth is only just matching GDP growth. Economic malaise in the wake of the financial crisis – inequality, unemployment, slow-to-recover wages, fears of automation – has fed into populist policymaking. This threatens to upend the pro-globalisation policies that underpinned the expansion of trade over much of the last 50 years. In addition, concerns mount about the sustainability of China's economic model, especially its degree of leverage and whether it can effectively reorient itself from an investment-led development strategy to a consumption-led one.

At the same time, the industry faces new opportunities and threats from the rise of digital, data, analytics, and automation. In an industry traditionally focused on physical assets, the digital era presents a host of new challenges, potentially disrupting business models and creating new value streams. Customer expectations of container transport are also being radically re-shaped by e-commerce and innovations in last-mile logistics; as end-consumers come to expect same-day delivery, the demands on the container transport industry – which is only a couple of steps removed – will only rise. And other innovations like 3D printing and hyperloops may fundamentally change the geography of trade and the container transport sector's role in facilitating it.



A period of exceptional growth – as the global economy boomed, global trade outpaced the economy, and container captured an ever-increasing share of trade – has begun to feel like a distant memory. At the same time, the rise of digital, data, and analytics is creating new expectations among the end-users of the container transport value chain and other stakeholders – throwing up new strategic dilemmas and investment requirements.

2. Where we are going



The container transport industry is characterised by short-term commercial competition on the back of investments in long-life assets. A ship launched today can expect to be on the water for the next 20 to 25 years. A container terminal will typically operate even longer, though individual pieces of equipment like cranes may be replaced or upgraded. In contrast, the fast-paced real-time competition for a customer's cargo shipment will feel entirely divorced from any long-term macro trends.

Therefore, looking 25 years out – to 2043 – is both essential and foolish. Indications of what the future holds can help companies position themselves for success. At the same time, industry players' long-term investments and the accumulated impact of many short-term decisions will come to define the future state.

Drawing on the insights of over 30 senior industry leaders, there was a general, though not absolute, consensus on five future trends:

- 1. The physical characteristics of the industry** are unlikely to change: the container itself will still exist, container ships will continue to ply the world's oceans (and won't be displaced by "sci-fi" concepts like autonomous floating containers or under-sea hyperloops), terminal operations will still be centred on crane loading/unloading and yard operations connecting to rail and trucks. Box sizes will be stable at today's standards, given the enormous investment requirements across the value chain to accommodate longer (53-foot) or wider (8-foot 6-inches) containers. Over 25 years, lighter-weight materials like carbon-fibre composites may start being introduced for containers and potentially ships to reduce weight and improve tensile strength.
- 2. Trade flows will become more balanced across trade lanes** as incomes converge between East Asia and developed economies, and the emerging economies in South Asia and Africa "catch up". The simplified picture of "factory Asia" producing for the American and European consumer will be increasingly antiquated, and intra-regional and north-south trades will likely grow faster than traditional east-west trades.
- 3. Automation will be broadly adopted across the value chain,** especially on the landside in ports, terminals, rail, and trucking. This will unlock significant efficiencies even within the constraints of today's infrastructure and assets.

“Boxes will remain as today. Customers prefer frequency, not bigger boxes.”
– *Container shipping executive*

4. Digital, data, and analytics will cause

a fundamental shift in the sources of value creation.

Customers will no longer just seek transport capacity between two locations (from container liners, terminals, and intermodal providers) and “out of sight, out of mind” orchestration (from freight forwarders). They will come to expect guaranteed delivery at a specific time and transparency of their cargo at every stage in the process – all at a lower door-to-door price than today. They will expect a higher degree of reliability, transparency, and user-friendliness; companies that can't supply this will suffer.

5. The industry leaders will look very different.

Some will be larger versions of the current leading incumbents after consolidating further, either focusing on one part of the value chain or integrating across it. Some of today's leaders will evolve and change their business models in response to the new challenges. Some will be “digital natives” – either start-ups that have scaled or large e-commerce players that have decided to optimise the container transport leg of their supply chain. All segments will face fundamental questions about their business models and role in the container transport value chain.

“

“The good thing about aircraft is that the people load themselves. We need our boxes to load themselves too.”

– *Container shipping executive*





Three fundamental questions

These broad trends paint only a fuzzy picture of the future, however. The industry is faced with some fundamental questions:

1. What will happen to containerised trade?
2. How will value be created?
3. Who “wins”?

The answers will “trigger” various possible futures and determine the industry’s shape and health in the coming decades.



1. What will happen to containerised trade?

The tailwinds of globalisation, Asian industrialisation, and containerisation cannot blow forever. Since the global financial crisis, it is not clear whether they will continue to blow at all; they may instead become headwinds. Meanwhile, questions persist about how robotics, automation, and 3D printing as well as evolving consumer habits will change the global manufacturing footprint and whether supply chains will shorten as a result.

The most recent period of **globalisation** was powered by liberalising trade policy, expanding global supply chains, and integrating over one billion workers in China into the global economy.⁶ Many of these trends appear to have slowed since the global financial crisis. Trade policy liberalisation is much more piecemeal today, with smaller bilateral, regional, or “pluri-lateral” deals favoured over World Trade Organization-led multilateral deals, and historic leaders like the United States and the United Kingdom focused on revising existing trading relationships. The expansion of global supply chains, through fragmenting and offshoring different parts of the production process, has stalled and even modestly reversed since 2011.⁷ And, in China, with the working-age population in decline and wages rising, the global economy has now digested the bulk of the available Chinese labour force.

On the other hand, there are some forces and trends that may underpin continued globalisation. For example, China’s Belt and Road Initiative – which seeks to catalyse up to US\$1 trillion investment in transport and other infrastructure in Asia, Europe, and Africa – may enable participating countries to trade even more, even in the absence of further policy reform. The rise of “digital globalisation” is already giving small and medium enterprises the opportunity to sell to a global customer base through e-commerce platforms: approximately 12% of global goods trade in 2015 was from cross-border e-commerce, and the share is growing.⁸ And, even in the absence of further trade liberalisation, digitally enabled transparency may also shine a purifying light on trade flows: many countries’ trade and customs remain opaque and sometimes corrupt. Greater transparency enabled by digital technologies could unlock trade that today is stifled, while also increasing safety and security by reducing cargo misdeclaration.

“

Digital will help reduce corruption, which slows trade in so many places today.”

– *Digital freight forwarder*

⁶ For a comprehensive treatment, please see OECD, “The future of global value chains: business as usual or ‘a new normal’?” (July 2017).

⁷ Bart Los, Robert Stehrer, Marcel Timmer, Gaaitzen de Vries, “An anatomy of the global trade slowdown based on the WIOD 2016 release,” GGDC Research Memorandum 162 (December 2016).

⁸ McKinsey Global Institute, *Digital Globalization: The New Era of Global Flows* (March 2016).

Asian industrialisation, which was both a cause and consequence of globalisation, created a third “pole” in global trade where before there had only been North America and Europe. The development journeys of Japan, South Korea, Taiwan, and Singapore were transformational for their societies and the global economy. But the scale of China’s economic ascent, starting in the early 1980s, was unlike anything experienced before: China has accounted for a fifth of global GDP growth since 1980 and over 90% of the 700 million people lifted out of extreme poverty between 1981 and 2010 (Exhibit 2).⁹

Now Asian industrialisation has become a story of two countries: China with its US\$17 trillion economy and 1.4 billion-person population, and India with its US\$7 trillion economy and 1.3 billion-person population. Combined, the two represent a quarter of global GDP, approximately 30% of global goods trade, and nearly 40% of global population. China is managing a slowdown in its annual real GDP growth from 10+% to 6-7% and the shifting of its economy from investment to consumption. The evolution away from investment-led growth in recent years has had the effect of reducing the “trade intensity” of its economy.¹⁰

Meanwhile, India is looking for a policy recipe – including tax, labour market, and land reform, infrastructure investment, ease of doing business improvements, and skills upgrading – that sustainably accelerates its growth and ignites industrialisation. On this front, India is working to copy some of the most successful parts of China’s recipe with its “Make in India” campaign. Still, India has a long way to go: manufacturing is only 14% of GDP (vs. 33% in China) and some analysts worry it is facing “premature de-industrialisation,” which could undermine its export and import growth.¹¹

9 Defined as population living on less than US\$1.25 per day PPP 2005 USD.

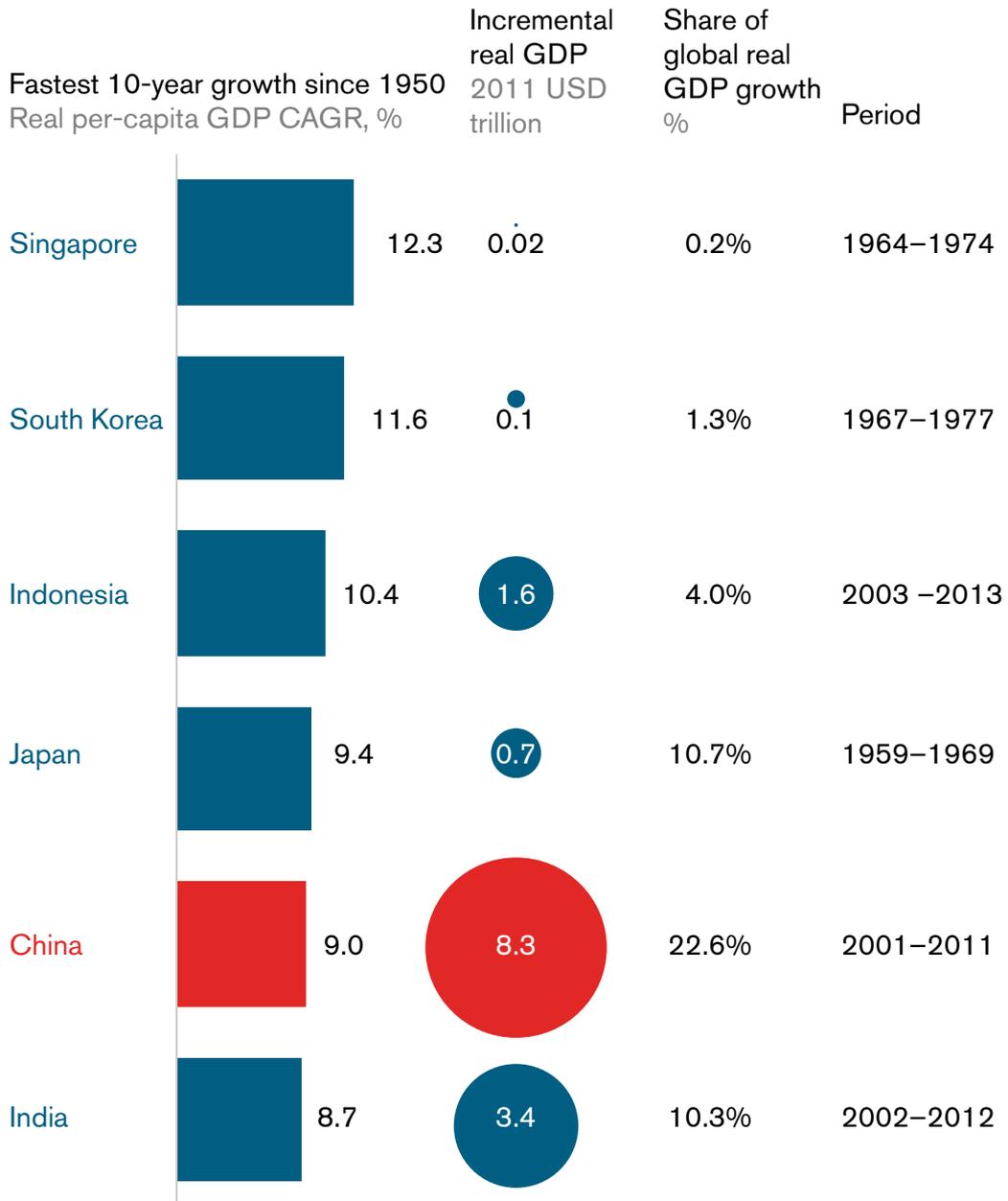
10 Bart Los, Robert Stehrer, Marcel Timmer, Gaaitzen de Vries, “An anatomy of the global trade slowdown – based on the WIOD 2016 release,” GGDC Research Memorandum 162 (December 2016).⁸ Defined as population living on less than US\$1.25 per day PPP 2005 USD.

11 Dani Rodrik, “Premature Deindustrialization,” NBER Working Paper No. 20935 (February 2015).

Exhibit 2

The scale of China's economic development has no peer in recent history

Output-side real GDP at chained PPP 2011 USD



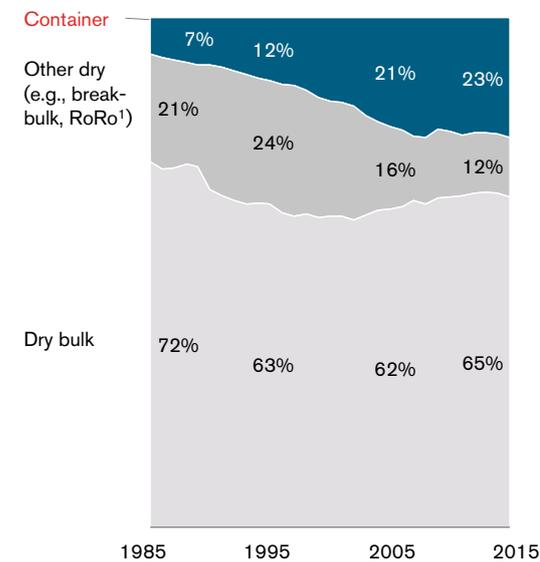
SOURCE: Penn World Table version 9.0; McKinsey analysis

Containerisation – the increasing use of containers as the preferred mode of transport for individual commodities – has been on a steady march since the late 1950s. Containers accounted for 7% of dry seaborne trade tons in 1985 and 23% three decades later (Exhibit 3). This growth happens in three different ways. First, goods can be transported in containers when they weren't before – this is what people typically think of as containerisation. Second, trade in more highly containerised goods can grow faster than overall seaborne trade. Third, more containers are needed when they are under-utilised; the “stuffing” of containers falls. In recent years, the first source of growth – containerisation itself – has slowed considerably, contributing only 0.3 p.p. of the 3.6% annual seaborne container trade growth during 2010-15.

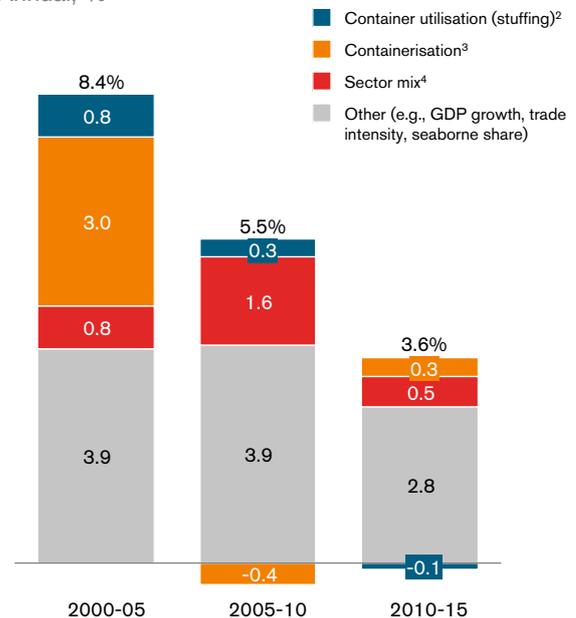
Exhibit 3

Containerisation has slowed considerably since the early 2000s

Container share of dry seaborne trade
% of total dry seaborne trade tons



Composition of seaborne container trade growth
Annual, %



1 Roll-on, roll-off

2 Positive growth contribution implies lower utilisation of containers (and vice versa)

3 Positive growth contribution implies the penetration of containers within specific sub-sectors (i.e. containers capturing share) (and vice versa)

4 Positive growth contribution implies faster trade growth in highly containerised sub-sectors (and vice versa)

Source: IHS, McKinsey analysis

Fundamentally, this is because many commodities have fully containerised already. The “low-hanging fruit” has been harvested in the first 60 years of the container; there is little further scope for containerisation in furniture, butter and cheese, or televisions, for instance. What’s more, many containerised goods themselves are miniaturising, needing less containers: for example, a twenty-foot container could fit approximately 100 CRT televisions, but the same container today could carry 600 flat-screens.¹² Meanwhile, many dry bulk commodities like coal and iron ore may not obviously lend themselves to better economics by shipping via container.

The future of containerisation then will be decided by how “mid-containerised” commodities evolve. Here the picture is mixed. Consider automobiles, which were 18% containerised in 2000, rose to 25% containerised by 2005, and remained 25% containerised in 2015. The competition with RoRo transport is fierce, but even hypothetical full containerisation would only result in a 4% increase in the total number of TEUs on the ocean today. On the other hand, agricultural products hold considerable potential given the total volumes traded. But for every commodity like fresh grapes and cherries (48% containerised in 2000 and 61% in 2015), there is one like bananas (57% in 2000 and down to 48% in 2015).

What could change this ambiguous outlook? An efficient containerised supply chain can act like a conveyor belt from factory to consumer. Even for traditionally bulk-carried commodities such as agricultural grains, there is an efficiency upside from smooth, daily dispatch and arrivals of containers of cargo, instead of monthly bulk collection and delivery. A mature container industry, with full visibility and predictability in the supply chain, can capture more of these commodities.

“ More and more products are transported in small quantities. We see it every year: some products change from bulk to smaller quantities – and it gets put in a container.”
– *Container leasing executive*

“ There is a huge piece of the developing world where containerisation is low, largely on account of inadequate infrastructure to handle containers.”
– *Container terminals executive*

12 Calculation assumes 24-inch screens across CRT-tube and flat-screen televisions (for “apples-to-apples” comparability), 80% container utilisation, and 20% volume increase per television for packaging.

There is also long-standing opportunity for containers on “through transport” – the igniting spark for TT Club (“Through Transport” Club). The container allowed the same “wrapper” to be used on the ship, the train, and the truck. In many locations, however, “through transport” is still not being used to its fullest. Much China-origin cargo is consolidated into containers only near the port. Over 90 percent of containers arriving in Los Angeles/Long Beach are destined for the inland, but half of these are opened, destuffed and transloaded in the port area itself. Imports into Indonesia are almost always opened in logistics zones just behind the key ports, with the goods travelling inland in smaller trucks. There is significant value in growing “through transport.” Investments in infrastructure – like better Indonesian roads – will make more possible. Improved analytics will help container transport players track their boxes as they move inland. Autonomous trucks make the through-transport move simpler and cheaper. And by simplifying the hand-offs of cargo between players, containerised transport and especially “through transport” tends to be safer than other ways of moving goods.

“ It’s not like before with more and more commodities going into boxes. That transition has already happened.”
– *Container terminals executive*

Robotics and 3D printing are often touted as a revolution in manufacturing, potentially reducing the cost to make goods by reducing the labour required. Considering that much of Asian industrialisation and export prowess has been due to competitive labour costs, this “Industry 4.0” revolution could have enormous consequences for the geography of manufacturing and trade. Robotics could reduce the labour required in the manufacturing process and therefore developed countries, which tend to have high labour costs (not fully offset by higher productivity), start to enjoy a wave of “near-shoring.”

On the other hand, many goods are not produced in a specific location due to labour costs; there are many other drivers of manufacturing footprint. For example, automobiles are typically manufactured regionally due to the costs of transport, import tariffs, and the need to tailor the product to local preferences. Petrochemicals tend to be produced where there is abundant access to feedstocks and energy prices are low. We estimate that only 10-15% of TEUs are filled with goods primarily manufactured in specific locations because of labour costs. The assumption that labour automation will lead to significant “near-shoring” may, therefore, be too simple.

There is a big question mark around the impact of 3D printing – also known as additive manufacturing because the process builds up a product from powders rather than milling it down from a larger piece of material. This indisputably reduces waste, and the trade in raw materials – much of which is containerised – could be substantially reduced as well. On top of that, 3D printing may enable production closer to the consumer, perhaps even in one’s own home. Due to its immaturity, 3D printing still tends to be a slower and more expensive option for most products. The technology’s development could be a major determinant of future trade patterns: it may remain a niche technology, but if it outperforms traditional manufacturing in terms of speed, quality, and cost, then all bets are off.

“ 3D printing isn't really making an impact yet but once it happens, it will happen so fast and then it will definitely reduce the need for transport.”
– *Container shipping executive*

“ If you look at cheap items, pressing them is a very cheap and fast way to do it, and ocean transport is cheap as well, so it's less expensive to ship from Asia to rich countries [than to produce locally]”
– *Container shipping executive*

Evolving consumer habits are being shaped by growing worldwide incomes as well as environmental awareness, demographic preferences, and e-commerce and new digitally-enabled forms of ownership. Supply chains are responding as a result. As societies grow wealthier, consumption habits tend to shift towards services and away from goods – for example, a pleasant holiday instead of a fourth television (Exhibit 4). Digital and e-commerce have in some sense accentuated this trend: digital goods like e-books substitute for the physical product. And new “rent everything” ownership models like ride-sharing or clothes rental may significantly increase the utilisation of goods, requiring lower production – and trade – to satisfy the demand of a given population.

The overall effect of this “de-materialisation” of demand is ambiguous. Just because consumers are consuming relatively more services and less goods says nothing about the habits of the businesses providing those services. More holiday-goers create more demand for aircraft; more users of ride-sharing apps create more demand for cloud computing servers. “Rent everything” ownership models may also reduce the cost of consumption to such an extent that consumers can afford to pay for a broader set of goods and services than before.

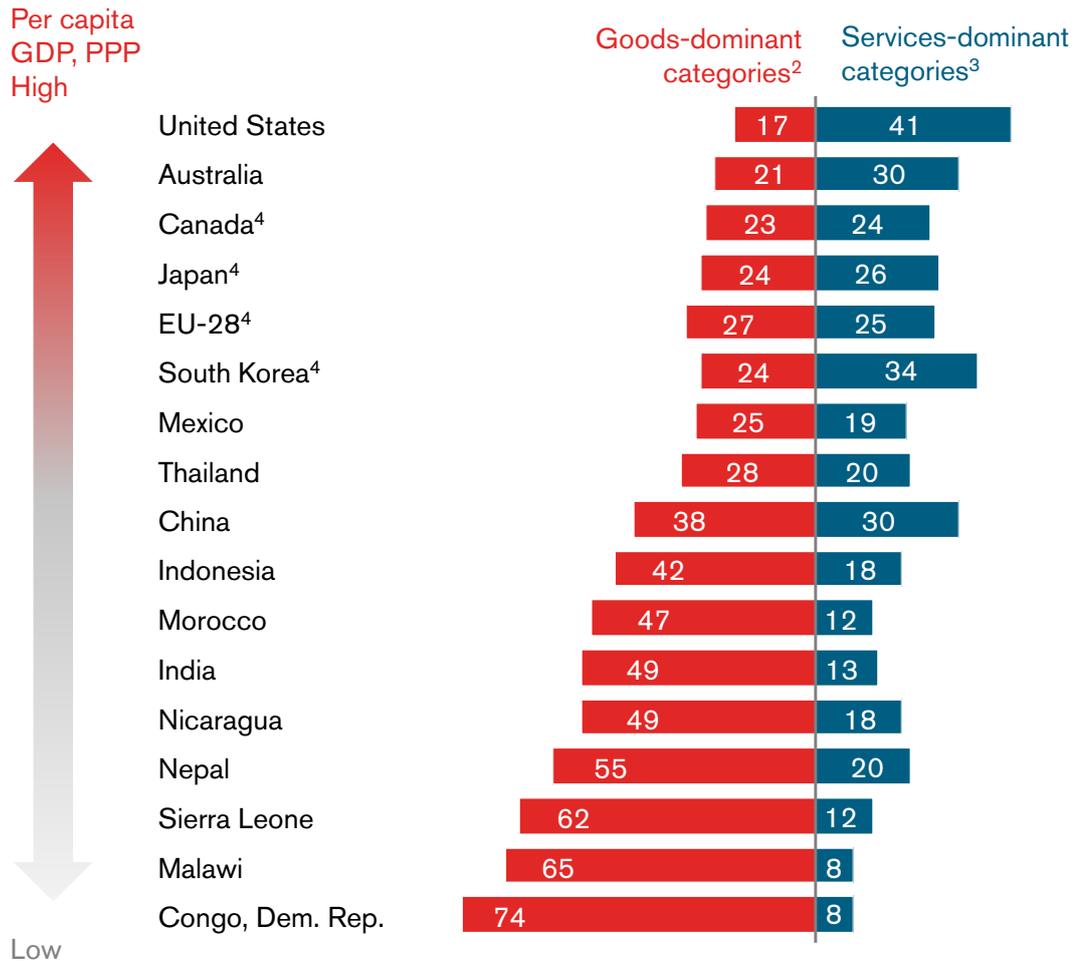
But the increasingly frictionless nature of services-oriented consumption is also changing consumer expectations for what goods they buy. E-commerce firms are innovating to ensure they fulfil orders with exceptional speed and watertight reliability. In this vein, the tension between long multi-national supply chains and responding to consumers' need for immediacy was never more apparent than during the fidget spinner shortage in summer 2017. A simple but addictive toy, the fidget spinner became a sensation with kids in Western countries via social media. Traditional retailers were caught unawares, and many small merchants – selling via e-commerce platforms and purchasing from Chinese contract manufacturers – were swiftest in meeting the demand. However, as the trend matured (in the space of days) and traditional retailers tried to catch up, the multi-day lead times required for maritime shipping were deemed unattractive and many importers relied on air cargo. The primary lesson of this craze and logistical response is the need for adaptable and responsive supply chains. At what point does speed of container shipping start to be meaningful to customers (rather than slow-steaming to save on fuel costs) or do retailers start to favour local or regional manufacturing options?

“ Factory-to-consumer is a relatively unknown expression at the moment, but it will become much more important over the next five years.”
– *Freight forwarding executive*

Exhibit 4

The share of services in household consumption rises with per-capita income

Household-consumption expenditure by country¹
% of total household consumption expenditure



1 Does not include public spending on health care and education.

2 Includes furnishings and household equipment; clothing and footwear; alcoholic beverages and tobacco; and food and non-alcoholic beverages

3 Includes restaurants and hotels; education; health; recreation and culture; and communications

4 Household consumption figures from Eurostat; all other figures from the World Bank Global Consumption Database
NOTE: Other categories not shown include housing, water, electricity, gas, and other fuels; miscellaneous goods and services; and transport.

Source: World Bank Global Consumption Database; Eurostat; McKinsey Global Institute; McKinsey analysis

One could imagine a world where traditional supply chains (i.e. manufacturer in a developing country; ocean freight; and distributors, warehouses and retail stores in consuming country) are upended by a supply chain direct from the factory to the consumer, disintermediating the ocean freight, distributors, warehouses, and retail stores entirely. With e-commerce thus far, only the retail stores have felt the disintermediation. But if manufacturing were to move closer to the customer, or customers came to value – and pay for – very fast fulfilment via air freight (as they did with fidget spinners), then pressure on the traditional container transport value chain could be significant.

Therefore, across all these trends, the outlook for the “demand side” of the industry is ambiguous. A few trends point to faster growth, but other trends point to a slowdown. And one’s point of view on the question can be easily shaped by the evidence considered.

2. How will value be created?

Whereas providing the service of moving cargo from one end of the world to another via container has proved to be a challenging business, customers have benefited from the dramatic expansion of this service at a low cost to them. Indeed, after adjusting for inflation, the cost of transporting goods around the world has been falling for centuries, and the container was only the latest innovation to reinforce the trend. The paradox of beneficial cargo owners and, ultimately, end-consumers enjoying lower and lower costs while industry players struggle to share in the value-creation has been a perplexing one for many industry participants. That dynamic doesn’t appear poised to change, but the industry remains focused on finding new ways to create value for their customers and, hopefully, sustainable returns for themselves.

We start first by looking at the future potential sources of value creation. Then, in the next section, we will look at who is likely to capture this value – or, “who wins.”

There are six ways value could potentially be improved in container transport over the next 25 years:

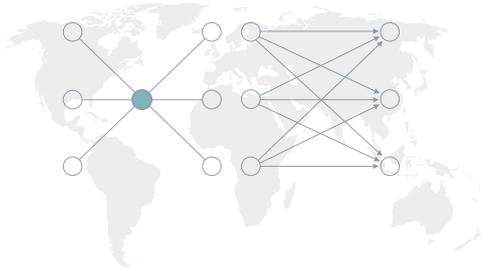
1. Greater economies of scale
2. Flexibility
3. Supply chain reliability and predictability
4. Consolidation and integration
5. Automation and productivity
6. Environmental performance

Six sources of value creation

1 GREATER ECONOMIES OF SCALE



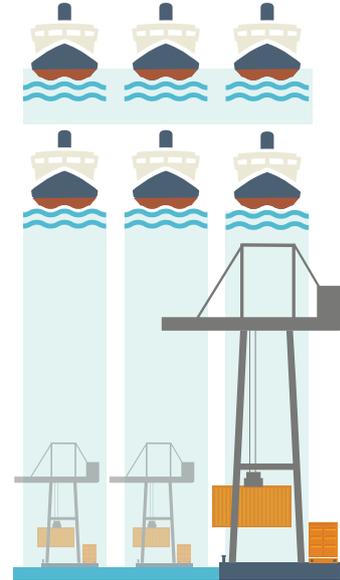
2 FLEXIBILITY



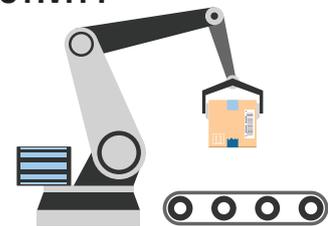
3 SUPPLY CHAIN RELIABILITY AND PREDICTABILITY



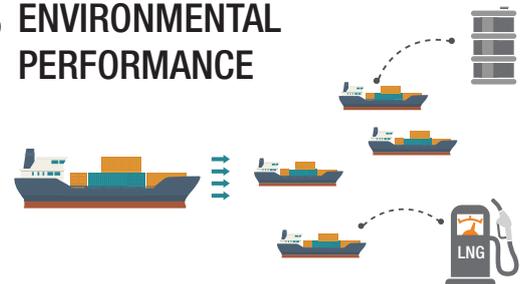
4 CONSOLIDATION AND INTEGRATION



5 AUTOMATION AND PRODUCTIVITY



6 ENVIRONMENTAL PERFORMANCE



Greater economies of scale

Reinforced by the decline of the price-setting power of shipping conferences since the 1990s and their demise in the 2000s, the liners have focused even more on minimising costs in order to earn a profit. Primarily, this has taken the form of ever-larger ships to enjoy lower operating costs per container. In the 20 years from 1985 to 2005, the largest container ship doubled in capacity from approximately 4,500 TEUs to 9,200 TEUs. A year later, in 2006, a ship of nearly 15,000-TEU capacity was introduced and sizes have continued to balloon to over 21,000-TEU capacity today. A parallel approach, especially during the period of high oil and fuel prices, has been “slow steaming,” which conserves fuel, reduces pollution, and lowers cost for a given leg – at the expense of speed.

Ship economies of scale are the source of much debate within the industry, in terms of the technical feasibility of larger ships, the trade-off between ship capacity and network flexibility, and the additional costs imposed on other segments of the value chain, especially ports and terminals, when introducing larger ships. To the extent container shipping remains a commoditised product (i.e. customers appearing to prefer lower prices over increased speed and flexibility), liners may very well decide to continue investing in larger and larger ships. But ship economies of scale only work if the ship is filled – meaning liners will continue to look for any opportunity to book volumes, including from freight forwarders.

“ The shipping lines only worry about their link in the chain – they make their link in the chain more efficient by making the other links in the chain less efficient.”

– *Container terminals executive*

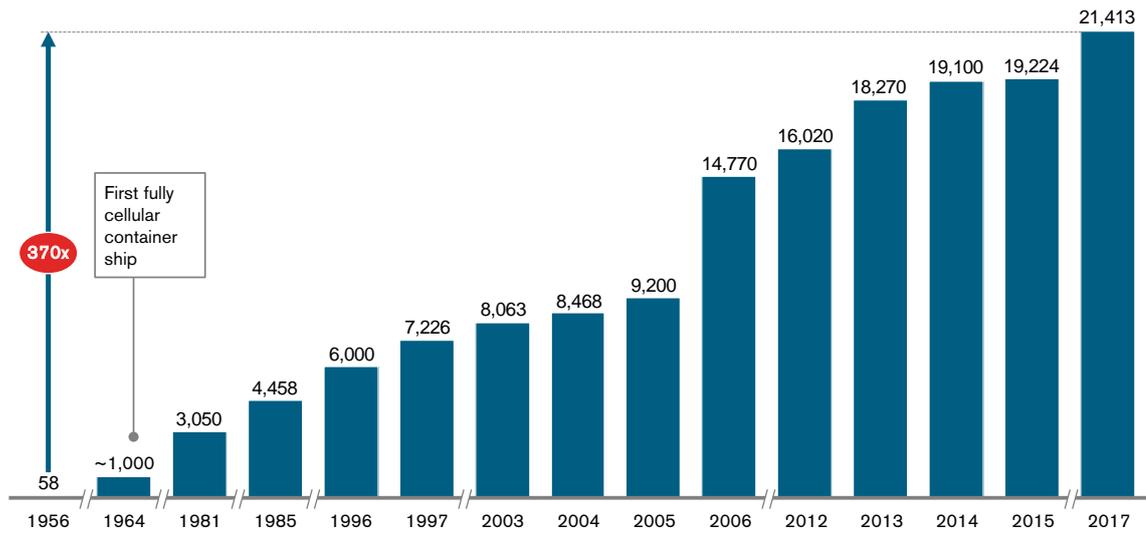
Economies of scale are also relevant in other segments of the value chain. Larger terminals can sustain higher levels of utilisation. Double-stack trains reduce on-carriage costs. Larger freight forwarders have more relationships and bargaining power with transport providers, enabling them to offer better services to beneficial cargo owners.

The costs of scale, however, are legion. Ever larger ships are forcing more frequent and more expensive investments in new cranes, quay walls, and other port infrastructure, depressing container terminals' returns. Meanwhile, the unit-cost benefits to liners diminish with each new expansion, and there is a point where port and hinterland congestion caused by ultra-large ships fully counteracts the expected unit-cost benefits.

Exhibit 5

Container-ship capacity has grown 370-fold since the first voyage, in 1956

Maximum container vessel capacity and company in year of introduction, TEU



Source: Press reports

Flexibility

If customers push harder for speed and flexibility of service, even at a slightly higher price, then more modular solutions may come into vogue. Smaller, more frequent ships enable point-to-point networks and ensure faster turnaround times in ports. Up to the present day, customers on average have favoured lower cost over better service for the ocean-shipping leg of the supply chain. How much they would value faster, more direct services remains a major question. In this way, scale would be deprioritised in favour of flexibility and modularity.

New commercial practices could also be introduced to better align incentives across the value chain. Today, terminal pricing is essentially a flat tariff per container moved, with some variations based on whether it is empty or full, trans-shipment or gateway. This pricing approach doesn't accurately reflect all the costs borne by terminal operators and therefore incentivises inefficient behaviours. For example, a trans-shipment container uses the same berth space, equipment, and labour as a gateway container, but its movement draws a lower price. Tariffs, fees, and discounts that better reflect ship size, stowage plans, port congestion, ship arrival and terminal delays, and other factors could promote behaviours that would result in higher productivity for all parties, including customers.

“ In 25 years [...] I see a comeback from the 10,000-TEU vessels.”

– *Container terminals executive*

Freight forwarders are in a particularly privileged position to help make their customers' supply chains nimbler. By being asset-light, forwarders can swiftly reorient their services across different container transport providers based on customer demand and preferences.

Supply chain reliability and predictability

Customer needs are changing, especially as e-commerce upends consumer expectations and last-mile distribution – forcing changes further up into the container value chain. As beneficial cargo owners look to make their own supply chains nimbler, container transport players have much to offer in terms of digitised document flow, omniscient cargo tracking, and predictive analytics. A more reliable seaborne containerised transport leg – which also requires a different way of working and integrating across container lines, port authorities, customs agencies, terminal operators, and intermodal transport providers – could make the ship on the water an extension of the warehouse on land: inventory in the former would be as good as “safety stock” in the latter. Smaller ships and more flexible service offerings could also improve supply chain reliability.

“

Economies of cyber networks will be more important than economies of scale.”

– *Container shipping executive*

The interface with the customer and across the value chain is also increasingly a battleground between freight forwarders, liners, and digital start-ups. For the customer interface, user-friendly design, simplicity, and real-time responsiveness are in focus. New interfaces will also be needed with customs and inland logistics providers. Freight forwarders in particular are well-positioned to capture value by being the digital “glue” in the supply chain, managing these interfaces and winning the upside from the value created in a smoother chain.

Consolidation and integration

In recent years, mergers between container liners have started to help mitigate the over-capacity in the market, optimise networks, and reduce overhead costs. The top three container liners had 26% market share in 2000, 39% in 2013, and 47% in 2017. This is still a far cry from the 70% market share the three largest airlines in the US domestic market or the 90% share of the three largest international express package companies.

Barring regulatory pushback, the logic of consolidation remains valid in the liner segment. For example, timing capacity additions to demand becomes easier in a more concentrated market, helping reduce the rate volatility caused by supply/demand mismatches.

The container terminals and freight forwarding segments have not seen as much consolidation; today the top three players in each enjoy 34% and 24%¹³ market shares, respectively. Partially this is because local advantages – such as access to land and relationships with customs authorities, importers, exporters, and intermodal transport providers – are more meaningful than for container liners. However, there may be some additional opportunities that could be captured by consolidating (not least to negotiate from a stronger position with larger and larger container lines).

For example, players are exploring “smart” stowage – loading a ship such that containers are optimally positioned for rapid unloading at each port of call. This requires digitised data on each container’s final destination as well as optimisation algorithms. For a ship that is calling at terminals operated by different companies – that is, most ships – the optimised stowage plan would have to be shared by all the players touching cargo along the trade route, a real challenge in an industry where the degree of digital maturity differs considerably. Consolidation among container terminal operators could help make this work.

“

If I were to plan a vessel across a trade route, I would know how to stow that vessel to push it out from port in the quickest time. Six different port operators with six different terminals – you will lose time. How the previous ports moved containers determines the productivity at follow-on ports. It points to the benefits of having a network.”

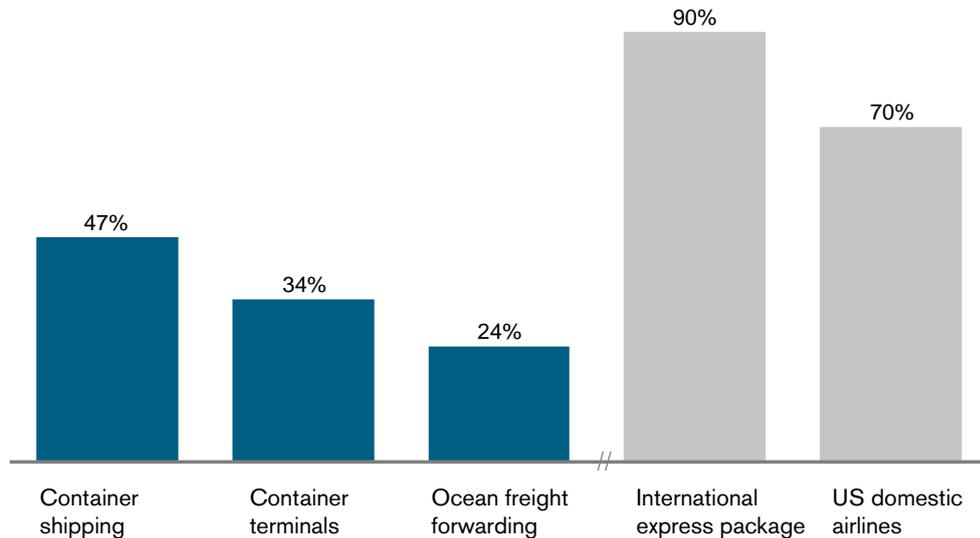
– *Container terminals executive*

¹³ Specifically in ocean freight forwarding.

Exhibit 6

The container transport industry is less concentrated than others

Top 3 market share, current



Source: Alphaliner; McKinsey analysis

Vertical integration would be another potential way to optimise the end-to-end value chain, unlocking efficiencies and other benefits that are difficult to capture across multiple participants. Beyond “smart” stowage, these include timing sailings and arrivals to terminal availability, providing a single point of accountability for the full customer journey, enabling end-to-end visibility on the status of cargo, and coordinated capex planning. On the other hand, there are substantial challenges that need to be overcome.

“ Value chain will be easier if you have four or five or six global operators doing everything.”
– Container leasing executive

“ Would a competitor line want to call on your terminal and give you all the information about all the cargo that they carry?”
– Container terminals executive

Automation and productivity

In an industry that is inherently deflationary, operational productivity has always been critical to individual players' success. The productivity imperative has only become more pronounced with the rapid expansion of ship capacity. All else being equal, larger ships take longer per box to unload due to the longer distances cranes must swing to reach a given container. Similarly, yard operations become more challenging with a larger volume of containers being unloaded and loaded with each ship call.

The focus in the coming decades will be to automate in order to reduce cost and improve productivity. We estimate 1-2% of a container shipping line's cost base comes from on-ship labour, and many technologies exist today to automate much of what a crew does. Labour costs are more significant in other parts of the value chain, with the possibility of automating roles like crane operator, truck driver, and customs officer.

“ Automation will happen on the landside first with driverless trains then driverless trucks. Last will be driverless ships because of the environmental risks – you have to blame someone if something happens, and the captain gets blamed today – and because doing maintenance on board is cheaper than doing maintenance in port.”

– *Container shipping executive*

In some terminals, autonomous cranes and “autostrads” now move containers from ship to port gate without human intervention. Broadly speaking, the introduction of automation has saved labour costs without yet improving productivity, but this is only a matter of time as technologies mature and companies better integrate them into end-to-end terminal operations. Cybersecurity vulnerabilities must also be rectified to tap into the full potential.

Other opportunities for productivity improvements abound. For example, embracing tandem lifts of multiple containers at a time could speed up the loading and unloading of ships. Doing so would require strengthened cranes – perhaps gantry cranes at redesigned berths – as well as “smart stowage” optimisation algorithms to ensure the right containers are stowed together.

“ The driver of automation in ports going forward will be cranes. Bigger and faster cranes require more acceleration, making it uncomfortable for someone to be on the crane. We need to get people off the crane from a health point of view.”
– *Container terminals executive*

Hinterland connectivity could also undergo a revolution. Today, many container terminals are land-constrained by developed urban areas and face significant congestion for inbound and outbound logistics. Hyperloops (for example in Dubai) or train evacuation (in Los Angeles) are being considered to move containers quickly from the terminal to an inland yard where they can then be put on a truck or train. However, the existence of yards today mostly reflects the inefficiency of moving a cargo from the terminal to inland transport networks and the storage of unutilised containers. With autonomous trucking, Internet of Things enabled containers, data integration with customs authorities, and so on, one could imagine a world where cargo is pre-cleared by customs, autonomous trucks pull up to the side of the ship and are directly loaded at the same time from autonomous multi-lift cranes positioned along the ship, before setting off onto the public roads for final delivery. In such a world, the yard would be significantly shrunk.

Environmental performance

Seven percent (7%) of global carbon dioxide emissions today come from cross-border transport of goods.¹⁴ At the same time, new environmental regulations and international agreements focused on air pollution and greenhouse gases are coming into force. For the industry to meet the “green” challenge over the long term likely entails the use of new fuels and higher conversion efficiency.

Terminals, due to their position close to urban areas, have led the way in electrifying their operations to reduce emissions. Their environmental impact will improve further as trucking also electrifies and becomes autonomous.

For liners, liquefied natural gas (LNG) draws the greatest amount of attention, but some suggest ships powered by nuclear, hydrogen fuel cells, or even electricity are on the horizon. Each of course presents its own challenges: LNG requires new bunkering infrastructure across many ports; nuclear poses additional environmental and security risks; hydrogen fuel cells are still many years away from full-scale commercialisation; and there is no battery available today that could power a container ship from Shanghai to Singapore, let alone Rotterdam, without many, long re-charging stops.¹⁵ In the meantime, some hybrid concepts are starting to emerge: for example, the Auriga Leader is a RoRo ship covered with more than 300 PV solar modules providing around one-tenth of its power requirement.¹⁶

“

There is pressure to reduce the carbon footprint of the logistics chain. If we don't get cleaner, it might affect the volume of commerce because people switch to local-for-local consumption due to a smaller carbon footprint.”

– *Container terminals executive*

¹⁴ International Transport Forum, “The carbon footprint of global trade” (2015).

¹⁵ In the very distant future, a combination of a high-density battery and some form of renewable power generation (e.g., PV solar, wind, tidal) holds the promise of energy self sufficient ships. Ships that don't need to dock to re-fuel may call on ports less and indeed may transship containers at sea – either ship-to-ship or ship-to-floating container platform, where the containers would be picked up by another ship later. Such a fundamental change in propulsion would upend the business model for transshipment-focused container terminals.

¹⁶ Marine Insight, “Auriga Leader – The World's First Partially Propelled Cargo Ship,” <https://www.marineinsight.com/types-of-ships/auriga-leader-the-worlds-first-partially-propelled-cargo-ship/> (4 July 2017).

3. Who “wins”?

The industry today is entering a period of incredible experimentation as different players try to find a winning formula to create value. Horizontal consolidation, especially in the liner segment, has captured the most headlines as financially robust companies look to establish a stronger position in the market. Some companies are experimenting with vertical integration – offering freight forwarding, container shipping, and terminal operations under one roof at a potentially lower all-in cost. Almost everyone is trying to take advantage of the disruptive power of digital, data, and analytics, which also begs the question whether and how “digitally native” start-ups or e-commerce end-users become much bigger players in the container transport value chain.

Who “wins” – that is, who creates and captures the most value – over the next 25 years is the big question, since no one formula yet seems ascendant. For all the investment in digital, data, and analytics, it is not clear if customers will pay for additional services. The demise of freight forwarding as a standalone business has been predicted many times in the past, but freight forwarders have adapted creatively over decades.

“

For as long as I've worked in this industry, many have long predicted our decline. But my business has never been better.”

– *Freight forwarding executive*

The e-commerce leaders, though, loom large. Having benefited from network effects and a laser-like focus on providing a better service to customers at a lower cost, companies like Amazon and Alibaba have expanded rapidly. In recent years, Amazon has started making major inroads into logistics, primarily innovating in last-mile distribution and building a position in air cargo (Prime Air). Amazon has a track record of developing a capability for its own use and later opening it up for third parties, including its cloud-computing business (Amazon Web Services) and its warehousing, inventory management, and fulfilment operations (Fulfilment by Amazon). Amazon has an ocean freight forwarding licence from China. Would Amazon or another e-commerce player ever build a position in the container transport industry? For its part, Alibaba has recently pledged to invest an additional US\$15 billion in its own logistics platform, Cainiao, and its marketplace now hosts customer interfaces for major liners.

Today approximately half of container ships arrive at least 12 hours late, which imposes a cost on downstream players. Terminals sit idle for long periods (and are then congested at times when multiple ships arrive simultaneously). Trucks wait for late cargos. Retailers need to carry additional inventory to meet demand. The inefficiencies of the current value chain could act as an invitation to players who believe they could manage it better.

The “digital natives”

“Digital natives” are companies that apply technology to solve previously unsolvable challenges. They can be either large internet players or scrappy tech start-ups; some traditional firms have also managed to transform themselves so completely that they too can be considered “digital natives” today. Here are some examples of “digital natives” who could potentially re-shape the container transport industry:

Amazon

The e-commerce giant has an ocean freight-forwarding license from China, and has continuously stretched itself into logistics, including air cargo and last-mile distribution. While not yet a player in container transport, its moves in logistics are the focus of much attention and debate.

Clearmetal

A provider of advanced analytics supply chain solutions, Clearmetal’s AI-based predictive services help customers reduce lead times, better manage inventory, and optimise across modes.

Flexport

An “e-freight forwarder,” Flexport helps customers move their cargo while providing a number of digital and analytical solutions to track cargoes in real-time and reduce working capital.

NxtPort

A data-sharing platform in the Port of Antwerp, NxtPort collects and shares data across a number of players (including shippers, forwarders, ship’s agents, carriers, terminals, insurance brokers, among many others) in order to increase participants’ operational efficiency, safety, and revenue.

NYSHEX

A digitally enabled exchange for container liners, beneficial cargo owners, and freight forwarders, the platform offers a standard forward contract to lock in rates up to six months in advance.

Spire

The satellite company’s maritime tracking solution is used by logistics firms, financial firms, and governments to keep a nearly real-time record of ship positioning.

Xeneta

The start-up benchmarks its customers’ ocean freight rates in real-time, giving beneficial cargo owners visibility on how their rates differ from the benchmark.

“ Certainly not impossible that Amazon would get into the physical assets. The physical assets generate all the data. For Amazon to go into the more physical assets would be because that’s the only way they can get their hands on proprietary data that generates these competitive advantages.”

– *Container terminals executive*

“ The risk is that if the industry does not change, Amazon or Huawei will change it for us.”

– *Container shipping executive*

Similarly, there are lots of start-ups seeking to serve customers better. Many are focused on making the cargo management experience more digital and user-friendly, enjoying a lower cost structure than the more labour-intensive freight forwarders. Others seek to provide an operating system for today’s asset operators to help optimise the end-to-end value chain. Still others focus on solutions to provide visibility and predictive analytics. The Uber of container transport has not yet arrived, but many are trying.

Given all this experimentation, in truth it is the shipper and ultimately consumer who “wins.” Today’s shopper has the greatest variety and quality of goods and services to choose from in human history. The container – an innovation that significantly reduced transportation costs, reduced pilferage, damage and spoilage, and accelerated time from producer to consumer – has been at the heart of this fortunate situation. The focus of today’s and tomorrow’s container transport players is to continue making this “conveyor belt” of global trade faster, more reliable, safer, and cheaper.



The container transport industry faces a fascinating, complex future. In this research, industry experts are generally in consensus about some things: the physical characteristics of the industry won’t radically change; trade flows will rebalance towards intra-regional and north-south flows; automation holds enormous potential; digital, data, and analytics will be central to competitive dynamics; and the industry leaders of 2043 will look very different from today’s (though they may be the same or similar companies).

However, the points of consensus are complemented by questions and disagreements of considerable substance: Will trade demand grow at historical, blistering rates or stagnate over the long run? How will value be created – will the logic of digital competition trump the industry’s traditional dynamics? Which players will “win” and why? The answers to these questions will “trigger” different futures in the industry.

In spite of the uncertainty and disagreements, there is an underlying dynamism to the industry as it innovates and experiments in preparation for its next chapter.





A woman with dark hair and glasses is shown in profile, focused on her work. She is seated at a desk with several computer monitors. The background is a blurred office environment with blue lighting and bokeh effects from other screens. A large red rectangular overlay is positioned on the right side of the image, containing the text '3. Four visions of the future' in white.

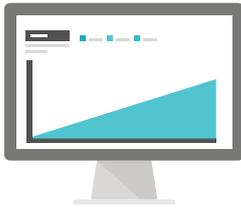
3. Four visions of the future

It is impossible to know how different uncertainties facing the industry will come together over the next 25 years. However, combining elements in logical ways and deducing the implications can be a useful thought exercise. We have developed four such futures: digital reinvention; digital disruption; third wave of globalisation; “peak container” and consolidation. These illustrate the wide range of outcomes that could come to pass in the container transport industry.

To construct the scenarios, we had to make some judgement calls on how certain trends and discontinuities combine together. These four futures certainly are not the only ones that could transpire; indeed, the future may instead entail some combination of these or include further elements that could not be predicted.

Digital reinvention

TRADE DEMAND



**1-1.5x
MULTIPLIER**

"SLOW AND STEADY"
TRADE GROWTH

MODEST ADDITIONAL
CONTAINERISATION

~25%

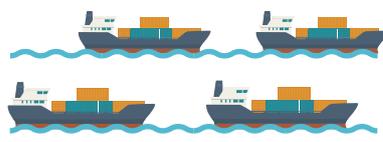


SHORTER, MORE DIVERSE SUPPLY CHAINS
(E.G., INDIA TO CHINA, AFRICA TO EUROPE)

CHINA MANAGES SLOWDOWN,
INDIA DOES NOT ACHIEVE
"BREAKOUT" GROWTH



SECTOR ECONOMICS



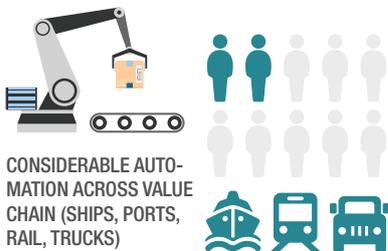
SCALE ECONOMIES LOSE SALIENCE;
FLEXIBILITY IS VALUED



SMALLER SHIPS,
MORE
POINT-TO-POINT,
LESS
TRANS-SHIPMENT



DIGITAL, DATA,
AND ANALYTICS
A FUNDAMENTAL
DRIVER OF VALUE



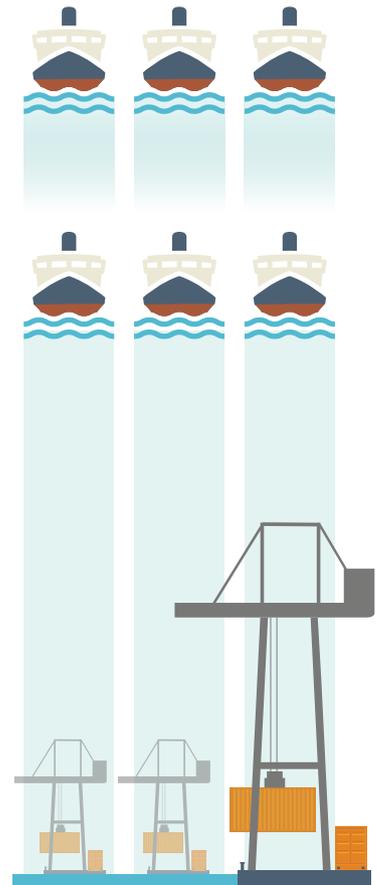
CONSIDERABLE AUTO-
MATION ACROSS VALUE
CHAIN (SHIPS, PORTS,
RAIL, TRUCKS)

INDUSTRY STRUCTURE

4-5 MAJOR INCUMBENTS AND "LONG
TAIL" OF POINT-TO-POINT PLAYERS

VERTICAL INTEGRATION ENABLES
DIGITISATION AND PROVISION OF E2E
SUPPLY CHAIN SERVICES

FREIGHT FORWARDING RADICALLY
SHIFTED TO A DIGITAL MODEL



It's 2043 and the container transport industry's traditional incumbents are even stronger. Digital, data, and analytics have indeed become the fundamental driver of value creation. Players with significant asset footprints – particularly when coupled with vertical integration – lead the way, with proprietary data that allows them to out-compete any potential disruptive entrant. Data and technologies like blockchain are used in creative ways to ensure reliability across the value chain, real-time transparency on cargo flows, and seamless integration with customs and customers' supply chain systems. That doesn't mean the operating systems and solutions are always developed in-house; many "digitally native" suppliers of software and analytical solutions thrive.

The integration of digital, data, and analytics into container transport operations is sped up through vertically integrated business models. The coordination challenge across a mosaic of players proves to be too challenging in this timeframe – too many operating systems, too many applications that can't talk to each other, too many IT infrastructures. Only by working together are the freight forwarders, container lines, and terminal operators better able to develop an ecosystem of digital tools that "talk" to each other. Many end up merging. Customers love it and align closely with their preferred container transport provider.

“

“We have a situation where the container business is commoditised. Can a provider provide enough differentiation to value where he will see ... a willingness to pay a little more? Airlines figured out how to provide more services without bigger and bigger planes.”

– *Container terminals executive*

This vertical integration means there are approximately four to five major players, as well as a large number of smaller companies servicing geographies that haven't caught the attention of the majors. Technology has also helped better optimise the networks within these large, vertically integrated players. As such, economies of scale in ship sizes remain somewhat relevant, but the value of network flexibility – enabled by smaller ships – has increased. Terminal investments

can be matched to the expected changes in the fleet, and “smart” stowage as well as crane operations have been perfected to minimise the cost and time of moving a container from the ship onto the fleet of autonomous trucks that pull up on-demand. Many terminal yards have been converted into e-commerce logistics zones in the middle of prime urban areas. Container alliances disappear, having lost their appeal as players consolidate.

The digital advances have unlocked many efficiencies in the supply chain, helping spur further trade growth. But this growth is offset by the effects of modest near-shoring and occasional protectionist policies, sparked by advances in manufacturing automation. Containerisation increases on the margins, mostly due to faster-growing trades in highly containerised goods. And while China manages its transition to a services-based economy, India doesn't achieve “breakout” growth. Add it all up and trade growth has essentially held to 1-1.5x global GDP growth since 2018.

For the integrated players that lead this industry, returns are quite good on average. Having effectively seen off the challenge from “digital disruption” by embracing digital, data, and analytics, they now deliver extremely reliable and transparent service to their customers. They have also established a different competitive dynamic, competing on value-adding digitally enabled services, rather than offering larger and larger ships and terminals. The better coordination across ships and terminals means both segments, while sitting under one umbrella, have been able to improve their capital productivity and operational performance.

Standalone freight forwarding has had to adapt considerably and not everyone is successful; the coordination challenges have been brought in-house to the vertically integrated majors and the interfaces with customers have been fully digitised. Some global freight forwarders still thrive by offering to arbitrage across all the major integrated container transport players, as do specialised niche players focused on local markets, but they still have to work very hard to compete against the majors' end-to-end offer with attractive all-in costings.

Digital disruption

TRADE DEMAND



**1.5-2x
MULTIPLIER**

REDUCED FRICTION VIA
DIGITAL UNLOCKS NEW
EXPORTERS/IMPORTERS

MODEST ADDITIONAL CONTAINERISATION

~25%



SHORTER, MORE DIVERSE SUPPLY CHAINS
(E.G., INDIA TO CHINA, AFRICA TO EUROPE)

CHINA MANAGES SLOWDOWN,
INDIA DOES NOT ACHIEVE
"BREAKOUT" GROWTH



SECTOR ECONOMICS



SCALE ECONOMIES LOSE SALIENCE;
FLEXIBILITY IS VALUED



SMALLER SHIPS,
MORE
POINT-TO-POINT,
LESS
TRANS-SHIPMENT



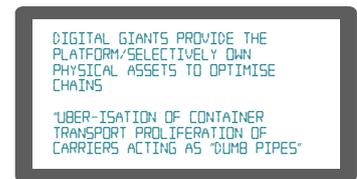
DIGITAL, DATA,
AND ANALYTICS
A FUNDAMENTAL
DRIVER OF VALUE



CONSIDERABLE AUTO-
MATION ACROSS VALUE
CHAIN (SHIPS, PORTS,
RAIL, TRUCKS)

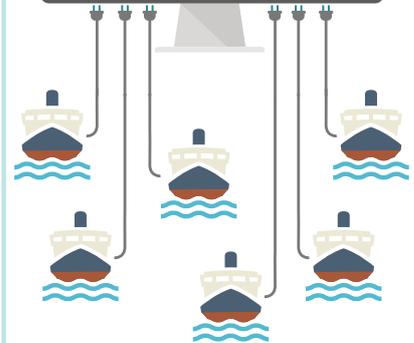


INDUSTRY STRUCTURE



DIGITAL GIANTS PROVIDE THE
PLATFORM/SELECTIVELY OWN
PHYSICAL ASSETS TO OPTIMISE
CHAINS

"UBER-ISATION OF CONTAINER
TRANSPORT PROLIFERATION OF
CARRIERS ACTING AS "DUMB PIPES"



LED BY "DIGITAL
GIANTS" – ENABLES
DIGITISATION AND
PROVISION OF E2E
SUPPLY CHAIN
SERVICES

FREIGHT
FORWARDING
BECOMES TOTALLY
DIGITAL



Digital Disruption is a world in which today's incumbents struggle. They fail to move with sufficient haste and purpose in adopting digital, data, and analytics. Instead, other "digitally native" companies succeed in better managing the end-to-end value chain by leveraging technology and win a large share of the profit pool from marginalised asset owners and traditional freight forwarders. This could happen in many different ways. For example, some of today's "e-freight forwarding" or aggregator start-ups may succeed in capturing a large share of customers; think of Expedia and its role in the air travel and hotel industries. Alternatively, a start-up may introduce a platform that more efficiently matches supply of transport capacity to demand – an Uber of container transport. Perhaps most extreme, an e-commerce player might decide to use its large balance sheet and advantage in data and analytics to take a physical position in container transport, much like Amazon's recent moves in air cargo.

Here, we imagine the "Uber-isation" of container transport, wherein incumbent container line brands become irrelevant: from the customer perspective, one container ship travelling on a given route is the same as any other. The existence of the digital platform makes barriers to entry relatively low, as anybody who can afford to buy or lease a container ship can plug in and connect immediately to customers. In effect, the container shipping industry becomes characterised by a plethora of port-to-port basic liner services – or even tramping. Average returns for ship owners and operators are desperately thin.

“ When all information is available, what is the role of a liner? Basically you provide the asset – and an asset operated by itself. The role of shipping liner services change. It becomes like a tram service. All you do is optimise your pool of freight. Barriers to entry get much lower. With cyber-connectivity, it doesn't matter if you have one asset or multiple – the asset is anonymous.”
– *Container shipping executive*

However, the real-time matching of supply and demand in the liner segment also means smaller ships can carve out a more profitable niche. Container terminal operators celebrate as the rush into larger and larger ships is blunted. Customers begin to value flexibility and adaptiveness; the cost of seaborne transport might be slightly more expensive than before, but goods are delivered faster and more reliably.

Traditional freight forwarding does its best to adapt. Indeed, the further the digital platform extends into inland logistics, including trucking and rail, the less value-add a freight forwarder can provide. The promise of digitisation and blockchain in the flow of customs forms and other documentation has been fully realised, and there is little need for manual intervention to ensure rapid processing at the border or in player-to-player hand-offs. Some innovative forwarders succeed in digitising their business models to "go digitally native" as well.

Overall trade growth in this world does not differ markedly from the Digital Reinvention scenario, except in one respect: the simplicity of the digital platform as well as the efficiencies it has galvanised have made international trade even more accessible for small and medium-sized producers the world over. Therefore, there is a modest uptick in trade growth to 1.5-2x global GDP growth, which is neither reinforced nor diminished by macroeconomic factors like China and India's growth patterns. In sum, the container transport value chain has become much more efficient, but the value of this revolution has been captured by customers and "digitally native" new entrants.

“ Ship, terminal, and customer will be much more connected in terms of information flow, which will smooth the supply chain, making containers more attractive again.”
– *Container shipping executive*

Third wave of globalisation

TRADE DEMAND



>2x
MULTIPLIER
RE-ACCELERATION OF
TRADE GROWTH

CONTAINER CAPTURES
SIGNIFICANT SHARE FROM BULK



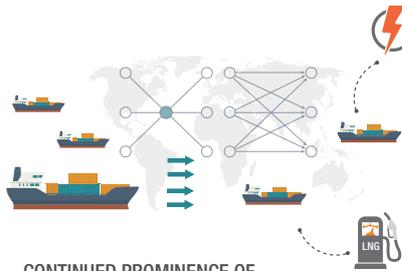
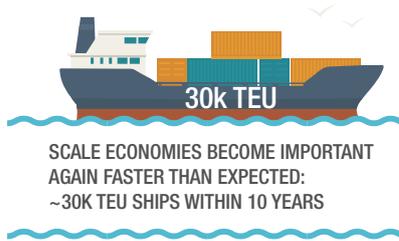
SPECIALISATION RESULTS
IN SIGNIFICANT SUPPLY
CHAIN FRAGMENTATION



CHINA MANAGES
SLOWDOWN WHILE
INDIA GROWS >10% P.A.



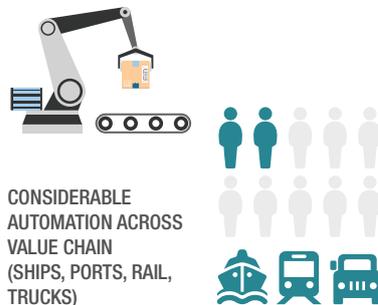
SECTOR ECONOMICS



CONTINUED PROMINENCE OF
HUB-AND-SPOKE NETWORKS

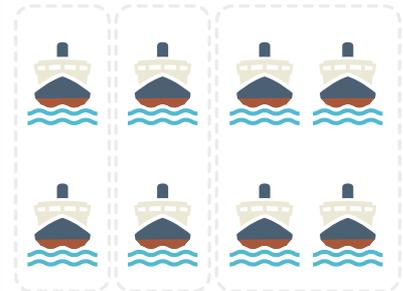
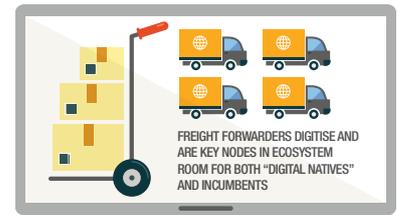


DIGITAL, DATA,
AND ANALYTICS A
FUNDAMENTAL
DRIVER OF VALUE



CONSIDERABLE
AUTOMATION ACROSS
VALUE CHAIN
(SHIPS, PORTS, RAIL,
TRUCKS)

INDUSTRY STRUCTURE



7+ INCUMBENTS AND "LONG
TAIL" OF POINT-TO-POINT
PLAYERS

ALLIANCES REMAIN
IMPORTANT AND EXPAND
SCOPE

VERTICAL INTEGRATION
PROVES TO BE OF LIMITED
VALUE



Perhaps the demand side of the industry – global trade – is not condemned to lower growth after all. Third Wave of Globalisation posits a return to the “go-go” years of the 1990s and early 2000s, when trade growth significantly outpaced global economic growth. In this instance, India achieves “breakout” growth greater than 10% annually, and supply chains, which had already been migrating from China to other parts of Asia, reorient again to tap into India’s abundant pool of labour – a tidal wave of over one billion workers (again) rapidly integrating into the global economy. Supply chains fragment further, as countries specialise on the intermediate goods and manufacturing services where they have a competitive advantage.

Of course, there is more to the story than just India. China gracefully manages its transition towards services and consumption and its export-oriented sectors retain their vim. Africa’s middle-class consumers awaken, and the same manufacturing renaissance might come to pass in many populous Africa countries like Ethiopia, Tanzania, and Kenya. What’s more, containerisation regains its upward trajectory, as the modularity, adaptability, and “through transport” characteristics of containers proves attractive even for shippers of agricultural commodities, automobiles, and other products.

“ You may begin to see China, Thailand, Korea, Japan are no longer the cheapest places to produce. India, Myanmar – the pace of infrastructure development in these economies will determine the next migration of manufacturing.”

– *Container terminals executive*

In this world, digital continues to grow in importance, but it does not fundamentally change the game. Competition is still based on the availability of capacity and infrastructure at the right place and right time as well as helping customers navigate a still-complex and fragmented industry. The return of fast trade growth has ensured fragmentation remains the norm: consolidation loses its appeal as most players focus on growth investments to meet the demand. Liners in particular push towards larger and larger ships, including some of 30,000 TEUs or more, causing further investment anguish among ports and terminals. The continued fragmentation paired with larger ships means alliances among the liners remain useful. Vertical integration across freight forwarding, terminals, and container shipping is considered a distraction as all players instead “go for growth.”

For the freight forwarders, much of the trepidation about digital disruption is muted. Digital proves to be complementary to their services; the freight forwarders themselves digitise and cement their place as central players in the container transport ecosystem. Many new small and medium-sized exporters emerge and require freight forwarding services to reach overseas customers. Therefore, freight forwarders continue to earn a satisfactory return, while the container lines and terminal operators see returns similar to the last 25 years.

“Peak container” & consolidation

TRADE DEMAND

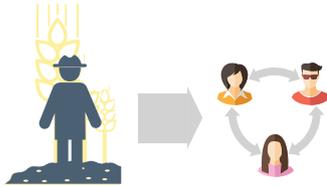


<1x
MULTIPLIER

FURTHER SLOWDOWN
OF TRADE GROWTH

NO MORE CONTAINERISATION

MARKET STAYS FLAT AT **23%**



INCREASING SHARE OF “LOCAL FOR LOCAL” SUPPLY CHAINS

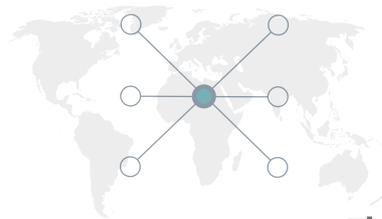
CHINA’S EXPORT ENGINE SPUTTERS AND INDIA DOES NOT ACHIEVE “BREAKOUT” GROWTH



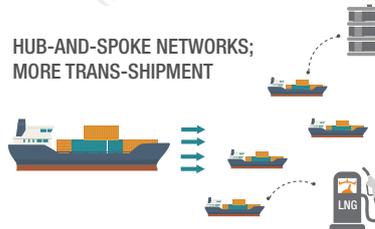
SECTOR ECONOMICS



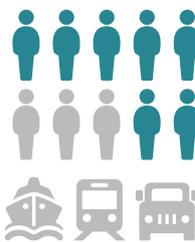
SCALE ECONOMIES LOSE SALIENCE BECAUSE INSUFFICIENT DEMAND TO FILL SHIPS



HUB-AND-SPOKE NETWORKS; MORE TRANS-SHIPMENT

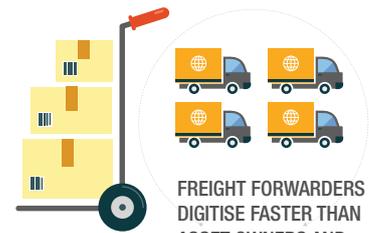


DIGITAL, DATA, AND ANALYTICS ONLY AN “OVERLAY”



GRADUAL AUTOMATION, ESPECIALLY LANDSIDE (PORTS, RAIL, TRUCKS)

INDUSTRY STRUCTURE



FREIGHT FORWARDERS DIGITISE FASTER THAN ASSET OWNERS AND AVOID DISRUPTION



ACCELERATED CONSOLIDATION RESULTING IN 3-4 LEADING LINERS
VERTICAL INTEGRATION PROVES TO BE OF LIMITED VALUE
ALLIANCES LESS VALUABLE
“DIGITAL NATIVES” PLAY IN THE MARGINS;
NO ENTRY BY “DIGITAL GIANTS”



“Dreadful”: that was the word uttered by a container terminals group CEO during a results presentation in 2031. At some point in the late 2020s, trade had gone into reverse. Geopolitical conflict, trade disputes, growing interest in local products, and a complete revolution in manufacturing technologies had spurred a major shift towards the re-shoring of manufacturing. 3D printing had finally come of age, and was starting to be used for the manufacture of entire products, not just individual pieces – a full aircraft engine, say, instead of just one nozzle. Advanced robotics had become cheap and effective, encouraging more near-shoring and quickly displacing millions of workers who couldn’t re-train fast enough. Mass “technological unemployment” was one of the most pressing socioeconomic issues of the day.¹⁷ Dislocation and resentment fed populist, nationalist, and revisionist political movements; trade wars were already a frequent occurrence, and geopolitical conflict didn’t seem far away.

“China will turn into Japan: low growth as its population ages.”
– *Container shipping executive*

“Robotics and 3D printing are going to cause the populists to come to power.”
– *Container terminals executive*

“Peak container” – the cresting and eventual decline of containerised trade – was at hand. Everyone in the container transport industry felt it. Liners that had over-extended themselves were overwhelmed by rates that did not cover their operating costs. Those in a stronger position quickly focused on consolidation as a survival strategy, and 3-4 major leading liners eventually formed. Terminals and freight forwarders suffered as well but had other advantages: terminals often enjoyed prime real estate that could be put to other uses, especially on behalf of e-commerce firms, and freight forwarders could re-focus their business on domestic and intra-regional cargo movements.

The expected digital revolution in container transport never lived up to its promise. Industry incumbents facing significant financial duress were unable to invest in the talent and technologies to make it happen, and the tech sector lost interest once it became clear that international trade was on the decline. Container transport looked little different from today – except the container ships and terminals were starting to rust, and “growth” was no longer in the vernacular.

All in all, the container lines faced paltry returns, despite the thinning of their ranks. Terminals’ revenues also suffered due to declining volumes, with some able to preserve margins by automating where possible. Meanwhile, freight forwarders proved nimble in reorienting themselves from ocean freight-forwarding to the fast-growing domestic and intra-regional trades.

¹⁷ For a thoughtful analytical treatment of the question of automation and “technological unemployment,” please see McKinsey Global Institute, *Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation* (2017).



It is not hard to imagine four different worlds for the container transport industry over the next 25 years. The first two – Digital Reinvention and Digital Disruption – assume digital, data, and analytics will be the most important industry trend and the real question is who leads the transformation: incumbents or new entrants? The latter two – Third Wave of Globalisation and “Peak Container” and Consolidation – assume digital is important but not a fundamental shift, and instead the real question is the outlook for trade growth. In truth, the world to 2043 will probably adopt some characteristics of all of these scenarios or surprise us with something entirely unexpected. The question then for industry players is, how can one prepare for these unknowns and steer their businesses in the face of a range of scenarios?



4. Conclusion:
Preparing
for the next
25 years

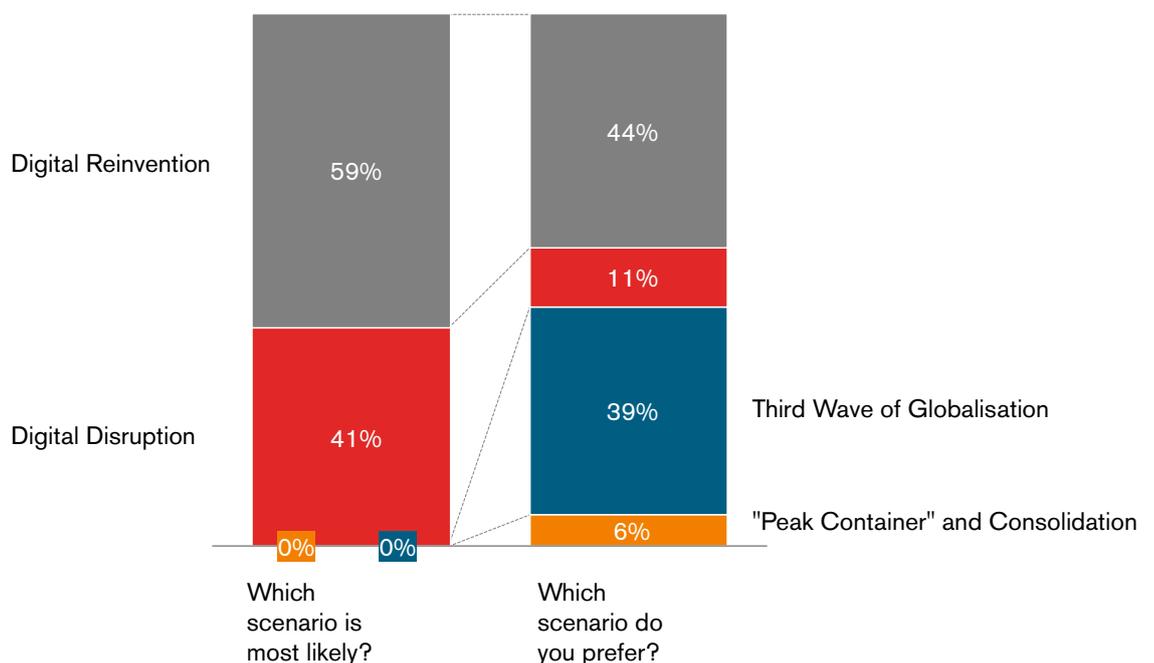
The container transport industry is approaching a crossroads. The external environment is rapidly changing, and it is clear the long-standing formula for value-creation will have to change as well.

The directors of TT Club were polled in late 2017 about these futures, and a few things stood out (Exhibit 7). First, the future is digital: every one of the respondents thought the most likely scenario would be either Digital Reinvention or Digital Disruption, with a modest lean towards the former. Second, many would prefer a world in which the demand side continues to drive the industry forward, as described in Third Wave of Globalisation, but no one saw this scenario as likely. Third, while only 11 percent of respondents preferred it, 41 percent thought Digital Disruption was most likely – perhaps a sign of resignation to trends that may seem inexorable.

Exhibit 7

The future is digital

Responses of TT Club directors (8 November 2017)



Preparing for such a range of outcomes would be taxing for even the most agile and foresighted of companies. It may however offer a ray of hope: some of the trends on the horizon, like digital, have the potential to change the industry's dynamics fundamentally.

There are a few things players in the container transport industry can do today to prepare for an uncertain future:

- **Focus on the real end-customer: the consumer.** The container transport industry has historically focused on serving its immediate customers – beneficial cargo owners – but has perhaps not paid as much attention as it should have to what was happening a few links further along the chain. The real “customer” of the container transport industry – even if separated by last-mile distribution providers – is the everyday consumer, who is increasingly enjoying the speed, flexibility, convenience, and low cost associated with online shopping. The e-commerce revolution is only just beginning to disrupt supply chains, especially in last-mile delivery, and there is much more to come. The dynamism required of today's container transport industry to keep up with the pace of development will only intensify. One shift for container transport players would be to measure success not only by how well or inexpensively they have delivered their own services, but also how much they contribute towards optimising the end-to-end supply chain to the consumer's benefit. Taking a holistic view is likely to reveal opportunities for additional efficiencies through “win-win” collaborations with other players.
- **Monitor the “trigger points.”** US President Dwight Eisenhower once said, “Plans are worthless, but planning is everything.” Perfect preparation for an uncertain future is impossible, but the act of planning – and retrospectively assessing where trends or discontinuities were over-looked – is an important discipline. Across our four futures, there are a number of “trigger points” that a foresighted company might carefully monitor: infrastructure investment and unit-labour costs in major economies, the number of SMEs selling globally on e-commerce platforms, 3D printing adoption, venture-capital funding for container transport start-ups, the latest order for the next-largest ship, the speed of adoption of digital platforms, among many others. Furthermore, stress-testing the company's financials against a range of market and industry outcomes can help build resilience and ensure risks are appropriately mitigated.

- **Digitise radically.** Standing still on the question of digital, data, and analytics is out of the question. The potential for value-creation is enormous, and the costs of not doing anything at all are very high. The battle for the customer relationship should not be ceded lightly by any player. Use cases for step-changes in efficiency and performance should be piloted, refined, and quickly scaled: predictive maintenance, “smart” stowage, seamless document flow, and omniscient cargo tracking, among others are all vital areas to explore. Players should actively form partnerships to build the industry-standard platform and ecosystem. It’s potentially a “winner take all” dynamic, but even for those who are not aspiring to win it all, staying one step ahead of the direct competition will be an important differentiator for the foreseeable future.
- **Automate and innovate.** Over the long run, cost pressures are not going to subside. Leading companies will continue to reduce their cost bases, improve productivity, and enhance safety. Autonomous technologies available today and in the not-too-distant future are extremely promising for the industry. There remains an exceptional learning curve in terms of adopting these technologies and maximising their value. Similarly, other innovations like propulsion technologies, advanced materials, Internet of Things solutions, modularised shipping concepts, and so on could change the game unexpectedly – and to the great benefit of the first-mover or fast-follower.

• • •

The future is unknowable, but that is not an excuse for inaction; rather it should prompt companies to invest in strategic thinking to best position themselves for the future as it unfolds. There are a number of things the container transport industry can do to prepare for the next 25 years: focus more closely on the end consumer; systematically monitor and discuss “trigger points”; pursue digitisation with conviction and pace; and automate and cultivate a spirit of experimentation and innovation. The container transport industry has enjoyed a dramatic and dynamic past – and the future looks no less exciting or demanding.

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