Shrinking supply chains and the consequences for ports and maritime logistics

Michael Bell
Professor of Ports and Maritime Logistics

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Outline of thought piece

- The causes and consequences of shrinking supply chains

- The impact of "Industry 4.0" on supply chains, specifically
  - Port and ship automation
  - Electrification of ports and urban logistics
  - Digitalisation in shipping, ports and urban logistics

- The future looks increasingly sustainable and efficient, but where are the jobs?

Shrinking supply chains

But we live in exciting times

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Shrinking supply chains

- Industry 4.0: Digitalisation, electrification and automation are trnsforming supply chains, but where are the jobs?
- Aging population: Relatively wealthy consumers in developed and developing countries are being replaced by relatively poor consumers
- Urbanisation: Urban consumers are accessing goods requiring fewer resources (including energy), so less seaborne transportation
- Emerging economies: Manufacturing can no longer absorb large pools of cheap labour, due to automation
- Trade costs: Transportation costs will remain low, logistics will become more efficient, and the cost of trade will reduce
- Automation: Manufacturing will gravitate toward consumers through inventory cost pull, supply chains will shorten as imports are substituted

- Prediction: Seaborne trade will stagnate or decline, ocean shipping efficiency will continue to improve, extrapolating past trade volumes into the future will overestimate growth

Electrification in ports

Ports have the potential to be much greener

Maasvlakte II aims for zero emissions

- APM Terminals has contracted NV Nuon Energy for wind generated electricity to power cranes and container handling equipment at the Maasvlakte II terminal.
- Maasvlakte II will achieve near-zero emissions through the electrification of quay and yard cranes and battery powered Lift-Automatic Guided Vehicles (Lift-AGVs) to transport containers between the yard and quay.

- Source: greenport.com, 16/12/14

Environmentally friendly hybrid RTGs reduces emissions 10%

- Approximately 10% of the diesel emissions from cargo handling equipment at ports are emitted by RTG cranes, so more efficient RTGs directly lessen the environmental impact of ports.
- The use of the battery hybrid technology on the cranes substantially reduces fuel consumption and harmful emissions.

- Source: www.greenport.com, 21/01/16

Hybrid straddle carriers with regeneration save 40% fuel

- The Kalmar hybrid straddle carrier regenerative energy system converts electrical braking and spreader lowering energy into electric power that is stored by the battery.
- The new system can deliver a 40% decrease in fuel consumption compared to existing machines, while also meeting stringent engine emission regulations.

- Source: Klamar

Hybrid tugs cleaner, quieter, save fuel and maintenance

- The hybrid tug from Kotug , 'RT Emotion', was delivered by Damen Shipyards to its owner in Bremerhaven.
- The vessel's hybrid propulsion is generated by three electric motors, complemented by a battery pack and managed by an intelligent Hybrid Propulsion System.
- Kotug says emissions are cut by 50%, noise is significantly reduced, combustion is cleaner, and improved fuel economy results in maintenance savings.

- Source: www.greenport.com

Onshore power supply save fuel at berth

- Stemmann-Technik has completed onshore power supply projects for cruise ship terminals at the ports of Hamburg and Shanghai.
- Power and data transmission to the cruise ship is supplied by an onshore vehicle which can be moved along an underground cable channel.
- Stemmann-Technik also supplied a charging system for an electric ferry.

- Source: www.greenport.com, 21/7/16

Electrification in urban logistics

Also in urban areas electrification can make logistics greener

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Four principles of good city logistics

1. Goods should be moved in urban areas by the most appropriate vehicles, at the most appropriate times, by the most appropriate routes
2. Movement should be reduced to a minimum compatible with efficient consumer response (freight-km minimised)
3. Inventory should be reduced to a minimum and held as far as possible outside urban centres
4. Deliveries in urban areas should be consolidated and empty returns minimised (vehicle-km/freight-km minimised)

Conventional vehicles ☹ e-vehicles ☺

- EVs:
  - Significantly reduce emissions of CO2, SOx, NOx, and particulates
  - Quieter than conventional cars
  - Improve traffic flow, due to faster acceleration
  - Ideal for urban distribution
  - A first step to autonomous trucks and logistics as a service (LaaS)

Source: Sven-Jöran Schrader

Siemens to bring eHighway demonstration to California

- The eHighway will have a two-year trial near Gävle in central Sweden.
- The eHighway concept is being tested in California near the Los Angeles and Long Beach container ports, where truck traffic is dense and emissions are a concern.
- The new technology permits the trucks to operate as EVs when on the electrified road, and as hybrid vehicles at other times.

- Source: www.Lloydsloadinglist.com, 15/8/16

StreetScooter ramps-up production as demand grows for e-vehicles

- Deutsche Post-DHL is ramping up production of its StreetScooter to roll out more than 20,000 a year.
- StreetScooter's latest model has a range of 200 km, and a top speed of 120 kph, with DHL noting that a number of customers are looking for increased range.
- The company is testing a model with fuel cells and a range of 500 km.
- Source: www.theloadstar.co.uk, 3/10/17

Toyota Motor North America tests hydrogen fuel cell truck for drayage at the Ports of Los Angeles and Long Beach

- Local, frequent trips (around 320 km per day) will test the drayage capabilities of the fuel cell system while capturing performance data.
- So far, the truck has successfully completed 6,400 km (320 km per hydrogen fill).
- The truck generates more than 670hp from two fuel cell stacks and a 12kWh battery, a relatively small battery to support class 8 load operations.

Source: www.porttechnology.org, 15/10/17

Zurich drone delivery test the first in a major European city

- Mercedes-Benz, Swiss e-commerce platform Siroop and US drone developer Matternet are trialling same-day delivery in Zurich, Switzerland.
- Drones will deliver goods weighing up to 2kg to a landing platform on the courier van roof, and the van then makes the final delivery to the consumer.

- Source: www.theloadstar.co.uk, 3/10/17

Automation in ports

The robots take over, benefitting safety and reliability – eventually

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Initial automation of container terminals

- Dimensions of the ISO container lends itself naturally to automated handling.
- 1990, ECT terminal, Rotterdam, pioneered automatic rail mounted gantry cranes (ARMGs) combined with automatic guided vehicles (AGVs).
- Both the ARMGs and AGVs ran on tracks (subsurface transponders in the case of the AGVs).
- Automation was partially extended to the quay cranes with the twin trolley system, found in Hamburg and more recently in Rotterdam.

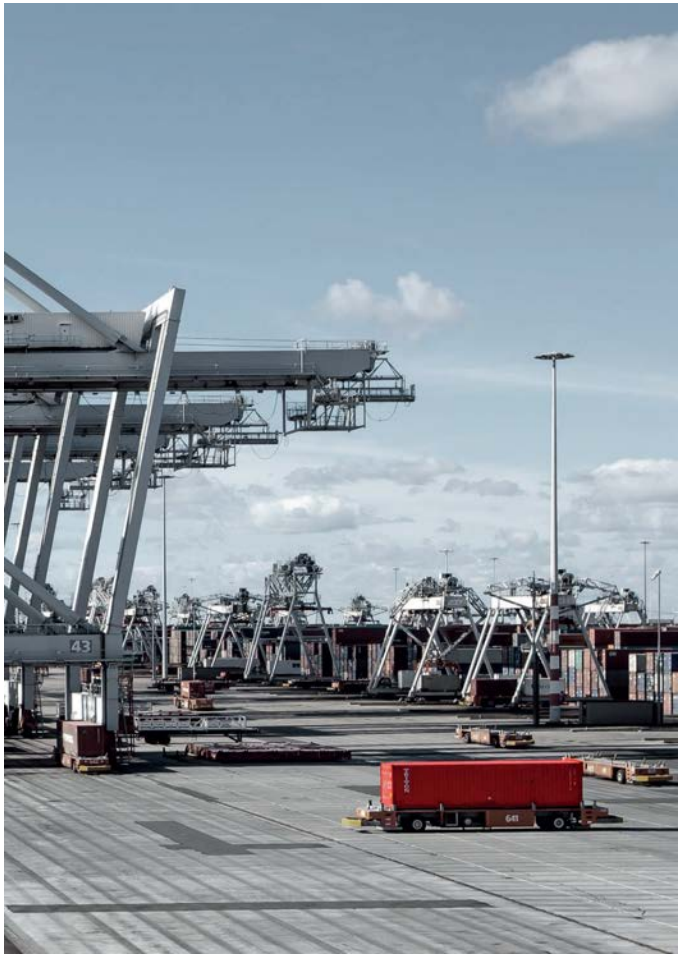


Photo: Kalmar

Container terminal automation downunder

- In Australia, where straddle carriers were the main mode of terminal operation, the challenge was to automate these.
- Autostrads were pioneered in Brisbane and are now operating in Sydney.
- Autostrads required more sophisticated (free roaming) navigation, developed by Sydney University.

Photo: Kalmar

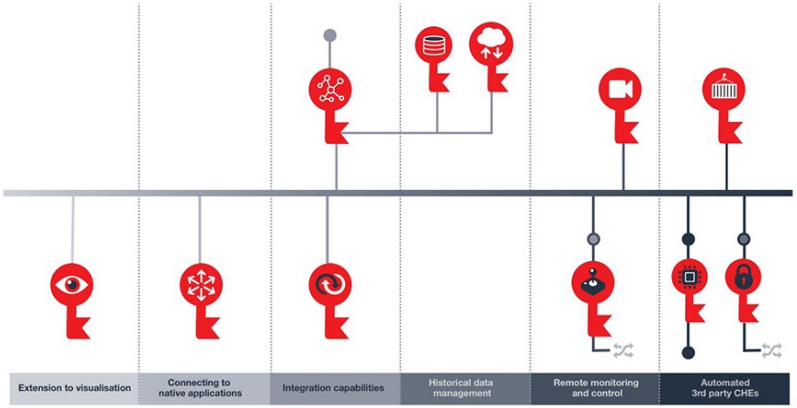
Combining Autostrads with Automated Rail Mounted Gantry cranes (ARMGs)

- AGVs must be loaded and unloaded by a crane (the ARMG or the quay crane).
- Less AGVs would be required if they could load or unload themselves, hence decoupling themselves from the ARMG and quay crane.
- The TraPac terminal in the Port of Los Angeles is combining ARMGs for stacking with Autostrads for moving containers around and intermediate stacking.

Photo: Kalmar

Open architecture key to successful automation

- A shared terminal automation ecosystem will provide more scope to deliver affordable automation.
- Accessing the core functionality of the automation platform though the opening of interfaces will enable terminal operators to be able to customise and develop systems in-house or with their preferred partners.



- Source: www.portstrategy.com, 30/9/17

Autonomous shipping

Easier to achieve than AVs for the road network

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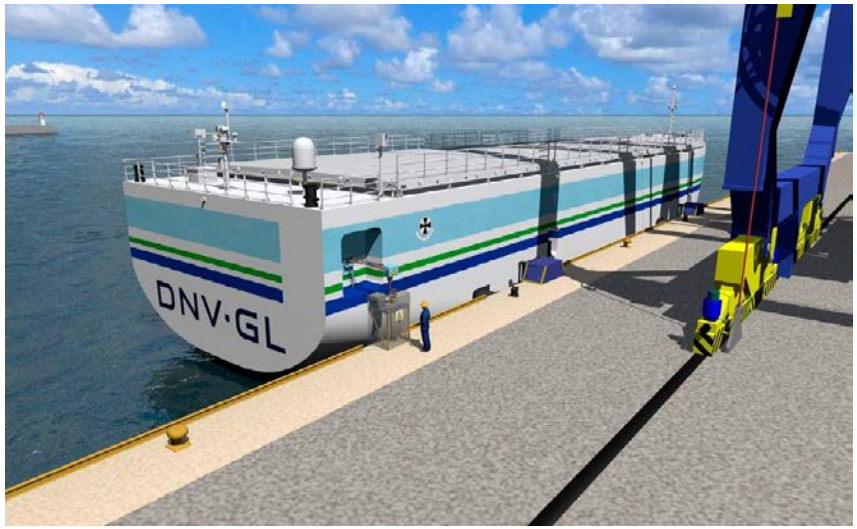
Autonomous ships; smaller, cheaper and more direct?

- If you strip out the life support systems and the bridge, the result is a lighter, more economical ship.
- Add a modular design with pre-tested elements and the end product “will be significantly cheaper than the vessels of today” (Rolls Royce).
- For maritime terminals, smaller ships won’t require large cranes or deep drafts, so there may be a change in ports of call, like the low-cost airlines in Europe.
- Could this revive coastal shipping in Australia?

Source: Rolls Royce

Five steps to the fully autonomous ship

1. Remote control to replace pilots: Pilots boarding ships can be a dangerous maneuver.
2. Remote maintenance of engines and other equipment: Rolls Royce engaged in engine leasing and remote diagnostics.
3. Autopilots: Current autopilots to gain more capability and safety features.
4. Crew size: Plan an orderly reduction (what would a low crew vessel look like?).
5. IMO: New convention for low and no crew ships on the high seas.



Source: DNV

Autonomous shipping technically almost there

- Navigationally, there is few technical obstacle: An autonomous ship could berth itself safely.
- The biggest challenge is not interaction with regular shipping, which complies with the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs), but situation where rules are not followed.
- The technology is not totally novel, smoothing the technical and regulatory challenges ahead.

Source: Rolls Royce

Rolls-Royce and Google Cloud team up to apply AI to autonomous shipping

- Rolls-Royce and will develop 'intelligent awareness systems', which are essential to making autonomous ships a reality.
- Rolls-Royce will use Google's Cloud Machine Learning Engine to train artificial intelligence (AI) for detecting, identifying and tracking the objects at sea.

- Source: www.seatrade-maritime.com, 4/10/17

Rolls-Royce and TCOMS develop smart ships

- UK-based engineering company Rolls-Royce and the Technology Centre for Offshore and Marine Singapore (TCOMS) are developing smart ship technologies.
- By developing technology for sensors, data analytics and the Marine Internet of Things (MIoT), ships will become more reliable, efficient and integrated into global supply chains.

Source: www.worldmaritimenews.com, 18/04/17

Wärtsilä takes part in autonomous shipping project

- Wärtsilä Corporation (engine designer and builder) and marine information and communication technology (MICT) companies are creating the first autonomous marine transport system.
- The initial focus will be on a fully autonomous cargo system for the Baltic Sea by 2025.
- Wärtsilä believes that artificial intelligence, robotics, and remote connections will characterise the future shipping industry.

Source: www.worldmaritimenews.com, 18/04/17

Autonomous ships are a 'huge opportunity' for shortsea shipping

- Yara Birkeland will be the first fully electric and autonomous container ship, due for delivery in second half 2018.
- This is a 'huge opportunity' for shortsea shipping, where this new technology is likely to make an impact first.
- Could this new technology revive Australian coastal container shipping?

- Source: www.seatrade-maritime.com, 1/6/17

- Image courtesy of YARA Birkeland

Rolls-Royce unveils plans for an autonomous patrol ship

- The patrol ship will use a combination of AI and sensors, instead of a crew.
- It will offer a platform for operating drones.
- Electric power will assist stealth, reliability and the environment.
- Rolls-Royce plans to equip the boat with solar panels and 3,000kWh of energy storage to keep the ship at sea as long as possible.

Source: www.engadget.com, 14/9/17

Shipping lines are also showing great interest

- Japanese shipping line NYK intends to test an autonomous containership in the Pacific Ocean in 2019.
- The ship will sail under remote control from Japan to North America with a crew on standby.
- According to Allianz in 2012, between 75% and 96% of marine accidents are a result of human error, often due to fatigue.

- Source: www.worldmaritimenews.com, 20/10/17

IMO discusses rules for autonomous ships

- IMO's Maritime Safety Committee (MSC) has launched meetings to discuss safety rules for autonomous ships.
- Such rules would eventually be added to relevant IMO conventions (SOLAS and MARPOL) to take account of security and environmental impact of autonomous ships.
- "Technology moves quickly. Regulation moves slowly." says International Group of P&I Clubs

- Source: www.porttechnology.org, 19/6/17

Digitalisation in shipping and ports

Apps, databases and electronic data interchange have huge potential to improve efficiency

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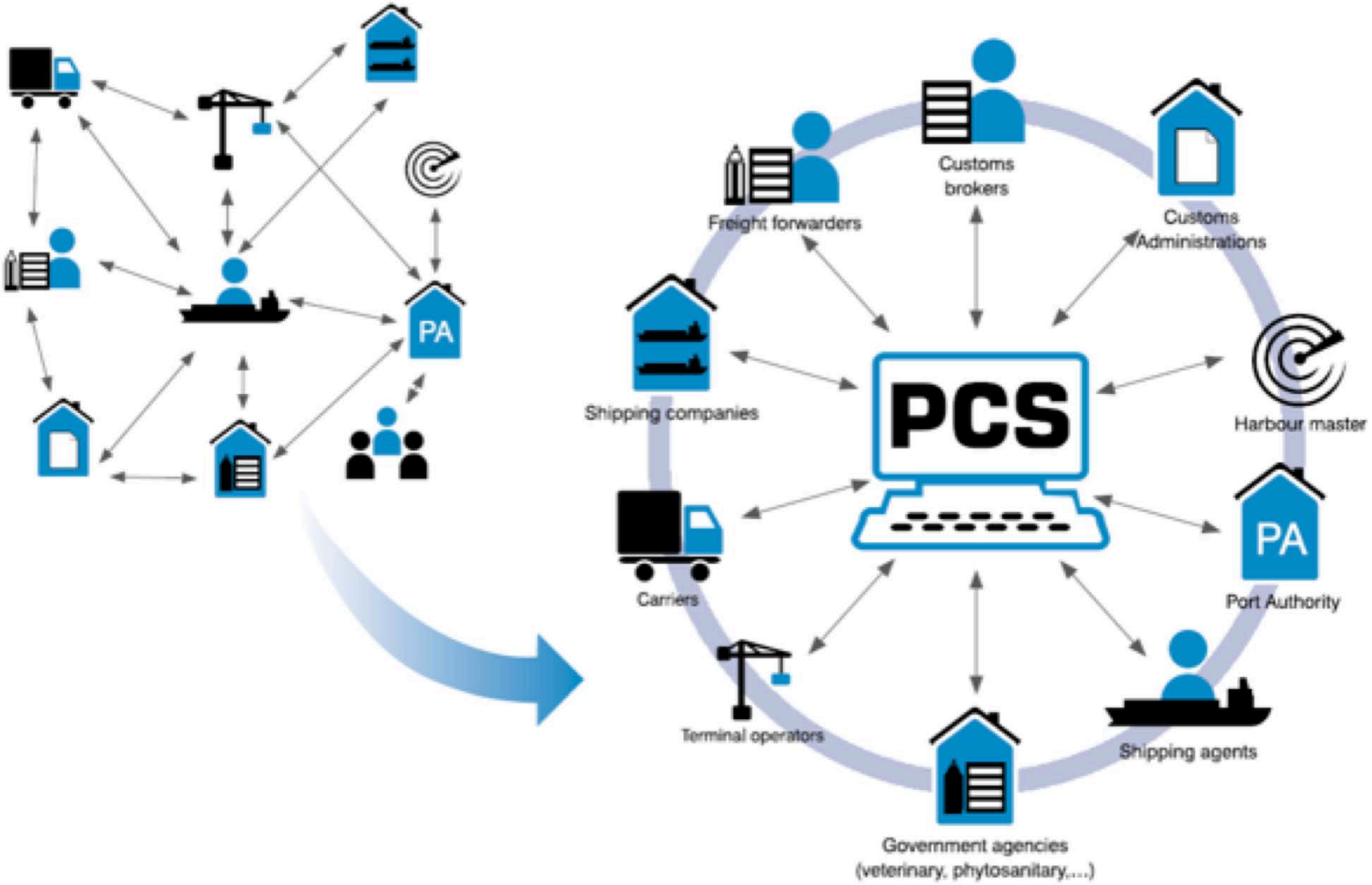
Integrating port operating and management systems

- The port eco-system combines the PMS (port management systems), the TOS (terminal operating systems) and COS (carrier operating systems) for better end-to-end co-ordination across port operations.
- Data components have been standardised with the support of the International Harbour Masters' Association, BIMCO and not-for-profit organisation GS1.

- Source: www.portstrategy.com, 14/10/17

Port Community System (PCS) concept: A sophisticated database



Port Community System benefits

- Data component standardisation, facilitating electronic data interchange.
- Error reduction through elimination of paper and rekeying.
- Transparency of information and fraud detection and reduction.

“Last mile” headaches

- The “last mile problem” a challenge for logistics providers, transportation companies, retailers, and consumers.
- The final leg (last mile) to homes and offices often incurs the highest cost and greatest complexity.
- Last mile challenges have grown with the proliferation of online shopping.
- A number of new apps are helping to tackle these challenges.

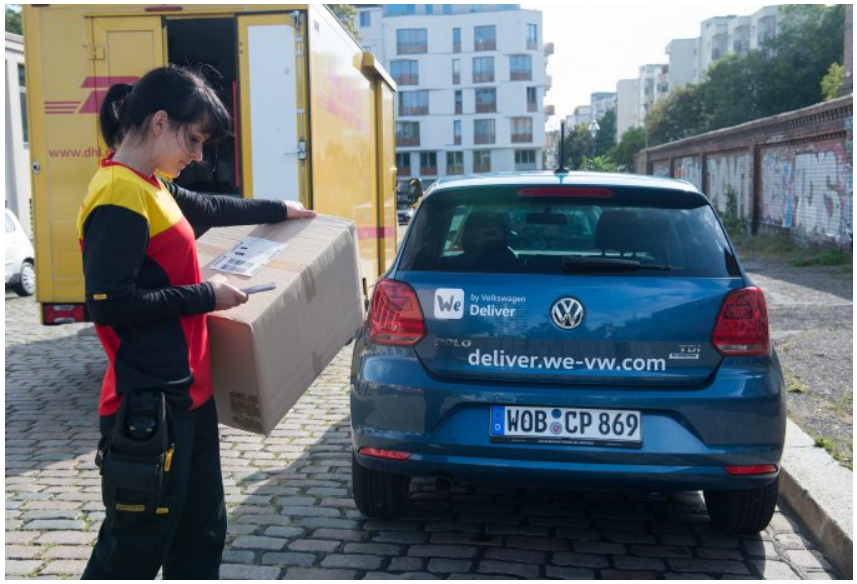
Some startups

CBINSIGHTS

	Flirtey	MATTERNET	STARSHIP	dispatch	robby	Marble
Headquarters	Reno Nevada United States	Menlo Park California United States	London England United Kingdom	South San Francisco California United States	Palo Alto California United States	San Francisco California United States
Website	flirtey.com	mttr.net	starship.xyz	dispatch.ai	robby.io	marble.io
Status	Private	Private	Private	Private	Private	Private
First Funding	2014	2014	2017	2015	2016	2016
VC Backed	Yes	Yes	Yes	Yes	Yes	Yes
# of Investors	12	16	7	3	2	3
Days Since Last Funding	71	237	77	358	218	354
Total Funding	$19.92M	$11.51M	$17.2M	$2.02M	$120K	Undisclosed
Last Funding Round	$16M Series A Jan 18th 2017	$9.48M Series A Aug 5th 2016	$17.2M Series A Jan 12th 2017	$2M Seed VC Apr 6th 2016	$120K Seed Aug 24th 2016	Seed VC Apr 10th 2016
	investors Lowercase Capital Amity Ventures Menlo Ventures Qualcomm Ventures Partech Ventures World Innovation Lab	investors Undisclosed Investors Daimler	investors ZX Ventures Daimler Shasta Ventures Grishin Robotics Matrix Partners Playfair Capital	investors Andreessen Horowitz Precursor Ventures	investors Y Combinator	investors Eclipse Ventures Promus Ventures Lemnos Labs

The car boot as a lock box for delivery or pickup

- DHL is working with Volkswagen on a new method of collection or delivery of parcels to the boot (trunk) of cars.
- An app from VW tells DHL delivery drivers where the car is, and gives them a code to open the boot.
- Once the boot has been closed, the access code no longer works.



- Source: www.theloadstar.co.uk, 3/10/17

Conclusions

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Conclusions and a suggestion

- Industry 4.0 is transforming freight transport through electrification in ports and urban logistics, automation in ports and shipping, and digitalisation in trade, ports and urban logistics

- Container is experiencing headwinds caused by Industry 4.0, aging populations, increasing urbanisation leading to stagnating or shrinking supply chains

- This is stressing shipping and ports, leading to persistent low freight rates for shipping lines and ports ☹ and for supply chains ☺

- These changes are driving productivity growth and greater environmental sustainability ☺ , but where are the jobs? ☹

- Hong Kong has the potential to be a significant player in the move to greater autonomy in ports and shipping – this should be the policy focus ☺