



Five Forces Transforming Transport & Logistics PwC CEE Transport & Logistics Trend Book 2019

As the complexity of modern transport and logistics grows, it is increasingly difficult to understand what to focus on, so we have identified five key forces transforming the T&L segment

Our approach and the 5 major forces transforming Transport & Logistics

Based on our analysis of PESTEL trends and the impact and time-to-entry of relevant solutions....



...we have identified 5 major forces transforming Transport & Logistics, including urban transport:



Digitalization



Shifts in international trade



Software-driven process changes



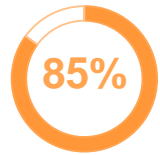
Changes in markets' domestic commerce



Machine-driven process changes

These forces are visible in the expectations expressed by T&L CEOs regarding the near future – concerning such factors as favorable economic growth outlooks, the impact of technology changes, and changes in distribution channels

Selected answers from the PwC CEO Survey 2018 (T&L cut)



of the T&L heads
in our 2018 CEO
Survey

Are confident about their company's prospects for **revenue growth** over the next 12 months (45% responded they were 'very confident', 40% 'somewhat confident').



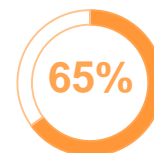
of the T&L heads
in our 2018 CEO
Survey

Are concerned about the **availability of digital skills** in both their workforce and their industry.



of the T&L heads
in our 2018 CEO
Survey

Anticipate that **changes in core technologies** of service provision will disrupt their business in the next five years (the sum of responses 'disruptive' and 'very disruptive').



of the T&L heads
in our 2018 CEO
Survey

Expect **changes in distribution channels** to disrupt their business in the next five years (the sum of responses 'disruptive' and 'very disruptive').



of the T&L heads
in our 2018 CEO
Survey

Believe global **economic growth** will improve over the next 12 months.

Comments

- Globally, T&L CEOs are clear that disruptions should be anticipated.
- PwC conducted 1,239 interviews with CEOs in 85 countries and 85 of these were in the transport and logistics industry.
- Transport and logistics respondents presented the following profile: 60% had 1–5 years of tenure, 94% were male and 5% were female, 36% were younger than 50.

Find more information
in Global PwC CEO
Survey T&L cut here

Source: PwC CEO Survey 2018.

We expect each of the transformation forces to impact the market successively, due to the trends driving them

The five forces transforming transport and logistics and their key driving trends



Source: PwC analysis, unescap.org; *Forces were categorized in time based on maturity of solutions evaluated as the most impactful; **Transportation services for seniors; Full PESTEL analysis available in section 6

All five forces transforming T&L – digitalization, shifts in international trade, software-driven process changes, changes in markets' domestic commerce and machine-driven process changes – will be accompanied by new solutions

The five forces transforming transport and logistics and the accompanying solutions, with an assessment of impact and maturity

Transforming Forces*

Emerging solutions



1. Digitalization

1.1. Digitalization solutions



2. Shifts in international trade

2.1. New trade route solutions



3. Software-driven process changes

3.1 Intelligent transportation systems (ITS)



3.2 Robotic Process Automation (RPA)



3.3 Predictive maintenance and drone supervision



3.4 Blockchain (DLT**) solutions



3.5 Artificial Intelligence (AI) solutions for T&L



4. Changes in markets' domestic commerce

4.1 Big business entering eCommerce



4.2 eCommerce investing in Logistics



4.3 CEP*** solutions for eCommerce



4.4 Sharing economy solutions



4.5 Logistics consolidation



5. Machine-driven process changes

5.1 Warehousing robotization (including drones)



5.2 Electro-mobility



5.3 Warehousing supported by AR, VR****



5.4 High Speed Rail (HSR)



5.5 Last mile delivery optimization (incl. drones)



Time to entry

1 year+

2 years+

3 years+

4 years+

5 years+



Very high impact



Low impact



Very high maturity



Low maturity

Source: PwC analysis; *Forces were categorized in time based on maturity of solutions evaluated as the most impactful; **DLT = Distributed Ledger Technologies; ***CEP = Courier Express Parcel; ****VR = Virtual Reality, AR = Augmented Reality.



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3 Software-driven core process changes – trends and solutions

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5 Machine-driven core process changes – trends and solutions

6 Additional information – sector definitions, solutions analysis grid, list of future speculated growth drivers

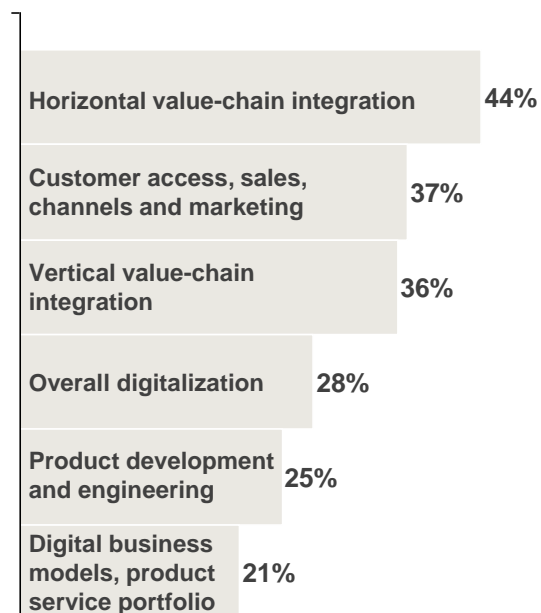
Digitalization is already transforming all T&L segments and it is expected to be the most impactful trend over the coming years, reshaping entire businesses

Adjusting to changes: Digitalization overview

Impact on T&L



Percentage of commercial transportation companies reporting advanced levels of digitization and integration:



Opportunities for business



- Simplified internal processes with wider application of digital solutions
- Increased revenues with extended digital reach to customers
- Extended possibilities for online marketing
- Lower business risk due to online payments
- Lower impact of talent supply gaps
- Lower cost to serve clients
- Opportunities to address clients' needs with completely new services

Solutions



Digitalization solutions no longer concern simple ICT (Information and Communication Technologies) as they are enabling new business models, transaction types, marketplaces and services offering revenue sources

They concern all T&L segments.

Past: ICT / Workplace

Present: Business model / Company

- **Historically, ICT-focused digitalization concerned:**
 - Collaboration, Office Packages, Communication
 - Automation of administration
 - ERP Systems
- **What is new:**
 - New business models
 - New processes
 - New transaction types and places where they're created
 - Marketplaces
 - New services / revenue sources

Impact on Consumers



- More convenience for consumers and business clients and more possibilities for personalization with regards to online ordering, tracking, payments for services

Find more on Transport Digitalization in PwC "Global Digital IQ®" survey 2017 here

Find the T&L findings from PwC "Industry 4.0" 2016 survey here

Source: PwC Analysis, PwC "Global Digital IQ" survey.

Digitalization solutions influence business processes and models, and their application is driven by consumer behavior, the availability of technology and tangible business opportunities

Digitalization – solution definition and overview of relevant information

Solution: digital technologies which change business processes and models to generate value for the business

Key drivers of digitalization



Consumer pull

Consumers, and particularly Generation C, are already fully adapted to the digital environment. They naturally expect to be always connected and they are increasingly willing to share their data.



Technology push

Digital technology continues to expand its influence. The infrastructure backbone of the digital world now brings affordable broadband to billions of consumers.

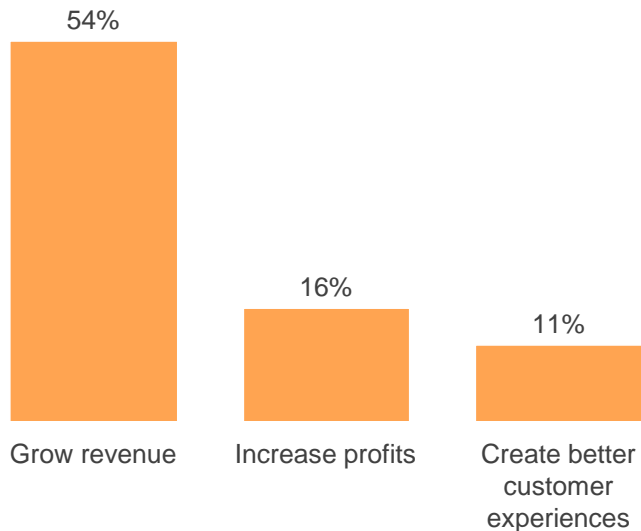


Economic benefits

The economic benefits to be captured through digitization are real. A wave of capital has poured into the new digitalization technologies and companies, and the public markets reward early innovators with unprecedented valuations.

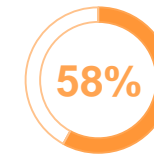
T&L companies' expectations towards digitalization

What value do you expect from your digital technology investments?
They will enable us to...



Percentage of respondents who marked the reply in 2017 Digital IQ Survey (T&L industry)

Barriers and ways to overcome them



of the T&L heads in our 2018 CEO Survey

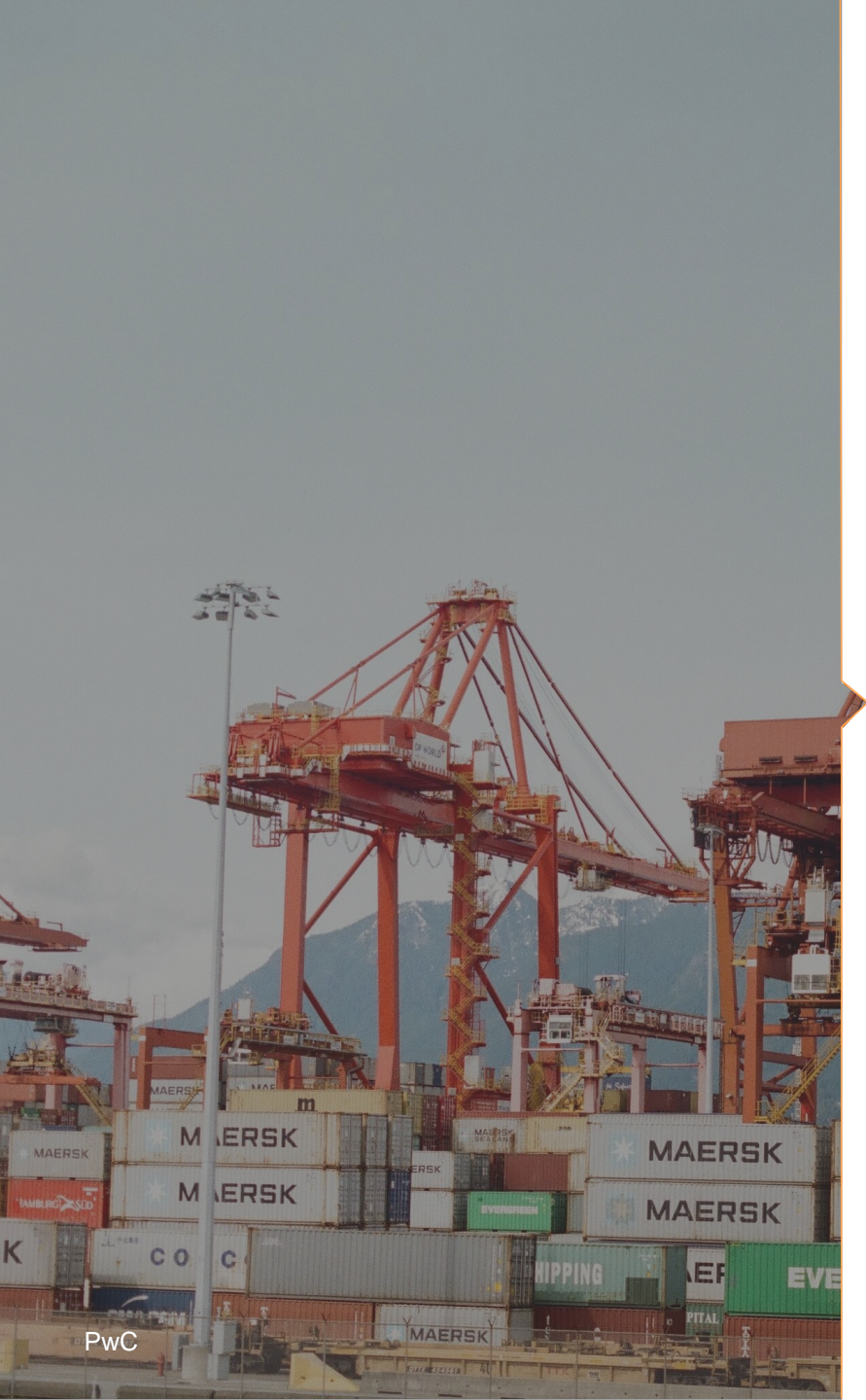
Believe it is difficult for them to attract digital talent

Find more information in PwC report "PwC's 21st CEO Survey T&L Cut" [here](#)

Our digitalization framework assumes 3 steps:

- I. Understanding client and end-user needs as well as industry changes and applying lean startup and growth hacking approaches to prototype growth solutions
- II. Redesigning existing and developing new services, products and business models, including mobile solutions, business architecture, digitized functions, managerial, transactional, back-end and core T&L processes
- III. Developing base digital capabilities in the areas of innovation management, data, system interactions, digital talent, digital culture, partner networks, digital tools and resources

Source: PwC Analysis, PwC Strategy&, PwC Global Digital IQ® Surveys.



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Shifts in international trade are already visible in growing numbers of land transports from China to the EU and we expect them to intensify in the mid-term

Adjusting to changes: overview of shifts in international trade

Impact on T&L

- The transport corridors between China and the EU with the Belt and Road Initiative as well as other connections of emerging economies are expected to grow rapidly over the next few years.
- Such developments will lead to lower costs of transport and will enable the creation of new services.

**3673
vs 17**

were the numbers of trains from
China to EU in years 2017 vs 2011

Opportunities for business

- Lower costs of trade and investments along emerging trade routes, especially associated with the Belt and Road Initiative corridors from China to Europe
- Modernization of railways, highways, telecommunication and hubs located along main transport corridors
- Increasing accessibility to new business areas, which were not popular before because of high logistics costs
- New trade agreements altering the profitability of trade along specific routes
- Emerging market trade flows enabling services to be offered on a larger scale
- Adjustment of supply chain strategy to benefit from decreasing costs and delivery time

Solutions

New trade route solutions will revolutionize international trade between Europe and China, in such areas as:

- **Investments in transportation infrastructure**, including intermodal terminals, customs processing centers
- **New, cross-border services** offered by service providers

The T&L segments that will be impacted to the largest extent are:



Impact on Consumers

- Cost reduction meaning larger accessibility to products and goods from foreign markets
- Shorter transit times and, consequently, shorter delivery time
- An increasing inflows of goods from emerging economies increasing competition and choice across different product categories

Legend

– applicable segments



Posts, Courier,
Express Parcel



eCommerce



Supply
Chain Management



Transport & Warehousing
infrastructure



Railways



Sea & Inland
Transport



Road
transport



Freight
forwarding

Source: PwC Analysis, Reuters.

With growing China-EU volumes, new investments and the opportunities to quickly enlarge land transport fleet, new trade route solutions such as services and infrastructure development can be expected in approximately two years' time

New trade route solutions - definition and overview of relevant information

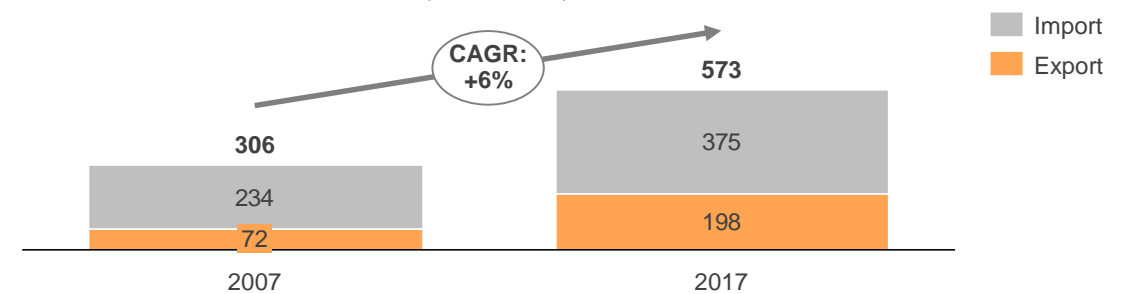
Solution: developments of new infrastructure, operations and services along newly opening trade routes



Planned investments in Europe, related to Belt and Road Initiative



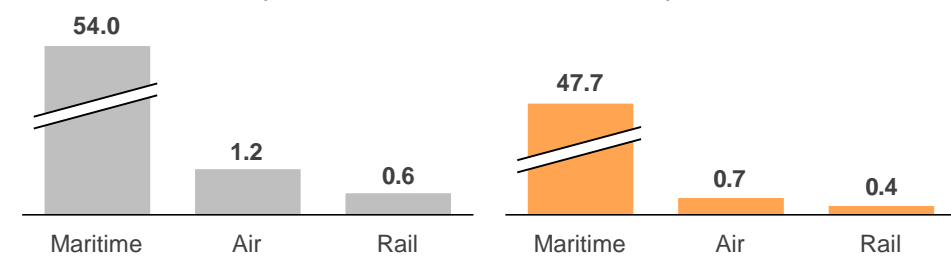
China-EU trade value in 2007-2017 (billion USD)

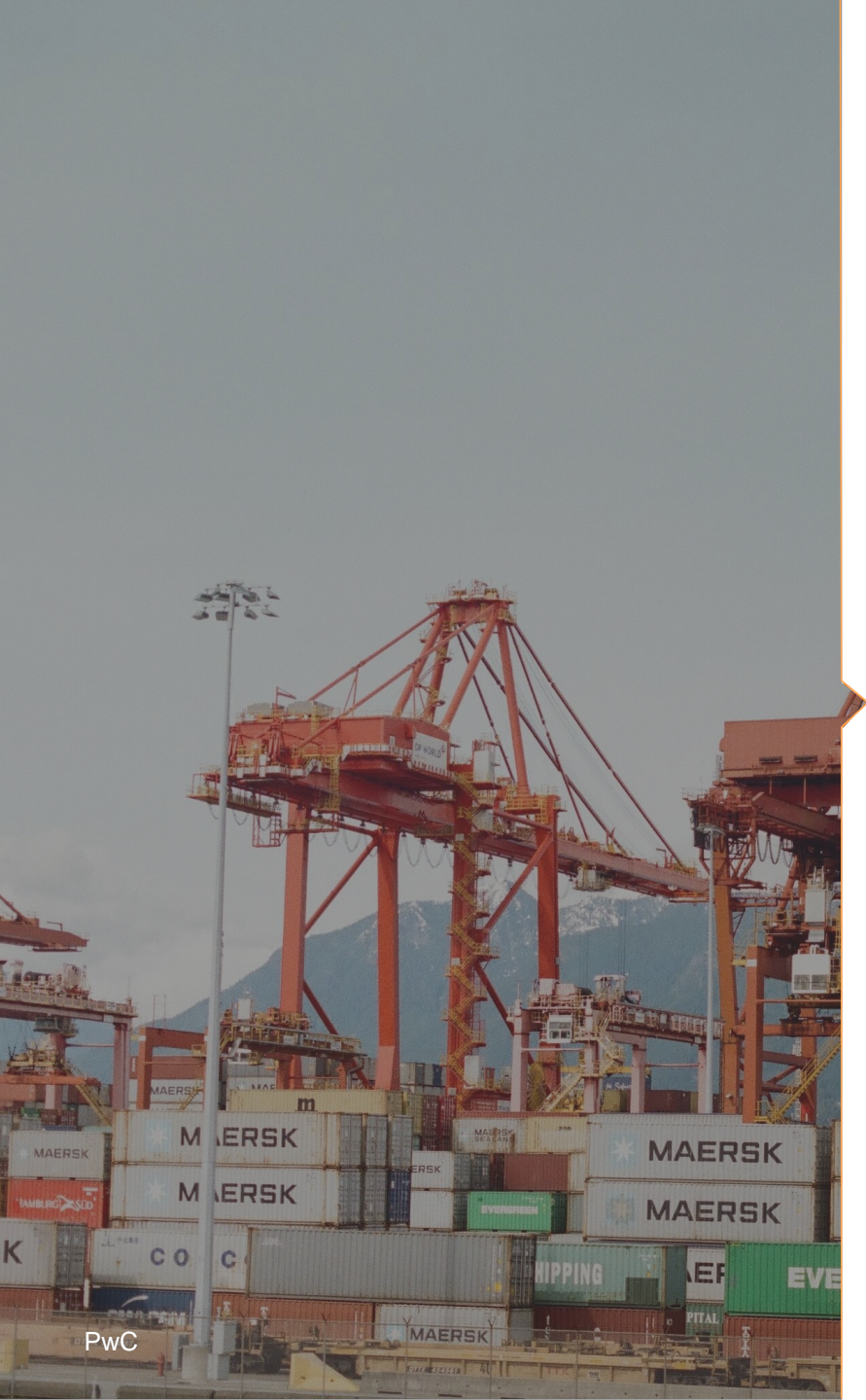


Volume of goods transported by modes of transport in 2016, (million tones)

from China to the European Union

from the European Union to China





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5 Machine-driven core process changes – trends and solutions

6 Additional information – sector definitions, solutions analysis grid, list of future speculated growth drivers

Software-driven processes solutions are expected to grow dynamically over the next few years, generating even larger benefits for the business, but they still need to find their way into the mainstream

Adjusting to changes: Overview of software-driven core process changes

Impact on T&L

- Global Intelligent Transport System (ITS) market in roadways is expected to reach over 72.3 billion USD by 2022.
- Global predictive maintenance market is expected to grow by 37% p.a. in '18-'22 reaching over 10.9 billion USD in 2022.
- Global Robotic Process Automation Market is expected to reach more than 1.2 billion USD by 2021.

>35%

are the annual growth rate forecasts for Global RPA and Predictive Maintenance Markets in 2016-2021

Opportunities for business

- Implementation of freight management systems, ITS
- Avoidance of unnecessary maintenance costs and mistakes in simple, repetitive processes
- Improved control over processes and human behaviors leading to improved quality of services
- Software automation due to development of AI and RPA solutions
- RPA solving talent supply gaps and make tracking, calculation or claims management faster and better in quality, contributing to higher consumer satisfaction
- Predictive Maintenance stabilizing delivery times and ensuring that the fleet is always available

Solutions

- The following emerging solutions were analyzed in relation to software-driven core process changes



Intelligent Transportation Systems



Robotic Process Automation



Predictive Maintenance and Drone Supervision

All segments

Blockchain (DLT) Solutions

All segments

AI solutions for T&L

Impact on Consumers

- Smoother transportation services with improved safety
- Larger reliability of transport systems
- AI solutions such as autonomous trucking and delivery are already being developed by Uber Technologies Inc., which is expected to improve the efficiency and reduce the delivery time of commercial shipments, since there would be no need for rest periods.

Legend

– applicable segments



Posts, Courier, Express Parcel



eCommerce



Supply Chain Management



Transport & Warehousing infrastructure



Railways



Sea & Inland Transport



Road transport



Freight forwarding

Source: PwC Analysis, BIS Research, Statista, HfS Research.

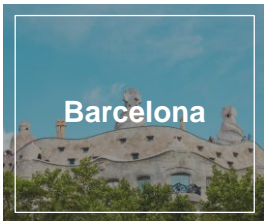
Intelligent Transportation Systems used to optimize and improve efficiency of transportation networks are already applied, whereas we expect their more dynamic growth beyond 2 years' time as standards develop in the market

Intelligent transportation systems – solution definition and overview of relevant information

Solution: systems and technologies integrating different elements of transport infrastructure, vehicles and software to improve safety and efficiency of transportation networks

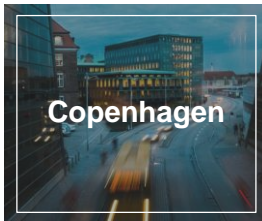


Examples of cities using Intelligent Transportation Systems



Barcelona

Barcelona is implementing ITS solutions such as smart parking and traffic systems to monitor congestion. It has also invested in clean transport, with hybrid buses and a smart cycling initiative.



Copenhagen

Copenhagen is implementing many ITS solutions: traffic management systems, collecting data in order to optimize transportation network and promote "green driving".



Montreal

Montreal is implementing ITS solutions for traffic light synchronization and collection of previously incomplete or missing mobility data.

Solution

Description



Traffic management systems

Systems that make transportation networks more efficient, share real-time information, synchronize traffic lights and assign street space dynamically



Toll collection systems

Solutions which automatically collect tolls from vehicles moving through certain roads, highways or tunnels, resulting in time savings



Freight management

Already applied solutions with growing popularity, usually optimizing freight and gathering information to control efficiency and conditions of fleet



Data collection (V2I, V2V, GPS)

Using big data to analyze movement and traffic to dynamically react to changing situation when something unexpected happens on the road



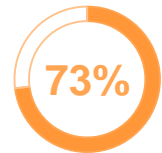
Parking guidance

Solutions using real-time data to inform drivers where they will be able to easily leave their cars, resulting in more convenient and smoother transport



Public transportation

Public transport systems gathering and analyzing data, adjusting operations to the needs of citizens, enabling greater efficiency



of executives in
our 2017 Digital
IQ Survey

Said they are already making investments in the Internet of Things and 63% are planning further investments in the next 3 years

Robotic Process Automation is expected to have moderate influence and its large-scale spread in T&L segments such as posts, courier, express parcel, eCommerce, forwarding and supply chain management can be expected in the mid-term

Robotic Process Automation – solution definition and overview of relevant information

Solution: software technologies used to replace repetitive tasks and manual labor with automated algorithms / bots



Key areas requiring RPA support



RPA might be used as an **automation and support tool** for companies operating in various T&L sub-segments.

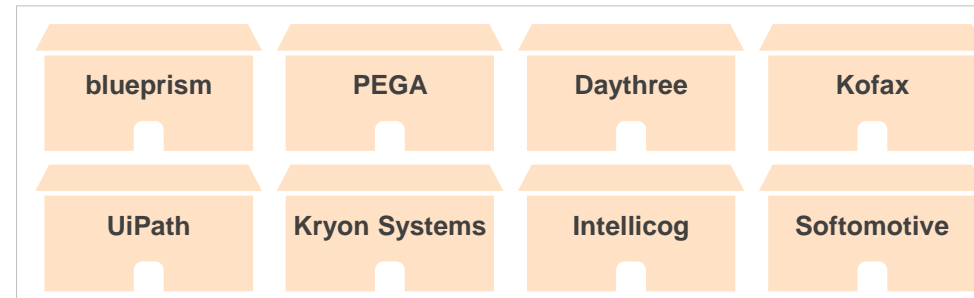


Soft robots can support a variety of business activities such as Transactions, HR services, IT, Finance & Accounting and document processing.

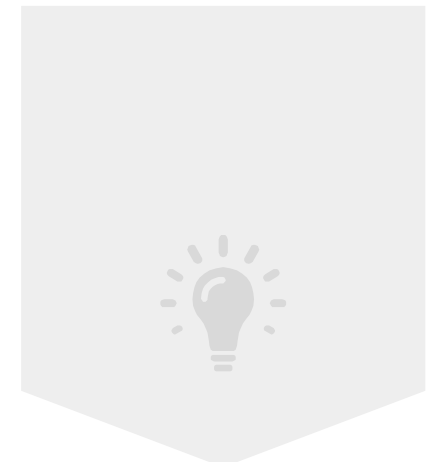
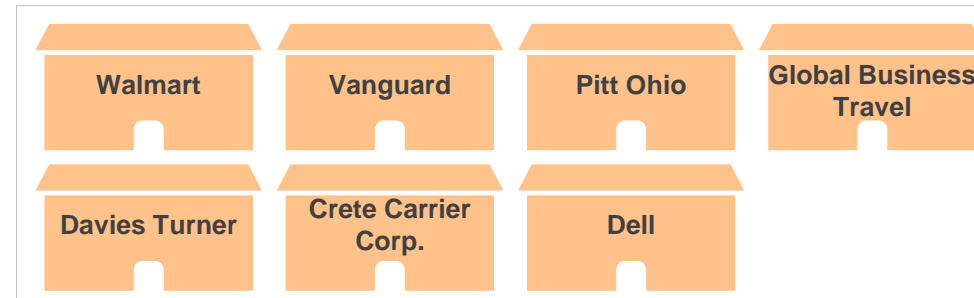


So far **banking companies** have shown the **greatest interest in this technology**, whereas T&L companies are already experimenting with their application and / or using it to accelerate their businesses.

Examples of companies supporting implementation of RPA



Examples of companies already using RPA



Find more information in "Organize your future with robotic process automation" here

Predictive maintenance solutions are used to foresee upcoming events, save costs and better respond to needs; drone supervision is also applied with similar objective, facilitating the supervision of vehicles and infrastructure

Predictive maintenance and drone supervision – solution definition and overview of relevant information

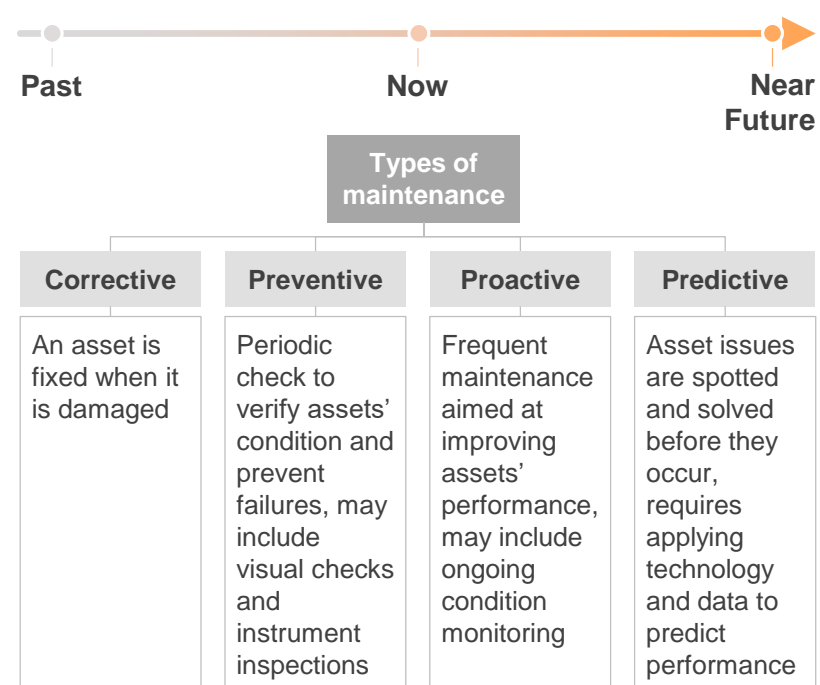
Solution: smart technologies using software, data and monitoring tools (as well as drones and sensors) to prevent equipment / asset failures and maximize asset performance



Benefits of predictive maintenance

Cost reduction	▶ Predictive maintenance helps reduce downtime and allows companies to use their equipment without breaks . Moreover, regular periodic maintenance is a waste of money if the assets are in good condition.
Improvement in quality of services	▶ Predictive maintenance helps companies to stabilize delivery times and to ensure that all of the companies' fleet is available and ready to work at full capacity.
Positive impact on employees	▶ Reacting to problems with equipment before they occur improves safety and comfort of staff, resulting in better efficiency and morale , since accidents become rare.
CSR and environmental issues	▶ Better maintenance has a positive impact on environment and waste management . Sub-optimal operation is spotted, allowing machines to be used for longer times, resulting in savings in raw materials and natural resources .

Levels of predictive maintenance



Drones are becoming a more popular tool for predictive maintenance in different areas due to the high time- and cost-effectiveness as well as accuracy that they provide.



Find more about Drone Powered Solutions here

Find more about Predictive Maintenance 4.0 in our 2017 Market Survey here

Blockchain, and in the wider sense all distributed ledger technologies, are expected to have a moderate influence on all T&L segments, with effects visible in 3 years' time at minimum

Blockchain (DLT) solutions for T&L – definition and overview of relevant information

Solution: technologies enabling storage of uniform data spread across multiple sites via a peer-to-peer network by using consensus algorithms



Advantages of DLT



Security – End-to-end product identification and auditability while maintaining privacy with hash keys



Efficiency – Reduced need for document processing (thanks to automation)



Transparency – Easier and reliable tracking and source checking

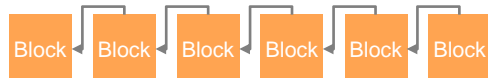


Reliability – Once a piece of information is put into the network it cannot be easily changed

Main types of DLT

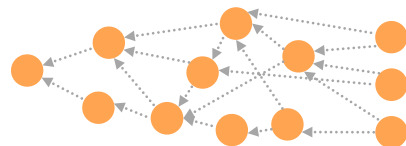
Blockchain

Transaction validation based on calculation of all transactions in the current block – done by “miners”; results in fees



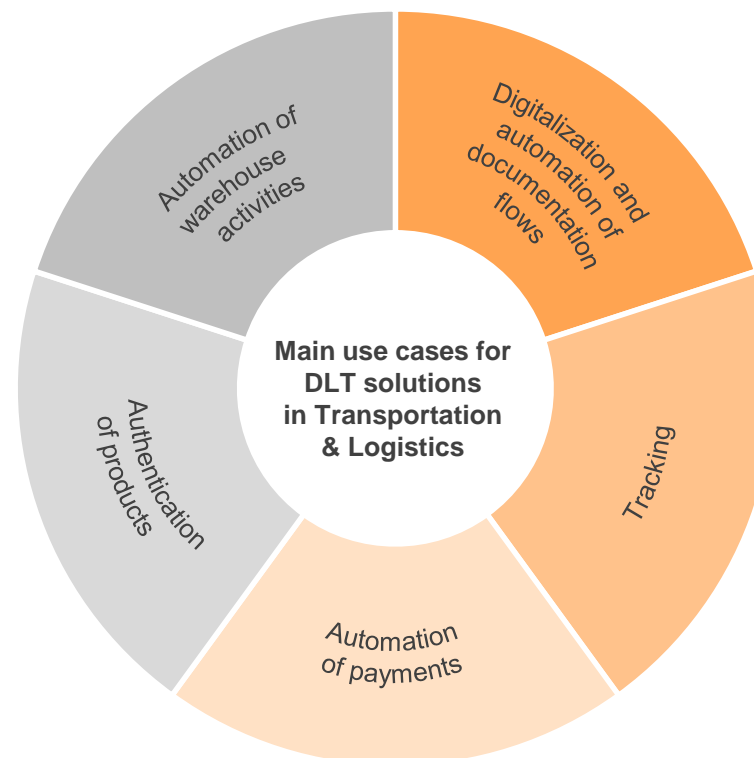
Directed Acyclic Graph

Transaction validated by verifying preceding transfers – done by the transaction maker; no fees



Authorized party validation

(only permissioned ledger) – a few selected parties validate all transactions; results in fees



Comments

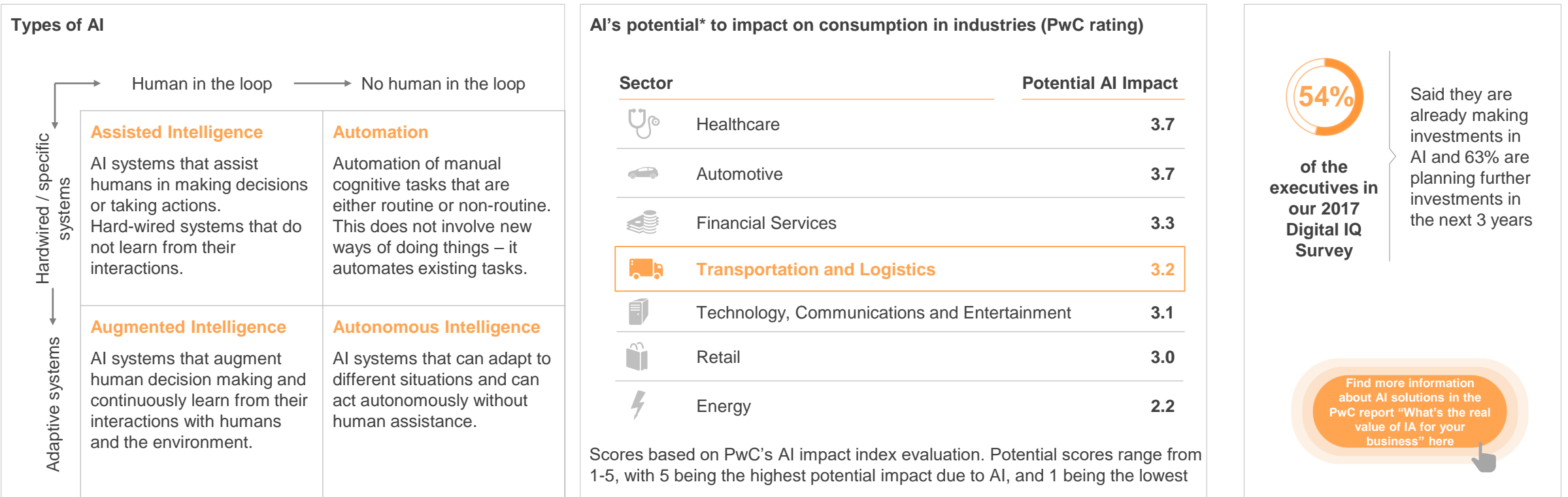
- Overall, companies from the Transportation and Logistics sector tend to value Blockchain-based solutions for the possibility to create internally robust, transparent and secure systems that allow them to deliver higher service levels at a lower cost.
- Postal and CEP operators are expected to profit greatly from the use of DLT due to high dispersion of their activities.
- The technology is already being implemented in large Logistics companies, such as Maersk, which is cooperating with IBM on developing its Blockchain platform.

Source: UK's Government Office for Science, "Trust in Trade" report by IBM, ECB "In Focus" Issue 1 2016.

Artificial intelligence solutions can reshape the way operations, traffic and networks are managed, but the current maturity of such solutions suggests that they will need more than three years to find their way into the mainstream

Artificial Intelligence (AI) solutions – definition and overview of relevant information

Solution: computer systems with capabilities of sensing the environment, learning and taking action in response to what they are sensing and their objectives



Source: PwC Analysis. *Assessment of economic potential for AI between now and 2030



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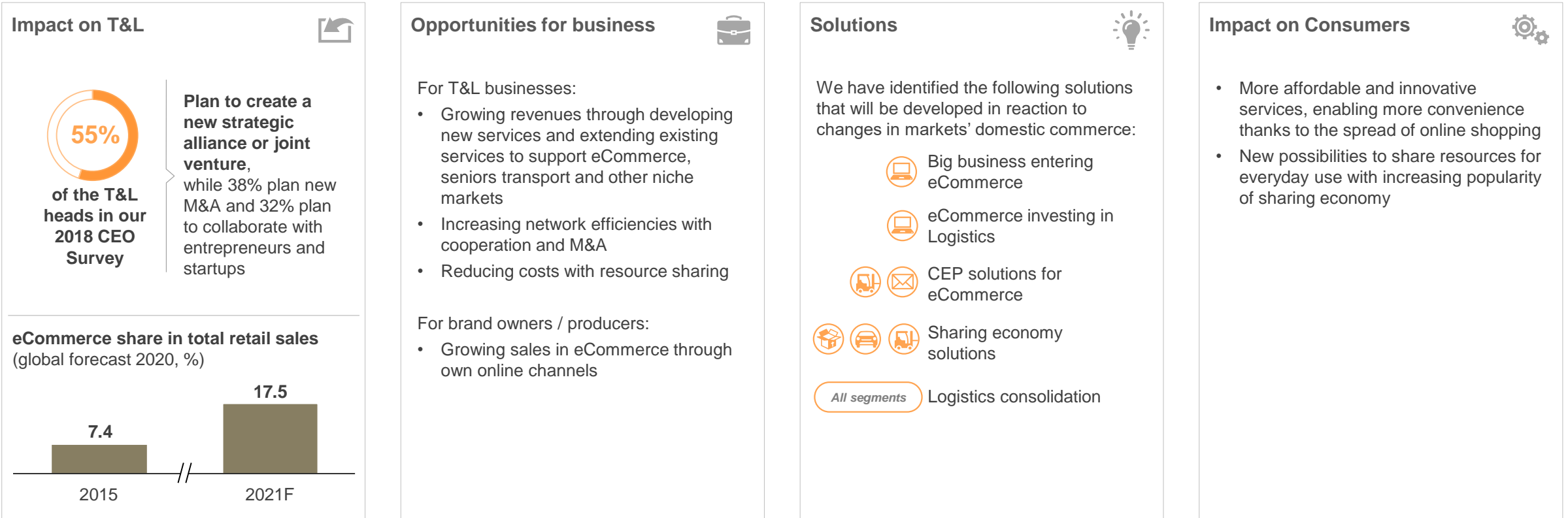
Emerging solutions: a closer look into the most impactful trends

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eCommerce growing across regions, coupled with increasing levels of optimization in T&L, are highly likely to create a push for sharing economy and value chain integrations between T&L companies, eCommerce and producers

Adjusting to changes: Overview of changes in markets' domestic commerce



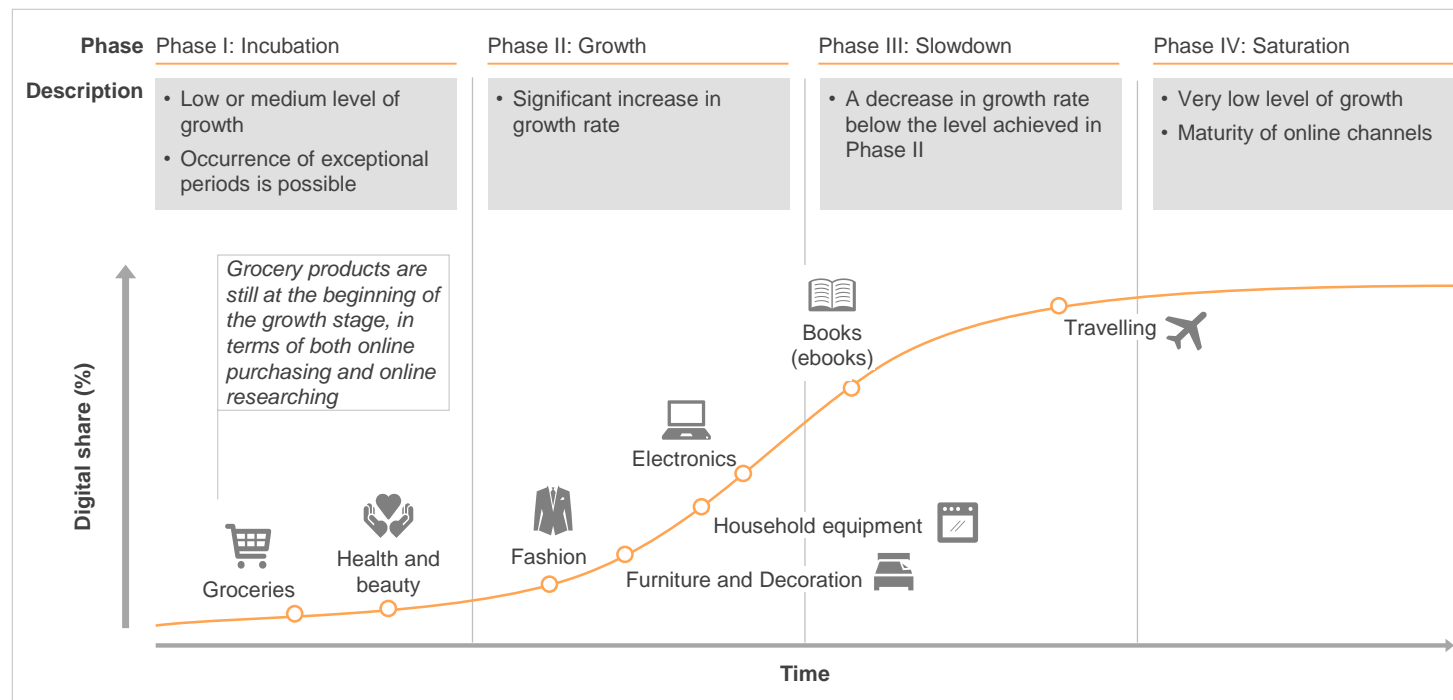
Big companies and brand owners start looking towards opportunities to offer their products online, which may yet have high impact on eCommerce as such initiatives gain momentum over the next four years

Big business entering eCommerce – solution definition and overview of relevant information

Solution: platforms, campaigns and contract setups enabling big brands to sell their products to consumers online, either directly or through a selected partner



Different product categories progressing in online penetration phases



Reasons which make eCommerce attractive to Brand Owners

Market factors

- Online stores are gradually becoming **industry standard** for brick and mortar companies
- Market entry barriers** are falling due to talent availability. Investing in online marketing and SEO allows companies to raise their share in the eCommerce market quickly

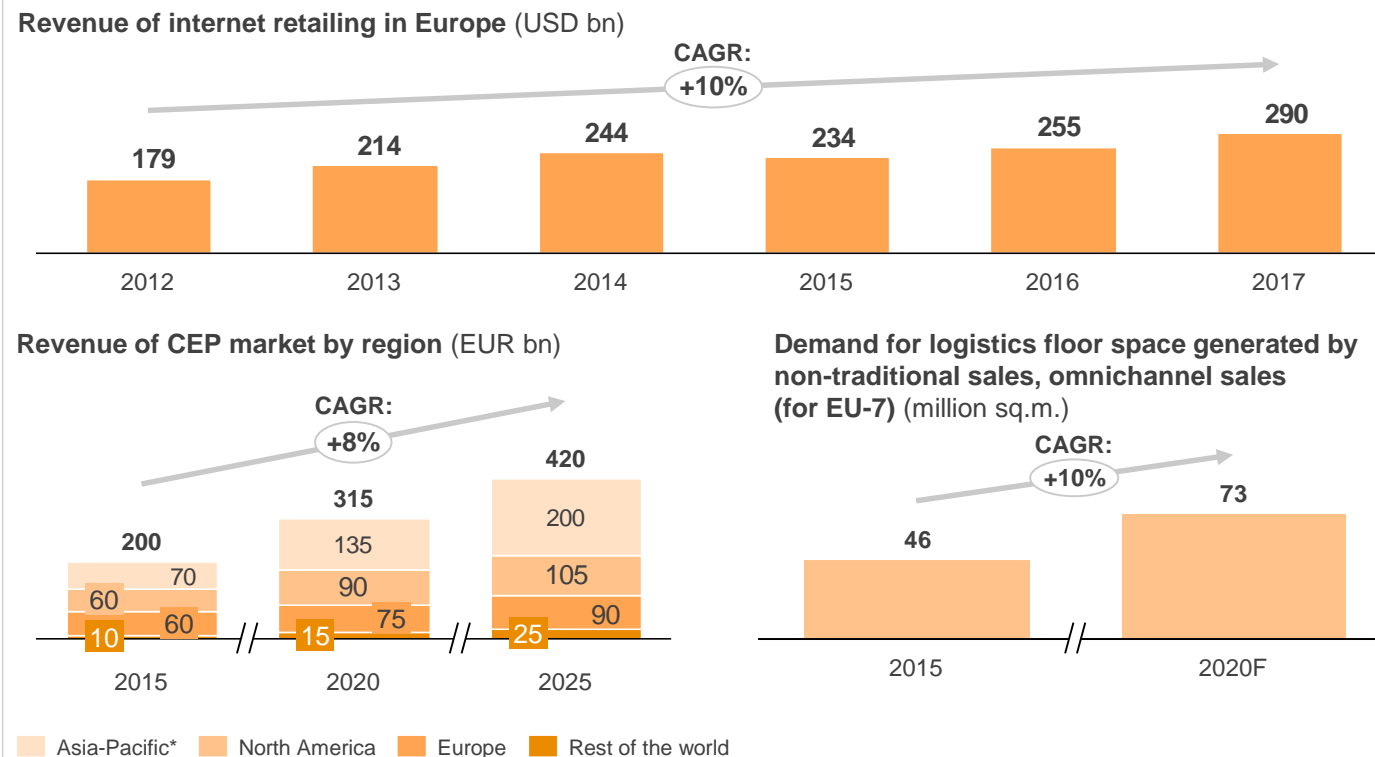
Company factors

- Big companies are already gathering knowledge based on **first experiences** in eCommerce
- Retail companies are using their physical stores as **click-and-collect points** to make delivery smooth and drive the cost down
- Entering eCommerce requires the right competencies, but big businesses have the ability to fund this development when needed




eCommerce businesses are expected to start investing in Logistics in the longer term, seeking possibilities to close value chains, and such trend is already visible in the activities of eCommerce giants

eCommerce investing in Logistics – solution definition and overview of relevant information

Solution: logistics startups and acquisitions done by eCommerce companies to integrate elements of the digital sales value chain



Examples of eCommerce companies investing in Logistics

Amazon 	Otto Group 	ASOS 
<ul style="list-style-type: none"> Developing delivery service Shipping with Amazon Investing 1.5 billion USD in air cargo hub Building warehouses and fulfilment centers across various geographies 	<ul style="list-style-type: none"> By 2020 the Hermes Group planning to invest up to 580 million USD in building and expanding high technology logistics centers, goods warehouses and ParcelShop network Investment of 116 million USD in expanding the otto.de platform, expanding eCommerce 	<ul style="list-style-type: none"> Expected CAPEX for the full year to be 297-323 million USD ASOS investing in upgrade of its 200 localized websites, is incorporating more Artificial Intelligence into services like its recommendations engine and visual search Investments in new warehouses in Atlanta, United States

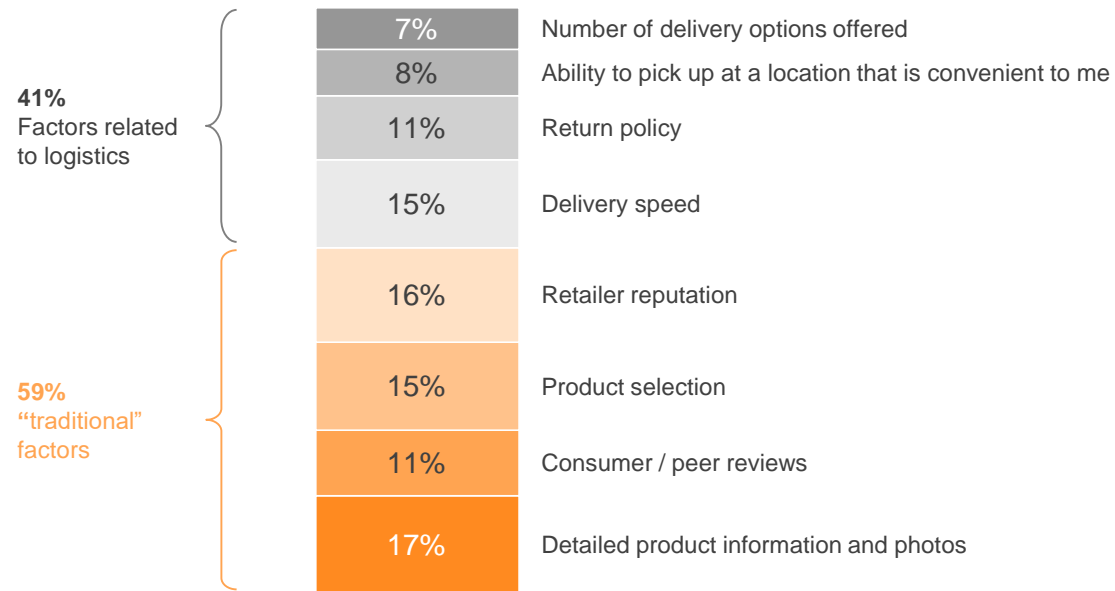
Source: PwC analysis, Euromonitor, Statista, Reuters; *Asia-Pacific includes India, China, Japan, Korea, Southeast Asia, Indonesia and Australia.

CEP companies are being pushed to design tailor-made solutions for eCommerce and we expect such solutions to have medium impact on CEP companies over the longer term, due to the shift to Omnichannel sales

CEP solutions for eCommerce – definition and overview of relevant information

Solution: varied CEP services tailored by carriers to the needs of eCommerce businesses

Factors taken into consideration when choosing an e-retailer



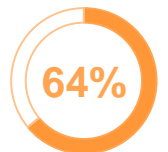
Example CEP solutions for eCommerce

Existing service extensions

- Dynamic parcel redirections, delivery form changes
- Integrated shipping of purchases from different shops
- Automated/pre-readied returns documentation
- Automated delivery / repeated deliveries

New Services

- Ship from shop/ship to shop
- Customer service data / CRM integration
- Additional services such as consumer loans, ePayments, Transactional security, Marketing automation / lead generation and even corporate loan scoring



64%
of the T&L
heads in our
2018 CEO
Survey

Say that changes in customer behaviours in the next five years will cause serious disruption to their businesses

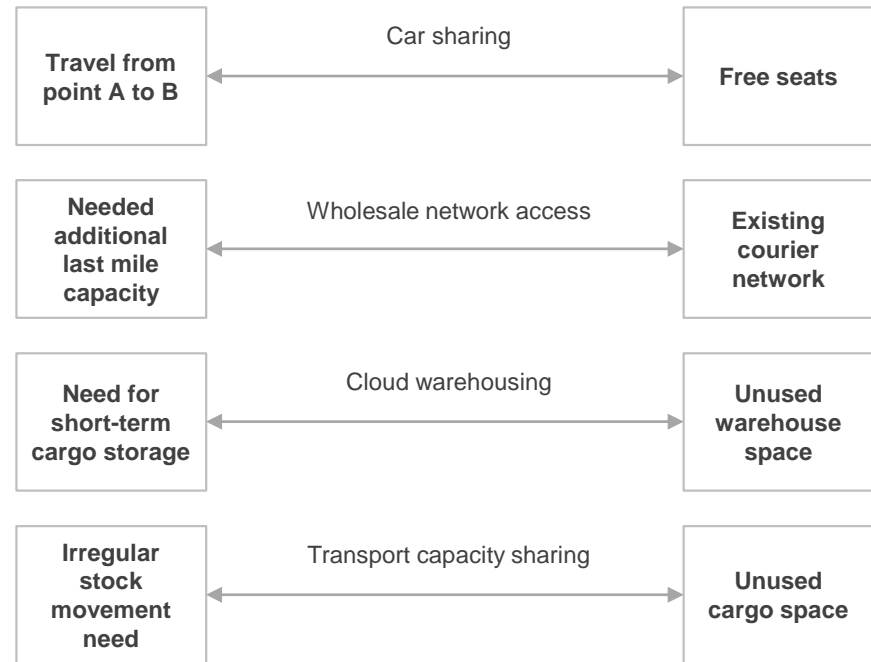
Source: PwC analysis, 2014 UPS Pulse of the Online Shopper.

As a substitute for rental economy, sharing economy is finding applications in supply chain management, road transport and freight forwarding, but it has yet to find a way of functioning in the mass market

Sharing economy solutions – definition and overview of relevant information

Solution: services where free capacities are shared between owners and recipients, leading to their improved utilization

Examples of sharing economy applications



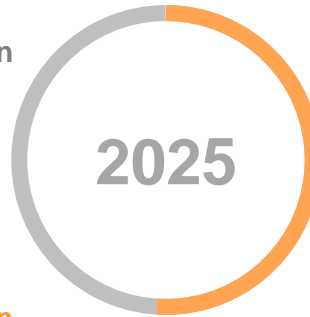
\$15 bn

\$240 bn



\$335 bn

\$335 bn



Sharing economy

- Crowdfunding and P2P lending
- Sharing music and movies
- Accommodation P2P

- Car sharing
- Online employee management

Rental economy

- Rental of equipment
- B&B and hotels
- Borrowing books

- Car rental
- DVD rental

More information is available in the PwC report "The sharing economy. Consumer Intelligence Series"

Source: PwC analysis.

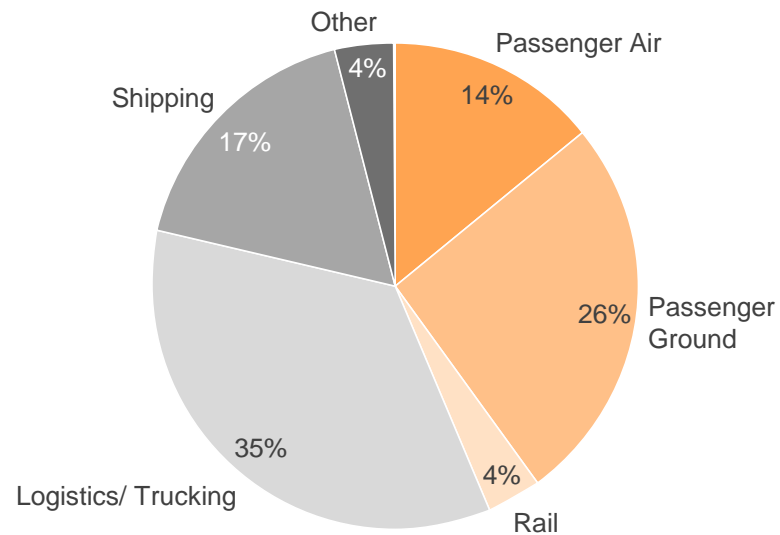
The emergence of global players in eCommerce is likely to encourage unprecedented M&A activity, which will accelerate in T&L in three to five years

Logistics consolidation – solution definition and overview of relevant information

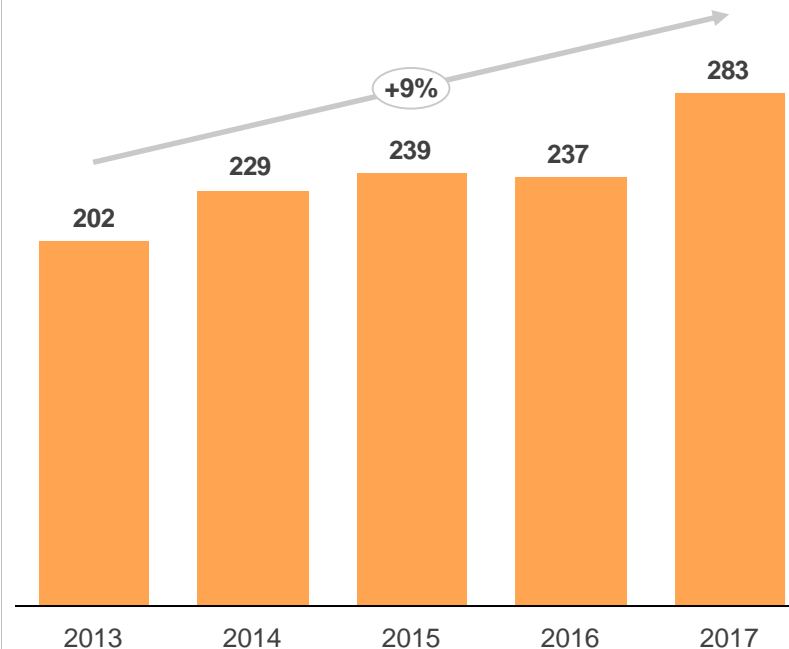
Solution: consolidation of businesses and services in order to improve network efficiency and profitability levels inside or across sub-segments



Share of sectors in T&L market in terms of deal value (2017)



Global T&L deals count in years 2013-2017



T&L M&A activity – key statistics in H1 2018

12%	\$34B	\$20.5B
Is the share of technology driven acquisitions	Is the total value of transactions with European participants	Is the value of the largest T&L transaction

More information is available in the PwC Report "M&A in the transport and logistics industry"

Source: PwC analysis.

PwC



CONTENTS – Section 5

Emerging solutions: a closer look into the most impactful trends

INTRO – The 5 forces driving changes in T&L

1	Digitalization – trends and solutions
2	Shifts in international trade – trends and solutions
3	Software-driven core process changes - trends and solutions
4	Changes in markets' domestic commerce – trends and solutions
5	Machine-driven core process changes – trends and solutions
5.1	Adjusting to changes: Overview of machine-driven core process changes
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5.3	Electro-mobility
5.4	Warehousing supported by AR&VR
5.5	High Speed Rail
5.6	Last mile delivery optimization
6	Additional information – sector definitions, solutions analysis grid, list of future speculated growth drivers

Among other benefits, machine-driven core process changes can increase the efficiency of deliveries and warehousing; however, they require investment in new technologies, thoughtful implementation and legal changes

Adjusting to changes: Overview of machine-driven core process changes overview

Impact on T&L



36%

is the growth in numbers of electric cars worldwide forecasted annually between 2018 and 2030 (CAGR)

12.6%

was the growth rate in the number of industrial robots shipped in Asia, Europe and North America between 2011 and 2016 (CAGR)

Opportunities for business



- Improving efficiency of warehousing using new transport technologies
- Solving the talent supply gap problem in the T&L sector by automating core operations
- Further Last Mile Robotization leading to increased reliability, speed and efficiency
- Further advancements in transport technologies, from high speed rails offering higher speeds, to the development of electro-mobility supported by regulators

Solutions



We have identified the following solutions in the area of machine-driven core processes:

- Warehousing robotization (including drones)
- Electro-mobility
- Warehousing supported by AR & VR
- High Speed Rail
- Last mile delivery optimization

Impact on Consumers



- To consumers and employees, machine-driven process changes will mean interacting less with people and more with machines in the future, but ultimately, will also result in a greater availability of flexible services.
- Overall costs of use may be one of the main factors to make consumers move from traditional engines to electric ones and in the long term, such solutions may reduce the impact of using fossil fuels from the cost and environmental perspectives.

Legend

– applicable segments



Posts, Courier, Express Parcel



eCommerce



Supply Chain Management



Transport & Warehousing infrastructure



Railways



Sea & Inland Transport



Road transport



Freight forwarding

Source : PwC analysis, International Energy Agency, Robotic Industries Association.

Robotization is expected to improve logistics processes in supply chain management, warehousing and transport infrastructure in the long term

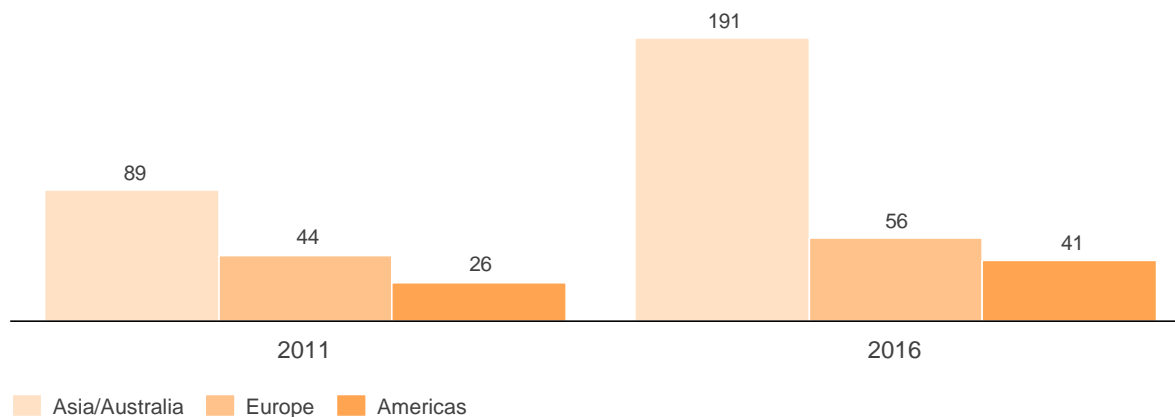
Warehousing robotization – solution definition and overview of relevant information

Solution: technologies using autonomous machines and / or cooperation between robots and staff to improve efficiency of logistics services

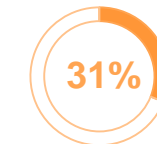
Examples of warehousing robotization application in respective logistics processes



Estimated worldwide annual shipments of industrial robots by regions (thousands)

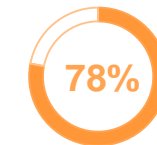


CEOs' views on warehousing robotization



31%
of the Business
and Technology
executives in
our 2017 Digital
IQ Survey

Are planning to make substantial investments in robotics within three years



78%
of the T&L
heads in our
2018 CEO
Survey

Are planning cost reductions, and the same percentage say they make decisions on the automation of tasks and jobs primarily based on how best to deliver their corporate purpose

Old approach to robotization



Old face of automation – all simple tasks are delegated to robots that replace workforce

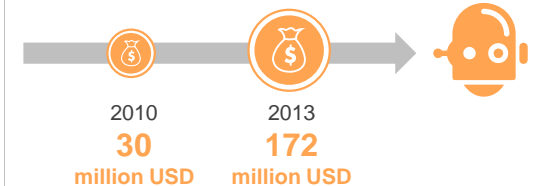


New approach to robotization



Robots work to support people instead of replacing workforce

US venture capital investment in robotics technology start-ups



Source: PwC analysis, "Mobile Robots – 2018" report by Interact Analysis, International Federation of Robotics; PwC / NVCA; MoneyTree Report based on data from Thomson Reuters.

Electro-mobility is expected to have a moderate impact on transport & warehousing infrastructure as well as on road transport in the long term, as it still needs innovation to gain the cost advantage

Electro-mobility solutions – definition and overview of relevant information

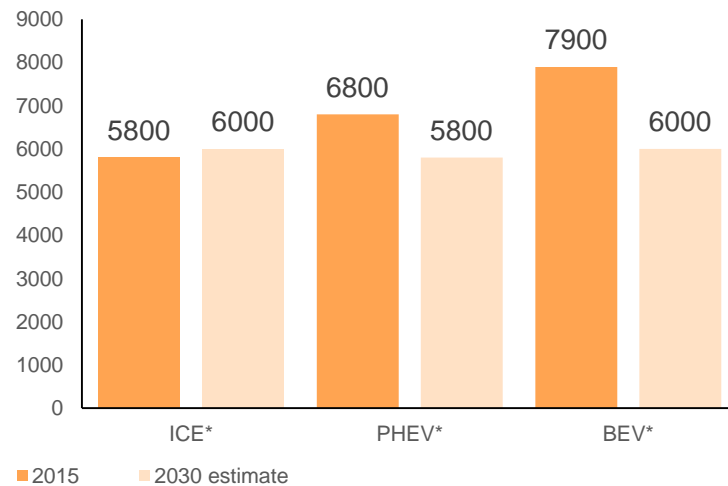
Solution: all types of vehicles utilizing any type of electric motor propulsion



Reasons for implementing electro-mobility

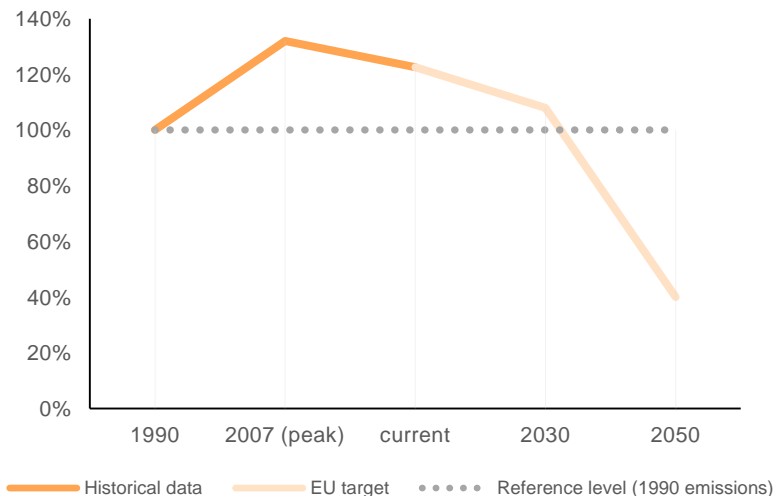
Total cost of ownership over 3.5 years

Overall costs of use of electric-powered vehicles will fall in the long run compared to traditional internal combustion engine (ICE) vehicles.



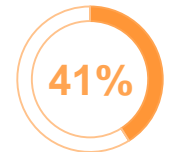
EU Transport GHG emissions

Environmental hazards resulting from excessive burning of fossil fuels lead to emission restrictions penalizing ICE-based transport.



Example of electro-mobility implementation

Palma de Mallorca has successfully reduced its dependency on petrol imports, noise pollution and carbon footprint through incentives for electro-mobility such as tax reliefs, parking privileges and public infrastructure investment in charging points.



of the T&L heads in our 2018 CEO Survey

Are concerned about climate change and environmental damage in the context of their respective businesses' growth prospects

Source: PwC Analysis, European Environment Agency, International Energy Agency, CIVITAS DYN@MO project; *ICE = Internal Combustion Engine; PHEV = Plug-in Hybrid Electric Vehicles; BEV = Battery Electric Vehicles

Augmented Reality and Mixed Reality devices offer effectiveness improvements in supply chain management which may gain wider market use in the shorter term with moderate impact

Processes augmented by AR & VR – solution definition and overview of relevant information

Solution: visual and/or interactive technologies in the areas of AR, VR and MR applied to improve effectiveness in business processes



	Augmented reality	Virtual reality	Mixed reality	Global AR smart glasses shipments in 2017 by sector	Global shipments of AR smart glasses (million USD)
Definition	Technology that layers digital information over real-world objects acting as a direct port to data stored in company's computer system.	Offers complete visual separation from the real world and immersion into the virtual reality with interactive digital 3-dimensional objects.	A combination of the two, giving users the possibility to simultaneously interact with holographic and real-world objects that influence each other in real-time.		
T&L use cases	<ul style="list-style-type: none"> Loading and unloading Order picking Intra-warehouse transporting Security, information handling, information display 	<ul style="list-style-type: none"> Complex structure/layout visualization Training aid Workflow simulation 	<ul style="list-style-type: none"> Remote repairs and maintenance Portable control panel Off-site workstation (PC replacement) 		
What does it look like					

Source: PwC Analysis, "augmented Reality in Warehousing and Logistics" report by ABI Research.

High Speed Rail infrastructure is already being developed, but given the pace we expect it to have moderate impact on T&L in the short term

High Speed Rail – solution definition and overview of relevant information

Solution: passenger rail transport operating at high speeds. EU definition: 200 km/h (120 mph) for upgraded tracks and 250 km/h (160 mph) or faster for new tracks.



Key numbers related to HSR development



1964 1st October world's first high speed train service from Tokyo to Osaka



29,792 km of high speed lines in the world (1 April 2015)



3,603 high speed train sets in operation (April 2015)



575 km/h world speed record (France 2007)



350 km/h maximum speed in revenue operation (China)



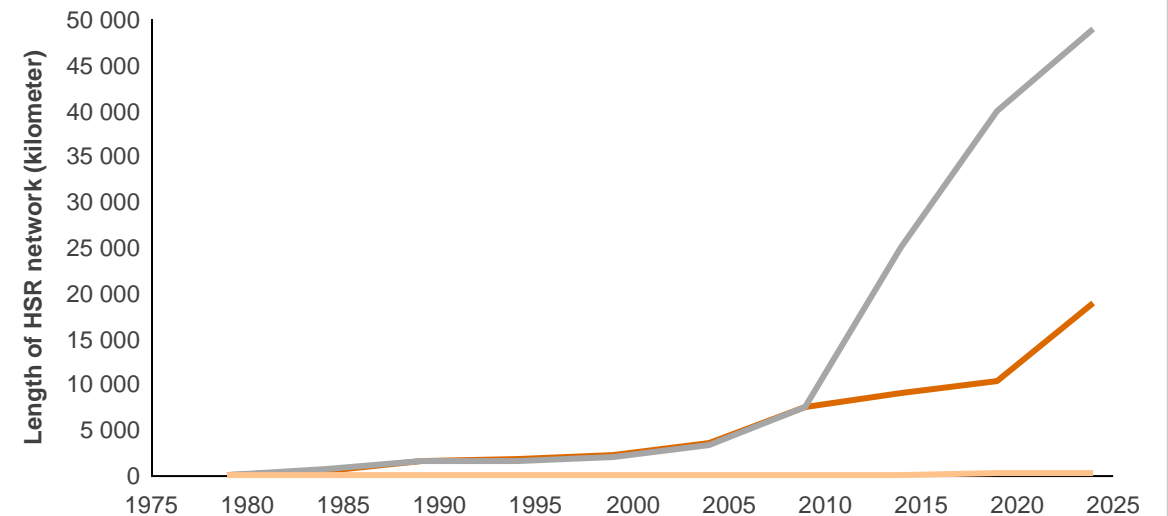
1,600 million passengers per year carried by High Speed Rail in the world (2015)

- **800** million passengers per year in China
- **355** million passengers per year in Japan
- **130** million passengers per year in France
- **315** million passengers per year in the rest of the world



80% modal split obtained by High Speed Rail in relations to air transport when travel time by train is less than 2.5 hours

High Speed Rail network in the World



The significant increase in the length of High Speed Railway lines in Asia is mainly related to the development of high-speed railway lines in China

— Europe — Asia — Rest of the world

Source: High-speed Europe, Guinness World Record, indiatimes.com.

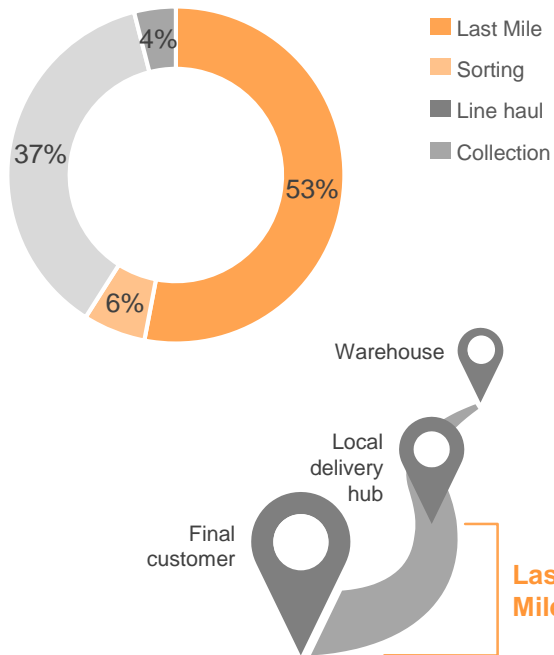
Last mile delivery optimizations are expected to have moderate impact on T&L industry over the next five years, with the main focus on such solutions from the postal and CEP (courier, express, parcel) segment

Last mile delivery optimization – solution definition and overview of relevant information

Solution: technologies and process innovations focusing on increasing the speed, convenience and cost effectiveness of deliveries



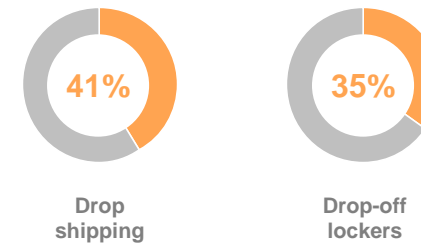
Share of delivery costs by part of shipping process



Biggest challenges with the last mile reported by global T&L executives:

Overall cost	28%
Adapting to customer demands	26%
Delivery efficiency	20%
Consistency	8%
Other	18%

Top two future last mile developments planned by global T&L executives:



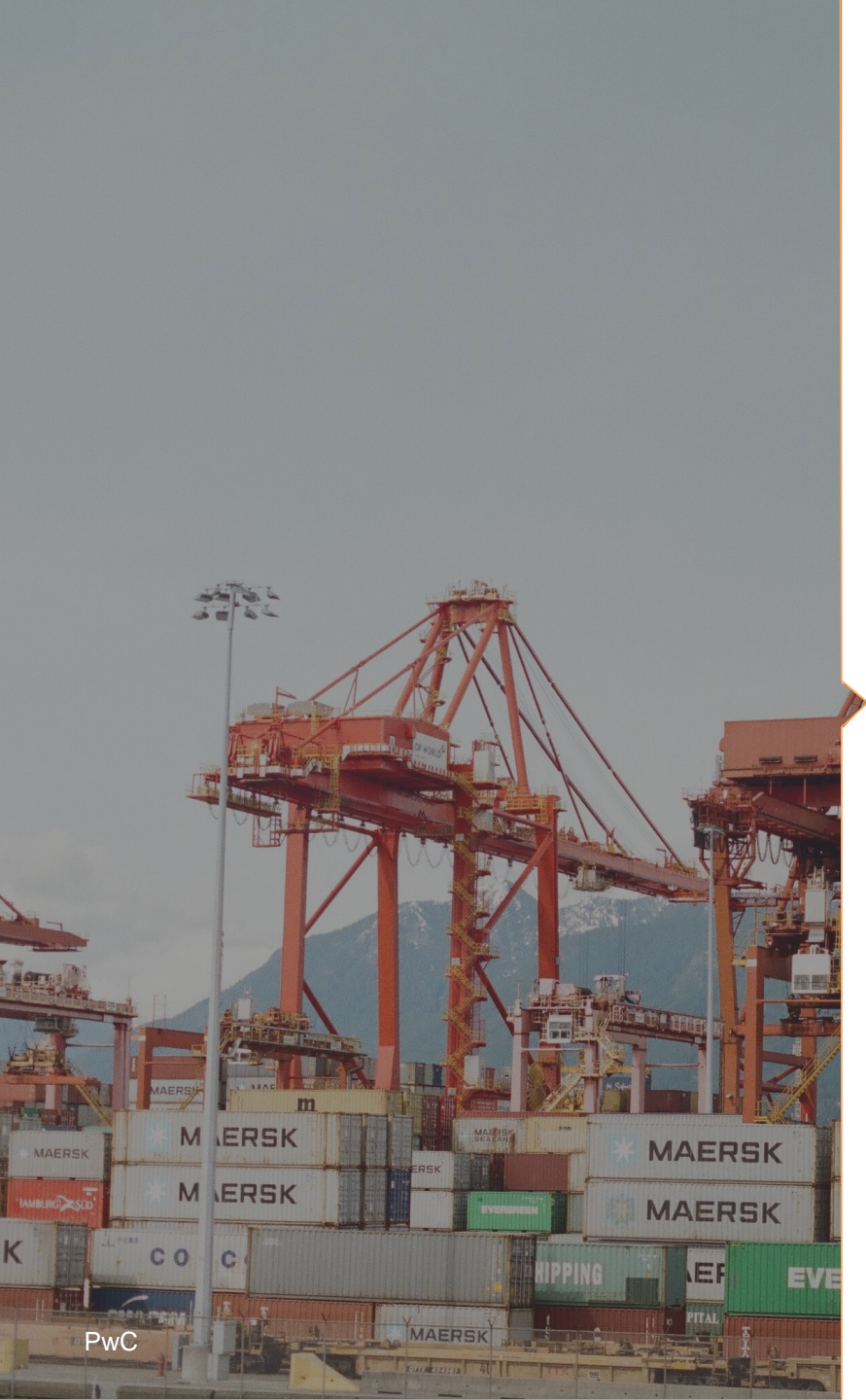
Although some business leaders are planning to develop robot deliveries, in-car deliveries most are currently focusing on drop-shipping and locker solutions, followed by in-house deliveries (34%) and crowd-sourced deliveries (32%).

Example of a company using Drone programs for last mile optimization



JD.com, the second biggest Chinese eCommerce company, has already operated drone programs in 4 regions in China. The JD drones can transport and deliver packages weighing between 5 to 15 kilos and cover distances as far as 50 kilometers.

Sources: PwC analysis, "The Last Mile Retail Study 2018" by Localz/EFT.



CONTENTS – Section 6









Emerging solutions: a closer look into the most impactful trends

INTRO – The 5 forces driving changes in T&L

- 1 Digitalization – a deeper look into the trend and its solution
- 2 Shifts in international trade – a deeper look into the trend and its solution
- 3 Software-driven core process changes – a deeper look into the trend and its solutions
- 4 Changes in markets' domestic commerce – a deeper look into the trend and its solutions
- 5 Machine-driven core process changes – a deeper look into the trend and its solutions
- 6 **Additional information – sector definitions, solutions analysis grid, list of future speculated growth drivers**
 - 6.1 Additional information – definitions
 - 6.2 Additional information – complete solutions development grid and PESTEL analysis
 - 6.3 Additional information – evaluation of least mature solutions
 - 6.4 List of abbreviations
 - 6.5 Authors

For the purpose of detailed analysis of solutions the T&L industry has been divided into 8 sub-segments covering passenger and cargo transport*

T&L industry sub-segments included in trends analysis

Sub-segment	Description – this segment is defined as companies dealing with...
 Posts, Courier Express Parcel	Postal services including collection, distribution, sorting and delivery of letters and parcels as well as supporting (e.g. fulfilment) services
 eCommerce	Internet sales delivered through an online buying experience and supplying products via physical distribution networks
 Transport & Warehouse Infrastructure	Ownership, management and maintenance of transport infrastructure (roads, hubs, gateways) and warehouse spaces, combined with transportation routes
 Railways	Railway transport including all elements of the value chain, from rail roads & infrastructure, through rolling stock, to commercial activities
 Sea & Inland Navigation Transport	Maritime transport, inland navigation transport, management and maintenance of ports
 Road Transport	Road transport conducted mostly by cars and trucks
 Supply Chain Management	All kinds of operational activities related to maintaining, managing and processing stocks of goods
 Freight Forwarding	Forwarding, consolidation of orders, coordinating the process of service buyers and shippers

*Aviation and drones were excluded as separate transport segments since they are analyzed in specialized PwC reports – please refer to the links provided above.

Timespan & regional definitions

- This report assumes a 5-year timeframe as the precision of prognoses beyond that point becomes very low (for the sake of accuracy and applicability of the information contained herein).
- Geographically, this report is focused on the region of Central and Eastern Europe. Therefore some of the information presented in it may not be fully relevant or suitable to other markets and regions.
- Aviation solutions and drones as a separate transport mode were not included in this report, as recent PwC publications on aviation cover them in greater detail – please refer to reports linked below. However, drones serving as solutions for other T&L sub-segments were included.

PwC Drone Powered Solutions webpage



Communications Review / July 2017 Drones report









2017 Commercial Aviation Trends report



From geopolitical changes, through the ever-present shift to digital economy and the internationalization of business, to growing consumer expectations and talent gaps as well as accelerating evolution of underlying technologies, we see that the identified PESTEL trends enable and urge the emergence of new solutions

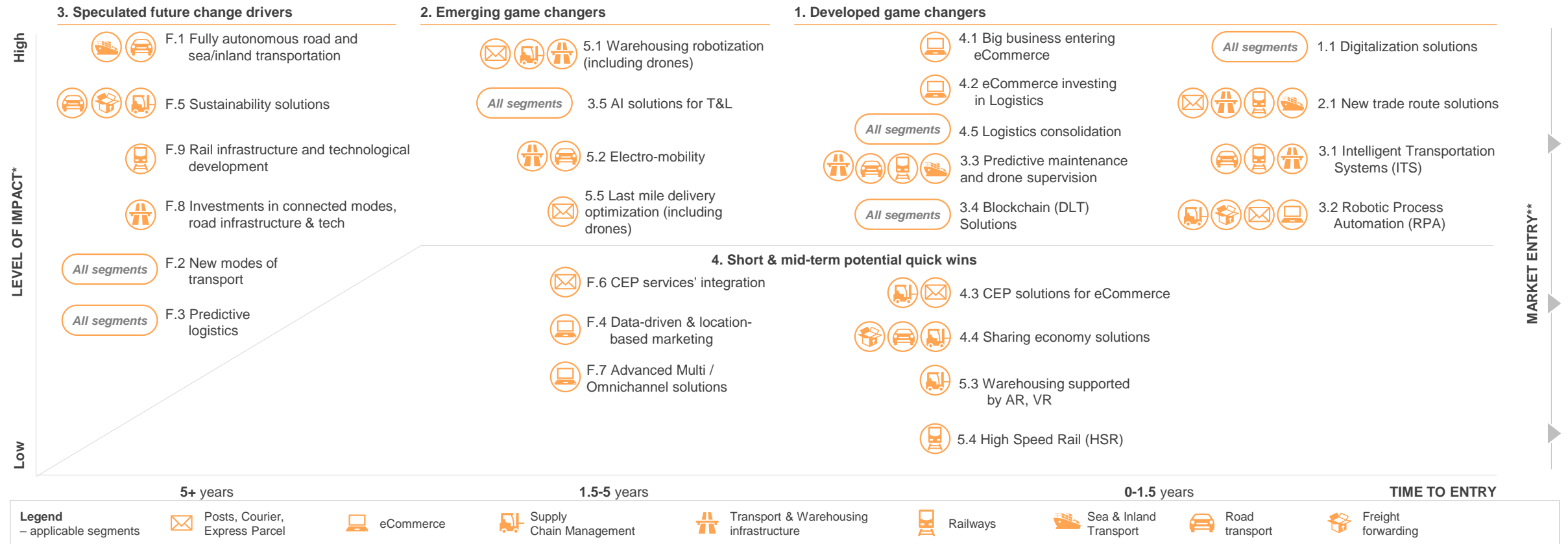
T&L industry sub-segments included in trends analysis

<p>Political </p> <ol style="list-style-type: none"> Free trade agreements: <ul style="list-style-type: none"> Trade agreements between the European Union and countries like Japan, Mexico, and Vietnam will increase the volume of trade. Development of CETA will have positive impact on Logistics of Europe and Canada. Secessionist tendencies in EU: <ul style="list-style-type: none"> Further disruption caused by Brexit may negatively affect the volume of goods transported to EU countries and cause delays due to restrictions. Attitudes advocating withdrawal from the EU in other countries may grow stronger in upcoming years. Trade wars: <ul style="list-style-type: none"> Consequences of trade wars may alter trade routes. Trades pressures from the US may also have positive impact on trade between Europe and China. Growth of Asia-Europe trade fueled by Belt and Road Initiative. 	<p>Economic </p> <ol style="list-style-type: none"> Optimistic economic growth forecasts, putting pressure on effectiveness, fueling development of T&L, as demand for transport services is linked to the economic cycle. Further growth of eCommerce penetration with growing share of mobile eCommerce, fueled by internet access. Increase in M&A activity driven by needs for growth of scale, improvements of efficiency and operating costs. Fuels (incl. crude oil) price fluctuations harder to predict due to changes in supply and demand. Further internationalization of logistics businesses, with emergence of new cross-border capital groups. Shift towards sharing economy to continue and allow for more efficient resource utilization within the T&L sector (sharing warehouses, trucks). 	<p>Social </p> <ol style="list-style-type: none"> Changes in consumer behaviors: <ul style="list-style-type: none"> Anticipation of reliability and faster delivery times will create new challenges for CEP operators. Consumer preferences shifting for buying online with home delivery, skipping the showrooming channel. Growing origin traceability expectations. Talent supply gaps acting as a bottleneck for implementation of digital innovations and increasing the cost of manual labor. Population ageing will increase the market demand for seniors transport solutions. Terrorist activities creating the need for better security and safety of T&L services, regardless of geography. 	<p>Technological </p> <ol style="list-style-type: none"> Evolution of base tech enabling innovative solutions (boosted by cost pressure): <ul style="list-style-type: none"> Artificial Intelligence optimizing supply chains' effectiveness. Big Data Analytics enabling data-driven decision-making. Digitalization of processes, touchpoints and models enabling new services and optimizations. Internet of Things creating an ecosystem for development of process-optimizing technologies. Electro-mobility advancements making electric-powered vehicles an important part of urban logistics and transportation systems. Other transport technology changes (including autonomous transportation, drones). Development of logistics Infrastructure: <ul style="list-style-type: none"> Across Emerging economies, accelerated by Belt and Road Initiative, focused in central Asia. Further growth of existing and emergence of new regional hubs. 	<p>Environmental </p> <ol style="list-style-type: none"> Environmental sustainability focus and the tightening of emissions standards will push logistics towards more eco-friendly and safe solutions ("green logistics"). Climate change is expected to continue shifting the pattern of weather events causing disruptions in supply chains. Shrinking resource deposits will lead to a rise in their prices and add to the popularization of recycling and more efficient resource allocation. 	<p>Legal </p> <ol style="list-style-type: none"> Data protection regulations may create obstacles for implementation of new technologies and collaboration between industry players. Barriers to trade (e.g. in the form of consumer protection laws, tariffs) can continue to limit Europe's exchange of goods with the world. Changing labor regulations, such as the EU agreement on posted workers' wages, may reshape the landscape of European logistics to the disadvantage of eastern European providers.
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Source: PwC analysis, Agility's Emerging Market Logistics Index 2018.

Having reviewed 25 identified solutions, we found that the most mature and impactful game changers include digitalization and new trade route solutions, followed by software solutions

PwC T&L Solutions' Development Grid – maturity and impact assessment by PwC based on individual industry information and interviews












Areas coding : 1 – digitalization; 2 – shifts in international trade; 3 – software-driven process changes; 4 – changes in markets' domestic commerce; 5 – machine driven processes; F – future change drivers (speculated)

*Level of impact - assessment of the solution's impact on the future shape of a given sub-segment **Market entry completion is considered as the establishment of profitable business models impacting the market in a noticeable way
Source: PwC analysis.

A number of solutions were classified as speculated future change drivers due to their current level of maturity and impact, whereas they can be considered potential extensions of already identified forces transforming T&L

Evaluation of speculated future change drivers

Group	Solution	Comments	Impact on the industry	Time to entry
Machine-driven process changes	Fully autonomous road and sea/inland transportation	Autonomous transportation is already present in rail and air transport but application to road and sea is limited by safety of the technology*; currently tested solutions still involve security drivers behind the wheel; the full autonomy of trucking, for instance, will require large regulatory changes, so we expect full entry in 5 to 10 years.		>5 years
	New modes of transport	New modes of transport, including hyperloop, are currently being tested, whereas their mass implementation will surely take more than 5 years.		>5 years
Software-driven process changes	Predictive logistics	Further beyond predictive maintenance, we expect software solutions to be put to use in predictive logistics. Such solutions used for forecasting logistics demand are already undergoing testing, whereas we expect ready, out-of-the-box solutions to become the preferred way of planning in the market more than 5 years from now.		>5 years
	Data-driven and location-based marketing	As eCommerce is growing and native ad networks are expanding, we are witnessing big data companies attempting to utilize user data for better ad targeting, based on real geolocation, with solutions already present in offline-online-offline marketing. Due to GDPR we expect such solutions to become popular in 1.5-5 years.		1.5-5 years
Changes in markets' domestic commerce	Sustainability solutions	As Transport and Logistics importantly contributes to pollution and the significance of climate change is growing in public debates, we expect sustainability solutions to hit the mainstream in more than 5 years.		>5 years
	CEP services' integration	With the growth of eCommerce, we expect CEP operators to start looking for opportunities to increase margins through integrating services by both consolidating shipments as well as integrating different services		1.5-5 years
	Advanced multi / omni-channel	In parallel with expansion of CEP service integration in the mid term, we also expect the further spread of more integrated omni-channel services offering greater delivery convenience (across different operators)		1.5-5 years
Other – infrastructure developments	Investments in connected modes, road infrastructure & tech	With the expansion of the Internet of Things, after the larger application of intelligent transportation systems we expect further developments in road infrastructure in connection with available technologies		>5 years
	Rail infrastructure and technological development	With the expansion of the Internet of Things, we expect further developments in smart rail and rail infrastructure in the long term		>5 years

*multiple businesses are working on such solutions starting with automation, whereas the technology necessary for large-scale, safe applications has not yet been identified, as is visible in e.g. the “Uber crash” incident.

Source: PwC analysis.

Key abbreviations used in the trend book are explained below

List of abbreviations

Abbreviation	Abbreviation
AI	Artificial Intelligence
AR	Augmented Reality
CEE	Central and Eastern Europe
DLT	Distributed Ledger Technology
HSR	High Speed Rail
ITS	Intelligent Transportation Systems
RPA	Robotic Process Automation
T&L	Transport and Logistics
VR	Virtual Reality

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