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Autonomous Trucking – The Disruptions on Logistics Value Chain

The Era of Digitized Trucking

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Agenda

Truck Study 2016

New Business Models

Truck Study 2016

New Business Models

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Truck Study 2016

The Era of Digitized Trucking

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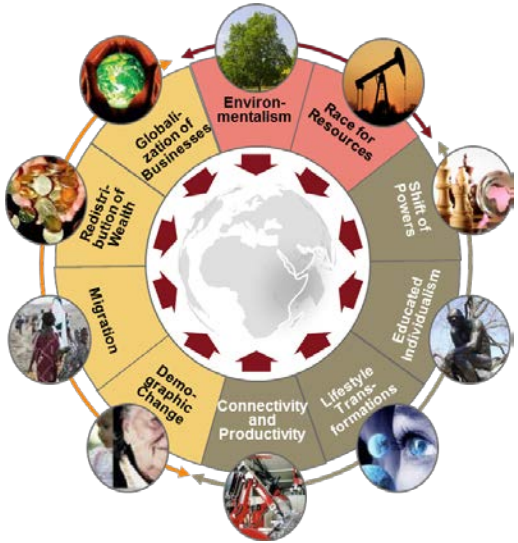
Global trends will have different impact on two principle market situations requiring tailored strategies to success

Framework Overview

Global Trends



Market Implications – Strategy to Success

Top Market – Industrialized
- Technology leading
- Complex logistics process
- Industrial digitization
- Cloud services
- Focus on TCO

Effective strategy to success

Basic/Value Market – Emerging
- Technology follower
- Universal/multi-use transport solutions
- Limited application of new technologies
- Sensitive investment costs

Source: Strategy& analysis

Digitization will change the entire logistics value chain in four dimensions

Digitization Impact

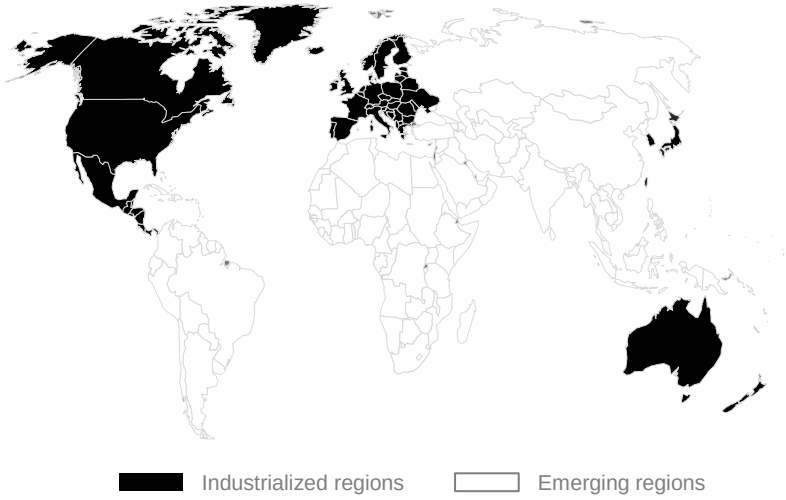
1. ***Connectivity, vehicle-to-x communication and autonomous driving*** *will* ***dominate*** *the technological trends in the* ***top market***

2. *Strengthening of* ***emissions regulations*** *and* ***techno-logical developments*** *will lead to a changed* ***logistic system*** *and processes*

3. Many industry ***stakeholders*** will be impacted and ***new opportunities*** and ***business cases*** present themselves to the well ***prepared stakeholders***
   - ***Financial attractiveness*** of many of these cases will lead to ***increased competition*** (TCO approach)

4. *We expect in the* ***long term*** *a* ***disruptive development*** *in the* ***entire logistics value chain*** *with significant* ***impact*** *on* ***their stakeholders***

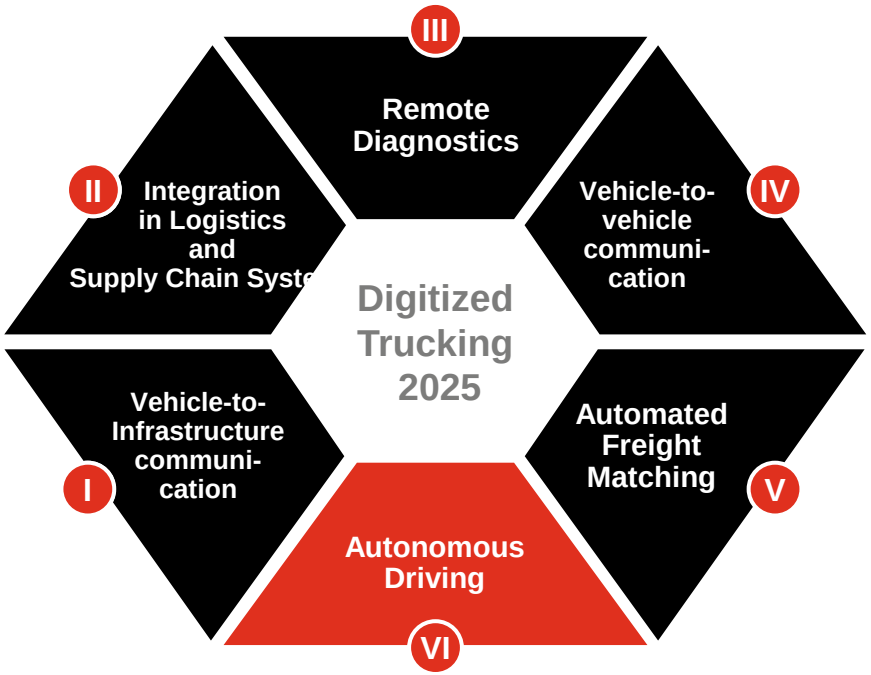
Effects in industrialized regions[1]



Source: Strategy& analysis

Six key technological advancements will lead the way forward

Overview of main technological trends

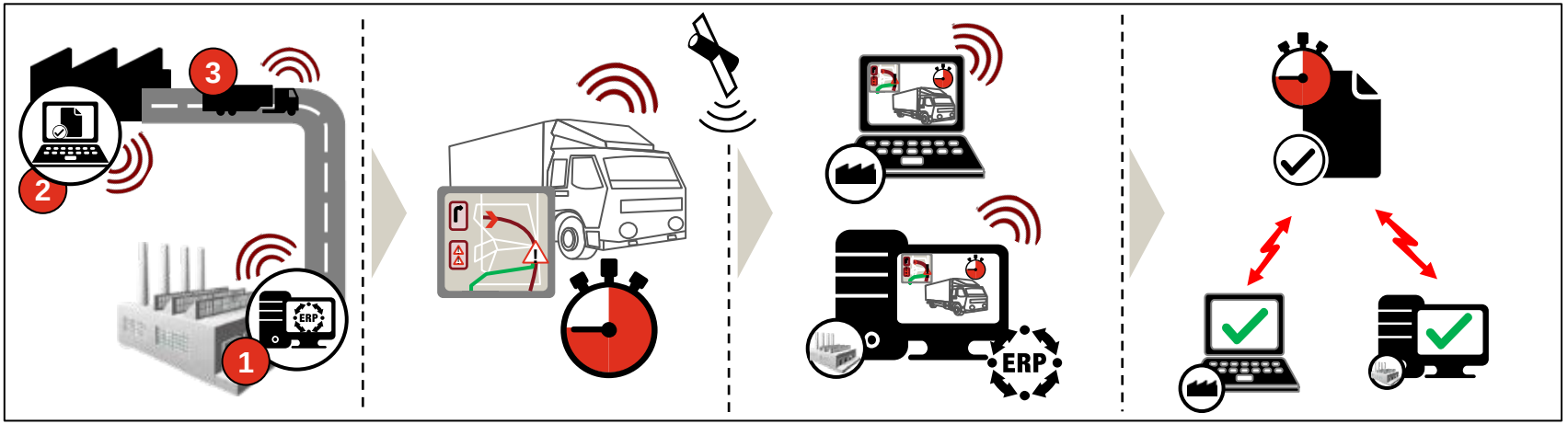


Source: Strategy& analysis

Integration of real time data in logistic systems will lead to automated coordination processes

II Integration in Logistics and Supply Chain systems

Use Case



Comments

- Customer orders goods
- Order is received, confirmation sent and **load dispatched with connected truck**

- Due to traffic or accident the **route is automatically calibrated** and the **ETA adjusted**
- **Expected delivery** time cannot be met anymore

- **Automated notifications** to the stakeholders about delay, reason for delay and new ETA
- Automatic integration of **new information** in **logistic** and company **IT systems**

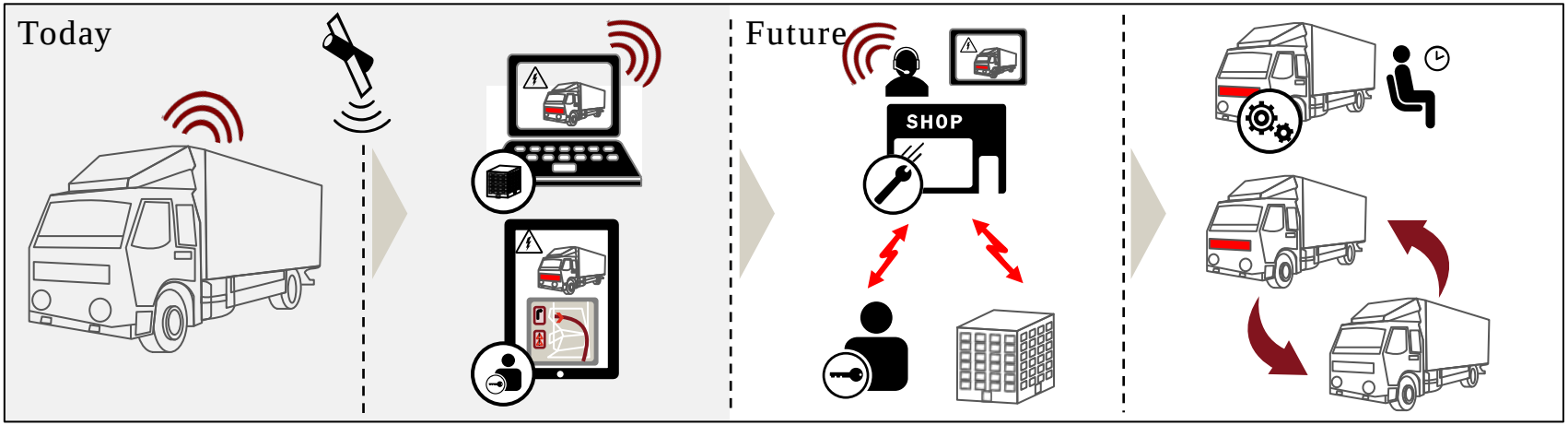
- **Automated coordination process** takes over, negotiated rate changes and **adjusts** following **logistics process chain** with new times and **alternative options**
- **Simple approval** of stakeholders

Source: Strategy& analysis

Digitization can enable more efficient repairs and reduce truck down-time considerably

III Remote Diagnostics

Use Case



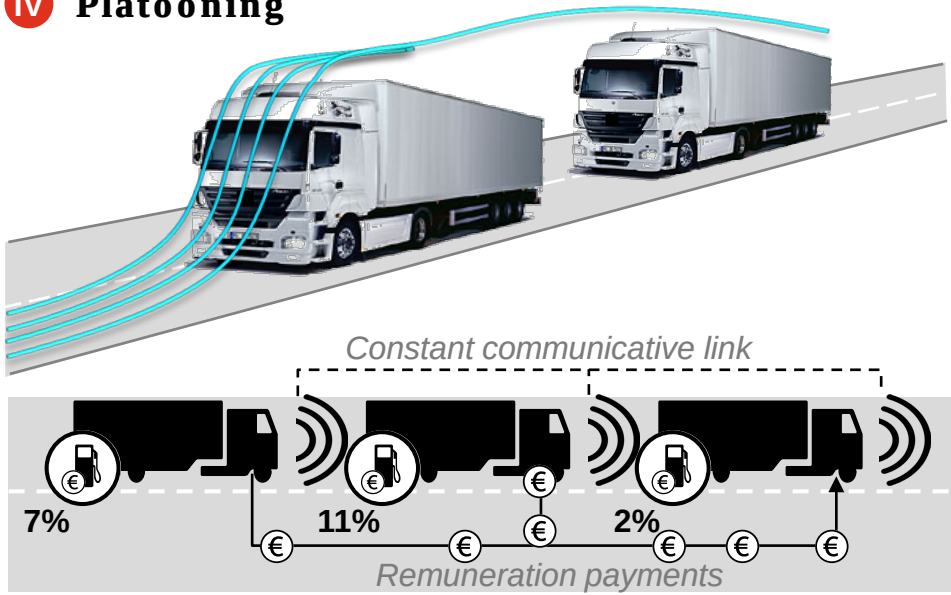
Comments

- **Truck continuously monitors** its own **maintenance status**, notifies issues immediately
- Gives **real-time updates** to **driver** and **fleet mgmt:**
  - Issues and **problem report** are sent to driver and fleet management
  - **Automated** suggestion of **closest repair shop** (within service agreement) **with spare parts available**
    - Chosen **repair shop** is automatically contacted
    - **Diagnostic report** instantly transmitted
    - Repair shop **starts analysis** immediately and has **contact** with **fleet management/ driver**
      - With diagnostic report **already analysed** and problem identified, the **repair** can **start immediately on truck's arrival**
      - Larger mechanical problems will result in **automatic order** of **replacement vehicle**

Source: Strategy& analysis

Platooning technology will reduce fuel consumptions and enable to create new business models for service provider

IV Platooning



Trends and challenges

- Utilizes **vehicle-to-vehicle communications integrated** with **advanced driving technology**, such as adaptive cruise control, collision avoidance systems, radar etc., to allow multiple trucks to drive in a very tight formation at highway speeds
- **Constant communicative link**
- Interlinked trucks **follow driving behaviour of lead truck**
- Platooning technology can save **consider-able fuel costs**, depending on trucks position in the platoon (for 3 truck platoon btw. **2 - 11% savings**)
- **Remuneration payments** through internal settlement system
- **Truck-&-Car platoons possible**

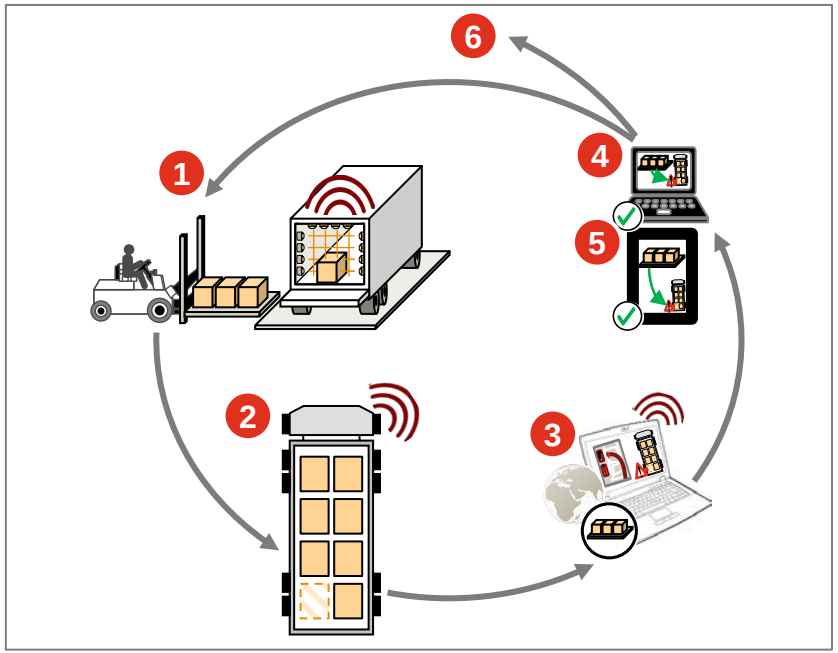
Platooning offers easy operational costs saving through reduced fuel need

Source: Peloton website, Daimler, Lastauto Omnibus (04/16)

Interconnectivity and advancements in automated load area tracking will pave the road for automated freight matching

V Automated Freight Matching

Example



Trends and challenges

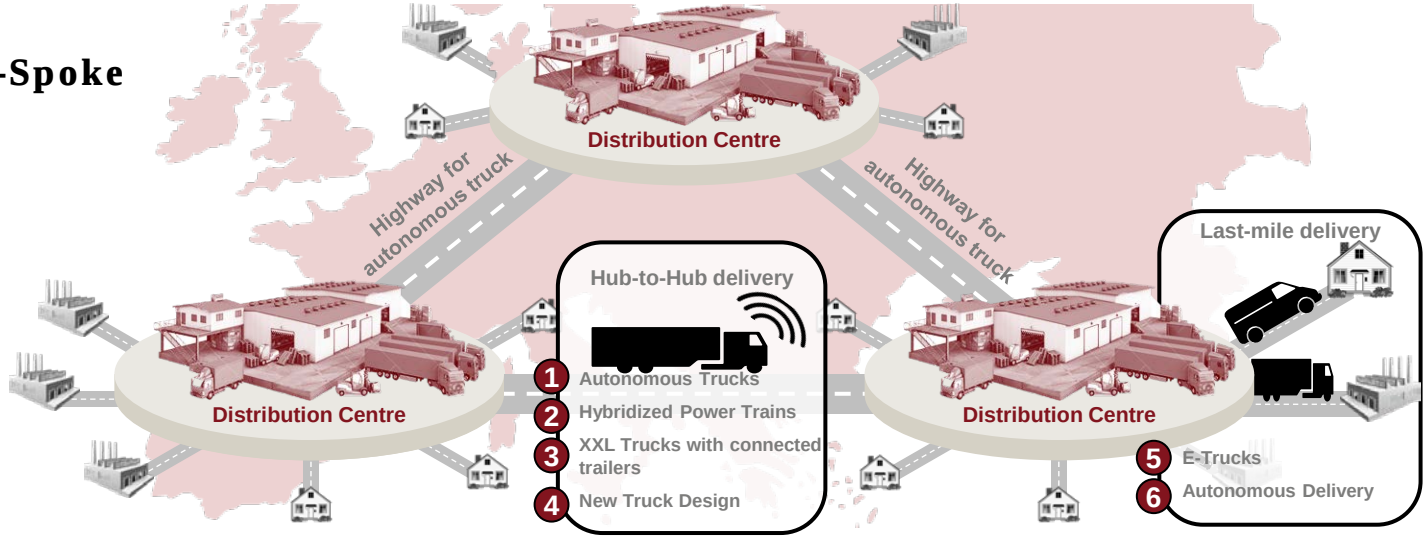
Sensor based automatic tracking of used up load area

1. Trailer recognizes its loading status and communicates it to truck; additional trailer information available (e.g. distance, maintenance, etc.)
2. Truck assess current loading weight and available capacity for more efficient transportation
3. Truck communicates loading capacity, scheduled route, ETA and other relevant information with digital freight matching platform
4. Driver and fleet management is notified about available freight sharing opportunities
5. Agreement is struck between truck operator and freight owner/ forewarder/ negotiator
6. Additional information can be collected to support trailer location tracking, maintenance organization, rental payments, etc.

Source: Strategy& analysis

We will see a much more established Hub-and-Spoke network, similar to the aviation industry

Trucking Hub-and-Spoke



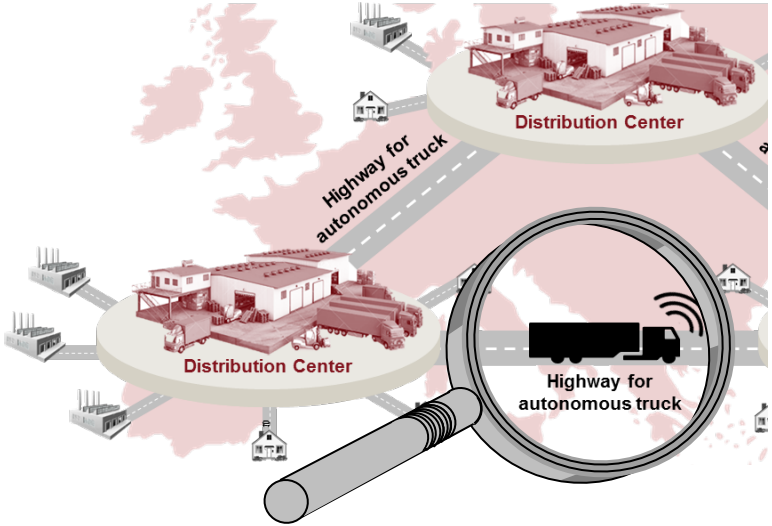
Vision

- **Large distribution centres** outside of **agglomeration areas**
- **Data-driven** routing and **freight sharing** between the centres
- Last-mile delivery with **electrified small-to-medium sized trucks**
- **Storage time** in distribution centre **minimal** due to just-in-time delivery planning along the entire supply chain

Source: Strategy& analysis

The Hub-to-Hub connections will be dominated by autonomous trucks

1 Autonomous Trucks



Vision

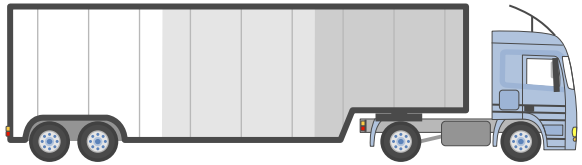
- **Autonomous trucks** will **dominate long-distance** transportation between large distribution centres outside of agglomeration areas
- Trucks will have the ability to **drive majority** of Hub-to-Hub route completely **without human interaction**
- **Platooning** between the centres **reduces** need for **long-distance drivers**
- Remaining **drivers** utilize freed up time for logistic **back-office tasks**
- **First road testing** done in **US (Freightliner)** and **Germany (Mercedes-Benz)**

Source: Photo by Daimler

Autonomous truck technology will change completely the truck design

4 Autonomous Truck – Future Shape

Truck Today



Traditional truck

- Traditional truck design
- Focus on traditional parameters like powertrain efficiency and advanced cabin design
- Integration of first features regarding autonomous trucking

Limited self driving truck

Autonomous Truck 2030

Completely self driving truck

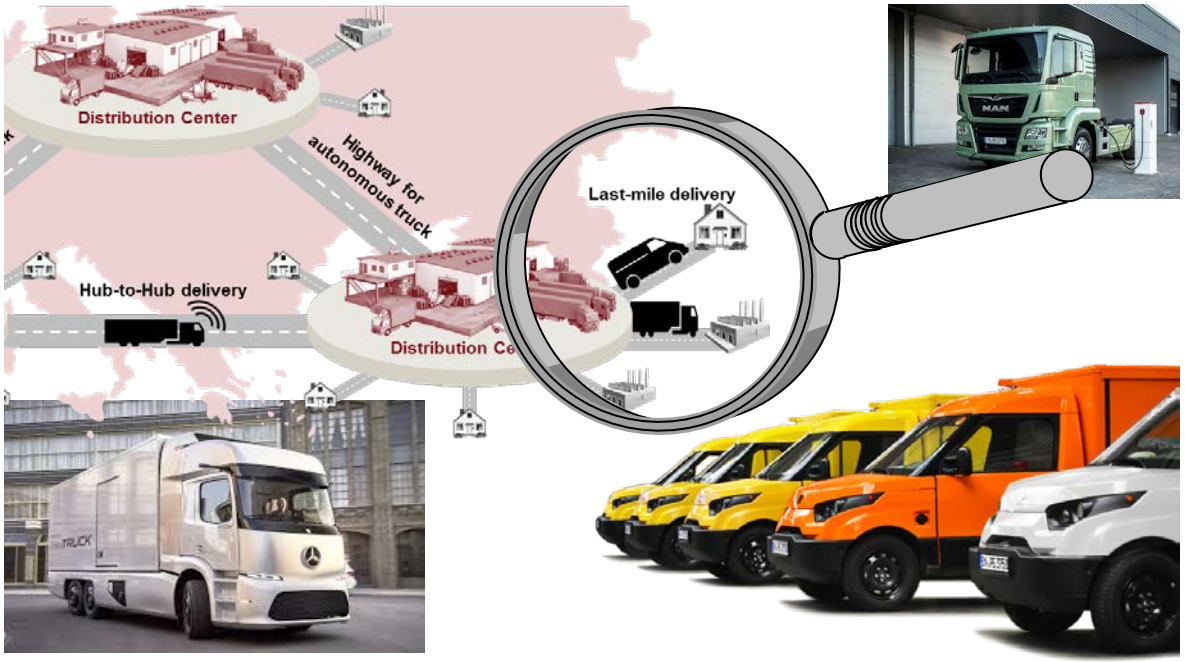
- Full focus on freight capacity maximization
- Powertrain efficiency and connected/autonomous driving capabilities
- No need for driver centricity

The fully autonomous truck in 2030 will look different from current solutions as e.g. cabin will not be necessary anymore

Source: Strategy& analysis

Hub-to-Delivery will be executed by hybrid and full-electric small to medium sized trucks

5 Electric, hybrid Trucks



Vision

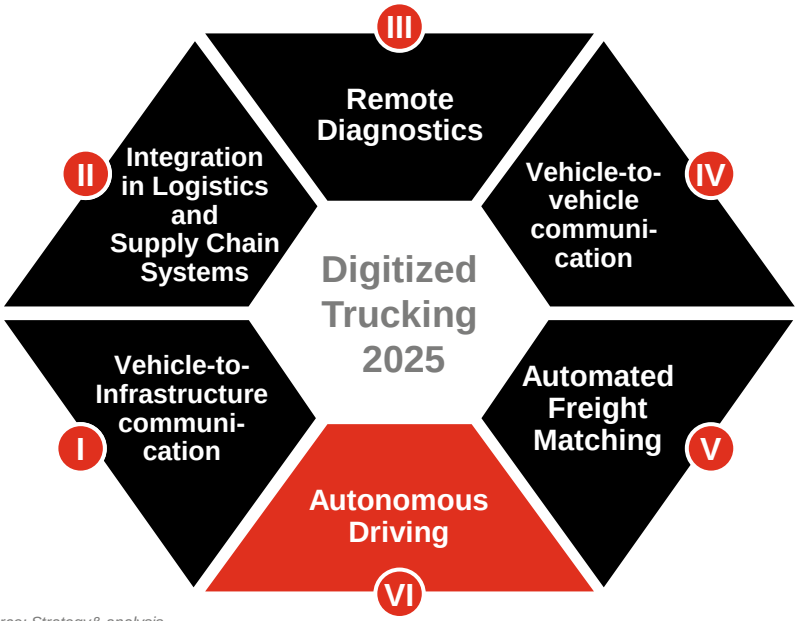
- **Last-mile delivery to end-customer** will be executed by **small-to-medium sized trucks**
- **Emission regulations** in cities seen as main **drivers** for **hybridization** and **electrification**
- Power train changes will **reduce fuel** consumption**, emissions** and general **air pollution**
- **Scale of city traffic and ban on certain vehicles will** prevent large trucks **from entering cities**
- Proof of concept: **DHL Group Street-Scooter**, electric delivery trucks

Source: Photo by DHL Group, Street-Scooter, Mercedes Benz, MAN

We have identified 7 main stakeholder that will be impacted, but can also benefit from these trends

Overview of main technological trends and stakeholders

Technological trends



Main stakeholders

1. Component supplier
2. OEMs
3. Service provider
4. Logistic provider / trucking company
5. Regulators
6. End-user/customer
7. Driver

Source: Strategy& analysis

Many possible connected service opportunities will be developed from these trends; we have selected 4 +1 business cases

Overview stakeholder Impact

PRELIMINARY

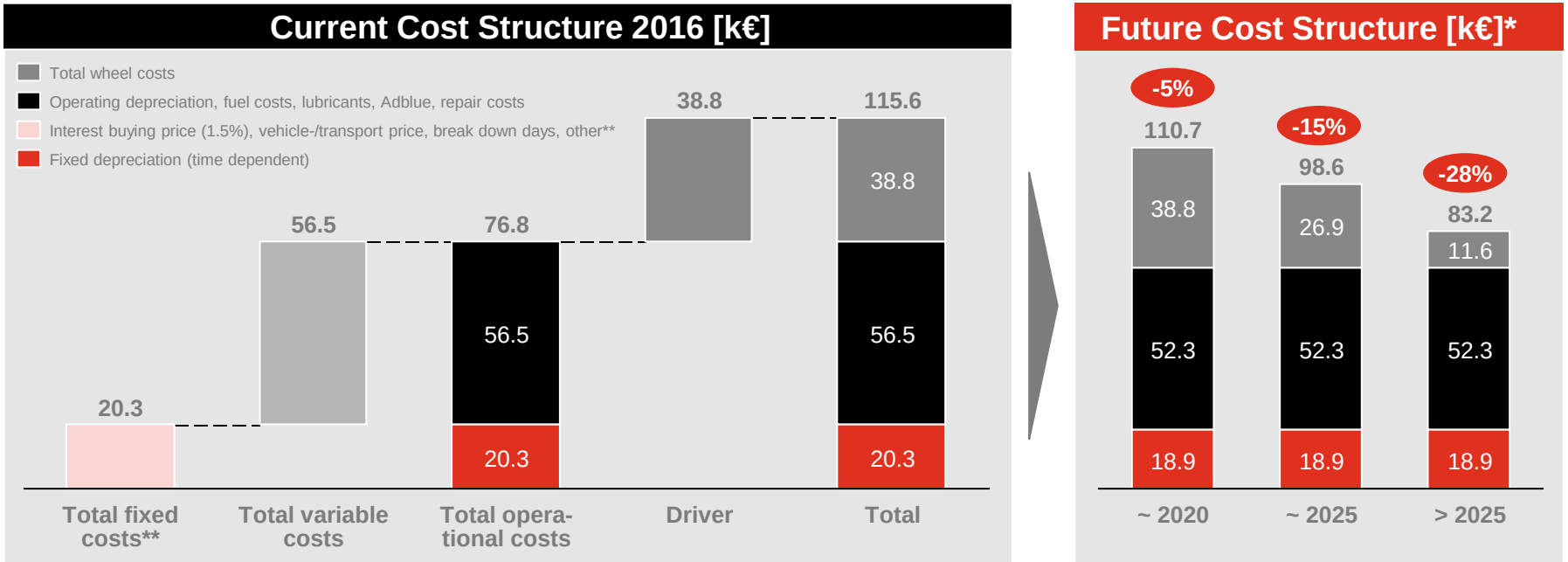
stakeholder	Technologies						
	Connected truck					Autonomous truck	
	Vehicle-to-vehicle	Vehicle-to-Infrastr.	Remote Diagnostics	Integration in Logistics Systems	Automated Freight-matching	Platooning	Full autonomy
1 Component Supplier	✓	✓	✓	✓	✓	✓	✓
2 OEMs	✓		✓	✓	✓	✓	✓
3 Service Provider	✓			✓	✓	✓	
4 Logistic Prv./Truck.Comp.		✓	✓	✓	✓	✓	✓
5 Regulators						✓	✓
6 End-user/Customer		✓					
7 Driver		✓	✓	✓	✓	✓	✓

Business case 1 | Business case 2 | Business case 3 | Business case 4 | Business case 5*

Source: Strategy& analysis

The annual operating costs for a traditional average long-haul truck will be reduced step by step with autonomous driving technologies

Business Case 5 : *Operating costs development of traditional average truck*



*** Additional investment and operational costs for autonomous technology is included*
*** Total fixed costs includes tax, testing costs, fixed rate for cleaning and communication costs*

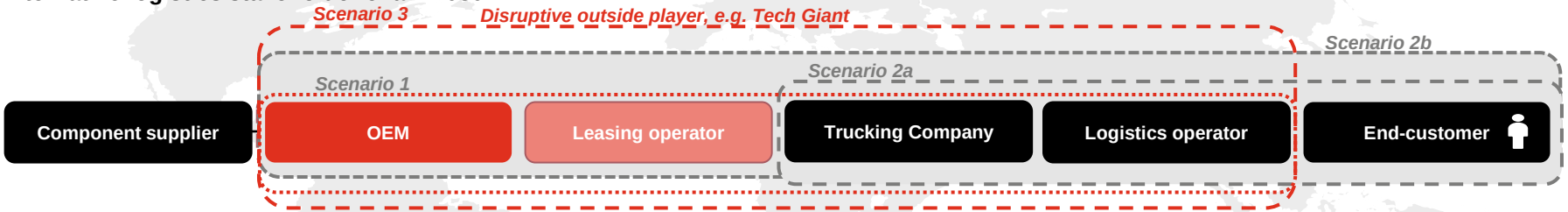
Remark: An annual driving basis of 140.000 km was taken
Source: Lastauto Omnibus (05/2016), PwC Strategy& analysis

Based on predicted trends, the logistics value chain will change dramatically

Outlook: Transition of the logistic value chain

Logistics stakeholder chain today

Alternative logistics stakeholder chain 2030



Current supply chain based on **multiple distinct** market **players;** First overlaps are visible, e.g. **OEM as leasing provider,** but generally clear separation along the value chain

Scenario 1:
Autonomy of trucks enables OEM`s participation **as mobility service provider** combining traditional services of **trucking companies** and **logistics provider as need for drivers and manual coordination decreases**

Scenario 2a:
Endcustomer will take over **parts of the logistics value chain** in order to get more **control** over the **hub-and-spoke network** as well as the **last mile delivery**

Scenario 2b:
Endcustomer will in some extent **expand** to the **design and manufacturing of specific truck solutions** in order to have tailored and **cost efficient equipment** available

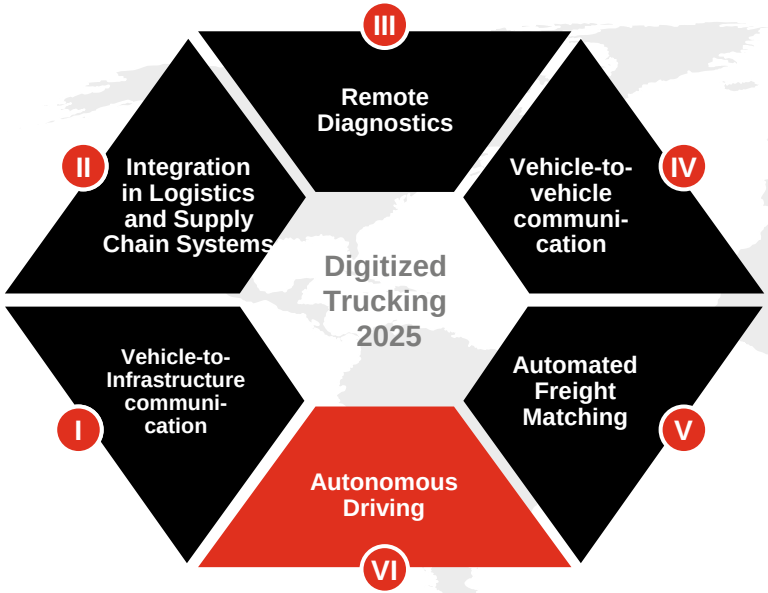
Scenario 3:
Outside Tech Giants may enter the **market** and occupy relevant parts of the **entire logistics value chain** causing **disruptive situations** for the **traditional players** in the value chain

Source: Strategy& analysis

Digitized trucking will lead to significant changes in the entire logistics value chain with adjusted roles of current and new stakeholders

Conclusion and Outlook

Technological trends



Main stakeholders

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6. End-user/ customer
7. Driver

Conclusion and Outlook

- **Trucking cost reduction** up to **28%** by autonomous driving
- Main **saving potential** is the **substitution of driver**, but limited by **adequate regulatory adaptations**
- Development of h**ub-and-spoke systems** is forced by **increased emission regulations** for urban areas and based on **autonomous trucking technologies**
- **Last-mile-delivery** will be done by **emission free midsize trucks**
- **Digitization** will **disrupt** the entire **logistics value chain** and enables the **market entry** of new **Tech Giants**

Source: Strategy& analysis

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Truck Study 2016

New Business Models

Digitized Trucking

New Business Models

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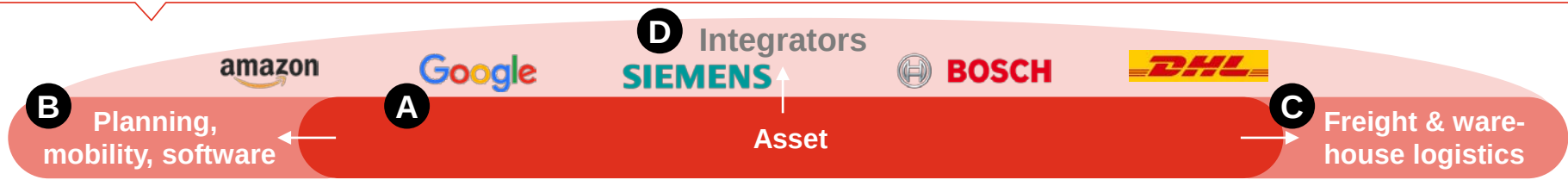
Digitization extends the scope for new services beyond the truck and encompasses the entire data and logistics chain



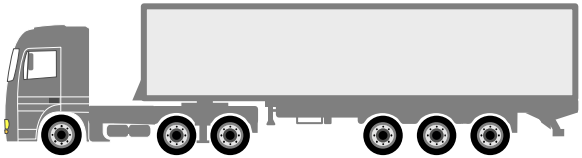
Cloud solutions / platforms / broker

Transwide
Teleroute
TimoCom

Logistivs Software

SAP
ORACLE

- Automated freight matching



Truck

Trailer

Components

Cargo

SCANIA
IVECO
DAIMLER
DAF
MAN
RENAULT
VOLVO

KÖGEL
KRONE
Die Trailer-Profis
WIELTON
SCHWARZMÜLLER

WABCO
KNORR-BREMSE
Carrier
Haldex
JOST
THERMO KING

- Remote diagnostics
- Truck / trailer telematics
- Smarter truck / trailer / components
- Integration of cargo into data flow

Logistics systems

KION GROUP
DEMATIC
WITRON
JUNGHEINRICH
swisslog
Member of the KUKA Group
SSI SCHÄFER

- Integration in logistics and value chain systems

Source: Strategy& analysis

In the last 2-3 years movement has entered the market for Connected Trailer / Truck and Logistics

Trend	Examples	
Connected truck & fleet management	SCANIA	▪ More than 200,000 trucks delivered with pre-installed Connected hardwa ▪ Customers receive basic evaluations free of charge with the aim of sellin "premium" service packages ▪ Scope: remote diagnostics, driver coaching, etc. 
Data aggregators & open platforms	MAN RIO	▪ Uniform information and application system with forecasting functionality ▪ Open platform includes vehicles from competitors as well as trailers and ▪ Starting from 2017 as standard and retrofittable 
	DAIMLER FLEET BOARD STORE	▪ Open cross-brand platform as market place for innovative apps ▪ Competitors can develop their own apps and offer them via the store ▪ From 2017 Introduction of the Fleet Board Store 
New players in telematics and logistics services	FR8.guru	▪ MAN Truck & Bus invests 2016 in FR8 Revolution ▪ Starting in 2017, US Startup will be a transport platform for the networking operators, shippers, transport companies and drivers 

Source: Strategy& analysis, company websites, Scania press release

Customer needs have to be drivers for the development of new services - TCO and efficiency improvement have to be considered simultaneously

Demand driver

Fleet profile

- > 70% of the fleets consist of different vehicle types and brands
- Operators use a **telematics system** across all brands and vehicle types

Application profile

- Demand for services doe not only depend on the industry affiliation, but also strongly on the **application profile**
- E. g. higher demand for decentralized fleets without regular return to central location

Fleet size

- Demand also depends on **fleet size**
- Large fleets often work with their own or highly individualized systems
- Small fleets organize offline or use simple and inexpensive solutions

Source: Strategy& analysis

TCO and efficiency increase are drivers for the successful application of digitalization solutions

Benefit in €

B2B customer requirements Connected Vehicle (various industries)

B2B customer requirements (aggregated)

- Multi-brand capability (use in entire fleet)
- Real commercial benefits for business
- Fast and clearly calculable payback rate for investments in connected services
- Easy to use for drivers and backoffice
- Easy integration into existing system landscape
- Low maintenance effort and high system reliability

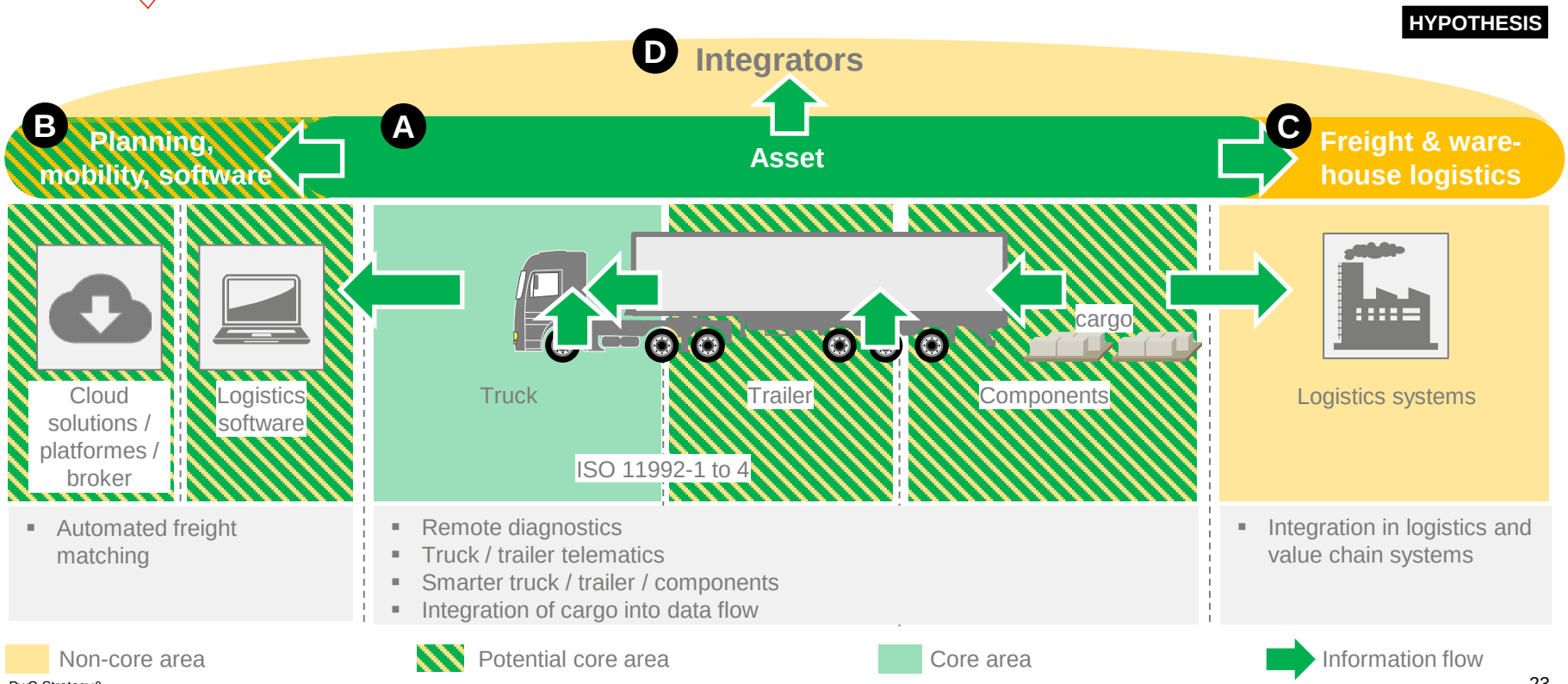

Construction


Mining


Logistics

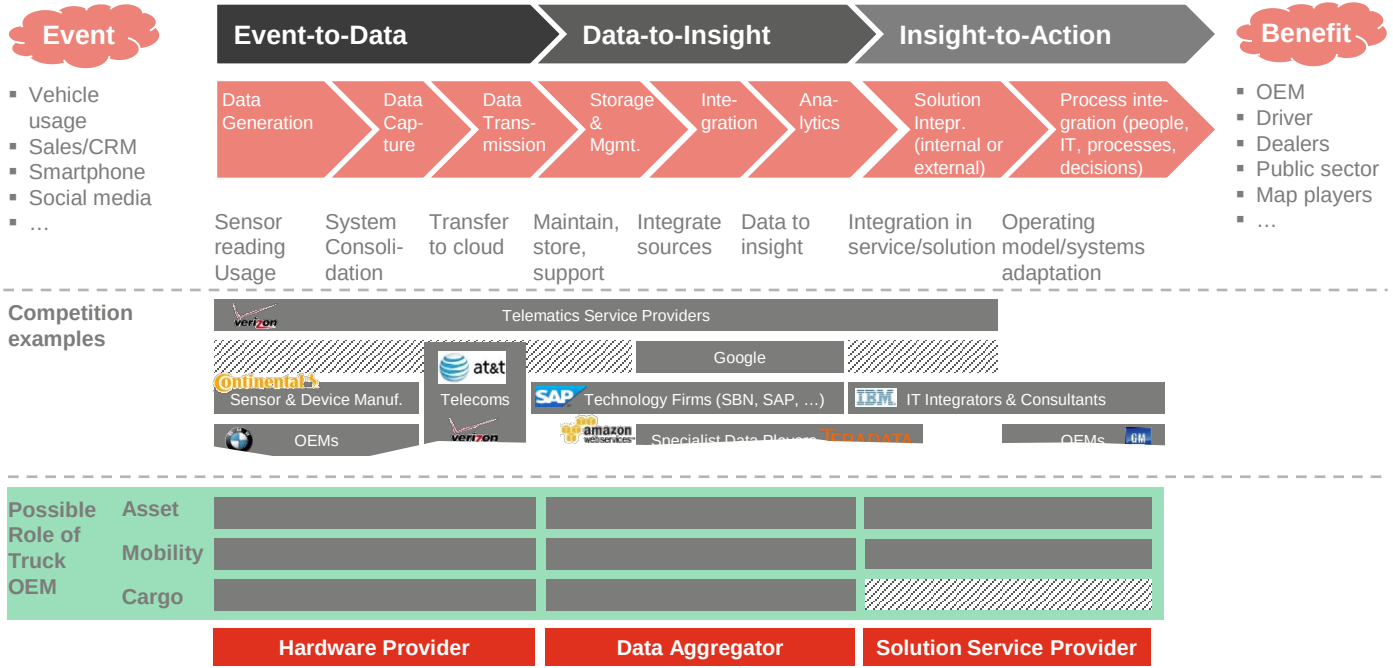

Car rental

The development of a clear vision of new areas of activity will form the basis for future business development



… and offers opportunities for the three core fields of asset, mobility and cargo data to cover a part of the ecosystem

Automobile industry data value chain / ecosystem



Description

3 Fundamental business models:

- **Event-to-data** hardware providers
- **Data-to-insight** - data aggregator
- **Insight-to-action** - solution service provider

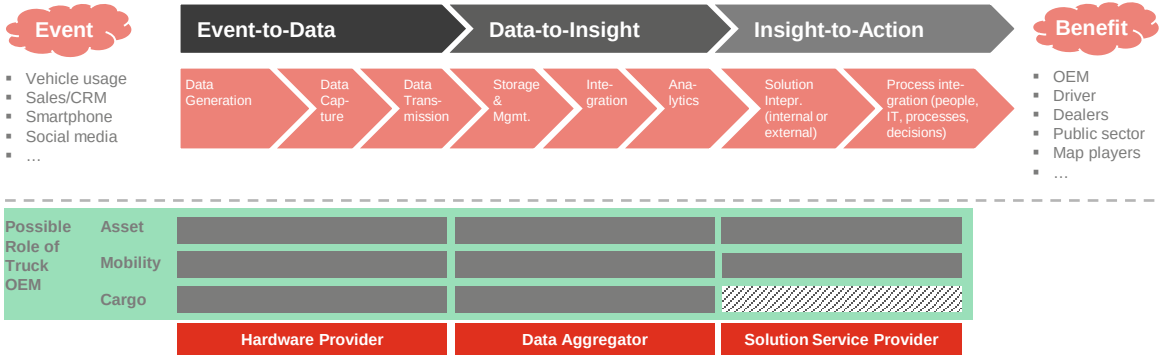
Role of the truck manufacturer:

- **Asset data** is the core business of the truck manufacturer and can be processed over the entire value chain
- **Mobility data** are original telematics information and can be processed
- **Cargo data** can play an essential future role as an integrator through the logistics chain

Truck OEMs have to find the sustainable way to play in order to achieve the right to win in the Trucking/Logistics Ecosystem of the future

Key Questions to be answered

Capabilities -Driven Strategy (CDS) Approach



Key Questions

- Where should Truck OEM play in the future? Asset – Mobility – Cargo
- What is the benefit for the Truck OEM customers – only recognizable use cases will provide a successful implementation
- What are the use cases for Truck OEM ?
- What are the competitors doing? How have they to be integrated in order to provide a brand independent solution?
- Who are the right partners to provide the necessary capabilities to achieve the right to win?
- What is the timeline for implementation – go to market?

Strategy & Impact