SELF-ORGANIZING LOGISTIVS AND COORDINATION IN AUTOMATED TRANSPORT

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19 June 2018

TNO innovation for life

IPIC 2018 - 5th International Physical Internet Conference

Highway Future

Source: https://www.mercedes-benz.com/en/mercedes-benz/next/mobility-concept-next/hitching-a-ride-through-the-physical-internet/

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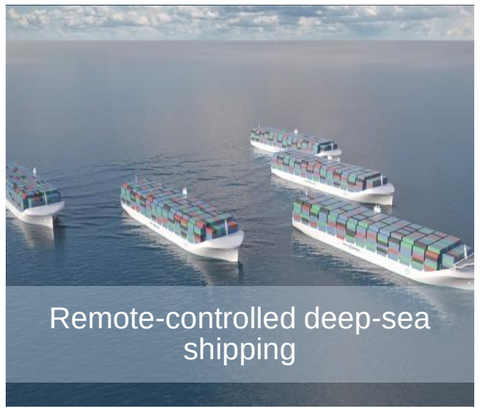
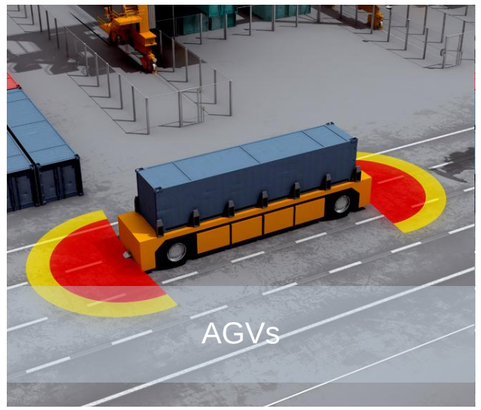
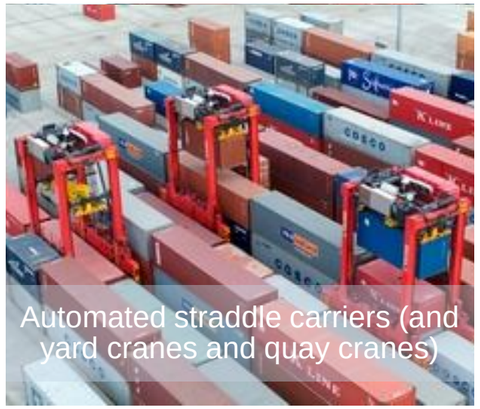
Automation and robotization happening in freight transport and logistics


Remote-controlled deep-sea shipping


AGVs

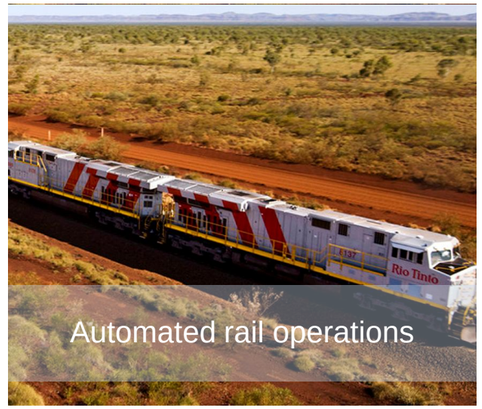

Automated inland navigation

Autonomous trucks


Automated straddle carriers (and yard cranes and quay cranes)

Automated terminal tractors and dollies


Truck platooning

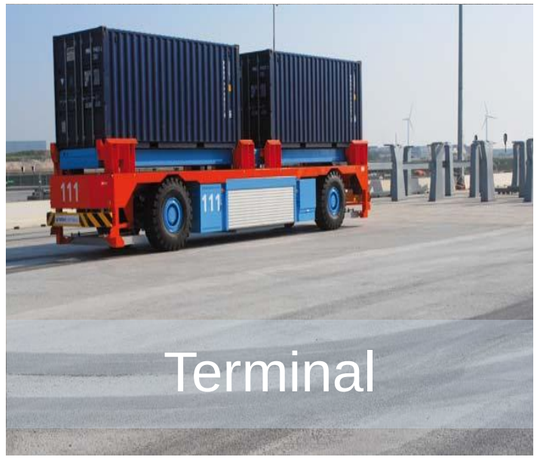


Automated rail operations

Automation in land-based freight transport

Long-haul / Semi

Long-haul / Platoon

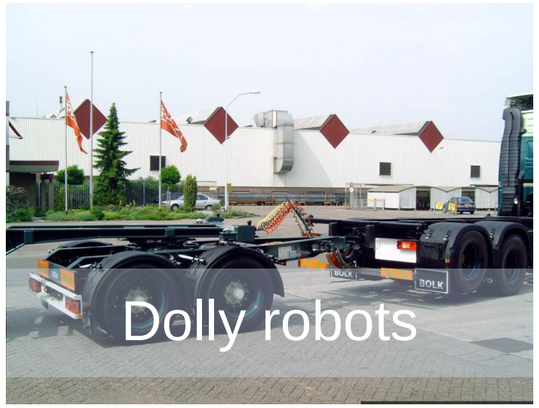


Terminal

Distribution Centers


Mining

Specialized



Dolly robots

Light-duty

State of Affairs: Automated Trucks

Society of Automotive Engineers (SAE) Automation Levels

Level	Name	Narrative definition	Execution of steering and acceleration/ deceleration	Monitoring of driving environment	Fallback performance of *dynamic driving task*	System capability (*driving modes*)
***Human driver* monitors the driving environment**						
0	No automation	The full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	N/a
1	Driver assistance	The *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes
2	Partial automation	The *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes
***Automated driving system* ('system') monitors the driving environment**						
3	Conditional automation	The *driving mode*-specific performance by an automated *driving system* of all aspects of the *dynamic driving task*, with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes
4	High automation	The *driving mode*-specic perfomance by an automated *driving system* of all aspects of the *dynamic driving task*, even if a human driver does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes
5	Full automation	The full-time performance by an automated *driving system* of all aspects of the *dynamic driving task*. under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**

Fig. 3. SAE International levels of development in Automated Vehicle automation [5].

Uber ATG (Otto) automated truck

UBER FREIGHT

- Regular Class 8 tractors
- 64 channel spinning LIDAR array
- Cameras, radar, GPS
- Semi-autonomous driving capability (SAE L2/L3)
- Delivering freight now with Uber Freight

Source: https://www.wired.com/2016/10/ubers-self-driving-truck-makes-first-delivery-50000-beers/
https://www.theverge.com/2018/3/6/17081626/uber-self-driving-trucks-delivering-cargo-arizona

EinRide T-Pod

- Fully automated / driverless
- Remote control operation possible
- 15 pallets
- 7 meters, 20 metric tons
- 200 kWh electric energy
- 200 km range

Source | https://www.einride.eu/sv

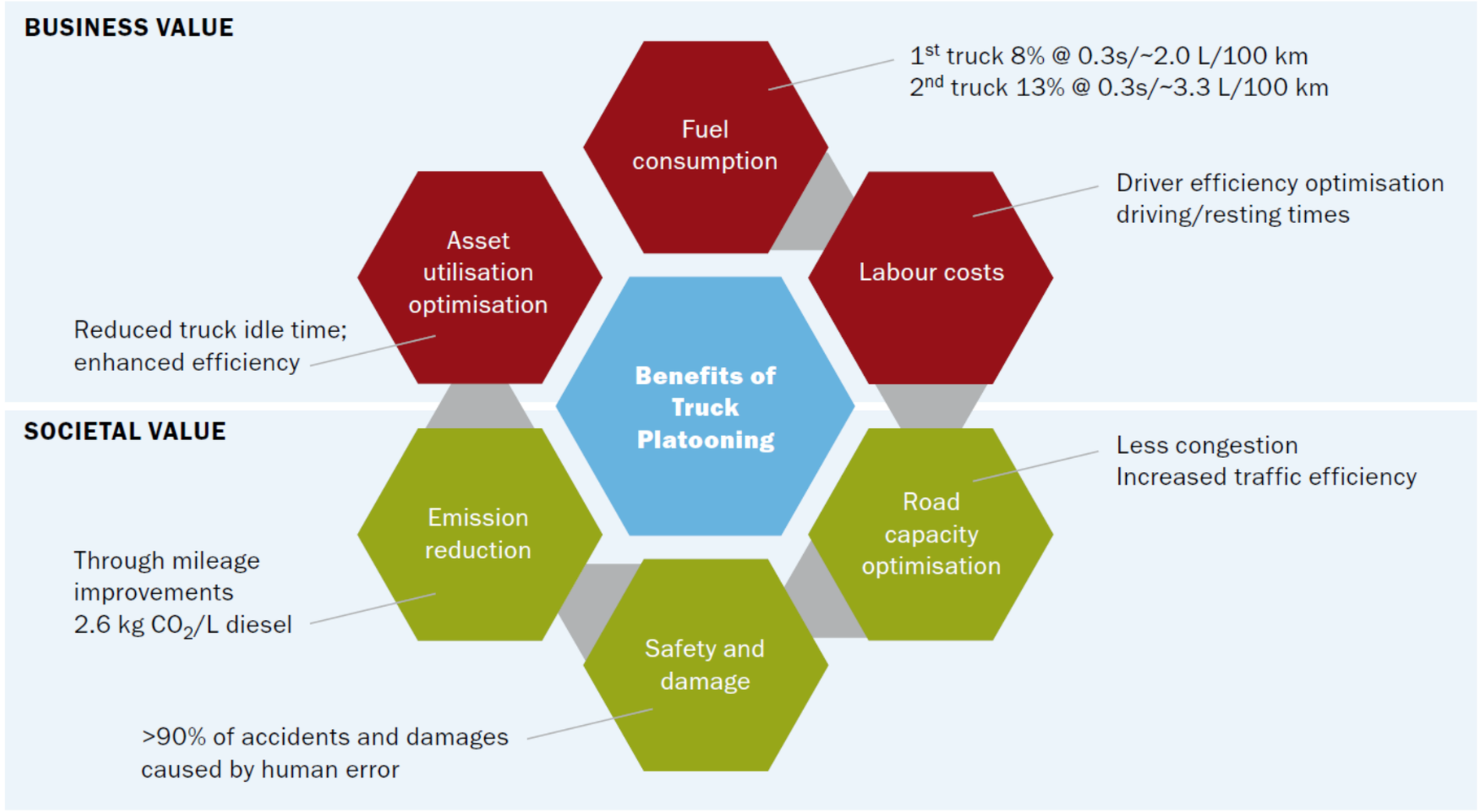
Truck platooning

Truck platooning: virtually-linked automated driving at min 0.3 s time gap with automated braking, throttle (and steering), enabled by C-ACC, wireless communication, GPS

Vision Truck Platooning 2025

- https://www.youtube.com/watch?v=I-xMdybBzUY

Benefits of truck platooning



Peloton Tech USA

- SAE L1 truck platooning
- Wireless communication
- Adaptive cruise-control
- Connected braking
- Forwards collission avoidance systems
- Driver monitoring
- Cloud-based supervision

Source | https://www.trucks.com/2017/04/13/peloton-technology-truck-platooning-60-million-capital/

Scania Autonomous Transport Systems: 1 manned truck, 3 automated followers

Scania and Toyoto Tsusho to trial 4-truck autonomous platoon at PSA Terminals, Port of Singapore

https://www.scania.com/group/en/scania-takes-lead-with-full-scale-autonomous-truck-platoon/

New project: ENSEMBLE

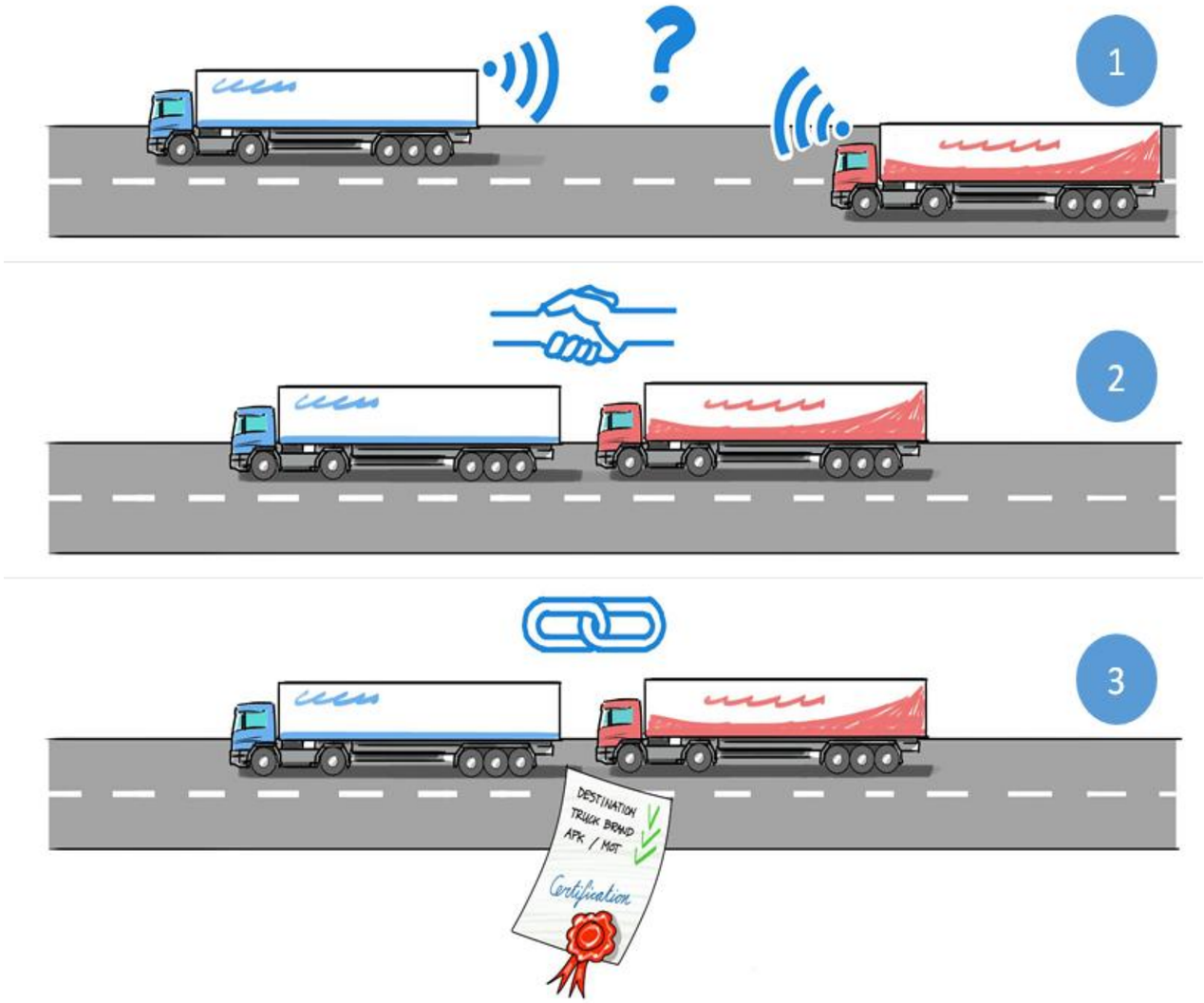
Multi-brand truck platooning | 2018 – 2021 | 20M EUR budget | 6 OEMs, rep. bodies, TNO coordinator| Kick-off 4 June 2018

TNO innovation for life
DAF A PACCAR COMPANY
DAIMLER
IVECO
SCANIA
ERTICO ITS EUROPE
CLEPA European Association of Automotive Suppliers
MAN
VOLVO
Applus IDIADA
IFSTTAR
NXP
WABCO
VUB VRIJE UNIVERSITEIT BRUSSEL
Kungl Tekniska Högskolan
ZF see. think. act.
FLEET BOARD

EUROPEAN TRUCK PLATOONING

creating
next generation mobility

Matchmaking for platoons



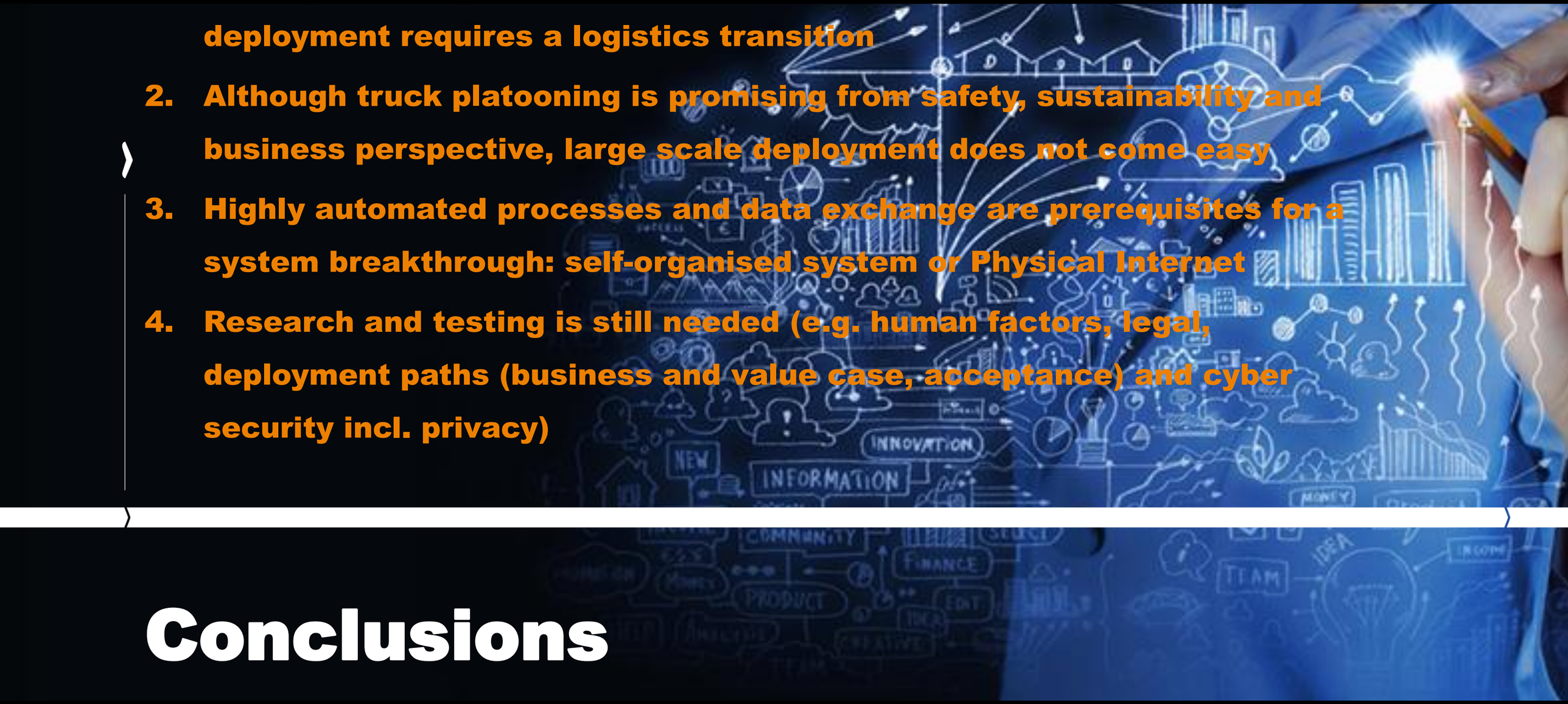
3 approaches for matching

1. Ad-hoc, opportunistic
2. Coordinated, orchestrated
3. Scheduled, planned

Types of data needed:

- Logistics (destination, route, cargo)
- Vehicle (torque, braking capability, lorry, fuel)
- Driver (schedule, driving time)
- Road (sections, tunnels, bridges, weather)

1. Truck platooning and automation are technical innovations, but deployment requires a logistics transition
2. Although truck platooning is promising from safety, sustainability and business perspective, large scale deployment does not come easy
3. Highly automated processes and data exchange are prerequisites for a system breakthrough: self-organised system or Physical Internet
4. Research and testing is still needed (e.g. human factors, legal, deployment paths (business and value case, acceptance) and cyber security incl. privacy)



Conclusions