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BOOSTLOG PROJECT

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The BOOSTLOG project consortium consists of:

Part. No	Participant organisation name (short name)	Country
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3	FUNDACION ZARAGOZA LOGISTICS CENTER (ZLC)	ES
4	STICHTING TKI LOGISTIEK (TKI Dinalog)	NL
5	HACON INGENIEURGESELLSCHAFT MBH (HACON)	BE
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EXECUTIVE SUMMARY

The main objective of WP4 is to develop a holistic framework for identifying, assessing, and building consensus on priority R&I gaps with a high potential contribution to EU policy objectives that need to be prioritised in future R&I actions.

The first round of results and recommendations are presented in D4.3, which builds on the results of the BOOSTLOG online survey to define high relevance topics for freight transport and logistics and their relevance in comparison to the external drivers (see D4.1). In combination with a gap analysis for R&D logistics clouds (see D4.2) and the comparison with regional and national logistics research work programmes, a final set of recommendations was derived.

This deliverable D4.4 starts the second iteration of this process and updates the list of trends, key enabling technologies and logistics concepts. The following lists provide an overview of the main findings in all three areas.

Most relevant logistics concepts:

1. Automation in logistics operations enabling smoother collaboration
2. Real time dynamic adaptation of logistics networks
3. Increased, real-time, data sharing
4. Decentralised data sharing
5. Multi- and synchromodal transport concepts and solutions
6. Full sustainability visibility enabling individual stakeholder decision making
7. Circular logistics services to accommodate transition to circular supply chains
8. Dynamic, eco-based, last mile control systems
9. Consumer centric solutions

Most relevant key enabling technologies:

1. Automated & autonomous driving
2. Distributed Ledger Technology
3. Digital Platforms
4. Artificial Intelligence
5. Data spaces
6. Internet of Things
7. Alternative engines & drives
8. Digital Twins

Most relevant market and societal trends:

1. Increasing effect of geopolitical developments
2. Reshoring, nearshoring, friendshoring
3. Socially responsible consumer engagement
4. Urban development from a holistic approach (liveable cities)
5. Resource limitations / scarcity (broad definition; human, water, raw materials, …)
6. Adaptation of climate change

7. Requirements for sustainability measurement and accountability (e.g. Corporate Sustainability Reporting Directive[1])
8. Less willingness to accept poor working conditions
9. Lack of qualified workforce

[1]https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en

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1 Methodology

The task of this deliverable is the identification and **prioritization** of (new) current trends, key enabling technologies and logistics concepts that may have a positive or negative impact on future logistics in Europe. The first collection was published in D4.1, which will be updated with new input.

The input for this updated collection was gathered through expert workshops involving all BOOSTLOG partners and members of the ALICE network. In addition, national and regional initiatives, and clusters (like ZLC, TKI Dinalog, VIL, Fraunhofer and LSP) also provided input based on their individual experiences and collections.

The next step will be the conduction of an online survey to link the logistics concepts with relevant key enabling technologies, and market and societal trends. Based on the survey the heat map, showing relevant concepts together with related trends and technologies will be created.

This heat map will form the basis for the gap analysis in D4.5. The final recommendations for future R&D activities, based on D4.4 and D4.5, will be published in D4.6.

2 Collection and clustering of promising logistics concepts

Summary

Out of the workshops nine logistics concepts were identified as the most relevant ones:

1. Automation in logistics operations enabling smoother collaboration
2. Real time dynamic adaptation of logistics networks
3. Increased, real-time, data sharing
4. Decentralised data sharing
5. Multi- and synchromodal transport concepts and solutions
6. Full sustainability visibility enabling individual stakeholder decision making
7. Circular logistics services to accommodate transition to circular supply chains
8. Dynamic, eco-based, last mile control systems
9. Consumer centric solutions

Details from workshops

Below you will find all clustered concepts which were discussed during the workshops. Topics which were mentioned several times by different participants are highlighted in bold.

Physical internet concepts
Automation in logistics operations in collaborative environments in open and universal processes and protocols enabling smoother collaboration between transport companies and LSP

Real time adaptation of logistics networks
Real and full realisation of the synchromodality model
Full Physical Internet implementation
Awareness and use of the "network state" based on the free capacity within the network
Use of high-capacity transport
Implementation of modular boxes for different missions (chemicals/liquids/bulk foods/perishables/pharma)
Facilitate collaboration between different transport stakeholders in a PI concept where the goods carry (crypto) wallets, alleviating the need for numerous administrative processes (even digitalised)
What could logistics 5.0 consist of? How would this be shaped and set up?
Automation of logistics chain decisions
Realisation of a holistic dynamic logistics ecosystem
Automated response to real-time changes resulting in dynamic rerouting
How logistics operations need to be reshaped when introducing zero emission trucks and automated vehicles (business operations); how to organise, which new tools and support systems to be developed, what interaction with (smart) warehouses
Standardisation on all levels
Centralized coordination of resources and operational activities
Increasing interoperability and reduce silos within the logistics and supply chain
Use of battery electric vehicles (BEV) as part of the smart grid within a deployed Physical Internet
Logistics network intermodal route planner to find the best (economic, ecologic) solutions in a dynamic way
Physical Internet concept through modularity of freight allocation
Flexible (automated) contract signing to support the Physical Internet implementation

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Data Sharing
Increased data sharing and collaboration
Real-time data sharing along a supply chain
Data exchange with traffic management across modes for optimisation
Data sharing and standards
Decentralised data sharing
Data "blind trust"
Data sharing, definition of semantics, GDPR, sovereignty, data standards and Data Spaces
Data connect: What data? What purpose?
Use of primary data of "IoT" sources and telematic devices across all modes of transport (as data sources – Ed.)
Integrated systems without a central owner (need for orchestrator)
(Implementation of – Ed.) data sharing standards through regulation and policy
The use of data spaces in logistics
Big Data in logistics and how to use it
Supply chain visibility
Integrated load/truck tracking beyond (EU) borders/states.
Full track trace delivery visibility (sense of awareness)
Collaboration concepts
Horizontal supply chain collaboration
Horizontal collaboration
Smart booking apps for modal shift to rail and IWT
Cooperative logistics based on data and infrastructure sharing
Horizontal connectivity: business models to decrease risky asset decisioning

Asset sharing
Shared warehouses,
Sharing of human resources for operations
Sharing of transport
Collaboration in sharing of transport capacity to move to 100% fill rates
Collaborative intermodal platform
Automation topics
Autonomous versus Human automation concepts. Automation as a lever in logistics operations improving collaboration between logistics stakeholders
Autonomous operations (freight location, loading, ...)
Integration of transport nodes – full integration of Urban Air Mobility (UAM)
New technology acceptability
Electrification and automation of barges to reconvert crews to remote piloting
Automation of moving
Autonomous transportation with droids/drones
Autonomous rail/river backbones
Seamless operations and synchromodality through automation
Automated mode change
Automation of handling
Zero emission logistics through automation
Disruption free charging of vehicles – charge while driving (driving transition)
Recovery of learnings from platooning concept and start from zero
Modal Shift
Multimodal transport concepts resulting in more resilient transport chains

Modal shift as lever to smooth, affordable, systematic and easy for all (SME & Large) and comprehensive for all people (need to stimulate transition – Ed.)
Synchromodal transhipment (focus on the transhipment – Ed.)
Environmentally friendly modal shift to rail – IWT (synchromodality mentioned – Ed.)
Move to multi-modal transportation
Multimodality (...)
Multimodality for freight & people (…)
Increase use of rail for direct transport to/from seaports with a high integration of the (nodes) dry ports with seaports
Freight fluidity (equals synchromodality – focus on transport not on PI – Ed.)
Increase multimodal rail transport requires the need to find solution to successor for pure single wagon load on rail – bundling of volumes – requires multifunctional terminals
Improve connections (for modal shift – Ed.)
Green concepts
Emission counting reflected in an eco-score to make end consumer aware and provide information to help decision making by end consumer
Full sustainability visibility across the transport chain to enable decision making by individual supply chain actors (logistics stakeholders – Ed.)
Energy consumption optimization
Concept of a maximal emissions quantity (allowance) in delivery of cargo (end to end) – linked to an emissions trade (between logistics and supply chain stakeholders -Ed.)
Make zero emission technologies cost competitive
Green Crowd shipping
Make consumption location data from vehicles available across the whole supply chain for detailed reporting/predictions/optimization
Circularity driven topics

Circular logistics to accommodate the transition to the circular supply chain
Circular logistics services – how to set up and facilitate flows in circular supply chains
Recycle
How can logistics enable the circular economy
Re-use
Last Mile concepts
Curb side management – dynamic access control systems
Urban logistics in car free cities
Mobility hubs – multimodal places in cities that can be equipped as smart zones
Proximity: Omni-channel and Micro hubs
Last mile delivery (…)
Last mile "unattended" urban concept
Eco-friendly last mile delivery in cities (cargo bikes)
15-minute city / society
Dynamic access control for city logistics – tool for cities to positively reward commercial parties when criteria are met
Human Centric topics
Slow down
Consumption
Educating, training and certifying professionals
Participatory planning / consumer preference (elicitation) / ex-ante stakeholder involvement
Socially resilient supply chain
Social conditions for transport workers (labour conditions/wages/rest/meaningful work) enabled by technology – job enhancing not removing

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Reduce
Systemic Change concepts
Optimization of supply chains; smaller and faster units of planning, operations, decisions, etc. (based on much more and much faster data being available – Ed.)
On-demand logistics
Collaboration models foreseeing (accommodating) a governance design by the public sector (currently public authorities cannot deal with growth – Ed.)
How to optimise nearshoring and friendshoring (and reshoring – Ed.) thinking to regional/local and global supply chain (global player and alliance decide for local level) (requires rethink of global supply chains – Ed.)
Stakeholder acceptability
Buffers storage/stocks versus Just In Time concept
Off-peak deliveries
Electrification of transport and the criticality of energy supply chains (requires a rethink of the current modus operandi and networks – Ed.)
Re-localization after delocalization failure during pandemic (near- reshoring and resilience – Ed.)
Warehouse as a service to manage underused spaced for freight consolidation

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3 Relevant key enabling technologies

Summary

Out of the workshops eight technology cluster were identified as the most relevant ones:

1. Automated & autonomous driving
2. Distributed Ledger Technology
3. Digital Platforms
4. Artificial Intelligence
5. Data spaces
6. Internet of Things
7. Alternative engines & drives
8. Digital Twins

Details from workshops

The following list gives a complete overview about all key enabling technologies which were mentioned during the workshops. The named technologies were grouped in different clusters.

Automated & autonomous driving
Platooning
Teleoperation
Autonomous trucks
Digital Automatic Coupling
Autonomous vehicles
Drones / Pods
Distributed Ledger Technology
Blockchain
Smart contracts
Digital Platforms
Collaborative Platforms
Digital training
Cloud computing & storage

Artificial Intelligence
Computer Vision
Trustworthy AI
Edge AI
Decision support
Real-time optimisation
Generative AI
Data spaces
Semantic technologies
Internet of Things
Smart sensors
Alternative engines & drives
Future Power Trains
Battery and recharging technologies
Battery chemistry
Recharging technologies
Battery electric
Hydrogen
CO2 as a resource
Light electric freight vehicles (cargo bikes)
Solid state batteries
Digital Twins
Robotics
Autonomous systems
(Robotic) Process automation

Automated loading and unloading
Intelligent transport systems
Integrated intelligent transport solutions
Cutting edge technologies
Fusion Power
Metaverse
Quantum computing
Hyperloop / Maglev train
Advanced materials
IT-Security
5G / 6G
XR / Extended Reality
Human interaction with systems and machines
Others / unsorted
Business intelligence
Geofencing
Distribute resource management
3D Printers
Preventive maintenance
Point of sale data solutions
Connected infrastructure (trains)

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4 Market and societal trends and drivers impacting logistics and transport

Summary

Out of the workshops the following nine concrete trends were identified as the most relevant ones:

1. Increasing effect of geopolitical developments
2. Reshoring, nearshoring, friendshoring
3. Socially responsible consumer engagement
4. Urban development from a holistic approach (liveable cities)
5. Resource limitations / scarcity (broad definition; human, water, raw materials, …)
6. Adaptation of climate change
7. Requirements for sustainability measurement and accountability (e.g. Corporate Sustainability Reporting Directive)
8. Less willingness to accept poor working conditions
9. Lack of qualified workforce

Details from workshops

Below is the list of main trends that have been identified during the workshop sessions. These main trends are clustered along the themes that were already used in deliverable 4.1. This was done to be able to redefine the list of market and societal trends gathered in the first phase of WP4.

Globalisation vs Protectionism
Increasing effect of geopolitical developments
Reshoring, nearshoring, friendshoring
Moving towards post-globalisation societies
Distributed manufacturing
Individualism
Socially responsible consumer engagement
Increasing awareness of individual choice on social impact
Ageing society
Digital dependency and digital skills gap
Economic Geography
Urban development from a holistic approach (liveable cities)
Increasing local-for-local production systems

Economic slowdown
Sustainability, Resource Optimization
Resource limitations / scarcity (broad definition; human, water, raw materials, …)
Adaptation of climate change
Requirements for sustainability measurement and accountability (e.g. CSDR)
Growing awareness of circularity
Restructuring of energy supply
Alternative fuels
Regenerative economy
Empowered workforce
Less willingness to accept poor working conditions
Lack of qualified workforce
Inclusive workforce
Protection of less empowered workforce / humanification of logistics
Increasing need for meaningful human-machine interaction
E-commerce
Increasing volumes of online ordering
Consumer-centered logistics
Algorithm-driven consumption

Besides these trends that could be categorised under the previously identified themes there were also some new trends that resulted out of the discussion that are worth mentioning and might also lead to restructuring the most important trends:

- Integration of entire (vertical) supply chains form a market driver perspective
- Increasing role of public authorities affecting logistics processes
- Increasing adoption of social KPI's in business decision making
- Increasing capital allocation based on impact-investment
- Increased digitisation and 'enforced' sharing of data