



# BOOSTLOG PROJECT

## DELIVERABLE REPORT

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### Disclaimer

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The BOOSTLOG project consortium consists of:

Part. No	Participant organisation name (short name)	Country
1 (Coordinator)	Alliance for Logistics Innovation through Collaboration in Europe, ALICE AISBL (ALICE)	BE
2	STICHTING SMART FREIGHT CENTRE (SFC)	NL
3	FUNDACION ZARAGOZA LOGISTICS CENTER (ZLC)	ES
4	STICHTING TKI LOGISTIEK (TKI Dinalog)	NL
5	HACON INGENIEURGESELLSCHAFT MBH (HACON)	BE
6	INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS (ICCS)	GR
7	Vlaams Instituut voor de Logistiek VZW (VIL)	BE
8	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V. (Fraunhofer)	GE
9	FIT Consulting SRL (FIT)	IT
10	FUNDACION DE LA COMUNIDAD VALENCIANA PARA LA INVESTIGACION, PROMOCION Y ESTUDIOS COMERCIALES DE VALENCIAPORT (VPF)	ES
11	TECHNISCHE UNIVERSITEIT DELFT (TU Delft)	NL
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## 1 Executive summary

In the framework of BOOSTLOG activity on Identification and prioritization of R&I gaps, Deliverable 4.1 launched a first set of high relevance topics for freight transport of logistics and D4.2 built upon those topics, focussing on a gap and white spot analysis. In D4.4, a second iteration on the identification of the most relevant logistics concepts was performed. This deliverable, D4.5, completes the gap analysis and white spots for the updated most relevant logistics concepts identified in D4.4. The results presented in this document will feed BOOSTLOG recommendations for policymakers.

Indeed, this document focuses on analysing existing European funded projects for the most relevant Logistics Clouds and identifying topics poorly or not covered by those projects. These Logistics Clouds stem from the projects' contribution identified in D2.1 including the most relevant logistics concepts identified by BOOSTLOG stakeholders in D4.4.

The analysis performed for the present deliverable has been focused on the most relevant logistics concepts (D4.4):

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

This deliverable also includes an analysis of national and regional projects covering the identified gaps as well as new European projects funded by the first calls of Horizon Europe programme. Furthermore, market trends (from Gartner Supply Chain Trends and the DHL Innovation Radar) have been scouted to challenge the identified R&I gaps.

When comparing these most relevant logistics concepts with the projects identified in Deliverable 2.1 (Detailed Mapping of EU-Funded Research Projects), the following conclusions were derived:

The biggest gap was found in the fields of *Customers centric solutions* and *Circular logistics services to accommodate transition to circular supply chains*.

A medium gap was found for the concepts of *Dynamic, eco-based, last mile control systems*, *Decentralised data sharing*, *Full sustainability visibility enabling individual stakeholder decision making* and *Automation in logistics operations enabling smoother collaboration*.

Finally, the most covered logistics concepts were *Multi- and synchromodal transport concepts and solutions*, *Increased, real-time, data sharing* and *Real time dynamic adaptation of logistics networks*.

Based on the results above, it can be seen that new recommendations should be issued, mainly to cover the gaps in *Customers centric solutions* and *Circular logistics services*.



## 2 Introduction

### 2.1 BOOSTLOG project

BOOSTLOG Vision is transforming European freight transport and logistics R&I ecosystem to perform optimally boosting impact generation out of R&I investment contributing to i) EU policy objectives towards climate neutrality, pollution, congestion and noise reduction, free movement of goods, internal security, digital transformation of logistics chains and data sharing logistics ecosystems and ii) *Companies* sustainability and competitiveness generating value for society.

In order to do so, BOOSTLOG has identified 4 main areas of action: i) increase visibility and support valorisation of R&I project Results, Outcomes and Implementation Cases in the freight transport and logistics field ii) develop and implement valorization strategies and guidelines to speed up the technological and organisational innovation uptake, including the creation of the Innovation Marketplace and issue recommendations to increase the impact of R&I public funding, iii) Define high potential & priority R&I gaps to make efficient uses of R&I investments and iv) Strengthen R&I impacts communication and Stakeholders engagement in the innovation process.

### 2.2 Scope of this deliverable

In the framework of BOOSTLOG WP4, “Identification and prioritization of R&I gaps”, Task 4.1 launched a second set of most relevant logistics concepts. The present deliverable builds upon those topics, performing a gap and white spot analysis. The outputs of this analysis, together with D4.4, will feed into the upcoming Deliverable 4.6 “Recommendations for future R&D Logistics Clouds (version 2)”.

This document is the second version of the gap analysis for R&I Logistics Clouds (version 1) delivered in D4.2.



### 3 Logistics concepts

The first step to performing the gap analysis targeted by this deliverable is to identify the current relevant trends in the logistics field. For this, D4.4 includes all the concepts that arose during an expert workshop development and prioritizes 9 of them as the most relevant logistics concepts after a discussion and experts' agreement.

The most relevant logistics concepts have been included in a survey<sup>1</sup> for experts to understand the current external influencing factors, like key enabling technologies, economic & market drivers and societal trends. The results of the survey will be used to develop a heat map presenting the promising logistics concepts versus the relevant key enabling technologies (KETs) and the market and societal trends and drivers impacting logistics and transport (all of them collected based on ALICE roadmaps and former national and European projects).



#### Overview and selection of promising concepts

On the following pages, you can first select the most relevant logistics concepts from your personal professional opinion and afterwards we will ask for your assessment of the relationship between the selected logistics concepts and the external influencing factors. (See further explanations for the logistic concepts [here](#).)

Please select therefore your top 3 logistics concepts that will be most important in the development of the logistics industry within the next 5 to 10 years.

This is a compulsory question and you can proceed only after answering it in the questionnaire.

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

Figure 1. Survey: most relevant logistics concepts vs trends

The survey output and the outcomes of the present deliverable will result in a set of recommendations for future R&D in logistics, BOOSTLOG D4.6.

<sup>1</sup> [https://ww3.efs-survey.com/uc/Fraunhofer\\_IZB/7229/](https://ww3.efs-survey.com/uc/Fraunhofer_IZB/7229/)



## 4 R&I Logistics Clouds

The next step for the gap analysis is to define the R&I Logistics Clouds against which the projects will be assessed. From the initial logistics concepts identified in an expert workshop involving BOOSTLOG partners and members of the ALICE network, a prioritization of the most relevant concepts was showcased in deliverable D4.4.

The most relevant logistics concepts are shown in Table 1.

Table 1. Most relevant logistics concepts identified in D4.4.

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

The detailed definition of the 9 most relevant logistics concepts is outlined below:

1. **Automation in logistics operations enabling smoother collaboration.** Automation in logistics operations refers to the use of technologies and processes such as machine learning, automation and robotics to streamline and optimize logistics activities, from order processing to delivery. By automating tasks such as inventory management, order fulfilment, handling and transportation planning, logistics service providers can improve efficiency, and enhance collaboration across the supply chain.
2. **Real time dynamic adaptation of logistics networks.** Real time dynamic adaptation of logistics networks uses advanced technologies and data analytics to optimize logistics operations based on real-time information, which helps to minimize disruptions and improve efficiency.
3. **Increased, real-time, data sharing.** Real-time data sharing is the immediate exchange of data for efficient decision-making, improving collaboration, visibility, and transparency in supply chain operations.
4. **Decentralised data sharing.** Decentralized data sharing describes the sharing and distribution of data among multiple parties in a network without the need for a centralized intermediary. This allows for greater security, transparency, and control over data, and is commonly used in blockchain technology and peer-to-peer networks.
5. **Multi- and synchromodal transport concepts and solutions.** Multimodal transport involves using pre-planned multiple modes of transportation to move goods in an integrated way, while synchromodal transport is a type of dynamic multimodal transport that emphasizes real-time coordination and optimization of transportation modes and routes using advanced technologies and data analytics.
6. **Full sustainability visibility enabling individual stakeholder decision making.** Full sustainability visibility enables stakeholders to have access to information, track and measure sustainability impacts across the supply chain, allowing for informed decision-making to further improve sustainability.



Technologies such as warehouse management systems, blockchain and RFID can be used to allow real-time tracking.

7. **Circular logistics services to accommodate transition to circular supply chains:** Circular logistics services enable the reuse, recycling, and recovery of materials and products. These services include solutions like reverse logistics and sustainable packaging to minimize waste and improve the sustainability of logistics operations.
8. **Dynamic, eco-based, last mile control systems:** Eco-friendly last mile control systems optimize delivery for sustainability and efficiency. Real-time data and analytics enable the system to dynamically adjust routes and transportation modes, including electric vehicles or drones, to minimize emissions and reduce environmental impact.
9. **Consumer centric solutions:** Consumer-centric solutions are products or services developed with the consumer's needs and preferences as the primary focus, aimed at improving customer satisfaction and engagement.

The top 9 most relevant logistics concepts show a trend towards data technologies, the connection of logistics networks, a focus on supply chains as well as autonomous based concepts, adding as well a circular and consumer centric approach.

These 9 concepts were selected as R&I Logistics Clouds for the later gap analysis, identifying their connection to the projects mapped in D2.1.





## 5 Mapping of projects contributions to the Logistics Clouds

As indicated in Section 4, the projects mapped in D2.1 (Detailed Mapping of EU-Funded Research Projects with 180+ projects mapped) were assessed against the top 9 most relevant logistics concepts identified in D4.4. This enabled the identification of the concepts addressed by each project. Figure 2 shows the number of projects addressing each of the 9 most relevant logistics concepts in their execution and delivering results pursuing these concepts.

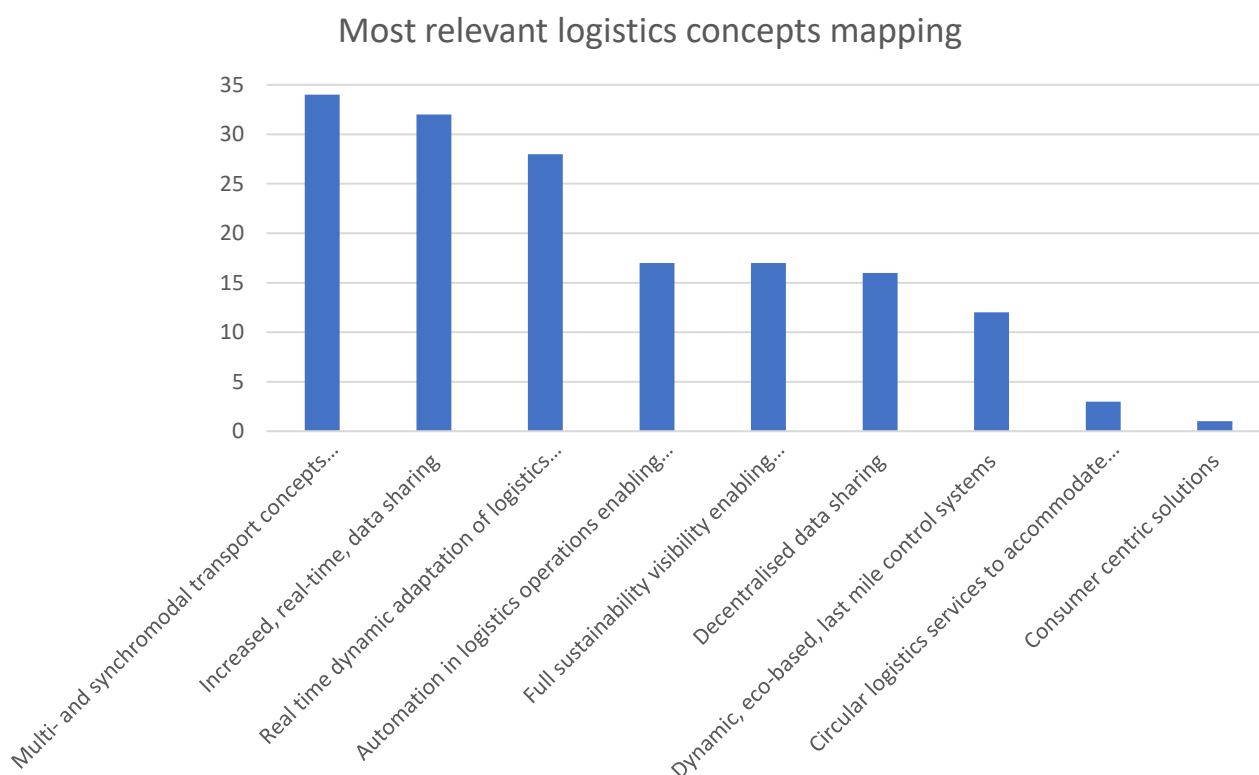


Figure 2. Top 9 most relevant logistics concepts mapping (D2.1).

The following table shows the percentage of the projects analysed addressing the most relevant logistics concepts. As can be observed there are some concepts addressed by a significant number of projects (at the top of the table). Some other concepts have been poorly addressed in the projects so far (at the bottom of the table) like *Consumer centric solutions* and *Circular logistics services to accommodate transition to circular supply chains*.

Table 2. Percentage of projects addressing the most relevant logistics concepts.

MOST RELEVANT LOGISTICS CONCEPTS	PROJECTS PERCENTAJE ADDRESSING THE CONCEPT
<i>Multi- and synchromodal transport concepts and solutions</i>	50%
<i>Increased, real-time, data sharing</i>	47,06%
<i>Real time dynamic adaptation of logistics networks</i>	41,18%
<i>Automation in logistics operations enabling smoother collaboration</i>	25%
<i>Full sustainability visibility enabling individual stakeholder decision making</i>	25%



<i>Decentralised data sharing</i>	23,53%
<i>Dynamic, eco-based, last mile control systems</i>	17,65%
<i>Circular logistics services to accommodate transition to circular supply chains</i>	4,41%
<i>Consumer centric solutions</i>	1,47%

A detailed analysis per cloud was performed to identify the promising concepts addressed by past or existing projects. An example of the methodology used for the Cloud analysis can be consulted in D4.2 Annex for the Coordination and Collaboration Cloud. This deliverable shows the joint results of the projects analysed in the different Clouds (including Coordination and Collaboration, Urban Logistics, Logistics Nodes, Multimodal Freight Corridors and Transport Network and Freight and Logistics Data Sharing Clouds).



## 6 Gap analysis

From the mapping exercise shown in Section 5, the following gaps have been identified. Figure 3 shows the degree of commitment of the projects with the most relevant logistics concepts.

An analysis of recently funded projects and upcoming calls in the Horizon Europe programme was performed to understand the most relevant logistics concepts hit by the new projects and upcoming calls and determine if the identified gaps are already tackled by upcoming R&D activities or need to be considered for future calls.

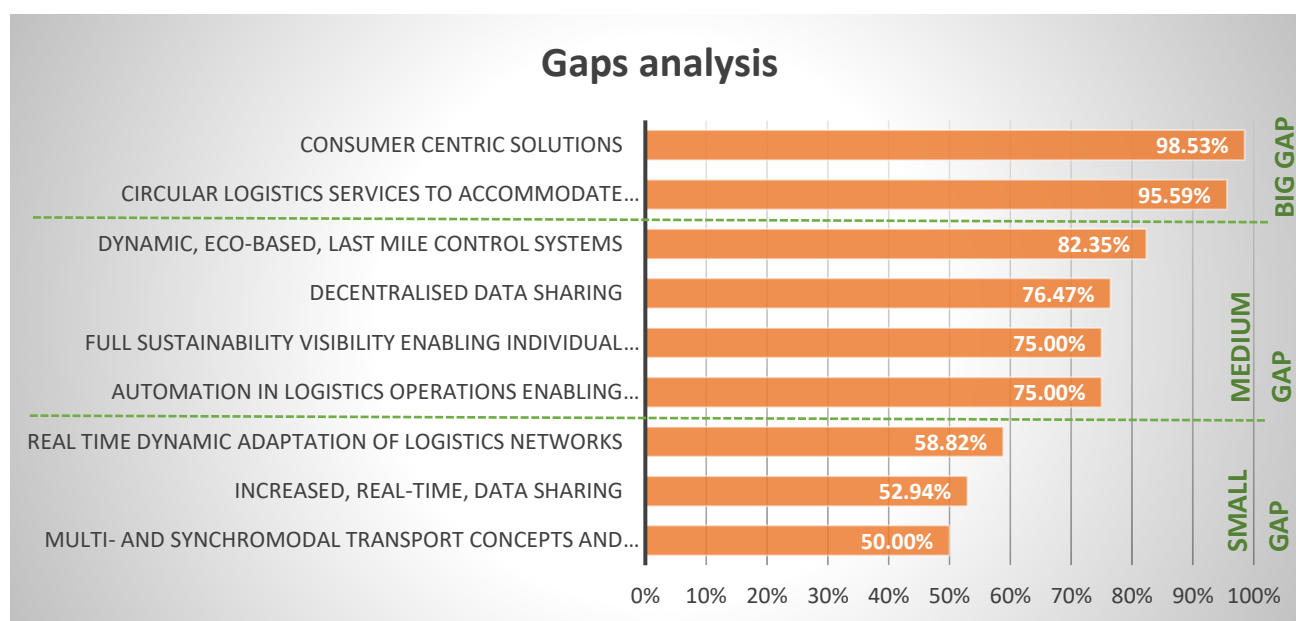


Figure 3. Gaps analysis (D2.1).

A **big gap** has been found for the projects ranked with more than 90% in the figure, for all of them more than 95% of the projects analysed did not address the concepts. Here, the *Customers centric solutions* concept (hit by only one project) presents the biggest gap on the list. *Circular logistics services to accommodate transition to circular supply chains* concept shows an important gap with only 3 projects addressing it.

Topics launched in the 2023-2024 calls are under the umbrella of different EU policies launched in 2020, including, among others, the Circular Economy Action Plan of March 2020. Therefore, circularity will be embedded into financed projects under those calls. Specifically, there is an open call for circular economy and bioeconomy sectors call (HORIZON-CL6-2024-CIRCBIO-01). Nevertheless, no topic calling for circularity in logistics is included in this call. As circularity is horizontal across sectors, topics in Cluster 5 (mobility) may eventually incorporate a circular economy approach.

In 2023 calls one can find a customer centric topic (*Zero-emission e-commerce and freight delivery and return choices by retailers, consumers and local authorities*<sup>2</sup>). This is a first step to tackle the identified gap, but much more research is needed in the field to cover this white spot.

<sup>2</sup> <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl5-2023-d6-01-06>



In 2022, the call of the Horizon Europe programme: *European demonstrators for integrated shared automated mobility solutions for people and goods*<sup>3</sup> (projects ULTIMO and MODI) also included the user centric approach. User centricity can be found in many mobility projects, but the freight perspective is seldom incorporated. This could also be a path to follow.

A **medium gap** was found for the concepts of *Dynamic, eco-based, last mile control systems*, *Decentralised data sharing*, *Full sustainability visibility enabling individual stakeholder decision making* and *Automation in logistics operations enabling smoother collaboration*, with gaps between 75% and 82%. In this case, *Dynamic, eco-based, last mile control systems* concept presents a higher gap in relation to the other concepts with only 12 projects addressing it, followed by *Decentralised data sharing* addressed by 16 and *Full sustainability visibility enabling individual stakeholder decision making* and *Automation in logistics operations enabling smoother collaboration* with 17 projects addressing the concepts.

The European Commission has started to address these gaps, with different topics. In 2021, the EU launched the call of the Horizon Europe programme: *New delivery methods and business/operating models to green the last mile and optimise road transport*<sup>4</sup> (project URBANE, DECARBOMILE and GREEN-LOG). This was followed by the 2022 call of the Horizon Europe programme: *Seamless safe logistics through an autonomous waterborne freight feeder loop service*<sup>5</sup> (project SEAMLESS), and *European demonstrators for integrated shared automated mobility solutions for people and goods*<sup>6</sup> (projects ULTIMO and MODI). Last, this is incorporated in the 2023 call of Horizon Europe programme: *Operational automation to support multimodal freight transport*<sup>7</sup>.

Finally, 3 of the most relevant logistics concepts show a **high rate of projects** addressing these concepts with more than 50% of contribution. These concepts are *Multi- and synchromodal transport concepts and solutions* with 50% of the projects analysed addressing it, *Increased, real-time, data sharing* with 47% and *Real time dynamic adaptation of logistics networks* with 41%.

Additionally, the 2021 call in the new Horizon Europe programme also tackled this, with the topic *More efficient and effective multimodal freight transport nodes to increase flexibility, service visibility and reduce the average cost of freight transport*<sup>8</sup> (project FOR-FREIGHT and MultiRELOAD). In 2022, with the topic *Urban logistics and planning: anticipating urban freight generation and demand including digitalisation of urban freight*<sup>9</sup> (projects DISCO and UNCHAIN).

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<sup>3</sup> <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl5-2022-d6-01-01>

<sup>4</sup> [https://cordis.europa.eu/programme/id/HORIZON\\_HORIZON-CL5-2021-D6-01-08](https://cordis.europa.eu/programme/id/HORIZON_HORIZON-CL5-2021-D6-01-08)

<sup>5</sup> <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl5-2022-d5-01-05>

<sup>6</sup> [https://cordis.europa.eu/programme/id/HORIZON\\_HORIZON-CL5-2022-D6-01-01](https://cordis.europa.eu/programme/id/HORIZON_HORIZON-CL5-2022-D6-01-01)

<sup>7</sup> <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl5-2023-d6-01-07>

<sup>8</sup> <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl5-2021-d6-01-07>

<sup>9</sup> <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl5-2022-d6-02-02>



## 7 Other projects gaps analysis

Apart from the projects identified in deliverable 2.1, the present document incorporates an analysis of national and regional projects as well as newly funded European projects (i.e. Horizon Europe programme).

### National and regional projects

In the scope of this deliverable an analysis of the most relevant national and regional topics addressing the most relevant logistics concepts was performed. 4 relevant projects were found and detailed below: GeoSence, GILA, PILL and Compose 3.0.

#### GeoSence

##### **Geofencing strategies for implementation in urban traffic management and planning**

GeoSence elaborates on geofencing solutions aiming at improving traffic flow, safety, and air quality. Challenges on how to obtain user acceptance and useful improvements are addressed.



##### **German, Italian & Latin American consortium for resource efficient logistics hubs & transport**

GILA is designed to contribute to global efforts in reducing the environmental impact (especially carbon impact) of logistics. Focus is laid on logistics sites that play a connecting role within transport chains and refer to all sites that combine different transport legs (within and between modes) or are the starting or end point of transport chains. Instead of “logistics sites” other terms can also be used, such as logistics nodes, hubs, facilities, centres or depots.



##### **Physical Internet Living Lab**

PILL aims at increasing the efficiency and effectiveness of node processes by utilizing assets and spare capacities in order to accommodate transport demand and facilitate the complex physical reality of logistics.

#### **Compose 3.0**

Compose 3.0 aims to investigate how human behavior, habits, preferences and motives influence the transitions to sustainable logistics and how these can be guided. Compose 3 focuses on the promotion and perpetuation of cooperation within the Dutch logistics system as a whole.

### Horizon Europe projects

An analysis of recently funded projects in the Horizon Europe programme was performed to understand the most relevant logistics concepts hit by the new projects. Figure 4 includes the projects and the funding Horizon Europe topics.



Figure 4. Horizon Europe funded projects identification.

The most relevant projects funded under the Horizon Europe programme are detailed below:

**DECARBOMILE** - Five pillars to DECARBOnize the last MILE logistics

**GREEN-LOG** - Cooperative and Interconnected Green delivery solutions towards an era of optimized zero emission last-mile Logistics

**URBANE** - Upscaling innovative green urban logistics solutions through multi-actor collaboration and PI-inspired last mile deliveries

**UNCHAIN** - Urban logistics and planning: Anticipating urban freight generation and demand including digitalisation of urban freight

**DISCO** - Data-driven, Integrated, Syncromodal, Collaborative and Optimised urban freight meta model for a new generation of urban logistics and planning with data sharing at European Living Labs

**SEAMLESS** - Safe, Efficient and Autonomous: Multimodal Library of European Shortsea and inland Solutions

**MODI** - A leap towards SAE L4 automated driving features

**ULTIMO** - Advancing Sustainable User-centric Mobility with Automated Vehicles



**FOR-FREIGHT** - Flexible, multi-mOdal and Robust FREIGHt Transport

**MultiRELOAD** - Port solutions for efficient, effective and sustainable multimodality

The previous projects (national and regional projects and Horizon Europe programme funded projects) were analysed to identify their contribution to the most relevant logistics concepts. The following table shows the identification of each project contribution.

Table 3. Other projects contribution to the most relevant logistics concepts.

FUNDED PROJECTS		Automation in logistics operations enabling smoother collaboration	Real time dynamic adaptation of logistics networks	Increased, real-time, data sharing	Decentralised data sharing	Multi- and synchronomodal transport concepts and solutions	Full sustainability visibility enabling individual stakeholder decision making	Circular logistics services to accommodate transition to circular supply chains	Dynamic, eco-based, last mile control systems	Consumer centric solutions
NATIONAL REGIONAL	GeoSense		X	X					X	
	GILA									
	PILL	X	X	X	X	X				
	Compose 3.0									
HORIZON EUROPE	URBANE	X		X					X	
	DECARBOMILE			X					X	
	FOR-FREIGHT		X	X		X	X		X	
	MultiRELOAD		X	X	X	X	X			
	DISCO		X	X	X	X	X		X	
	GREEN-LOG	X	X	X	X	X			X	
	SEAMLESS	X	X	X		X				
	ULTIMO	X		X	X				X	X
	UNCHAIN		X	X	X				X	
	MODI	X								

The national and regional projects identified are working in real-time data sharing and dynamic adaptation of logistics networks in accordance with the main contributions found in the projects included in the Clouds analysis. No project addresses the main gaps detected in Section 6.

As shown by the graph below, the projects funded under the Horizon Europe programme also follow similar contribution to the previous projects included in the BOOSTLOG Clouds.

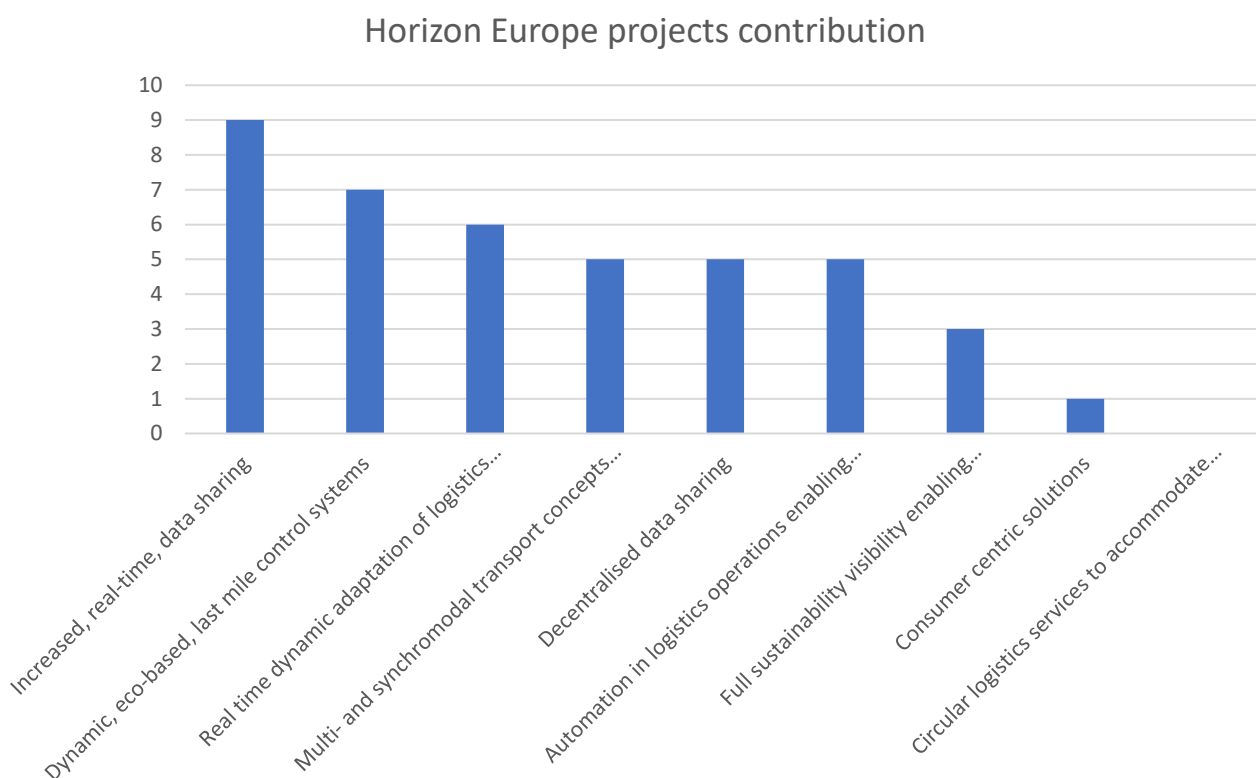


Figure 5. Horizon Europe projects contribution to the most relevant logistics concepts.

Higher contribution (with 90% of the projects analysed form Horizon Europe programme) is for *Increased, real-time, data sharing* followed by *Dynamic, eco-based, last mile control systems* (with 70% of contribution) and *Real time dynamic adaptation of logistics networks* (with 60% of contribution).

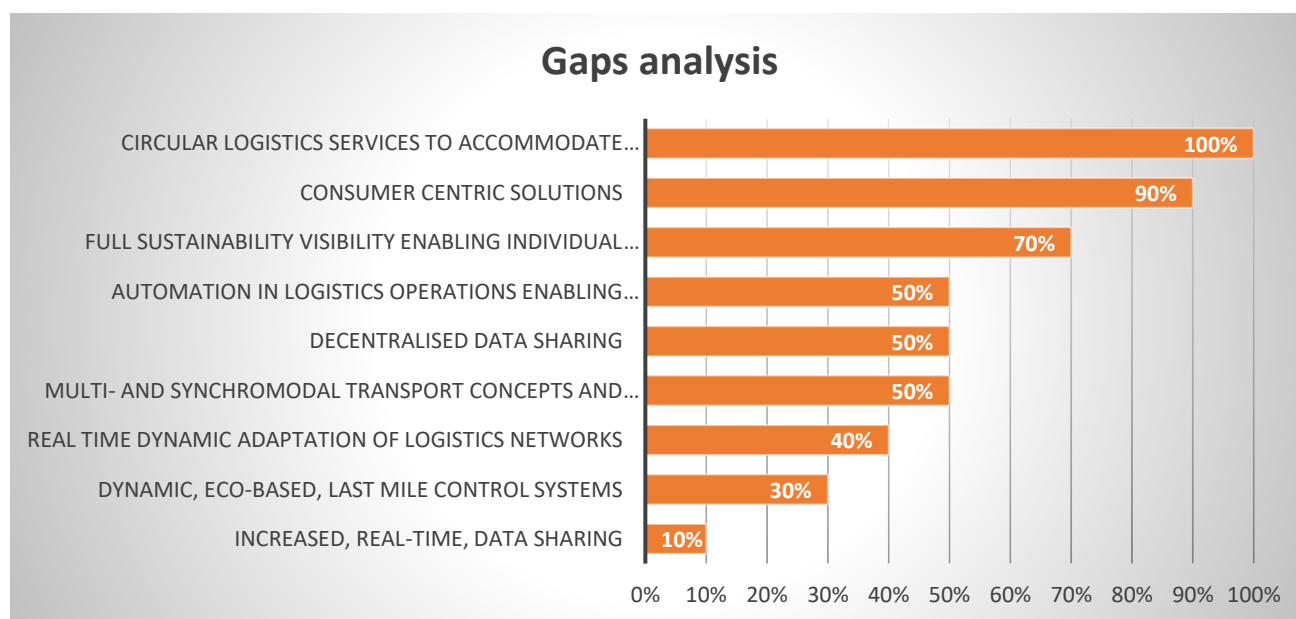


Figure 6. Gaps analysis for the Horizon Europe programme funded projects.





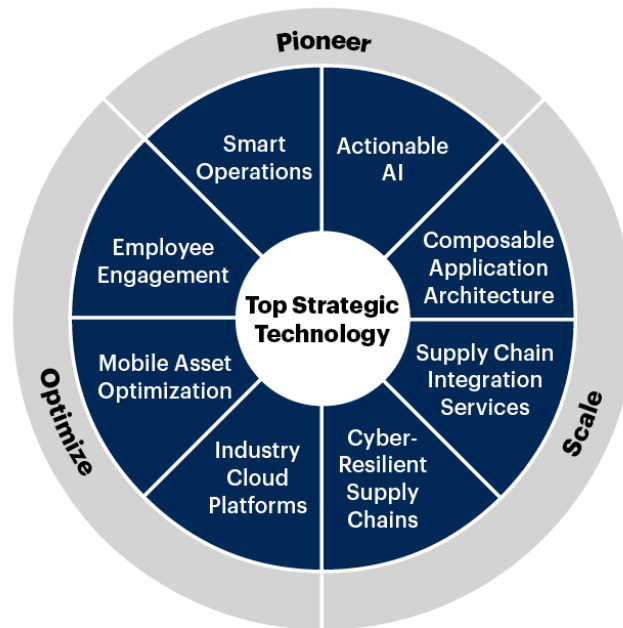
The gaps analysis performed to the projects funded by Horizon Europe programme show the same main gaps detected in previous logistics projects: *Circular logistics services to accommodate transition to circular supply chains* and *Consumer centric solutions* with 0 and 1 projects addressing this specific logistics concepts respectively. This indicates that the gaps detected in the projects analysed in BOOSTLOG (funded from 2001 to 2020) are still a gap in the first Horizon Europe projects.



## 8 Market trends

An analysis on the market trends was performed including the Gartner Supply Chain Trends and the DHL Logistics Trend Radar.

**Gartner** revealed the top supply chain technology trends for 2023 on May appointing to a 73% of average supply chain IT budget being allocated to growth and performance<sup>10</sup>.



Source: Gartner  
780865\_C

Figure 7. Gartner top supply chain technology trends for 2023.

The 2023 top supply chain technology trends are:

**Actionable AI.** Actionable AI delivers better data-driven decisions by mimicking the problem solving that humans make by augmenting decisions and keeping humans in the loop for validation purposes. Actionable AI learns patterns based on past decisions and experiences to adapt to changing, real world circumstances. Solutions continuously retrain models and learn within the runtime and development environments based on new data.

**Smart Operations.** Smart operations extend the pre-existing concept of smart manufacturing to encompass all core operational capabilities, including manufacturing, service and logistics that span warehousing, transportation and global trade. This involves the orchestration of a web of different and distributed processes and the underlying systems and data that support them. While manufacturing is ahead in pursuing smart operations, logistics organizations are rapidly embracing the potential of this idea to transform their businesses.

<sup>10</sup> <https://www.gartner.com/en/newsroom/press-releases/2023-05-10-gartner-reveals-the-top-supply-chain-technology-trends-for-2023>



**Mobile Asset Optimization.** Mobile asset optimization maximizes the use of an enterprise's mobile assets by combining business process software, sensory technologies and operational research techniques for optimization and business intelligence. This has implications inside the warehouse where intralogistics smart robots are garnering attention and investment. Outside, transportation visibility platforms can show carrier activity and capacity improving collaboration between shippers, carriers and logistics providers.

**Industry Cloud Platforms.** Industry cloud platforms combine software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS) with specific functionality for vertical industry use cases. They do so not as predefined, one-off, vertical SaaS solutions, but rather as agile composable platforms supported by a catalogue of industry-specific packaged business capabilities. In effect, they turn a cloud platform into a business platform and expand a technology innovation tool into one that also serves as a business innovation tool, creating added value beyond traditional cloud approaches.

**Employee Engagement.** Employee engagement is broadly a set of tools and applications used to help companies improve frontline worker performance, satisfaction and retention. This trend can span mixed reality and mobile devices to provide content that augments the job, wearables for safety and location management, collaboration tools and more. These technology investments have to be anchored in a broader workforce strategy that spans knowledge curation, skills development and training.

**Composable Application Architecture.** Composable business applications are designed to follow the core design principles of modularity, autonomy, orchestration and discovery, with a specific business use case. These packaged business capabilities are encapsulated software components that represent a well-defined business capability, recognizable as such by an end user.

**Cyber Resilient Supply Chains.** As supply chains implement more advanced technologies, they add additional supply chain partners, vendors and service providers to their "digital" supply chain. However, each addition of an external entity to the digital enterprise represents additional digital connectivity and increased cybersecurity vulnerabilities and risks. Cybersecurity represents the tools, processes and governance methods (mechanisms) needed to mitigate cybersecurity risks caused by the extreme heterogeneity of supply chain technologies and ecosystem participants.

**Supply Chain Integration Services.** Supply chain integration services encompass technology platforms, integration teams, strategic decision making on which applications to connect when and how (different integration strategies), and finally, cloud services to manage these integrations. Supply chain integration services elevate the role of integration from a tactical, execution-centric and technical view of system interoperability to a strategy-led vision of a more-interconnected world.

These trends can be related to some of the technology gaps identified in the present document:

- Decentralised data sharing (Industry Cloud Platforms)
- Full visibility enabling decision making (Actionable AI)
- Automation in logistics operations (Smart operations)

The ones not identified in the present document should be further reviewed to assess if they should be incorporated as future recommendations in D4.6.



**DHL** Logistics Trend Radar released on October 2022 compiled 40 trends that will help shape the direction of business, society and technology for the global logistics community over the next decade. Of these trends, decarbonization, robotics, Big Data, supply chain diversification and alternative energy solutions will have the greatest impact on logistics transformation.<sup>11</sup>

The Focus Areas of the DHL Logistics Trend Radar include:

- Automation & Efficiency
- Customer Experience
- Environmental Sustainability
- Health, Safety & Future of Work
- Physical & Digital Security
- Visibility & Resilience

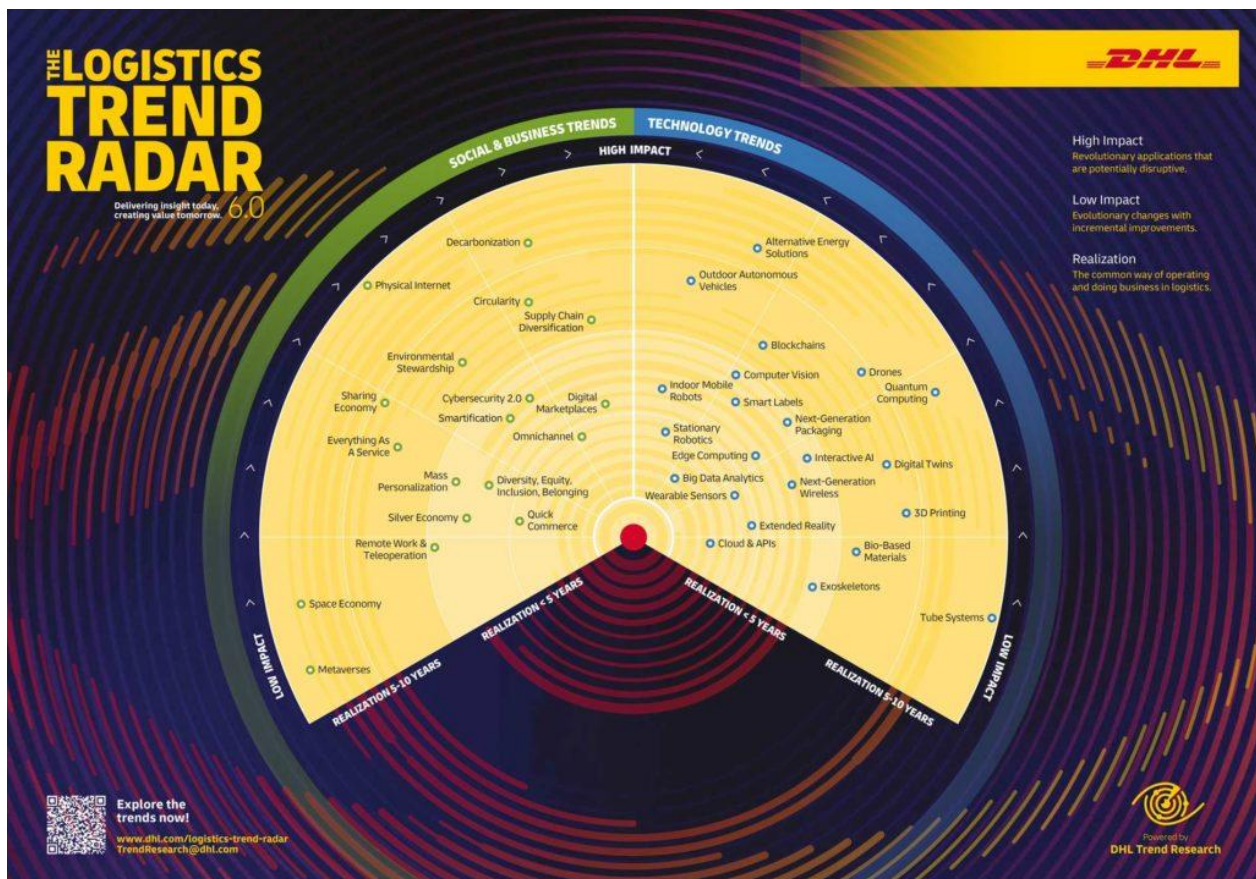


Figure 8. DHL Logistics Trend Radar

The main conclusions of the DHL analysis are listed below<sup>12</sup>:

<sup>11</sup> <https://www.dhl.com/global-en/home/insights-and-innovation/insights/logistics-trend-radar.html>

<sup>12</sup> <https://www.dpdhl.com/en/media-relations/press-releases/2022/dhl-launches-latest-dhl-logistics-trend-radar-with-most-impactful-trends.html>



- Megatrends and macro forces such as Covid-19, climate change, urbanization and geopolitical events are constantly fluctuating, accelerating the speed of transformation in logistics
- **Sustainability** continues to drive innovation with decarbonization and alternative energy solutions having the most potential in transforming logistics in the near future. 85% of consumers have become 'greener' in their purchase behaviour in the last five years, and 65% are making modest to total lifestyle changes, pushing companies to inspect ways to make their products greener, often focusing on their supply chains.
- Supply chain **resilience** now more important than ever encourages supply chain diversification with big data analytics identifying opportunities. 76% of businesses surveyed are planning to make significant changes to their supplier base within the next two years to ensure supply chain resilience.
- Growth in consumer demand pushes for more **automation and efficiency** with indoor mobile robots and stationary robots to help increase productivity. In the future, it will be impossible to imagine logistics without automated processes using collaborative robots.

Apart from addressing the technology gaps identified in the present document, DHL Radar also calls for circularity and user centric solutions in the coming years, in line with the main gaps identified in this deliverable. Indeed, calling for sustainability not only includes a circular approach but also a consumer driven decision making for greener solutions.



## 9 Conclusions

The analysis provided in the present document shows that 6 of the most relevant logistics concepts have been little studied in previously funded projects. The following concepts are worthy to be included as concerning topics in the future Research programs from the European Commission.

1. Automation in logistics operations enabling smoother collaboration
2. Decentralised data sharing
3. Full sustainability visibility enabling individual stakeholder decision making
4. Circular logistics services to accommodate transition to circular supply chains
5. Dynamic, eco-based, last mile control systems
6. Consumer centric solutions

This is especially true for circular logistics services and consumer centric solutions, that have been poorly covered by projects so far.

The analysis of market trends reinforces this conclusion, and identifies additional concepts subject to future assessment. To tackle this, Deliverable D4.6 will give concrete recommendations for future research maximising the impact of European research.