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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
12	EUROPEAN ROAD TRANSPORT TELEMATICSIMPLEMENTATION COORDINATION ORGANISATION - INTELLIGENT TRANSPORT SYSTEMS & SERVICES EUROPE (ERTICO ITS EUR)	BE
13	LINDHOLMEN SCIENCE PARK AKTIEBOLAG (LSP)	SW

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EXECUTIVE SUMMARY

This deliverable shows the outcome of the BOOSTLOG survey done in 2021 and the first set of recommendations which were derived out of the results.

65 organisations responded to the BOOSTLOG survey. The results show two main groups within the societal trends and economical drivers. The first group covers all topics related to sustainability, like circular economy, climate change, resource scarcity and depletion. The second group includes e-commerce and on-demand related trends. The most mentioned key enabling technologies are all focused on data-related topics, like data analytics, data infrastructure, digital twins, artificial intelligence and IoT. The top ten most voted promising logistics concepts are data sharing architecture / technology, interconnected logistics networks, system of logistics networks: the physical internet, fostering cooperation and collaboration among the logistics chain, supply chain visibility, autonomous operations, autonomous transport, e-commerce delivery concepts, supply chain resilience and synchromodality.

Based on the survey and additional expert workshops seven recommendations can be drafted:

1. Connected networks in a sustainable society
2. Coping with the on-demand economy
3. Prepare for disruption – resilience and visibility to the next level
4. Modular loading units for e-commerce
5. Requirements for sustainable intermodal networks, fleets and assets
6. Aligning initiatives for sustainability measurement schemes
7. Aligning initiatives for carbon emission accounting/measuring schemes

This first set of recommendations will be further detailed during the work on the upcoming BOOSTLOG deliverable D4.2, focussing on a gap and white spot analysis, and D4.3, focussing on discussing and harmonizing the final recommendations.

Work package 4 of the BOOSTLOG project deals with the development of a holistic framework for identification, assessment and consensus building around priority R&I gaps. One of the main tasks is the collection of input and feedback from project partners, ALICE members and also external stakeholders.

The identification and evaluation of promising logistics concepts and external influencing factors, like societal trends and economic drivers or key enabling technologies, has been done beforehand and is based on ALICE roadmaps and former national and European projects. The final list has been validated in several virtual workshops and is shown in detail in section 2 (promising logistics concepts), section 3 (key enabling technologies) and section 4 (market and societal trends and drivers).

The feedback on relevance and possible connections between concepts, trends and technologies has been collected via an online survey. This quantitative input from many stakeholders has afterwards been validated by an online expert workshop.

First results for possible recommendations based on the survey and the collected feedback are shown in section 5.

The following promising logistics concepts were collected based on ALICE roadmaps and former national and European projects.

	Development of a data sharing architecture for the logistics sector, which will lead to lowering the thresholds for data sharing between stakeholders in the sector.
	Combining flows / shipments from several independent supply chains resulting in a better transport capacity utilisation.
	A booking system for shipments, which enables to combine services throughout the full supply chain, from the initial production up to the customer.
	The supply chain's ability to be prepared for unexpected risk events, responding and recovering quickly to potential disruptions to return to its original situation or grow by moving to a new, more desirable state.
	Solutions that enable stakeholders in the logistics industry to co-operate and collaborate better in order to achieve individual and collective objectives.
	Shared warehouse capacities among several users in a structural way.
	Interconnected logistics networks enable shipments to move seamlessly from one to the other network allowing real-time (re)configurable supply chains in (global) supply chain networks for all types of companies and participants.
	Flexible and sustainable allocation of cargo to different transport modes and routes in a network under the direction of a logistics service provider, so that the customer (shipper or forwarder) is offered an integrated solution for its (inland) transport.
	Full consolidation of logistics flows from independent shippers. Additionally, the Physical Internet proposes to pool resources and assets in open, connected, and shared networks (i.e., connecting

	existing (company) networks, capabilities and resources) so they can be used seamlessly by network users and partners.
	Within transport, logistics and full supply chains more and more sustainable assets will be developed and used in order to reduce negative impact on the environment and society.
	The development and use of vehicles without any emissions (e.g., greenhouse gas emissions, air pollutants).
	Operations within logistics and/or supply chain management that take fully autonomous decisions without human intervention.
	A combination of at least two or more different modes to move your cargo from point of origin to destination. It is a concept to move goods towards the most efficient and environmental transport modes.
	The development of emission calculating standards for e.g., GHG emissions and air pollutants based on increasingly accurate measurement or modelling of actual emissions, moving towards actual emission accounting and reporting protocols.
	Synchronization in connection with logistics systems promises to increase efficiency by coordinating supply and demand flows over time and space.
	The seamless connection between any hub in a logistics setting to any other, even without a contractual relation
	The use of public transport capacities to transport shipments and goods.
	Applications that enable calculating sustainability KPIs in logistics operations and thus provide transparency on how to improve operations and reduce impact.
	The ability of operations in a supply chain setting to cope with unexpected events that might lead to disruption of flows.
	The role and importance of humans as driver of a vehicle are being reduced with increasing automation of monitoring, analysis, decision making and actuation (e.g., steering, braking) functions. Fully autonomous vehicles will only have people inside as passengers.

	Because of economies of scale, it pays off to bundle infrastructure. Large bundles of infrastructure links in a uni- or multimodal network are called corridors and the connecting major nodes are called hubs. Together, these often have a strategic function for an area.
	Mobilising non-professional service providers to carry freight parcels, in particular from passenger transport. Many platforms are trying to realize this idea.
	Usually there is a strict separation between planning and execution in logistics, both for flows of goods (demand) and deployment of transport assets (supply). However, if information can be processed quickly, planning could be dynamic, i.e., adjusted during execution.
	Consumers have a choice between different delivery channels, e.g., pick-up at shop, at a locker, delivery at home, at the neighbours etc. Based on this choice, the chain of services (modes, hubs, routing) is designed for maximum efficiency incl. environmental impact, which results in different concepts.
	Companies influence consumer choices to maximize the impact on achieving their goals (predominantly profit, but also increasing focus on environment and social impact), using all functions in the supply chain, from marketing and packaging to delivery.
	Logistics nodes connect links in a network and primarily support logistics processes. A node can be a simple network crossing but also an intermodal transhipment hub, a warehouse or a cross-docking centre. An autonomous logistic node is able to organise all internal operations by itself in an efficient and sustainable way.
	Boxes, totes and containers exist in many different sizes, but their physical and functional interoperability is limited. This results in a lot of lost container space, packaging material and transport capacity. The modular PI container proposes a multi-level standardized solution.
	Logistics service providers can decide to pool their transport assets (infrastructure or equipment) with proper organization (e.g., alliances) and communication to users (e.g., code sharing). This increases asset utilization but reduces actor autonomy and carries monopoly risks.
	Execution of supply chain processes can improve if those stakeholders responsible and able to take decisions during

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	execution are continuously aware of the performance of processes. This may require visibility of shipment locations, speeds, costs, stages of execution, payment status, etc.
	Logistics sites involve land, assets and operations with their own embedded negative sustainability impacts, e.g., opportunity costs of land use, visual intrusion of buildings and emissions due to operations. When these are mitigated, the sites can carry a label "sustainable".

The following Key Enabling Technologies (KETs) were collected based on ALICE roadmaps and former national and European projects.

Distributed Ledger Technology & Blockchain
Next Generation Wireless / 5G
Clouds & Virtualisation
Standardisation & data modelling
Internet of Things
Mobile Computing
Digital Twins
Data Science
Artificial Intelligence
Big Data Analytics
Robotics, Cobots & Automation

Self-Driving Vehicles / CCAM
Platooning
Augmented reality
Virtual Reality
Additive Manufacturing / 3D printing
Nano technologies
Alternative fuels & drive train technology
Predictive maintenance

The following market and societal trends and drivers were collected based on ALICE roadmaps and former national and European projects.

Reshoring	Transferring a business operation that was moved overseas back to the country/region from which it was originally relocated.
Crowd-economy	The Crowd Economy is a dynamic ecosystem of productive people who participate through a platform with a purpose to achieve mutually beneficial goals.
Personalisation / consumer centricity	Tailoring a service or a product to accommodate specific individuals, sometimes tied to groups or segments of individuals. Wide varieties of organizations use personalization to improve customer satisfaction.

On-demand-economy	[redacted]
[redacted]	[redacted]
Urbanisation vs reversed urbanisation	[redacted]
Local-for-local	[redacted]
[redacted]	[redacted]
Climate change	[redacted]
Circular Economy	[redacted]
Resource scarcity and depletion	[redacted] demand for a natural resource is exceeding the supply – leading to a decline of available resources (planetary boundaries).

	applying measures to reduce the footprint of these activities.
Skilled workforce shortage	Skilled workforce shortage refers to the mismatch of supply and demand of required skilled workers through several sectors of the economy.
Demographic change	Demographic change relates to the change in the population, for example in terms of average age, dependency ratios, life expectancy, family structures, birth rates etc.
Inclusiveness	Inclusiveness is the practice or policy of providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized, such as those having physical or mental disabilities or belonging to other minority groups.
New work & social innovation	The concept of social innovation focuses attention on the ideas and solutions that create social value—as well as the processes through which they are generated, resulting for instance in other forms of exchanging ideas and shifting worker roles within organisations.
E-commerce	The increased activity of buying and selling products and service over the internet.
Covid-19	The Covid-19 pandemic affected global society and along with it major disruptions in the supply chains which needed to be reorganised.

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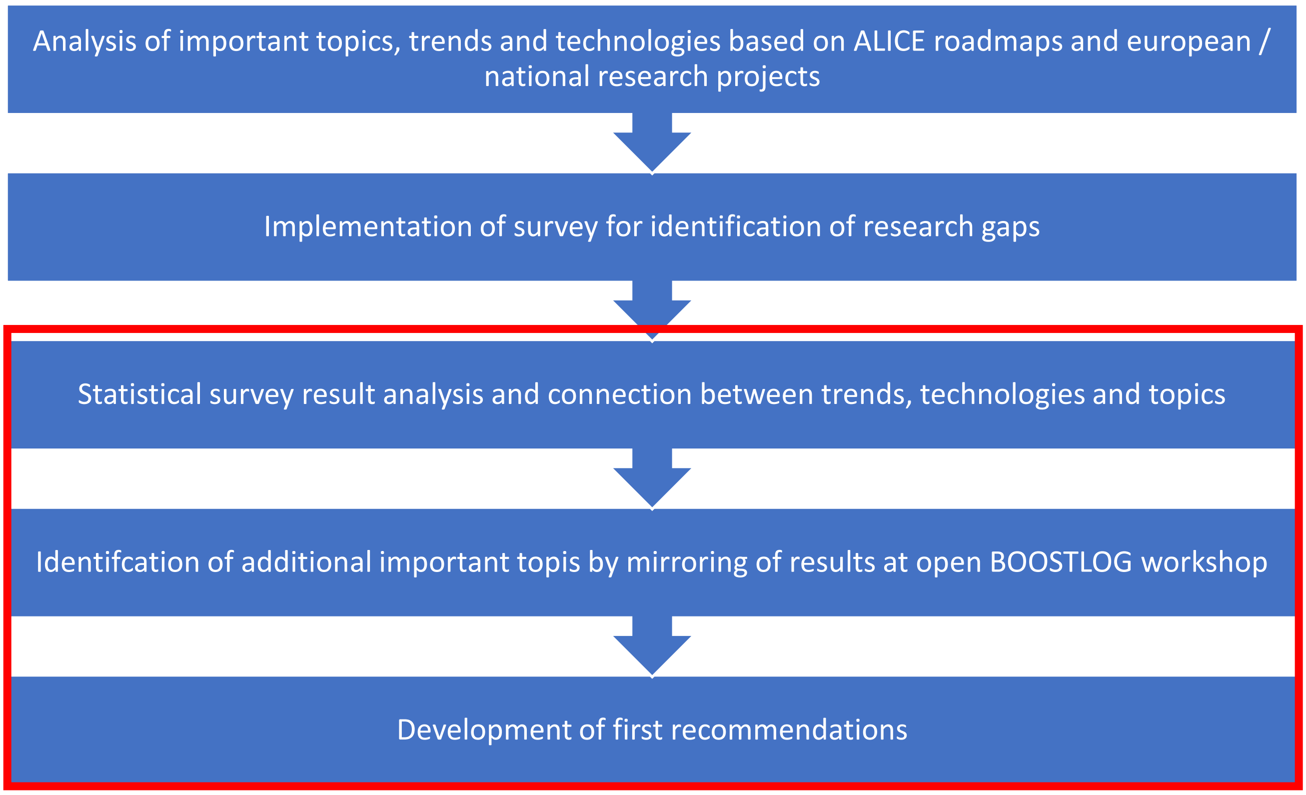

Figure 1: WP4.1 process model

For the survey analysis, steps 3-5 of the deliverables process model were conducted. In a first step, the survey results were statistically interpreted. Indicators such as the number of participants, the company structure and the ranking of the topics were evaluated. Based on these results, the connection between the topics and trends / technologies were analysed.

During an online BOOSTLOG event, the results were mirrored, and further important research topics were retrieved. In a last step, a set of first recommendations was developed. These recommendations build the basis for the next steps within WP4.

The BOOSTLOG survey was open for response from 07.07.2021 until 03.09.2021. In total 65 complete answers were received. Figure 2 gives an overview on the size of the organisations which took part in the survey. Most participating companies employ more than 500 employees. However, the cross-section of responses shows that there is a diverse mix of participating companies in terms of the company size.

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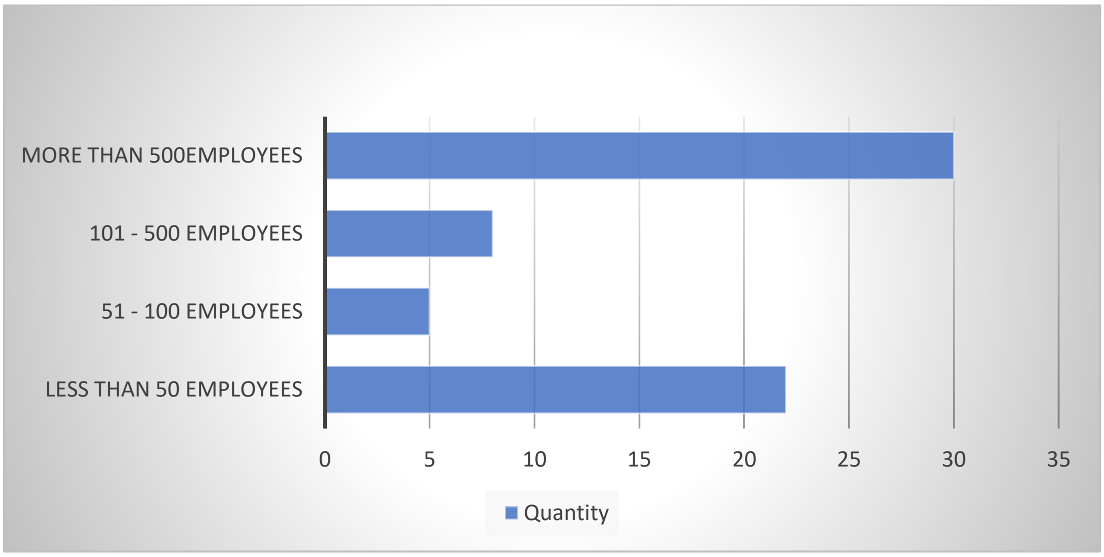

Figure 2: Overview on different sizes of organisation

Figure 3 shows the different types of organisations. Within the category "OTHER" most of the organisation described themselves as logistics cluster or logistics associations. A high number of participants was from the field academia and research as well as public bodies (total number: 25). From the industry side, a total of 21 complete surveys were considered. For further analysis, the survey input was differentiated between the total answers and the industry-based answers in order to take the industries perspective on research gaps into account. The comparison of all answers compared to only industry answers showed that the main research topics are rated mostly similar.

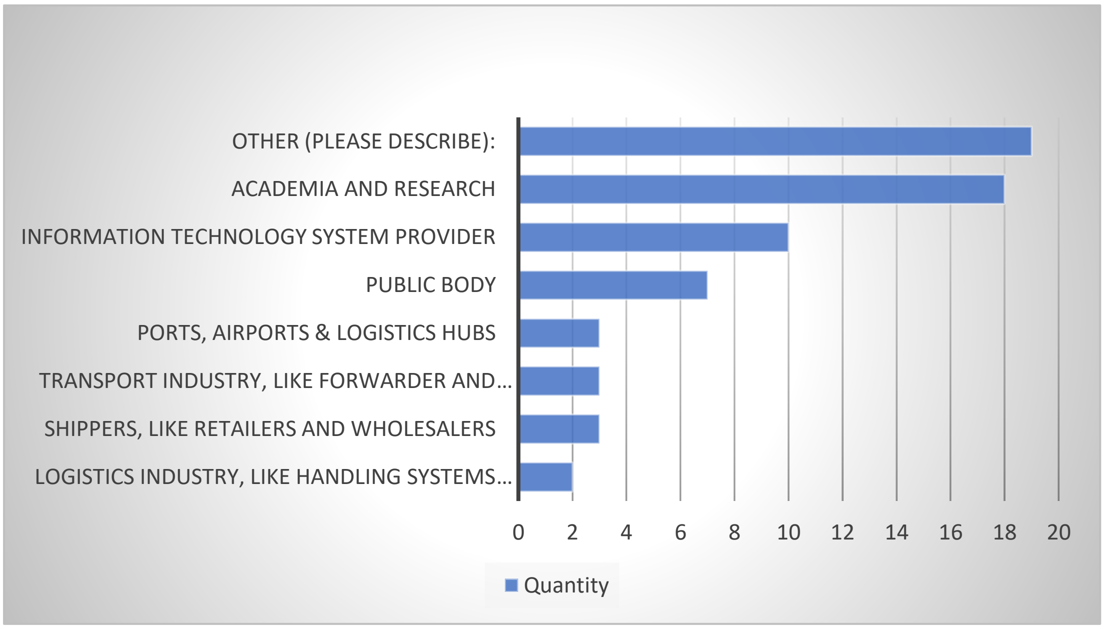

Figure 3: Overview on different types of organisations

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The ranking of all promising logistics concepts is shown in Figure 4. For the upcoming discussions only the top ten most voted concepts are referred to:

1. data sharing architecture / technology,
2. interconnected logistics networks,
3. system of logistics networks: the physical internet,
4. fostering cooperation and collaboration among the logistics chain,
5. supply chain visibility,
6. autonomous operations,
7. autonomous transport,
8. e-commerce delivery concepts,
9. supply chain resilience and
10. synchromodality and connected corridors and hubs

The top 10 promising logistics concepts show a trend towards data technologies, the connection of logistics networks, a focus on supply chains as well as autonomous based concepts. These 10 concepts were used for the analysis of their connection to technologies and trends.

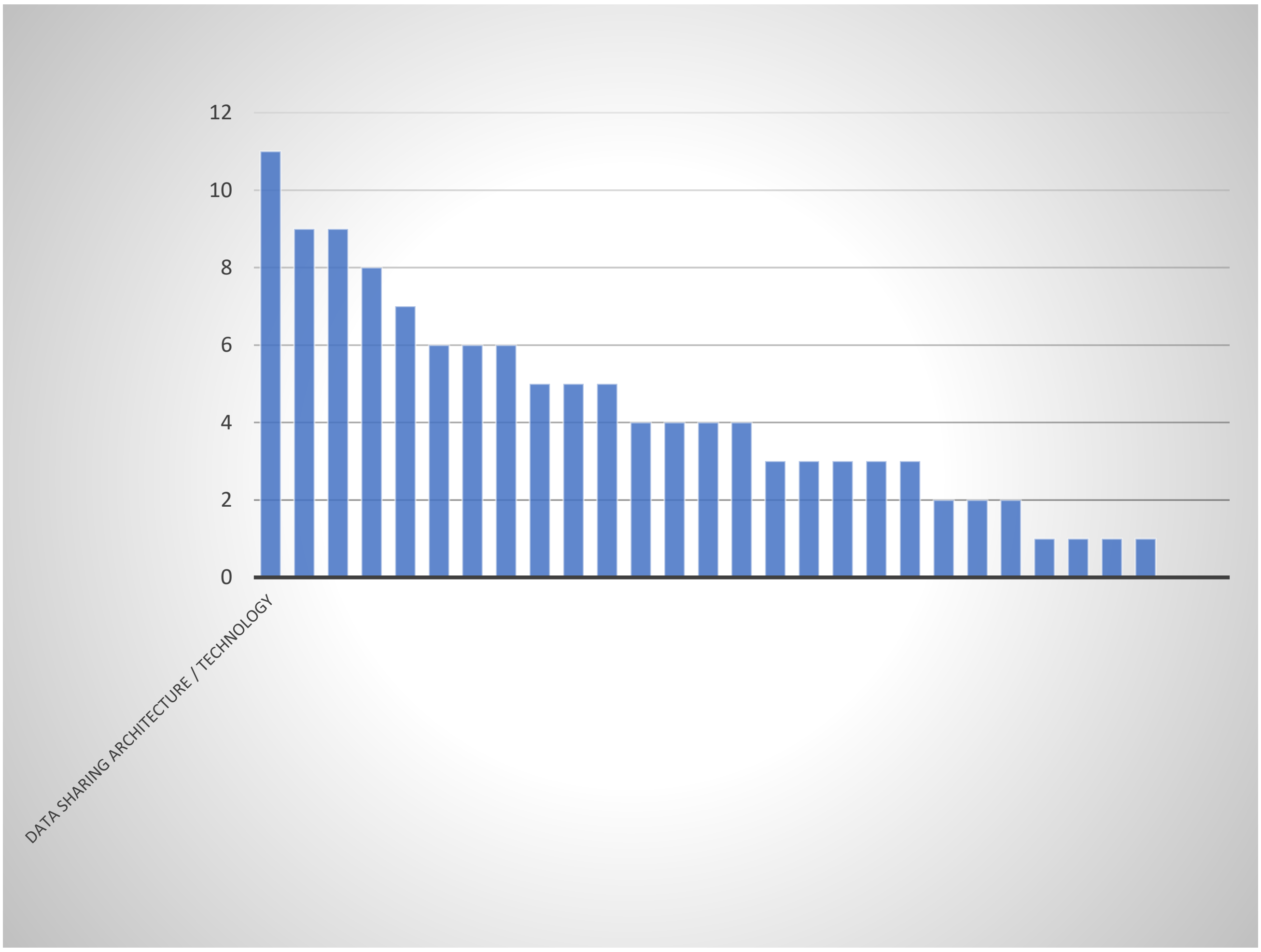

Figure 4: Ranking of promising logistics concepts

The next step was to analyse the relationship between the top 10 topics and the defined trends (see Chapter 4). For this purpose, the survey asked whether and to what extent the trends are relevant for the topics.

The results of this survey were analysed, and a heat map was created. The heat map shows the relevance of the trends for the top 10 topics on a scale of 1-3, scaled from blue to red. The most important trends in connection with the selected topics are shown in dark red.

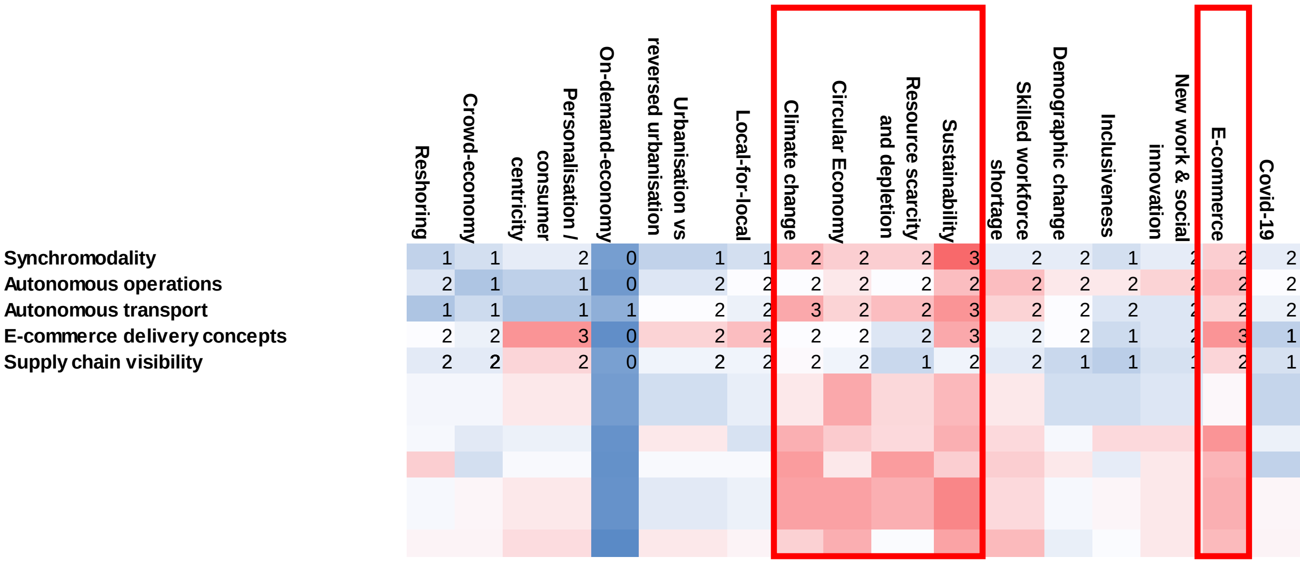

Figure 5: Connection between topics and trends

The analysis of the connection between the top 10 topics and current trends showed that two main trend groups are creating more heat than the others. These are sustainability related topics such as climate change, circular economy, resource scarcity and depletion and sustainability on the one hand side. The other trend is e-commerce.

Other trends, such as on-demand-economy or covid-19 were not regarded as important influence factors for the top 10 topics. New work & social innovation as well as skilled workforce shortage were important for only some of the top 10 topics.

The same analysis was conducted for the connection between topics and technologies:

	Distributed Ledger Technology & Blockchain	Next Generation Wireless - 5G	Clouds & Virtualisation	Standardisation & data modelling	Internet of Things	Mobile Computing	Digital Twins	Data Science	Artificial Intelligence	Big Data Analytics	Robotics, Cobots & Automation	Self Driving Vehicles / CCAM	Platooning	Augmented reality	Virtual Reality	Additive Manufacturing / 3D printing	Nano technologies	Alternative fuels & drive train technology	Predictive maintenance
Synchromodality	2	2	2	3	3	2	2	2	2	3	2	2	1	1	1	1	1	2	2
Autonomous operations	2	2	2	2	3	3	3	3	2	2	2	3	2	2	2	1	1	2	2
Autonomous transport	2	3	2	3	2	2	3	3	3	3	2	3	2	2	2	1	1	2	2
E-commerce delivery concepts	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	1	2	1
Supply chain visibility	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2	1	1	1	1
Fostering cooperation and collaboration among the logistics chain	2	2	2	3	2	2	2	2	2	2	1	2	2	2	1	1	1	2	2
Interconnected logistics networks	3	2	2	3	2	2	2	3	2	3	2	2	1	1	1	1	1	2	2
Supply chain resilience	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2
System of logistics networks: The Physical Internet	2	2	2	3	2	2	3	3	3	3	2	2	2	2	2	1	1	2	2
Data sharing architecture / technology	3	2	2	3	2	2	2	2	2	3	2	2	1	2	1	1	1	2	2

Figure 6: Connection between topics and technologies

The analysis of the connection between the top 10 topics and technologies showed, that all data driven technologies are important for the topics. The analysis shows that, independent of the topic, standardisation and big data analytics are important for the future research themes. Technologies such as self driving vehicles, robotics and alternative fuels were only regarded as important technologies for some of the topics.

With some minor exceptions, the answers from the industry and other organisations were alike. These results were presented in an open BOOSTLOG workshop to find missing logistics concepts. The results of the slido poll suggests, that most topics are included in the top 10 already.

Based on the topics most important trends and technologies, a set of first recommendations is given in the following chapter. The recommendations are derived based on the combination of topics with trends and technologies and give a first overview over interesting topics.

This chapter reflects a first selection of recommendations to move forward with research and innovation, based on the influencing trends identified and using Key Enabling Technologies. The description of the recommendation in this deliverable 4.1 of the Boostlog project is the result of the process described in the previous chapters. In a next stage the identified strong relationships generating 'heat' and the according recommendations described below will be mapped with the results of WP3, where a thorough analysis has been done on the direction and results of past and ongoing EU funded projects. This will lead to a gap analysis; the identification of topics which are not addressed (sufficiently) up to now. This will be reflected in deliverable 4.2. After this gap analysis the results will be discussed with experts in the field to make sure that the most relevant topics are recommended while also taking the scope of these recommendations into consideration. This will in turn lead to deliverable 4.3.

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R g x ks k s k g cx s kk s c c gtti

xs c s kc ttisx kx s ttix k tti x s

xs c kx k ffls gk ffk cxsx k c ffksx s k

Society is moving towards a situation in which resources need to be better utilised, i.e., amongst others moving towards a more circular society. In the meantime, supply chains are confronted with resource scarcity and rising prices, in the short and medium run. This means also that resources will have to be reallocated across the economy and between supply chains. Supply chains are already increasingly connected, but the assumption is that this connectivity will even further increase in the near future.

There is no clear picture, however, on how these connected supply chains and networks will help in solving the resource scarcity issues and how they need to be designed accordingly. It also is required to think about the organisation of these networks and the coordination of information and physical flows, given this specific challenge. The actual impact of these interconnected supply chains and networks (towards the Physical Internet) should also be measurables in terms of the impact on emissions and resource utilisation on a sectoral and economy level. It also needs to become clear in which technologies the industry should invest in order to cope with this transition.

There is a need to provide scenarios for the further development of interconnected supply chains and networks, moving towards the Physical Internet. This helps industry to get a better picture of required future investments. These scenarios should also evaluate the impact on performance indicators of the supply chain, but also on a more macro-economic level. Another important task is to provide insights into the required technological solutions and data-sharing frameworks that enable the transition and operational connection between supply chains and networks.

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xs c kx k ffls gk ffk R cxsx k c ffksx s k

The COVID-19 situation provided an extra incentive for customers to use online channels for their purchase. A trend which was already clearly visible before the pandemic. The industry is developing promising logistics solutions to cope with the growing demand of e-fulfilment. In many cases however it is observed that solutions focus on a specific part of the supply chain or last mile only. In some cases, it can be questioned whether the solution in a specific part of the chain is disturbing processes elsewhere in the end-2-end supply chain. In other words, an e-fulfilment solution which shows positive impact in a part of the chain may cause an overall negative impact in a full supply chain.

There is a strong need to be able to evaluate the impact of new promising logistics concepts providing last-mile solutions in the scope of the full end-2-end supply chains. The growing required capacity to cope with e-fulfilment flows needs to be coordinated in a better way to make sure that this capacity is aligned and performance in terms of utilisation is maximised.

This action leads to a more holistic view on the implementation of last-mile solution in the context of a full supply chain operation. This will in turn lead to insights into the alignment of these solutions and the impact this has within an end-2-end supply chain setting.

R s k

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xs c kx k ffls gk ffk x ffks s xk e x s xkc xc x s

The worldwide and European supply chains have experienced several disruptions in recent years. Not only the pandemic has caused disbalanced trade flows, but also natural disasters or blockage of main trade routes, have had their effect on supply chain execution. Disruptions often occur outside the scope of one of the partners in a supply chain, and timely information about the effect on individual shipments is not available in many cases. So, industry stakeholders tend to anticipate these disruptions by keeping/adding stock positions within the supply chain. This tends to be a suboptimal solution which can be avoided.

Industry and government stakeholders within a supply chain are in need for:

- Obtaining better visibility of resources and shipments that are already on route to destination in order to find better solutions and inform end-receivers about delays for instance. (Operational)
- The ability to predict the effect of disruptions that occur, based on end-2-end supply chain information. This leads to better decision support mechanism. (Tactical)
- Alternative supply chain strategies to cope with disruptions and secure service level agreements to the best effort. (Strategic)

Many solutions are available already to get better visibility and to achieve better steering information within supply chains. But it also turns out that to be able to reach next level robustness in supply chains, information available at one single point in the supply chain needs to become available throughout the chain. Furthermore, information that is available at sources outside of the operational supply chain tends to be crucial for decision support tools. The challenge is to connect all relevant dots to achieve the strategic, tactical and operational information which is needed for supply chains to become more robust and responsive.

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E-commerce flows are growing fast and tend to become more fragmented, at least on the national distribution level. Research has shown that many independent flows of parcels are obviously integrated, but the interoperability between parcel delivery networks is lacking at this point. At several stages in the e-fulfilment chain a number of handlings and transfers take place which leads to for instance relabelling or repacking of shipments. This is not sustainable, time-consuming and leads to errors in delivery. There is also an increasing call for traceability and optimisation of return shipments from consumers to avoid loss of value and increase the circularity of these e-commerce flows.

One of the promising concepts to address these challenges is to introduce modular loading units in the industry which can be used for e-commerce shipments. The idea is that once, in parts of the e-fulfilment network, these loading units are implemented, shipments can be routed and organised between independent networks of service providers in a more interoperable way.

But here are still many pieces of the puzzle to solve. A number of challenges need to be addressed, amongst others:

- What parts of the e-commerce supply chain could be redesigned using modular loading units? Are there parts of the network that are not suitable for this transformation?
- What should be the design of these e-commerce dedicated loading units? Can they be used in other supply networks of the future as well?
- What does the introduction of these units mean in terms of standardisation of information, labels and documents?
- How does the e-commerce network become interoperable using the loading units throughout independent supply chains and what does this mean for industry stakeholders that are part of this transition?

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Interconnected intermodal networks, the use of sustainable fleets and sharing of assets are promising concepts when it comes to reducing the external effects of transport & logistics. But a recurring barrier is the integration of and use of data from different sources. On the other hand, there is a trend to move to more paperless execution of supply chain operations., e.g. growing use of eCMR, eFTI regulations which should be implemented, data infrastructure developments, etc.

In practice solutions are developed within the industry that from the start are not designed to use in an interoperable way. This leads to uncertainty and difficulty at company level to invest in any digitised solutions. The question here is what basic conditions should be met in terms of digital information to ensure that solutions can act in an interoperable way in the near future. Given fact is that solutions will be developed. The challenge is to define the basic principles for any solution to ensure that the transaction costs of connecting several systems in a federated system are kept as low as possible.

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xs c kx k ffls gk ffk sxkcx c xs k cxsx c k ffk

It still is difficult to assess the impact of research projects on the way they contribute to sustainability targets. This assessment is relevant for at least two stages of an R&I project, i.e. (1) during the proposal stage and (2) during the course of the R&I project or by its end.

First, it is essential that those proposals shall be selected that may provide high/highest sustainability impact by meeting the drafted objectives. However, at this stage of a project, a lot of information can only be estimated, maybe some initial experiences/data from pilot projects (ex-ante approach). Therefore, on the one hand, the submitter of the proposal shall provide relevant information to sustainability impact performance categories in such a manner that, on the other hand, evaluators can compare different proposals on a level playing field and select those with the highest sustainability impact.

Secondly, the running R&I projects shall provide proof that they meet the drafted sustainability impact by the use of data and information gained from project activities (ex-post approach). This may require a more detailed approach.

The aim is to align initiatives for sustainability measurement schemes that may be applicable to sustainability impact assessment of (European) funded R&I project. It starts with the definition of sustainability KPIs relevant to the EU research agenda. This shall be followed by a framework that enables

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both ex-ante and ex-post sustainability assessment. Existing approaches on how to quantify sustainability KPIs shall be aligned, new approaches may need to be derived. If relevant, the integration of a benchmark/target value for sustainability indicators shall be discussed. The elaborated framework needs to be reviewed by relevant stakeholder groups, i.e., European Commission, evaluators, project proposal submitters.

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xs c s kc ttisx kx s ttix k xs gxk ffk

xs c kx k ffls gk ffk sxkc x c xs k c xsx c k ffkc xsx x g s stti

This may partly touch the action outlined before (see 6.6), but due to the fact that greenhouse gas emission quantification is a common task of logistics companies this action does not only address the above mentioned stakeholders but should moreover involve stakeholders such as ICT service providers (e.g. operators of data centers, …), ICT equipment producers, ICT users (e.g. LSP, shippers, …).

A major trend highlighted by the analysis is the digitalization of the logistics sector. The ICT sector is already a large energy consumer, the increased use of ICT will add on this. However, efficiency increase (e.g., chip technologies, data centers) is also prospected so that contrary developments can be expected.

Still, there is no common approach on how to estimate GHG emissions related to the use of ICT equipment and data servers related to transport operations. Ongoing standardisation discussions on the quantification of GHG emissions arising from transport chain operations outlined both the lack and need to provide such an assessment framework in the near future. This will enable informed choices with regard to the future digitalisation of the logistics sector.

This action shall identify and align applicable approaches and elaborate the relevant framework. Such a framework shall further specify which carbon accounting approaches can help at what level (models, practical, real-time) for which type of information and communication needs (e.g., for transport/handling, supply chain, production, national/cross-border) and which standards should be aligned at EU and national levels to enable GHG info exchange between different roles as well as comparison of logistics chains

The action provides pilot use cases that prove the applicability and provide guidance for implementation of the elaborated assessment framework for measurement and reporting of GHG emissions arising from digitalization of logistics chains.

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	Trends																			Topics															
	Distributed Ledger Technology & Blockchain	Next Generation Wireless - 5G	Clouds & Virtualisation	Standardisation & data modelling	Internet of Things	Mobile Computing	Digital Twins	Data Science	Artificial Intelligence	Big Data Analytics	Robotics, Cobots & Automation	Self Driving Vehicles / CCAM	Platooning	Augmented reality	Virtual Reality	Additive Manufacturing / 3D printing	Nano technologies	Alternative fuels & drive train technology	Predictive maintenance	Reshoring	Crowd-economy	Personalisation / consumer centricity	On-demand-economy	Urbanisation vs reversed urbanisation	Local-for-local	Climate change	Circular Economy	Resource scarcity and depletion	Sustainability	Skilled workforce shortage	Demographic change	Inclusiveness	New work & social innovation	E-commerce	Covid-19
Crowd shipping	2	3	3	1	3	3	1	3	3	2	1	1	1	2	1	1	1	1	1	1	2	2	2	2	3	3	1	1	3	1	3	1	2	3	2
Shared warehousing	1	1	2	2	1	1	2	1	1	1	2	1	1	1	1	1	1	1	1	2	2	2	2	1	2	2	2	1	2	1	1	2	2	2	1
Hyperconnected hubs	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1	1	2	2	2	2	3	2	2	3	3	3	3	2	2	2	1	3	2
Agility: Plan, forecast and adapt to disruption	3	3	2	3	3	3	3	3	3	3	2	2	2	2	2	3	1	2	3	2	3	3	3	2	3	3	3	3	3	2	2	2	3	3	3
Influencing consumer behaviour	1	1	1	1	2	1	1	2	2	2	1	1	1	2	2	2	1	1	1	1	2	3	2	2	3	3	3	2	3	1	2	2	2	3	2
End-to-end international booking systems	2	2	3	3	2	2	2	3	2	3	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
Dynamic supply and demand planning	2	3	2	3	3	3	3	3	3	2	2	2	1	1	1	1	1	1	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	3	2
Flow synchronisation	2	2	2	2	2	2	2	3	2	2	2	2	2	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sustainability assessment tools	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2	1	1	1	1	2	2	2	2	2	2	3	3	3	3	2	2	1	2	2	1
Autonomous logistics nodes	2	2	3	2	2	2	2	2	3	2	2	2	2	2	2	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Shared networks	2	2	3	3	3	2	2	3	3	3	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	3	3	3	3	2	1	1	2	2	2
Public transport for logistics	2	2	2	2	2	2	2	3	2	3	2	3	2	2	1	1	1	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	3	2
Modular loading units (PI container)	2	2	2	3	3	2	3	2	2	2	3	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	3	2	2	2	1	1	1	2	1
Sustainable logistics sites, incl. warehouses	2	2	2	2	2	1	2	2	2	2	3	2	1	2	2	2	1	2	2	2	1	2	2	2	2	3	2	2	3	2	2	2	2	2	2
Sustainable fleets & assets	2	2	2	3	2	2	2	2	2	2	2	2	2	2	1	1	2	3	3	2	2	2	2	2	2	3	3	3	3	2	2	2	2	2	2
Synchromodality	2	2	2	3	3	2	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2
Connected corridors and hubs	2	3	3	3	3	2	3	2	2	3	2	2	1	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Emissions measurement & reporting schemes	2	2	2	3	2	2	2	2	2	3	1	1	1	2	2	1	1	2	2	2	2	2	2	2	2	3	2	2	3	1	1	1	1	2	2
Autonomous operations	2	3	3	2	3	3	2	2	3	2	3	3	2	2	2	1	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Autonomous transport	2	3	2	3	2	2	2	3	3	3	3	3	2	2	2	1	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
E-commerce delivery concepts	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	1	1	2	1	2	2	3	3	2	2	2	2	2	3	2	2	2	2	3	2
Supply chain visibility	2	2	3	3	3	3	2	3	2	3	1	1	1	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2
Shared transport / pooling and goods consolidation	2	2	2	3	2	2	2	2	3	3	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	3	2
Fostering cooperation and collaboration among the logistics chain	2	2	2	3	2	2	2	3	2	3	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	2	3	2	2	2	2	2	2
Interconnected logistics networks	2	2	3	3	2	2	2	2	2	3	2	2	1	1	1	1	1	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2
Supply chain resilience	2	2	2	2	2	2	2	3	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	3	2	3	3	2	2	2	2	3	2
System of logistics networks: The Physical Internet	2	2	3	3	3	2	3	3	3	3	2	2	2	2	2	2	1	2	2	2	2	2	3	2	2	3	3	2	3	2	2	2	2	3	2
Zero emission vehicles / cargo bikes	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	3	2	1	2	2	2	2	2	3	2	2	3	2	2	2	2	3	2
Data sharing architecture / technology	2	2	2	3	3	2	2	2	2	3	2	2	2	2	1	2	2	2	2	2	2	2	3	2	2	3	3	2	3	2	2	2	2	3	2

Figure 7: Heat map showing the results from online survey